ILUKA

Mineral Sands By-product Disposal

Crown Allotments 91, 94, 95, 96

Parish of Telangatuk

Rehabilitation and Vegetation Management Plan

Revision 3

Date: 7 June 2017

Document control

Revision	Details of review or changes	Prepared by	Date created	Document reference
Revision 0	Issued to ecological consultant, GHD for preparation of revegetation componemts	C Burns	17/04/17	
Revision 1	Figures 14, 15 and 16 added, Table 3 corrected, other minor edits	C Burns	20/04/17	
Revision 2	Further minor edits	C Burns, M Little	21/04/17	
Revision 3	Sections prepared by ecological consultant, ecological consultant, GHD, inserted	C Burns	7/06/17	
[Add as necc.]				

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1 Introduction

1.1 Background

Iluka Resources Limited (Iluka) disposes of heavy mineral processing by-products generated by its mineral separation plant (MSP), located near Hamilton in the Southern Grampians Shire, to a mining void at its Douglas Mine. The void at the Douglas Mine is located in the municipality if the Horsham Rural City in the Kanagulk area (Figure 1) and is known as Pit 23 (Figure 2).

Under the Horsham Planning Scheme the subject land is in the Farming Zone and under the provisions of that zone a permit is required for use and development for Industry (Refuse Disposal). Planning Permit 15-105 (the Permit) has been issued by the Horsham Rural City Council as the Responsible Authority and the conditions of that permit include the following:

Rehabilitation and Vegetation Management

34 Within 90 days of the commencement of this permit a ***Rehabilitation and Vegetation Management Plan (R&VMP)*** must be prepared to the satisfaction of the Responsible Authority. Three copies of the plan and an electronic version must be provided. When approved the R&VMP will be endorsed to form part of this permit.

35 The R&VMP must include a decommissioning process for formal completion of the rehabilitation of the Pit 23 site guided by the content of the *Rehabilitation Plan* described within the application and the *Decommissioning Plan* contained in the *Supplementary Response to Amended Notice to Supply Further Information* provided to the EPA and the Responsible Authority.

36 The rehabilitation component of the R&VMP must contain at least the following:

- a) Coverage on the pre-mining land characteristics including landform, stability, erosion resistance, water catchments and pattern including point of discharge of surface water from the subject land;
- b) Rehabilitation objectives, including in relation to landform, landform stability, surface drainage profile, site and gully erosion control, and post-closure maintenance and monitoring;
- c) Stabilization of exposed stored overburden;
- d) Detail of methods and techniques to achieve the stated rehabilitation objectives;
- e) Provision of a minimum cap depth of 5 metres over material disposed into Pit 23;
- f) An indicative rehabilitation schedule that includes milestones and validation requirements that relate to the management and partial release of the rehabilitation bond; and
- g) Measures for performance monitoring of site rehabilitation.

37 The revegetation component of the R&VMP must be based on the use of locally indigenous plants across the capping of Pit 23 and its buffer surrounds, and be prepared by a suitably qualified ecological consulting organisation.

38 Unless otherwise approved in writing by the Responsible Authority, the revegetated area shown on the endorsed VMP must be permanently protected by fencing to control grazing threats, including agricultural livestock, rabbits and other pest herbivores to the satisfaction of the Responsible Authority.

39 The subject land must be managed so as to ensure that high-threat environmental weeds (as identified by the Responsible Authority) are eliminated, and other environmental weeds are controlled, to the satisfaction of the Responsible Authority.

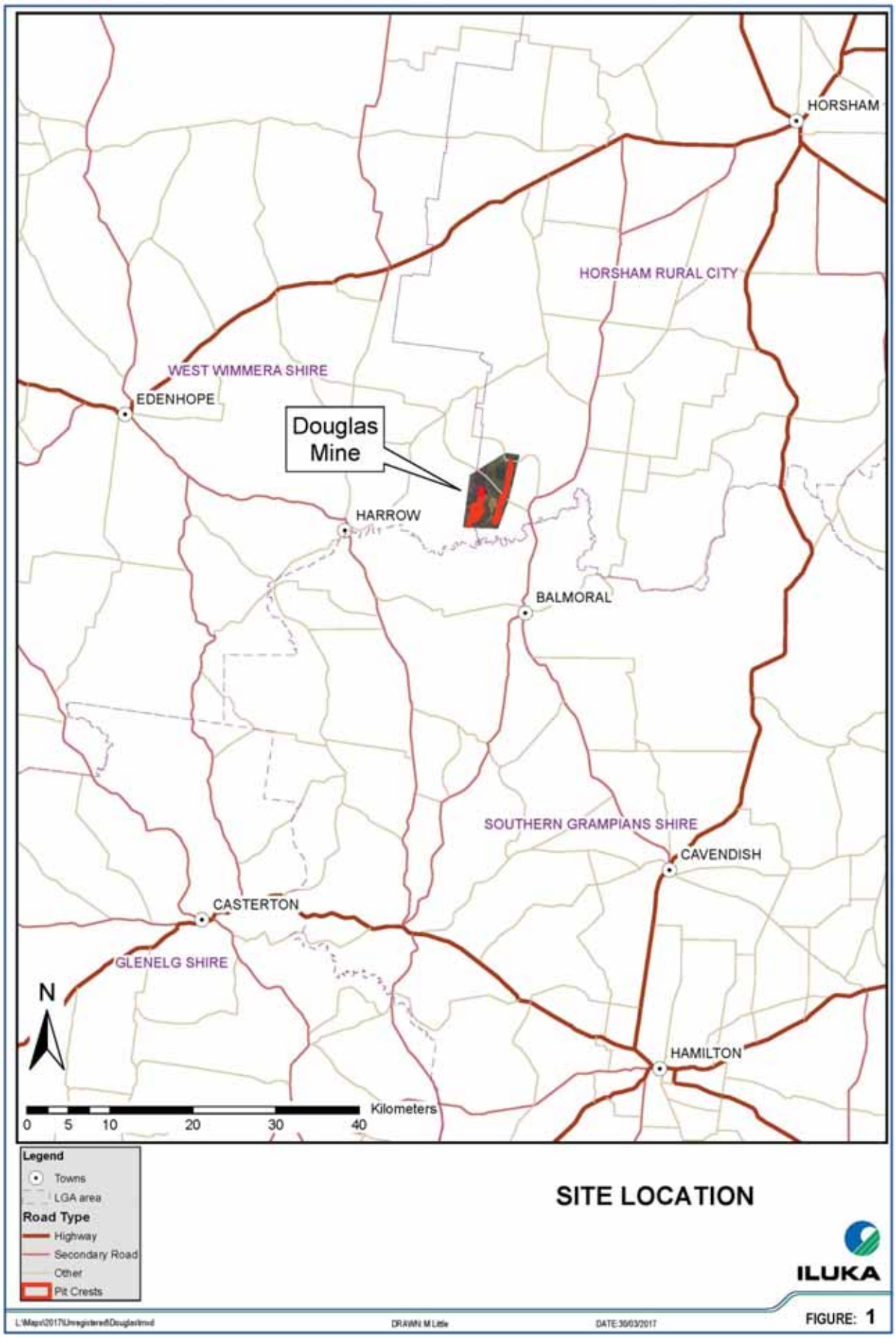
40 Upon completion of capping of Pit 23, or any approved stage of capping, the R&VMP must be implemented without delay and to the satisfaction of the Responsible Authority.

41 The vegetation component of the R&VMP must contain at least the following:

- a) Revegetation objectives for the Pit 23 area and surrounding buffer;
- b) Revegetation criteria against which completed works will be assessed;

c) Maps of the final intent for the revegetated area;
d) Methods and techniques to achieve the revegetation objectives, including:
e) Temporary revegetation or stabilization of exposed stored overburden.
f) The characteristics of the revegetation over Pit 23 and the surrounding buffer area, including the *Ecological Vegetation Class* (EVC), EVC *Bioregional Conservation Status*, number of trees, shrubs and other plants, species mix, and density of the vegetation;
g) Indicative pasture species mix to be established on the remainder of the land outside of Pit 23 and the surrounding buffer area;
h) Methods of managing weeds and pest animals;
i) Methods of interim protection for newly established vegetation;
j) Methods for potential fuel reduction for fire danger periods; and
k) Methods for maintaining minimum revegetation requirements, including density, diversity and survival.

This Rehabilitation and Vegetation Management Plan (R&VMP) has been prepared to satisfy this permit condition.


HORSHAM
HORSHAM RURAL CITY
WEST WIMMERA SHIRE
EDENHOPE
Douglas Mine
HARROW
BALMORAL
SOUTHERN GRAMPIANS SHIRE
CAVENDISH
CASTERTON
GLENELG SHIRE
HAMILTON
N
0 5 10 20 30 40
Kilometers
Legend
Towns
LGA area
Road Type
Highway
Secondary Road
Other
Pit Crests
SITE LOCATION
ILUKA
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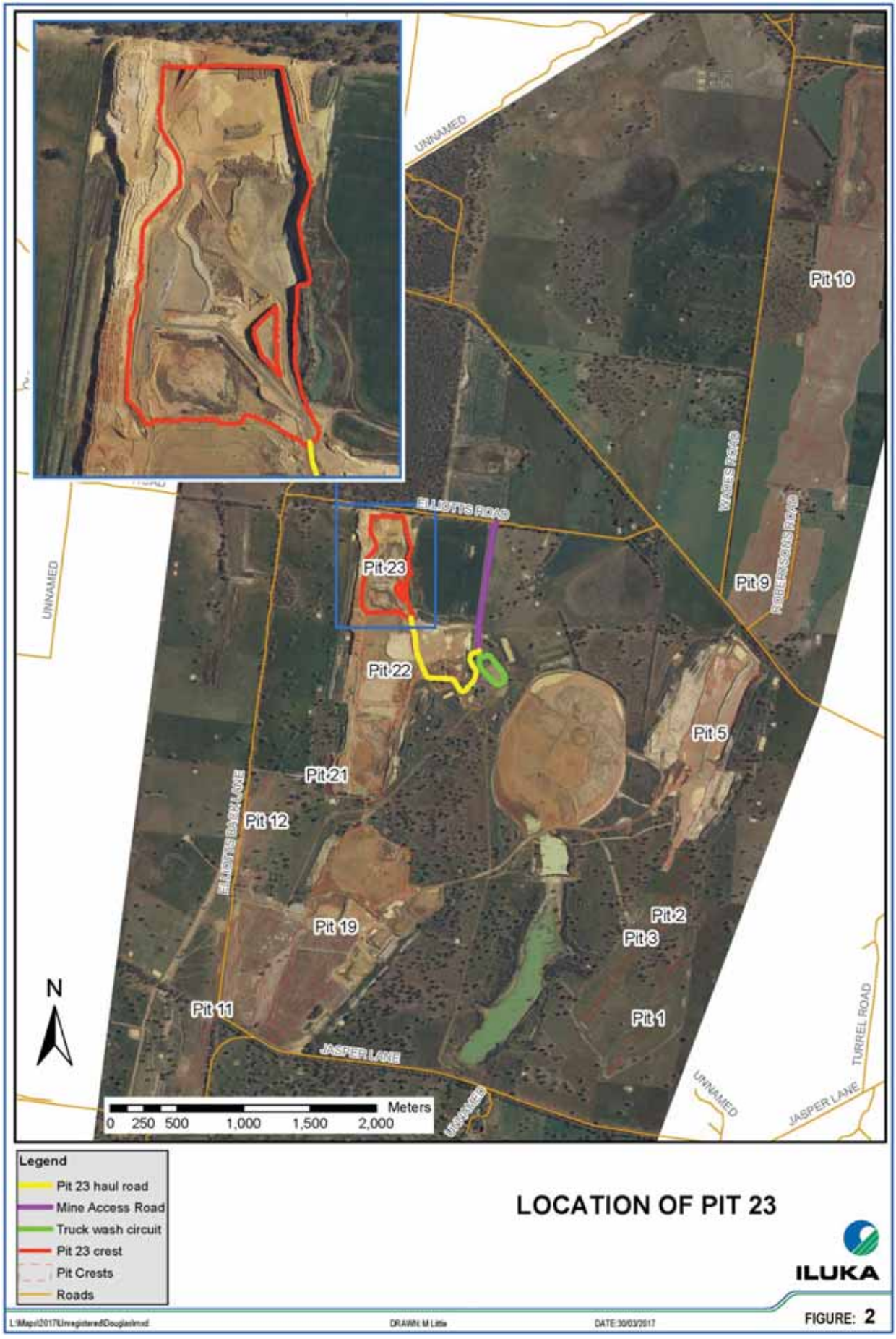
DRAWN M Little
DATE 30/03/2017
FIGURE: 1


UNNAMED
Pit 10
WADES ROAD
ELLIOTTS ROAD
Pit 23
Pit 9
ROBERTSONS ROAD
UNNAMED
Pit 22
Pit 5
Pit 21
ELLIOTTS BACK LANE
Pit 12
Pit 19
Pit 2
Pit 3
N
Pit 11
Pit 1
JASPER LANE
TURREL ROAD
UNNAMED
JASPER LANE
UNNAMED
Meters
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Legend
Pit 23 haul road
Mine Access Road
Truck wash circuit
Pit 23 crest
Pit Crests
Roads
LOCATION OF PIT 23
ILUKA
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DATE: 30/03/2017
FIGURE: 2

1.2 Purpose

This R&VMP provides the detailed management framework for rehabilitation of the subject land by:

- defining the end use and rehabilitation objectives for the subject land;
- describing the methods to be used for rehabilitation, including revegetation;
- identifying key issues that, if not managed, could compromise rehabilitation outcomes; and
- defining completion criteria and the monitoring program to be used for assessing the progress of rehabilitation and its completion.

As required by the Permit, this R&VMP has been prepared such that it is in general accordance with the content of the Rehabilitation Plan described within the application and the Decommissioning Plan contained in the *Supplementary Response to Amended Notice to Supply Further Information* provided to the EPA and the Responsible Authority. In addition the preparation of this plan has had regard to:

- other requirements of the Permit; and
- Iluka's Environmental, Health and Safety Management System standards pertaining to mine rehabilitation.

This R&VMP is one of a number of plans required by the Permit conditions, which together form the overall framework for the environmental management of the permitted development and use. The required plans include the:

- Environmental Management Plan (EMP), which includes the:
  - Groundwater Monitoring and Management Plan (GWMMP);
  - Surface Water Monitoring and Management Plan (SWMMP);
  - Air Quality/Dust Control Plan (AQDCP); and
  - management of other environmental aspects;
- Incoming Waste Monitoring Plan (IWMP);and
- this R&VMP, which incorporates:
  - capping earthworks management; and
  - vegetation management.

In addition some of the activities are subject to the *Radiation Act 2005* under which a radiation management licence (RML) has been issued to Iluka by the Department of Health and Human Services (DHHS). The conditions of that licence include a requirement for compliance with an approved Radiation Management Plan that includes a Radioactive Waste Management Plan.

The hierarchy and periods of application of the various plans are shown in Figure 3.

<table>
<tr><th>Phase</th><th>Disposal</th><th>Rehabilitation and closure</th><th>Post-closure monitoring</th></tr>
<tr><td rowspan="2">Regulator & regulatory instrument</td><td colspan="2">HRCC – Planning Permit (PP)</td><td></td></tr>
<tr><td colspan="3">DHHS – Radiation Management Licence (RML)</td></tr>
<tr><td rowspan="3">Relevant Management Plan (relevant regulatory instrument)</td><td colspan="2">Environmental Management Plan (PP)</td><td></td></tr>
<tr><td>Incoming Waste Monitoring Plan (PP)</td><td>Rehabilitation and Vegetation Management Plan (PP)</td><td></td></tr>
<tr><td colspan="3">Radiation Management Plan/Radioactive Waste Management Plan (RML)</td></tr>
</table>

Figure 3: Regulatory instruments and management plans

This R&VMP applies to the rehabilitation and closure phase only.

1.3 Scope

This R&VMP applies to:

- Pit 23 and immediate surrounds;
- the existing mine access road;
- the existing haul-road to Pit 23;
- a truck washing facility (and access road); and
- mine offices, ablution facilities and car park.

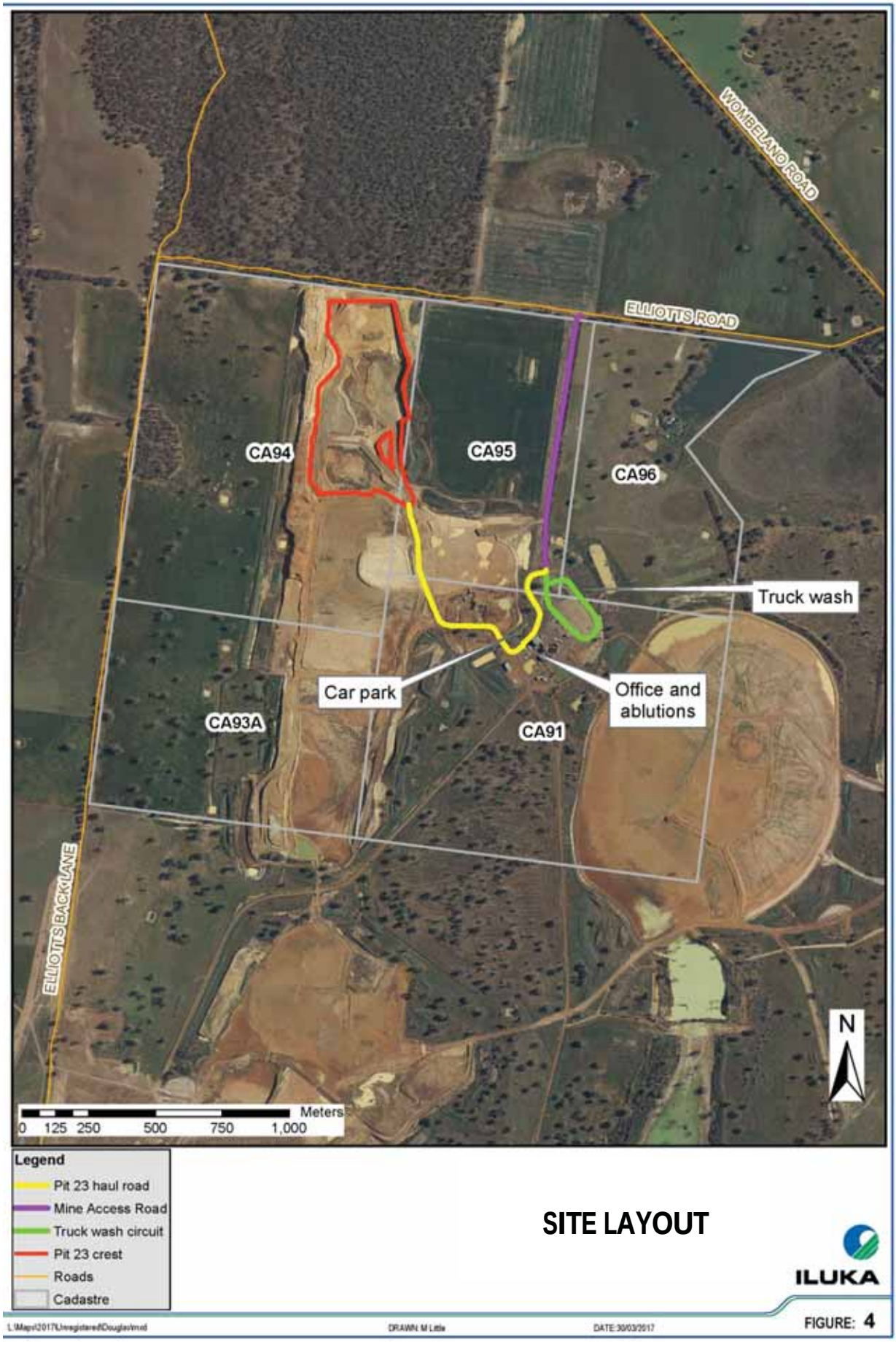
As shown in Figure 4, these features and facilities are located within parts of four Crown Allotments (CA) in the Parish of Telangatuk. Pit 23 is located predominantly on CA94 while the mine access road, haul road, truck wash, offices, ablution facilities and car park are located on CA91, CA95 and CA96.

Rehabilitation of the remainder of the Douglas Mine is being undertaken in accordance with a rehabilitation plan approved under the *Mineral Resource (Sustainable Development) Act 1990* (MRSDA) and is therefore outside the scope of this plan.

1.4 Objective

The objective of this R&VMP is to ensure that:

- the rehabilitation and closure approach is appropriately described;
- risks associated with rehabilitation of the subject land are appropriately identified and mitigated; and
- the proposed end use of the subject land can be successfully established and sustained.


WOMBELANO ROAD
ELLIOTTS ROAD
CA94
CA95
CA96
CA93A
CA91
Truck wash
Car park
Office and ablutions
ELLIOTTS BACKLANE
N
0 125 250 500 750 1,000 Meters
Legend
Pit 23 haul road
Mine Access Road
Truck wash circuit
Pit 23 crest
Roads
Cadastre
SITE LAYOUT
ILUKA
DRAWN: M Little
DATE: 30/03/2017
FIGURE: 4

2 Project description

A description of the development and use is provided within the EMP, which includes descriptions of:

- project location;
- land tenure;
- pre-mining land use;
- Douglas Mine history; and
- Pit 23 disposal operations, including;
    - MSP by-product types and quantities; and
    - disposal of other materials.

3 Environmental context

A description of the environmental setting of the Douglas mine is provided within the EMP, which contains descriptions of the following environmental aspects:

- climate;
- landform;
- soils;
- radiation;
- surface water;
- groundwater; and
- native vegetation.

4 Status of land disturbance

Table 1 shows the areas of disturbed land that will be rehabilitated by the implementation of this plan.

Table 1: Land to be rehabilitated

Disturbance type	Land parcels				Total (ha)
	CA91	CA94	CA95	CA96	
Pit 23	0	22.0	0.3	0	**22.3**
Adjacent Stockpiles	0	19.6	6.1	0	**25.7**
Mine Access Road	0.5	0	2.2	0	**2.7**
Haul Road	1.2	0	0.7	0	**1.9**
Truck wash (and access road)	2.4	0	0.3	0.4	**3.1**
Office, ablutions and car park	2.4	0	0	0	**2.4**
Total (ha)	**6.5**	**41.6**	**9.6**	**0.4**	**58.1**

5 End use and rehabilitation objectives

5.1 End use

As illustrated in Figure 5, the proposed end uses of the subject land are:

- biodiversity conservation for the land currently occupied by Pit 23 plus a buffer zone outside the pit crest; and
- agriculture for the remainder of the land.

The area of Pit 23 and the buffer zone surrounding the pit is subject to an agreement under Section 173 of the *Planning and Environment Act 1987* (PE Act) that restricts the use of the land to biodiversity conservation in perpetuity. The biodiversity conservation end use will minimise the risk of the cover overlying the disposed materials being breached by human activities (e.g. large scale excavation).

The land outside of Pit 23 and buffer zone will be returned to agricultural use to restore the pre-mining land use.

5.2 Rehabilitation objectives

Table 2 presents the rehabilitation objectives for the subject land. These objectives are in addition to the environmental management objectives stated in section 4 of the EMP.

Table 2: Rehabilitation objectives

Aspect	Objectives
Landform design and stability	The restored landform is structurally stable, resists erosion (comparable to surrounding landscape) and is visually compatible with the surrounding landscape
Surface water flow-paths	Surface water flows from rehabilitated areas are returned to their pre-mining catchments
Restoration of soil profiles and productivity	Soil profiles are equivalent to pre-mining, and soil characteristics do not pose an unacceptable risk to human health, the environment or existing local land uses
Native revegetation	Native vegetation communities of appropriate and agreed composition are established and are self-sustaining
Agricultural production	Agricultural productivity is comparable to pre-operational levels and can be maintained though standard agricultural practices
Radiation	To ensure that radiation doses arising from the rehabilitation operations, and the final rehabilitated site, are below the prescribed limits.


ELLIOTTS ROAD
N
0
100
200
400
600
800
Meters
Legend
Native vegetation area
Agriculture
Pit 23 crest
MIN5367
END USES
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DRAWN: M Little
DATE:21/04/2017
FIGURE: 5

6 Rehabilitation risk assessment

An assessment of the risks related to rehabilitation has been included in risk analysis and response plan prepared by AECOM for inclusion in the EMP. Details are included in Appendix B of the EMP.

7 Identification and management of rehabilitation issues

The following sections describe the identified issues and management actions relevant to the rehabilitation objectives listed in Table 2 and the controls and management actions relevant to the rehabilitation risks identified in the risk analysis. Overarching environmental objectives, and their associated risks and management actions are covered in sections 4 and 5 of the EMP.

7.1 Landform design and stability

This section refers to the design and stability of the final landform and not the stability of the pit walls during disposal operations that are considered in Section 9.5 of the EMP, which also describes the minimisation of risks of subsidence.

7.1.1 Assessment of risk

The results of a geomorphological assessment and classification of the local Pit 23 area were provided in support of the Permit application. These results showed the area to be in a depositional zone and that very low rates of erosion and deposition are expected to occur from raindrop impact and runoff due to the very low gradient and smooth slopes.

Landform evolution modelling, utilising data on the physical and chemical properties of topsoil and subsoil, was performed on the proposed rehabilitated Pit 23 landform for four scenarios:

- *Scenario 1*: Topsoil cover and subsoil cover with the establishment of a 75% vegetative cover after one year, and 90% cover after year five. This represents the most likely of the scenarios considered albeit conservative in regard to timing and extent of vegetative cover;
- *Scenario 2*: Topsoil cover and subsoil cover without effective establishment of vegetation (bare), representing an unlikely worst case scenario;
- *Scenario 3*: Topsoil cover and subsoil cover runs from scenario 1 runs were subjected to 100 mm/h intensity event at year 200, representing the likely impact of a >1-in-500 average recurrence interval (ARI) storm event; and
- *Scenario 4*: A full run (500 years) using parameters derived for the >1-in-500 ARI storm event to provide an assessment of sensitivity of the topsoil cover and subsoil cover.

The results of long-term modelling and storm interval modelling indicated that minimal erosion is expected but there is potential for gully erosion to penetrate the topsoil/subsoil cover within the 500 years. Storm event modelling predicted that a >1-in-500 ARI storm would not cause significant erosion of the topsoil/subsoil cover. Importantly, as all of the disposed material is contained within the existing pit shell, at least 5m below the final surface, no mobilisation of disposed material arising from erosion is predicted.

The following conclusions were drawn from the modelling results:

- the topsoil is relatively stable and resistant to erosion even without the establishment of vegetation; as such, the landform is predicted to remain stable prior to establishment of the vegetative cover and in the event of a fire;
- the subsoil is more erodible than the topsoil; however modelling predicts it will only be exposed in areas where gully erosion occurs; and
- Storm events will increase sheet erosion, but are not predicted to dramatically increase gully erosion or increase the risk of exposing underlying material.

Overall, the modelling predicted that, with sound land management practices reducing the risk of gully erosion, the topsoil/subsoil cover should remain in place for over 500 years.

The design of the final landform will be such that:

- no point on the finished surface will be higher than the highest point on the natural pre-mining surface; and
- a separation distance of 5 metres will exist between the top surface of the materials disposed of the final finished surface.

7.1.2 Management

The main management measures to minimise the risks to final landform compatibility and stability involve a final surface design consistent with the pre-mining landscape and the establishment of a vegetative cover as soon as possible after the placement of topsoil. The placement of overburden, subsoil and topsoil will be survey-controlled to ensure that the final surface matches the design.

The design minimises the risk of sheet erosion, with water shedding from the gentle slopes with minimal erosion expected from year to year. The risk of gully erosion, although predicted to be minor, will be managed by reducing slope angles e.g. to the northwest, eastern and southeast of the landform, if required. Furthermore, the land will be contour-ripped to reduce surface water runoff volumes and velocities and promote infiltration.

Establishing a cover of vegetation as soon as possible is recognised as important for promoting the stability of the reinstated landform. Following the placement of topsoil, it is expected there will be a short period (one to two months) where the topsoil will be bare prior to the establishment of a cover crop such as cereal rye. Following establishment of the cover crop native vegetation will be established, which will reduce the low erosion risk further. Measures described in Section 7 of the EMP will be implemented to prevent uncontrolled discharge of run-off from the area during vegetation establishment. The native vegetation will be protected by restricting land use to eliminate the likelihood of human disturbance and exposure of the soil surface.

Section 8 contains a more detailed description of the final landform design process.

7.1.3 Monitoring

Monitoring associated with landform design and stability will include:

- topographic survey of the finished surfaces of:
    - overburden;
    - subsoil; and
    - topsoil;
- long term monitoring at set monitoring locations within the Pit 23 footprint of final topsoil surface level to detect settlement and assess land stability; and
- landform function analysis (LFA) as described in section 10.2.

Monitoring will cease when the relevant completion criteria have been met.

7.2 Surface water flow-paths

7.2.1 Assessment of risk

Pit 23 sits atop a relict dunal ridge with the 62 ha western flank of the Pit 23 pre-mining surface being within the White Lake catchment, and the 161 ha eastern flank being within the Lake Kanagulk catchment. The White Lake and Lake Kanagulk catchment areas are 8,350 ha and 5,380 ha respectively. The Pit 23 pre-mining surface therefore constituted 0.7% and 3.0% of the White Lake and Lake Kanagulk catchments respectively. The likelihood that a variation of the final Pit 23 landform surface from the pre-mining surface impacting upon White Lake or Lake Kanagulk is therefore very low.

Drainage from the slopes in the pre-mining Pit 23 surface collected in low gradient waterway depressions. The depressions are broad and shallow with no defined beds or banks. Flow in these waterway depressions only occurred during heavy rainfall events. Variation of the final Pit 23 landform surface from the pre-mining surface has a low likelihood of impacting on adjacent drainage paths and watercourses, with the likelihood quickly decreasing with distance from the pit.

7.2.2 Management

The main management measure to ensure that surface water flows from rehabilitated areas are returned to pre-mining catchments involves the implementation of a final surface design consistent with the pre-mining landscape, with the placement of overburden, subsoil and topsoil being survey-controlled to ensure that the constructed final surface matches the design.

7.2.3 Monitoring

Monitoring to ensure that surface water flows from rehabilitated areas are returned to pre-mining catchments includes:

- topographic survey of the constructed final landform surface;
- delineation of surface water catchments and flow paths from the topographic survey; and
- comparison of the delineated surface water catchments and flow-paths to those that existed pre-mining.

7.3 Restoration of soil profiles and productivity

7.3.1 Assessment of risk

Soils from the Pit 23 footprint and other areas covered by this R&VMP were sequentially stripped and separately stockpiled as topsoil, subsoil and overburden. Soil stockpiles are identified by soil material and original source site. Rehabilitation of the disturbed areas will involve replacement of the soil materials in reverse order (overburden, subsoil and topsoil) to recreate the original soil profile.

While highly unlikely, contamination of soil material with naturally occurring radioactive material (NORM) may cause final surface gamma dose rates to be elevated. Gamma radiation dose rate surveys will be undertaken across the overburden, subsoil and final topsoil surfaces to ensure that final surface gamma radiation dose rates satisfy the requirements of the approved Radiation Management Plan.

The likelihood that the final soil characteristics pose an unacceptable risk to human health, the environment or existing local land uses is therefore negligible.

7.3.2 Management

The management measures relating to soil include ensuring that:

- stockpiled soil materials are correctly:
    - identified; and
    - quantified;
- the final landform design confirms that the desired final landform and soil profile can be constructed with the available soil materials;
- the stockpiled soil materials are replaced in the correct order (overburden, then subsoil, then topsoil) and to the correct thickness to ensure that the final soil profile matches the pre-mining profile;
- where the topsoil has a high clay content that may impede water infiltration, gypsum will be incorporated into its surface;

- the use of scrapers and/or tractor scoops for soil placement will be preferred to minimise over-compaction of the growth medium;
- soil placement will commence from the top of slopes to minimise erosion damage by stormwater run-off from bare upslope areas;
- prior to seeding, the soils may be cross-ripped to encourage rainfall infiltration and minimise run-off; and
- surface gamma dose rate surveys are undertaken across the overburden, subsoil and final topsoil surfaces during rehabilitation and remedial action taken, if required.

These measures will ensure that the characteristics and productivity of the soil materials (particularly the topsoil) are not compromised.

7.3.3 Monitoring

Soil profile assessment will be undertaken in the first year after construction of the final landform, and several years after vegetation establishment to enable assessment of plant root distribution through the profile. Soil profile assessment will involve excavation of soil pits or drilling of auger holes within rehabilitated areas until overburden or natural ground is encountered. Analogue sites will also be established in areas of the Douglas mine site outside the mining footprint. The soil profile will be recorded with all soil horizons described and their location within the profile measured. Soil profiles will be assessed in accordance with the "*Australian Soil and Land Survey Field Handbook*" NCST 2009.

In addition to field observations, soil samples from rehabilitation areas and analogue sites will subject to laboratory analyses for the following:

- pH (1:5 water to solids ratio);
- electrical conductivity;
- rainfall infiltration, topsoil and subsoil moisture content;
- exchangeable cations, Ca, Mg, Na, K and cation exchange capacity;
- exchangeable sodium percentage;
- sulphate;
- chloride; and
- organic carbon.

These results will be used in conjunction with field observations to enable calculation and comparison of the following characteristics for the rehabilitation areas and analogues sites:

- calcium:magnesium ratio;
- plant available water content; and
- electrical conductivity extract.

Soil monitoring will cease when relevant completion criteria have been met.

7.4 Revegetation

7.4.1 Non-native flora

7.4.1.1 Assessment of risk

The objective of revegetation with non-native flora is the return of land to agricultural production. Potential risks associated with re-establishment of agricultural production across the portion of the subject land outside the Pit 23 footprint and associated buffer include:

- agricultural productivity cannot be returned to pre-mining levels; and
- agricultural productivity cannot be maintained with standard agricultural practices.

Since 2007 approximately 50% of the Douglas Mine and 98% of the nearby Echo mine have been rehabilitated to agricultural production using standard agricultural practices. These practices are well understood and proven at site, and hence the risk that the vegetation cannot be established and required agricultural productivity cannot be achieved and maintained is negligible.

7.4.1.2 Management

The management measures to ensure the required level of agricultural production is achieved and maintained are those associated with restoration of the soil profile (section 9.1), and establishment of agricultural pasture species (section 9.3).

7.4.1.3 Monitoring

Monitoring of agricultural productivity will involve undertaking pasture growth measurements, and comparing annual pasture production (t/ha) on the rehabilitated areas to pre-mining levels and/or analogue sites. The monitoring and comparison will be undertaken for 3 years or until the relevant completion criterion are met.

7.4.2 Native flora

This subsection of the R&VMP has been prepared by ecological consultant, GHD.

7.4.2.1 Assessment of risk and control measures

Potential risks associated with establishment of native vegetation across the subject land include:

- the desired vegetation cannot be successfully established; and
- the desired vegetation is not self-sustaining.

Risks to successful establishment of native vegetation across the subject land include:

- browsing by herbivorous animals;
- crowding by weed species;
- poor soil quality (e.g. plantings into overburden material);
- attack by pest insects;
- planted species not suitable for the site; and
- dry seasonal conditions.

Grazing by animals will be prevented by exclusion from revegetated areas by fencing. Insect pests will be controlled using appropriate insecticides, as required. Weeds will be controlled as described in Section 9.4.7. The pre-mining soil profile will be re-constructed as described in Section 7.3 above. Native vegetation plant species will be selected from Ecological Vegetation Classes (EVCs) that naturally occur at or adjacent to the site. If during the first summer after planting, soil moisture levels are considered to be too low to support plant survival the revegetated area may be watered.

Taking these aspects into consideration the risk that native vegetation cannot be successfully established across the Pit 23 footprint and surrounding buffer area is low.

7.4.2.2 Management

To enable the desired end use of the area for biodiversity conservation, revegetation of the Pit 23 area and the surrounding buffer will involve establishment of native vegetation, with species selection being based on the appropriate EVC for the site. A detailed description of the approach for establishment of native vegetation is provided in Section 9.4

7.4.2.3 Monitoring

The newly established native vegetation will be monitored via the establishment of monitoring sites as described below:

Revegetation survey sites – five sites will be established at random locations in the revegetated area. Each survey site will consist of a 40 m long transect and will be surveyed as follows:

- 1 m x 1 m quadrats will be established every 3 m along the transect, starting at 0 m, on one side, giving a total of 14 quadrats. Quadrats will be surveyed for:
    - species composition;
    - species frequency;
    - native foliage cove;r
    - weed cover; and
    - cover of bare ground, organic litter and cryptogam/bryophyte/crust.
- a site quadrat (40 m x 10 m) will be established along the transect. All planted individuals present within 5 m either side of the transect will be recorded to determine species composition, richness and density; and
- photographic monitor points will be established at the start and end of each transect.

Analogue survey sites - have been established according to the above design (without recording species density in the site quadrat) in remnant vegetation in the Red Hill State Forest to allow comparison of rehabilitated areas and sites of undisturbed native vegetation of the appropriate EVC. Revegetation at the Pit 23 area can then be assessed against these 'benchmark' analogue sites.

Timing – Revegetated areas and analogue sites will be monitored annually for the first three years following planting and then at the 5-year and 10-year points. Analogue sites will also be re-monitored if a significant amount of time has passed since establishment.

7.5 Radiation

7.5.1 Assessment of risk

Under Section 22 of the *Radiation Act 2005*, it is an offence to knowingly, recklessly or negligently cause another person to receive a radiation dose that is greater than the prescribed dose limit. Requirements of Iluka's Radiation Management Licence include management actions to ensure doses both during rehabilitation works and following final site rehabilitation, are below the prescribed limit, and are kept As Low As Reasonably Achievable (ALARA).

It can be expected that rehabilitation works will be conducted in compliance with the *Radiation Act 2005* with radiation doses being maintained below prescribed limits in accordance with the approved Radiation Management Plan and Radioactive Waste Management Plan. This situation will also apply following the completion of rehabilitation.

The likelihood of adverse impacts on human health or the environment due to radiation during and following rehabilitation is negligible.

7.5.2 Management

The management measures used to ensure radiation doses during and following final site rehabilitation are below the prescribed limit are regulated by the DHHS under the *Radiation Act 2005*. For the rehabilitation operations undertaken in accordance with this R&VMP these measures primarily involve restriction of access to Pit 23, minimisation of dust emissions from materials within Pit 23, and ensuring that gamma radiation dose rates at the final landform surface are low.

7.5.3 Monitoring

Gamma radiation levels and radon concentrations in rehabilitated areas will be measured:

- following completion of topsoil reinstatement; and
- for at least one year after the topsoil reinstatement.

The results will be used to calculate the radiation dose received by the representative person (the person most affected), which will be compared to the radiation dose limit prescribed under the *Radiation Act 2005*.

Monitoring will cease when the relevant completion criteria demonstrating compliance with the *Radiation Act 2005* have been met to the satisfaction of the DHHS.

8 Rehabilitation Planning

8.1 Landform design criteria

8.1.1 Overview

The final landform will be designed to meet the following criteria:

- a separation of distance of 5m between disposed materials and the final land surface;
- a final land surface that at no point is higher than the highest point on the natural, pre-mining surface; and
- a rehabilitated landform that:
    - o is stable and resistant to wind and water erosion; and
    - o as near as is practicable, resembles the surrounding landform with accurate restoration of pre-mining natural drainage lines ensuring the return of surface water flows to their original sub-catchment.

The pre-mining landform of the area occupied by Pit 23 was stable and resistant to erosion, and in comparison to that landform the Pit 23 final landform will:

- have the same catchment area;
- have the same lack of defined flow paths;
- have similar slopes;
- have the same soil type; and
- be covered with native vegetation that will provide greater resistance to erosion.

The stability and resistance to erosion of the final landform will be, at least, as high as that pre-mining. Areas of land already rehabilitated on the Douglas Mine site provide evidence that stable and erosion resistant landforms can be created using the techniques to be applied to the Pit 23 area.

8.1.2 Catchment area and surface water flows

As noted in section 7.2, the Pit 23 footprint straddles what was a gentle north-south trending ridge that formed a surface water catchment divide. From the top of the ridge, surface water runoff would have predominately flowed to the west and east as overland flow prior to mining, as no defined flow paths existed. The final landform will therefore be designed so that pre-mining flow directions and the lack of defined flow paths will be recreated. There is no catchment area outside the Pit 23 footprint that contributed to or will contribute to surface flows across this area.

8.1.3 Slope gradient

The steepest gradient across the pre-mining surface was approximately 1:30 Vertical:Horizontal (V:H), which occurred in the south-east portion of the Pit 23 area. As no erosion features were evident across the pre-mining land surface, it can be assumed that this grade is stable for this soil type in this region. The final landform of the area currently occupied by Pit 23 will be similar to that of the pre-mining landform and therefore the slopes will be designed to be generally 1:30 (V:H) or less.

8.1.4 Soil types

Soils in the Pit 23 area were characterised as predominantly sandy loam, with some sand in the north-western portion of the pit. Prior to mining, topsoil, subsoil and overburden were sequentially removed and stockpiled. These soils will be sequentially returned to Pit 23 following completion of disposal. The final Pit 23 soil types will therefore be identical to those that occurred prior to mining.

8.1.5 Vegetation

Prior to mining, the Pit 23 footprint was used for mixed cropping/grazing agricultural activities. Following the replacement of overburden, subsoil and topsoil, the soil will be bare for approximately one to two months until a cover crop becomes established. The purpose of the cover crop is to stabilise the soil surface until native tree and shrub species become established. Once established, the native vegetation can be expected to provide greater resistance to erosion than the pre-mining landform, particularly since disturbance of the soil by agricultural activities will be prohibited.

8.2 Conceptual landform design

The general final landform design concept for Pit 23, based on the pre-mining landform and the design criteria described in Section 8.1, is shown in Figure 6. The conceptual final landforms at different locations across Pit 23 compared to approximate pre-mining contours are shown in Figure 7 to Figure 13. The design includes a minimum 5m cover over disposed materials comprising overburden (minimum depth of 4.68m), subsoil (~0.22m depth) and topsoil (~0.10m depth).

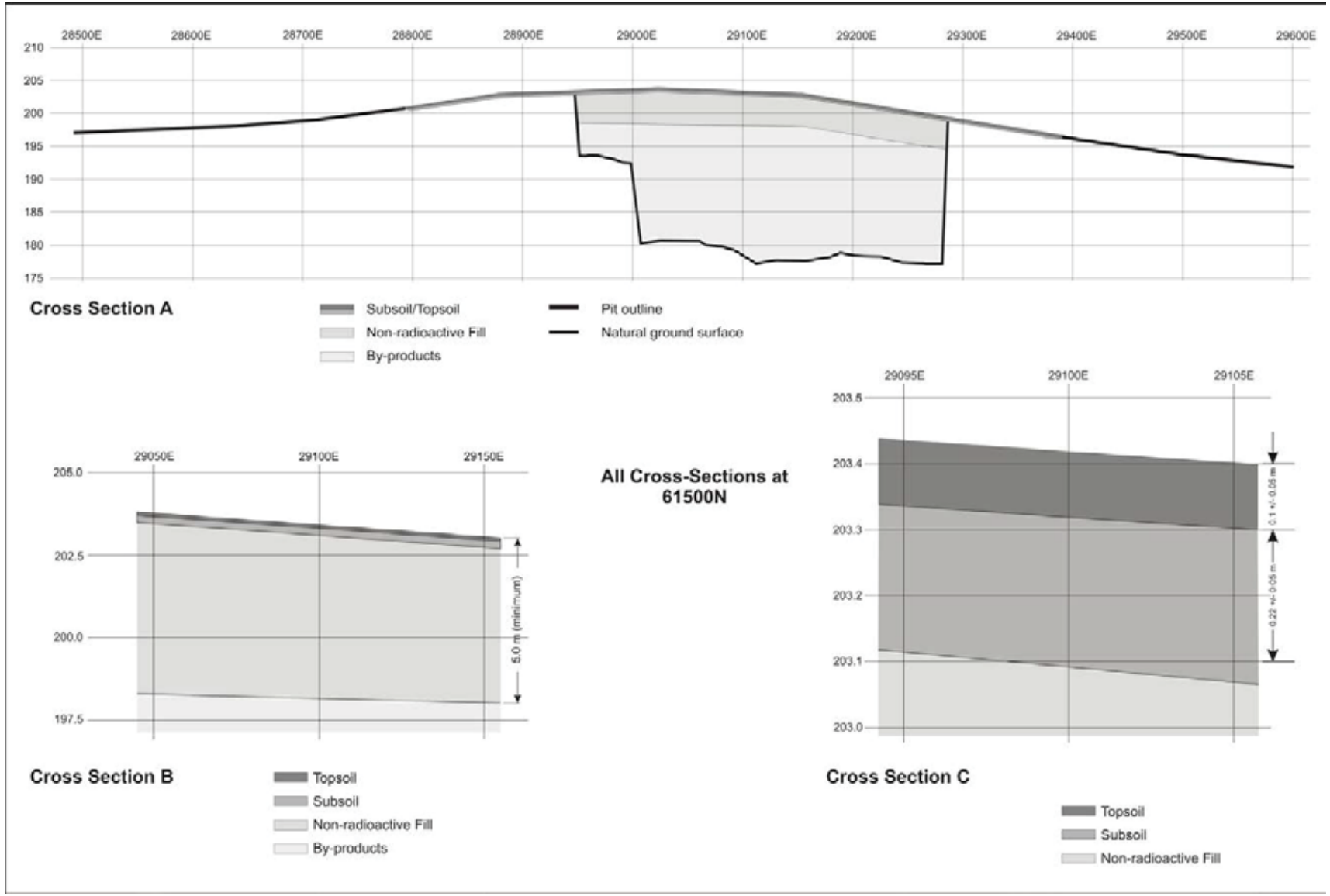


Figure 6: Pit 23 final landform conceptual design

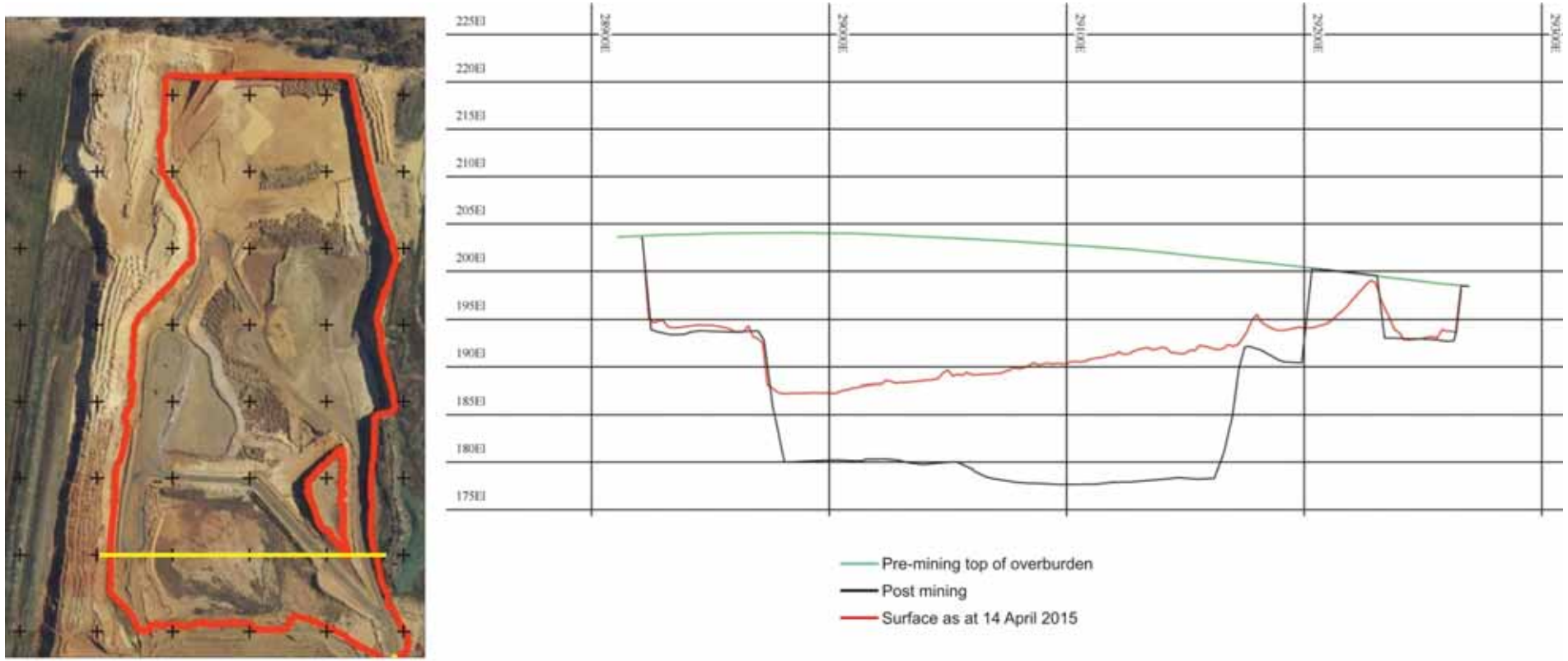


Figure 7: Pit 23 final landform conceptual design at 61300 North

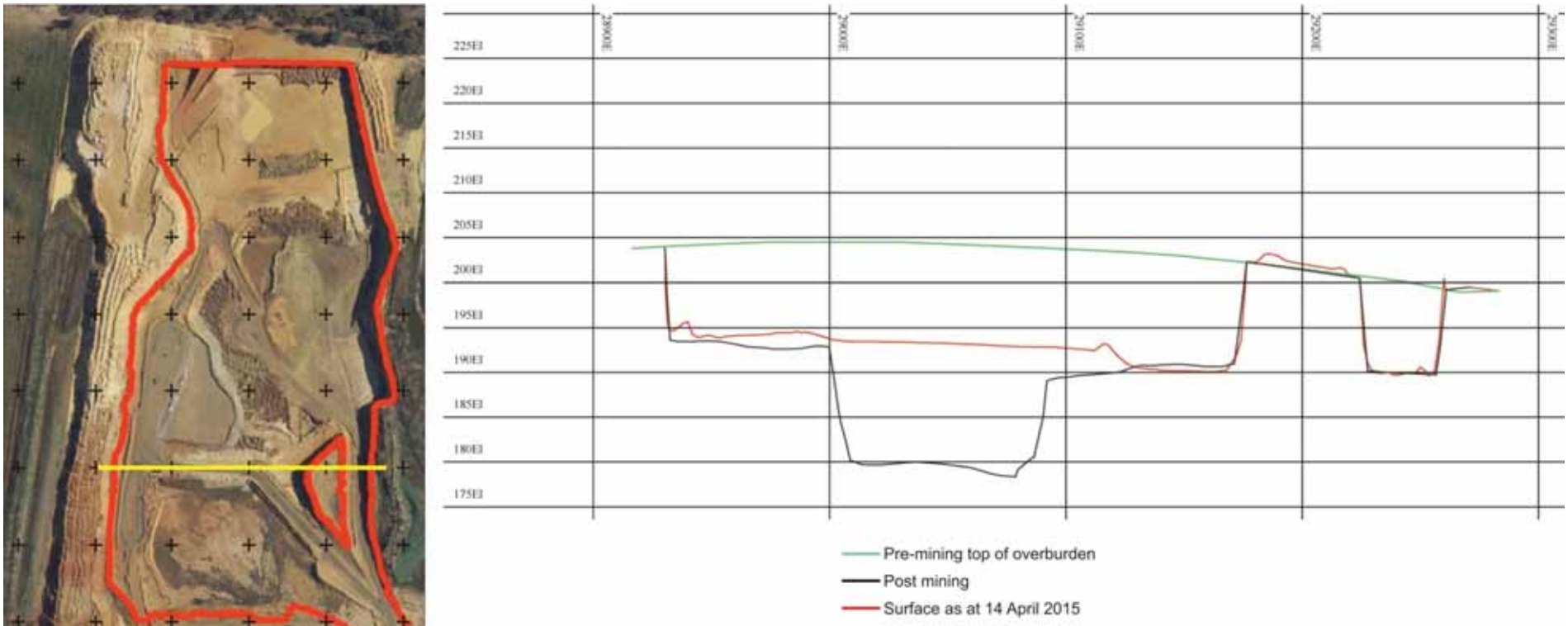


Figure 8: Pit 23 final landform conceptual design at 61400 North

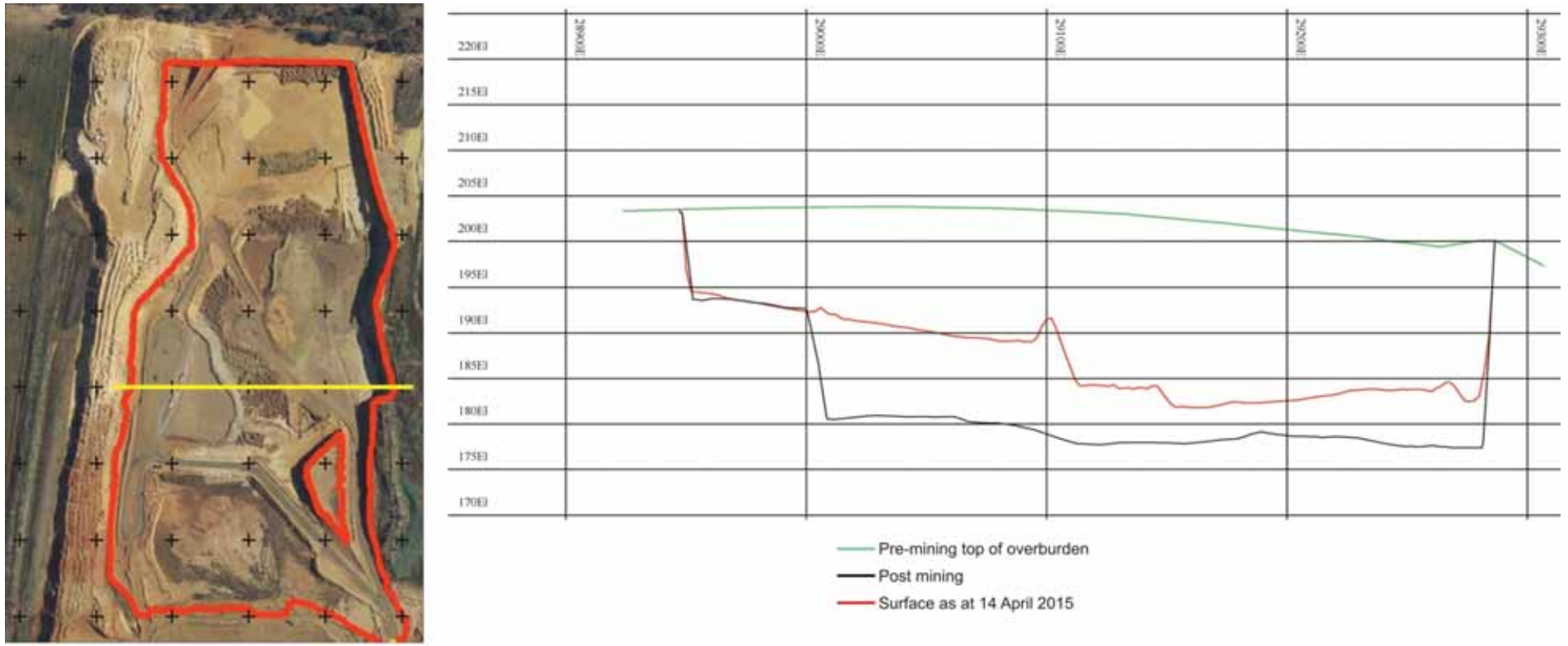


Figure 9: Pit 23 final landform conceptual design at 61500 North

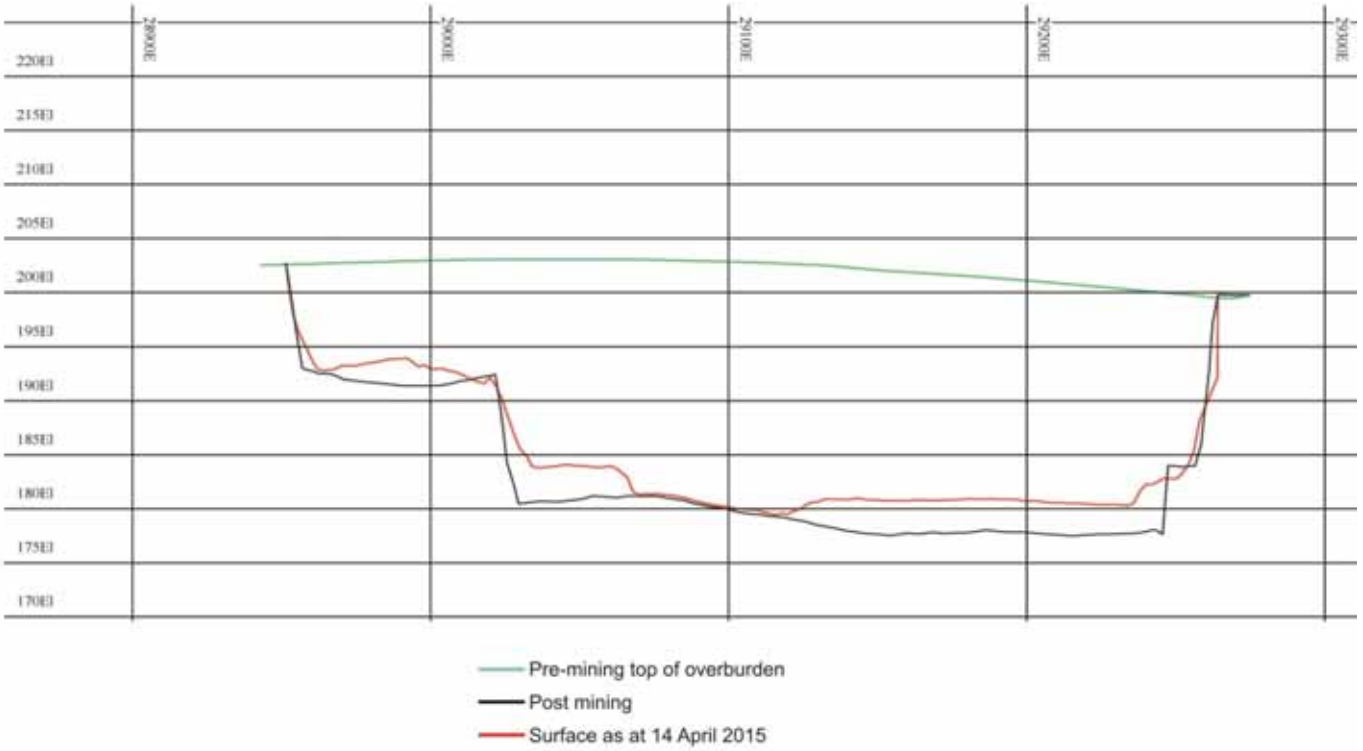


Figure 10: Pit 23 final landform conceptual design at 61600 North

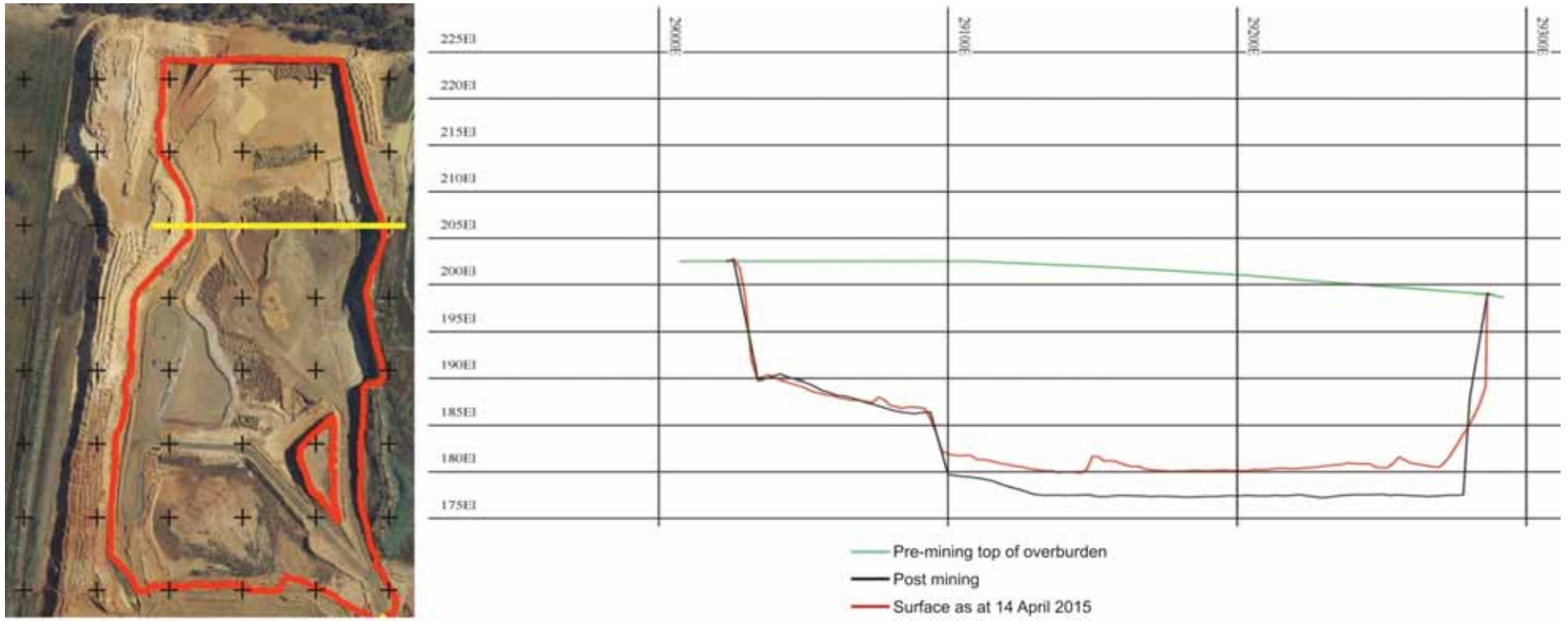


Figure 11: Pit 23 final landform conceptual design at 61700 North

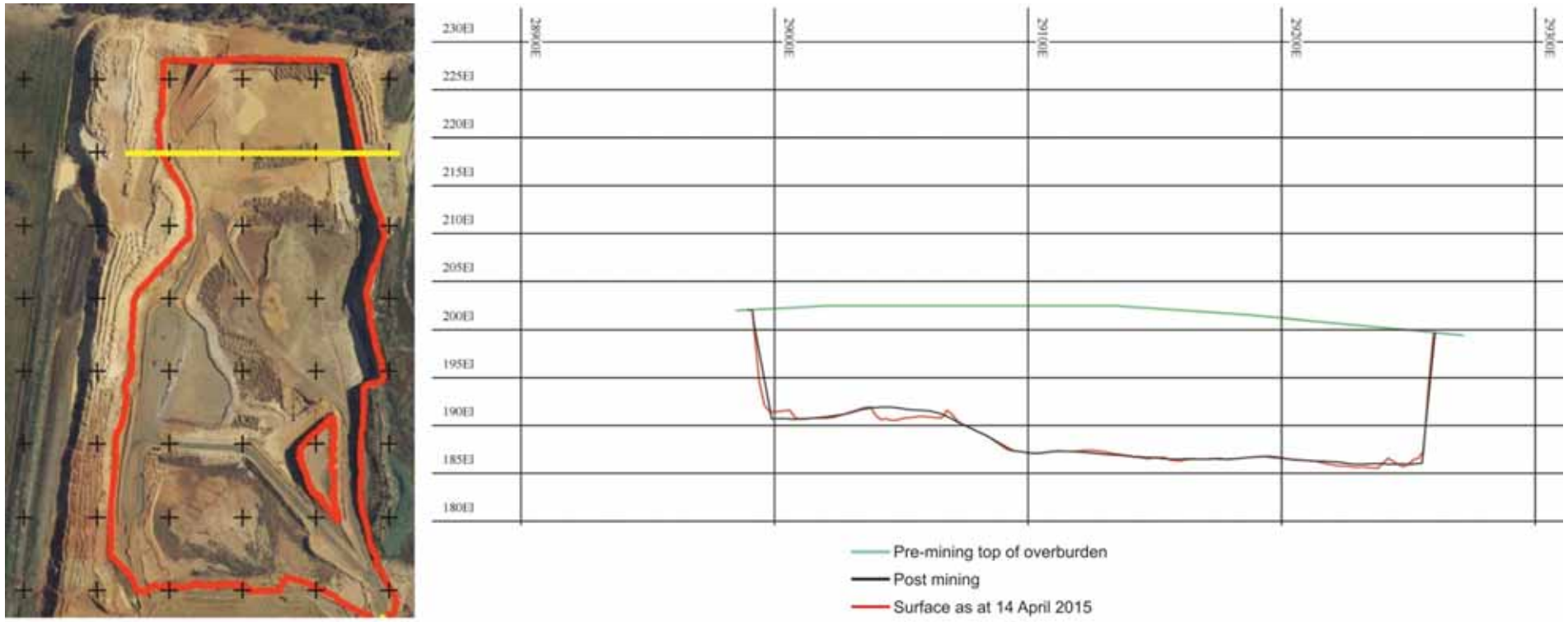


Figure 12: Pit 23 final landform conceptual design at 61800 North

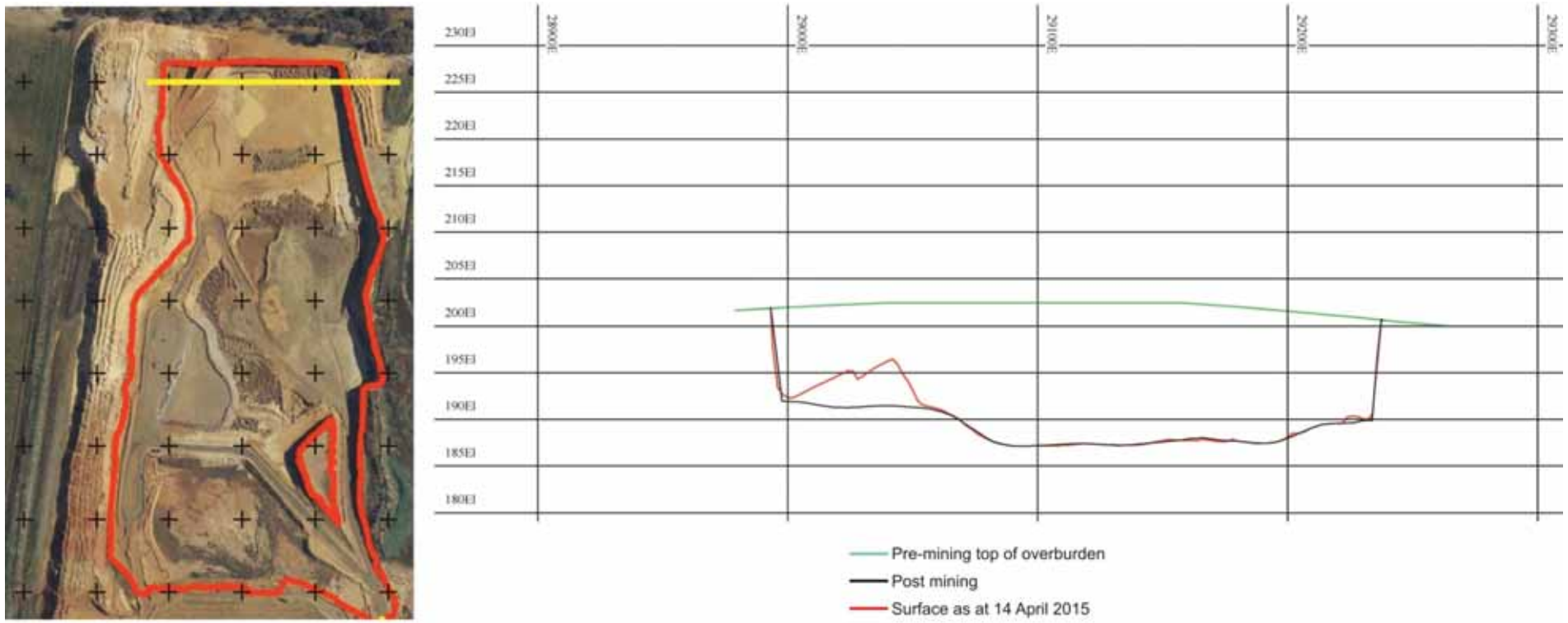


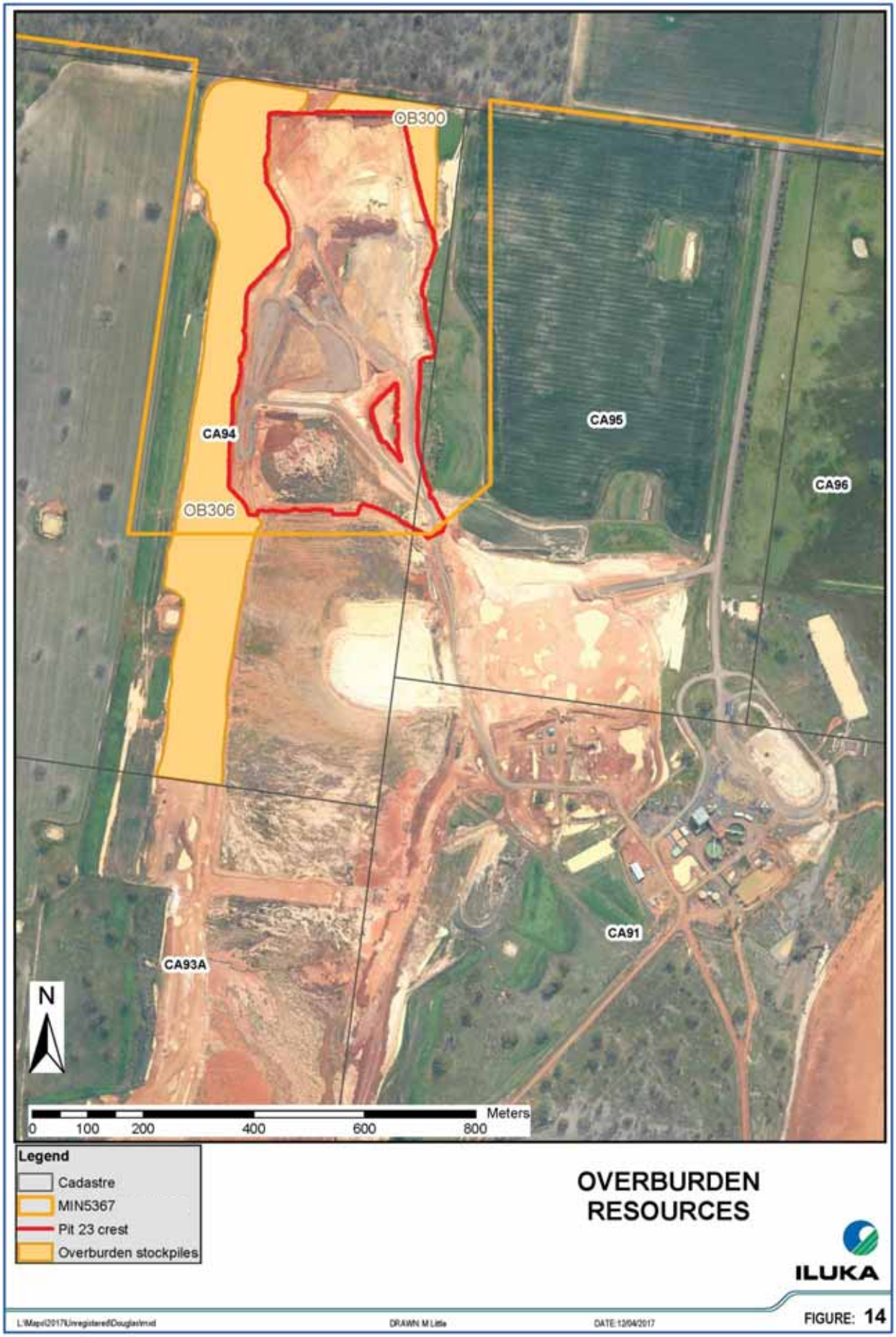
Figure 13: Pit 23 final landform conceptual design at 61900 North

8.3 Materials for rehabilitation of Pit 23 and surrounds

The volumes of material required to backfill Pit 23, establish a minimum 5m cover over the disposed materials and reinstate surface contours approximating the pre-mining landform are shown in Table 3 together with the sources of overburden, subsoil and topsoil. Figures 14 to 16 show the locations of the various stockpiles from which the materials required for rehabilitation of Pit 23 and surrounds will be drawn.

Table 3: Rehabiltation materials for Pit 23 and surrounds

Aspect	Volume (m^3)
Disposal	
Pit 23 void volume as at 10th April 2015	2,840,000
Total planned disposal to Pit 23	1,393,000
Intermediate covering over materials disposed of during disposal	400,000
Pit 23 void volume remaining at the end of disposal	**1,047,000**
Rehabilitation material volumes required	
Overburden for Pit 23 (minimum 4.68 m cover)	**979,800**
Subsoil over Pit 23 area (21 ha at 0.22 m cover)	46,200
Topsoil over Pit 23 area (21 ha at 0.10 m cover)	21,000
Total volume to Pit 23 void	**1,047,000**
Subsoil to Pit 23 surrounds (13.7 ha at 0.22 m cover)	30,140
Total subsoil required	**76,340**
Topsoil to Pit 23 surrounds (17.1 ha at 0.10 m cover)	17,100
Total topsoil required	**38,100**
Total rehabilitation materials required	**1,094,240**
Rehabilitation materials sources	
Overburden	
Overburden Stockpile 300	12,700
Overburden Stockpile 306 (part)	967,100
Total Overburden used	**979,800**
Subsoil	
Subsoil Stockpile 273	998
Subsoil Stockpile 275 (part)	31,284
Subsoil Stockpile 278	15,185
Subsoil Stockpile 279	21,416
Subsoil Stockpile 280	3,307
Subsoil Stockpile 281	4,150
Total Subsoil	**76,340**
Topsoil	
Topsoil Stockpile 393 (part)	17,497
Topsoil Stockpile 396	20,603
Total Topsoil	**38,100**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Pit 23 crest
Overburden stockpiles
OVERBURDEN RESOURCES
ILUKA
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DRAWN: M Little
DATE: 12/04/2017
FIGURE: 14


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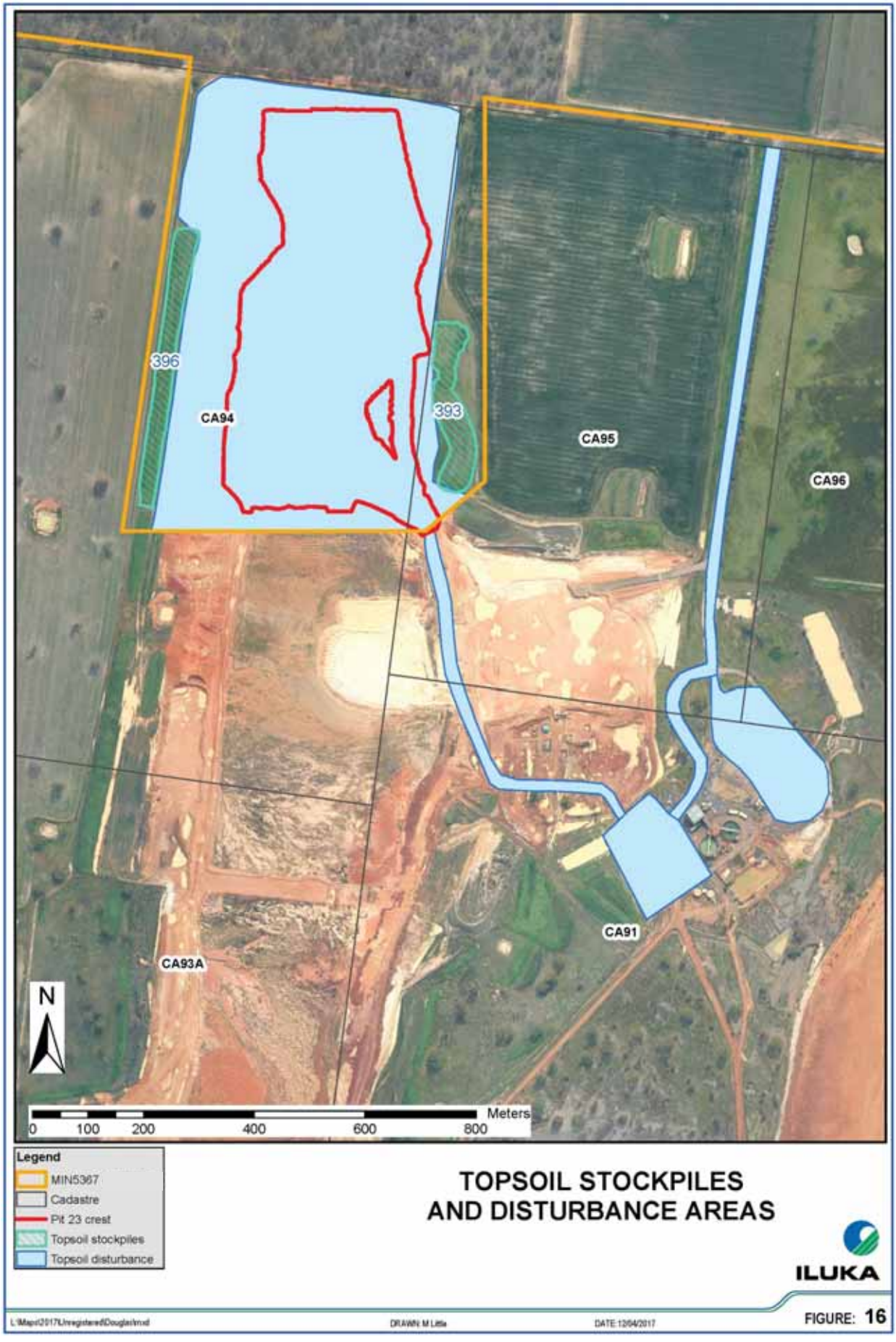
Pit 23 crest
Subsoil stockpiles
Subsoil disturbance
SUBSOIL STOCKPILES
AND DISTURBANCE AREAS
ILUKA
DRAWN: M Little
DATE:4/04/2017
FIGURE: 15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Pit 23 crest
Topsoil stockpiles
Topsoil disturbance
TOPSOIL STOCKPILES
AND DISTURBANCE AREAS
ILUKA
DRAWN: M Little
DATE: 12/04/2017
FIGURE: 16

9 Implementation

9.1 Soil profile restoration

9.1.1 Pit 23 overburden placement

At the completion of disposal, Pit 23 will be backfilled with overburden currently stockpiled in the vicinity of Pit 23. Backfilling of the pit will involve the use of a fleet of earthmoving equipment that may include, from time to time depending on the conditions, the following:

- excavators;
- dozers;
- graders;
- water trucks;
- dump trucks;
- scrapers; and
- tractor scoops / carry graders.

During the backfilling with overburden, clods of clay will be broken up to promote good mixing and compaction. Gypsum will be applied to the overburden surface at a rate determined by chemical analyses and regional experience and mixed into the surface by disc-ploughing. Typically, the top 1m of overburden will be ripped and disc ploughed prior to levelling. The final overburden surface will be trimmed to final design either using dozers and survey markers or using GPS controlled carry-grader and dozers.

During backfilling, surfaces of the overburden stockpiles will be disturbed increasing the potential for wind-blown dust and sediment laden run-off. To minimise the potential impact of dust generation from overburden stockpiles the working face of the stockpiles, the area of which will be kept to a minimum, will be watered so that dust generation during earthmoving is controlled and surfaces will be left wet to promote crust formation.

The techniques used for backfilling Pit 23 will be the same as those used for other pits at the Douglas Mine. These techniques have been found to produce a stable backfill with a very low propensity for subsidence. The overburden has been found to require little compaction beyond earthmoving equipment driving over it and limiting the height of tip heads to four metres or less. The area will be monitored for subsidence and if any does occur remedial works will be completed. The whole of the Pit 23 footprint will be backfilled to the final overburden design surface prior to the replacement of subsoil and topsoil.

9.1.2 Pit 23 subsoil and topsoil placement

Subsoil and topsoil stripped and stockpiled separately at the commencement of mining, will be spread using the following methodology:

- subsoil and topsoil will be placed in layers with the same or similar thickness as the layers of those soils that were present pre-mining;
- where the topsoil has a high clay content that may impede water infiltration, gypsum will be incorporated into its surface;
- the use of scrapers and/or tractor scoops for soil placement will be preferred to minimise compaction of the growth medium;
- soil placement will commence from the top of slopes to minimise the potential for erosion by storm water run-off from bare upslope areas; and

- if required, the risk of excessive dust generation will be reduced, as far as practically possible, by scheduling earthmoving activities to periods when moist but not wet soil conditions prevail.

Subsoil will be applied to the whole of the Pit 23 footprint to the final subsoil design surface prior to the replacement of topsoil. The final subsoil and topsoil surfaces will be trimmed to final design using a GPS machine-controlled carry-grader and dozers. Prior to seeding, the topsoil surface may be cross-ripped to encourage rainfall infiltration and minimise run-off.

9.2 Landform restoration

Rehabilitated landforms will be returned, as near as practicable, to the pre-mining condition. Restored soil surfaces will be surveyed to ensure pre-mining natural drainage patterns have been restored and that surface water flows will be returned to their original sub-catchment.

Where necessary, control measures will be implemented to minimise water erosion prior to establishment of a stabilising vegetative cover. Contour embankments may also be established on restored surfaces to reduce the velocity of runoff and promote pre-mining sheet-flow patterns. Wind erosion will be reduced by scheduling earthmoving required for landform restoration, as far as practicable, to periods when moist, but not wet, soil conditions prevail.

To ensure the final landform is adequately resistant to all forms of erosion, a detailed topographic survey of the Pit 23 area will be conducted at the completion of overburden emplacement with the measured profile being used as input to landform evolution modelling. The modelling will be used to identify any areas that would be susceptible to erosion and to optimise the profile by reducing slopes to eliminate such susceptible areas. If required, changes to the profile will be made prior to or during soil placement.

9.3 Re-establishment of agriculture

9.3.1 Pasture re-establishment

Agriculture is the proposed end use for areas outside the Pit 23 footprint and associated buffer area. The pasture will be re-established using the following methodology:

- apply fertilizer, lime, gypsum or other soil conditioners at a rate determined via soil testing, plant testing and agronomic advice;
- remove any large sticks in the returned topsoil;
- prepare the seedbed using a combination of secondary tillage implements (e.g. offset discs, scarifier, drag and harrows) typically used in the region;
- apply a pasture seed mix, typically consisting of perennial grass species such as phalaris, ryegrass, and incorporation of leguminous species such as subterranean clover to enhance soil nitrogen levels;
- roll the area to provide a firm seed bed for pasture establishment; and
- apply follow up applications of fertiliser, if necessary, consistent with local agricultural practices.

The final pasture species mix and fertiliser regime will be selected on the basis of expert agronomic advice.

In the first spring after sowing, the primary objective will be to develop a stable, productive soil profile by encouraging pasture root development and soil biota. Pasture will be grazed lightly to promote tillering of the ryegrass, an adequate cover of clover, and to control pasture weeds. Grazing of re-established pasture will not be permitted until the pasture has become sufficiently established to avoid both individual plants being pulled from the soil and clodding of the soil surface.

Land capability, established by independent agricultural assessment, will be assessed and compared with that pre-mining and of suitable analogue sites. Grazing intensity will be gradually increased to levels considered appropriate for the district and the seasonal conditions.

After pastures are established, they will be managed according to agricultural practices typical for the region. The primary management considerations are: grazing regime, weed and pest control, and fertiliser inputs.

9.3.2 Pasture weed and pest control

Weed control will primarily be achieved by using grazing regimes that promote pasture growth and discourage pasture weeds. Pastures will be monitored for problem weeds and pests. Where warranted, weeds will be controlled with herbicides. Similarly, where warranted, pests such as red-legged earth mite will be controlled with insecticides.

Invasive or Declared Weeds, if observed, will be spot sprayed with a suitable herbicide. Weed control procedures will follow normal agricultural practices, with agronomic advice sought where necessary.

9.3.3 Fertiliser application

Pastures will be fertilised annually as part of an ongoing maintenance program until soil capability has returned to pre-mining levels. The type, rate and number of fertiliser applications will be determined via soil testing and agronomic advice.

9.4 Native flora revegetation

This subsection of the R&VMP was prepared by ecological consultant, GHD.

9.4.1 Objectives of native vegetation establishment

The objectives for the establishment of native vegetation across the Pit 23 footprint and associated buffer are to:

- enhance landform stability and final surface protection;
- restrict future land use to biodiversity conservation, and thereby reduce the potential for disposed materials to become exposed by human activities; and
- establish a vegetation community that is self-sustaining and resembling the EVCs Plains Woodland (EVC 803) and Higher Rainfall Shallow Sands Woodland (EVC 882_61).

Condition 41 of the Permit specifies “Temporary revegetation or stabilisation of exposed stored overburden” as a requirement of the vegetation component of the R&VMP, however, the revegetation works will not commence until the overburden has been placed in the pit and covered with subsoil and topsoil. No overburden will be exposed or stored as part of the revegetation works.

9.4.2 Initial soil stabilisation

Soil preparation prior to planting will include ripping to promote moisture retention and root penetration.

To minimise the risk of erosion, a cover crop of sterile grass such as Ryecorn will be planted immediately after the replacement of topsoil. The cover crop will provide an erosion resistant surface within one to two months after completing the placement of topsoil.

9.4.3 Selection of native vegetation species

The selection of flora species to be re-established was based on the following:

- the EVCs that were present in the area prior to clearing;

- species present in the Red Hill and Young State Forests immediately to the north of the Pit 23 area (locally indigenous plants);
- the local environment;
- species robustness; and
- ease of propagation and/or likely availability from local populations or regional nurseries,

The publication *Native Vegetation Revegetation Planting Standards – Guidelines for Establishing Native Vegetation for Net Gain Accounting* (NVRPS) provides guidance for revegetation activities to ensure they qualify as native vegetation gain under Victoria's net gain policy. While the objective of the proposed revegetation works across the Pit 23 footprint and associated buffer area is not to achieve a required level of net gain, the guidelines provide useful guidance for selection of appropriate species and determination of survival targets.

Figure 17, obtained from the Biodiversity Interactive Map available on the Department of Environment, Land, Water and Planning (DELWP) website shows that the modelled 1750 EVCs present in the Pit 23 area were:

- Plains Woodland (EVC 803); and
- Higher Rainfall Shallow Sands Woodland (EVC 882_61).

Figure 17: 1750 Ecological Vegetation Classes

Areas of remnant vegetation in the Red Hill State Forest and nearby Youngs State Forest corresponding with the above EVCs were surveyed in May 2017 in order to determine the flora

species present (Appendix A), and to determine those suitable for use in revegetation Five analogue sites were established in either Plains Woodland (T1, T2, T3) or Higher Rainfall Shallow Plans Woodland (T4, T5) in the Red Hill State Forest to inform completion criteria (see Section 10.1). The location of the analogue sites is shown in Table 4 and in Figure 18, and the species present are listed on Appendix A and Appendix B.

Table 4: Location of analogue vegetation survey sites

Survey site name	Geographic locatione - Start		Geographic Location - End	
	Easting (m)	Northing (m)	Easting (m)	Northing (m)
T1	568,766	5,894,074	568,764	5,894,114
T2	569,140	5,892,252	569,115	5,892,260
T3	569,080	5,892,366	569,092	5,892,405
T4	568,867	5,892,714	568,908	5,892,731
T5	568,860	5,893,182	568,863	5,893,152

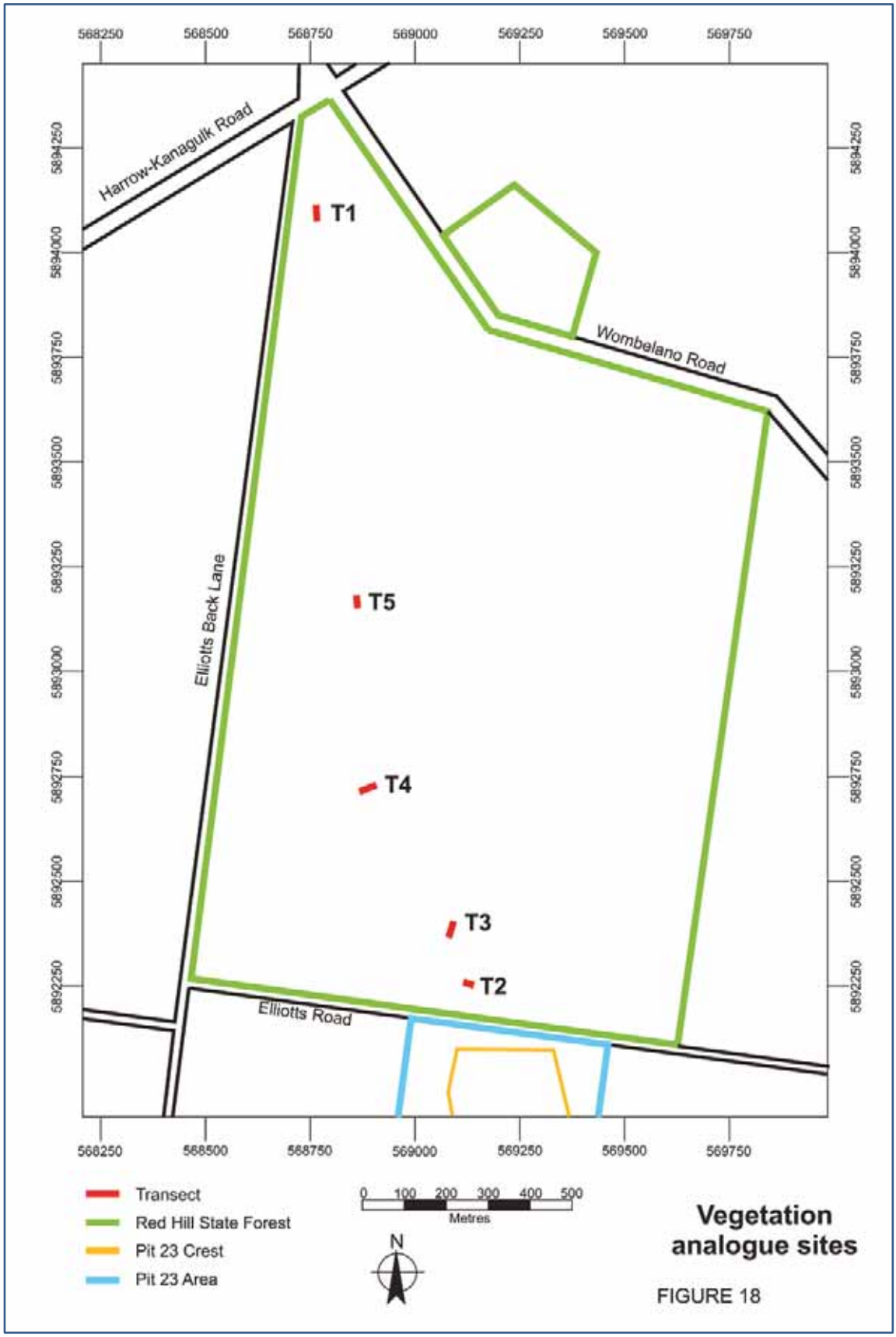
The difference between these two EVCs in the local region in terms of species composition and structure is often subtle, and the pre-1750 mapping is not always accurate. Additionally, while the original upper soil profile is to be recreated, it is recognised that the structure and condition is likely to be somewhat modified from what it would have been prior to mining. Given the substrate requirements or preferences of different species, it was determined that appropriate species to be reinstated should be selected from a mix of those typical of either one or both of these two EVCs.

The species recorded within the appropriate areas of the remnant vegetation, together with species listed on the EVC benchmarks for the Wimmera bioregion, were used as input to determine an appropriate mix of species for the revegetation schedule. While the understorey of both Plains Woodland (EVC 803) and Higher Rainfall Shallow Sands Woodland (EVC 882_61) are both dominated by graminoids and forbs, given the difficulties in restoring native grasses and other graminoids, and the prevalence of weed species around the Douglas Mine, the most practical means of maintenance dictates that the revegetation will focus on reinstating the tree and shrub layers.

This is consistent with the document, Native *Vegetation Revegetation Planting Standards-Guidelines for Establishing Native Vegetation for Net Gain Accounting* (NVRPS), which indicates that revegetation standards will generally require the use of woody species only. Native grass seed sourced from wild stands often has low viability, and the seedlings of many grasses grow slowly and compete poorly with weeds, as such reliable and cost-effective large-scale establishment methods are not available for most native grasses. The addition of a few small patches of grassier understorey will create habitat heterogeneity to promote faunal diversity.

The guidelines recommended in the NVRPS, were used to determine appropriate planting densities for different life-forms. As the NVRPS is aimed at establishing a particular EVC, the EVC adopted for application of the standards in determining target densities was the Higher Rainfall Shallow Sands Woodland (EVC 882_61) rather than the Plains Woodland (EVC 803), as it has a naturally higher composition of shrubs. The higher shrub density will aid revegetation success by reducing weed establishment. Plains Woodland (EVC 803), however, was adopted in application of the NVRPS for the large tufted graminoid target density. The goal is that the revegetated area will meet the objective of a self-sustaining vegetation community resembling the EVCs Plains Woodland (EVC 803) and Higher Rainfall Shallow Sands Woodland (EVC 882_61).

The plant species to be used in the revegetation, along with target number of plants per hectare are shown in Table 5, delineated by eucalypt trees, other (non-canopy} trees, medium shrubs, and small shrubs and other lifeforms < 1 m. Species selection and density is expanded upon below.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5892500
5892250
Harrow-Kanagulk Road
Wombelano Road
Elliotts Back Lane
Elliotts Road
T1
T2
T3
T4
T5
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Red Hill State Forest
Pit 23 Crest
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Vegetation analogue sites
FIGURE 18

Table 5: Native flora species to be established

Life Form	Species	Common name	Target no. of plants/ha	Proportion	No. of plants/ha	Planting Notes	Number of plants in 23ha area of Pit 23 and surrounds
Eucalypt trees	*Eucalyptus leucoxylon*	Yellow Gum	100	0.6	60	Scattered	1,380
	Eucalyptus melliodora	Yellow Box		0.2	20	Scattered	460
	Eucalyptus microcarpa	Grey Box		0.2	20	Scattered	460
Other Trees	*Allocasuarina luehmannii*	Buloke	50	0.5	25	Scattered	575
	Allocasuarina verticillata	Drooping Sheoke		0.5	25	Scattered	575
Medium Shrubs (>1m)	*Acacia acinacea*	Gold-dust Wattle	600	0.2	120	Scattered	2,760
	Acacia myrtifolia	Myrtle Wattle		0.2	120	Scattered	2,760
	Acacia pycnantha	Golden Wattle		0.2	120	Scattered	2,760
	Bursaria spinosa	Sweet Bursaria		0.2	120	Scattered	2,760
	Calytrix tetragona	Common Fringe-myrtle		0.2	120	Scattered	2,760
Small Shrubs (<1 m) (and climbers)	*Dillwynia sericea*	Showy Parrot-pea	1000	0.25	250	Loose clusters of 3-10 individuals	5,750
	Eutaxia microphylla	Common Eutaxia		0.25	250	Loose clusters of 3-10 individuals	5,750
	Kennedia prostrata	Running Postman		0.25	250	Loose clusters of 3-10 individuals	5,750
	Clematis microphylla	Small-leaved Clematis		0.25	250	Scattered	5,750
Large Tufted Graminoid (Grasses and grass-like tussocks <1 m)	*Austrostipa mollis*	Supple Spear-grass	500	0.5	250	Dense clusters of 10-20 individuals planted at 4/m^2	5,750
	Dianella revoluta	Black-anther Flax-lily		0.5	250	Dense clusters of 10-20 individuals planted at 4/m^2	5,750
TOTAL			2250				51,750

Eucalypt trees

The two appropriate EVCs are both woodland communities characterised by the canopy species *Eucalyptus leucoxylon* (Yellow Gum}, and/or *Eucalyptus melliodora* (Yellow Box) and/or *Eucalyptus microcarpa* (Grey Box). These species were all present at one or more of the analogue survey sites. As such, these species are the target canopy species for revegetation. At the analogue survey sites, Yellow Gum is typically the dominant species, particularly immediately adjacent to the revegetation area. As such, this species should be the dominant *Eucalyptus* species in the revegetation.

The NVRPS indicates a target for revegetation of overstorey trees as 50 plants/ha for woodlands and 100 plants/ha for dry forests. Analogue survey sites T1, T2, T3 and T5 were established in relatively mature stands of woodland. Therefore, these sites were used to inform target canopy tree density. The average tree density at these sites was 87 ± 17 trees/ha. As such an appropriate target Eucalypt tree density was determined to be 100 plants/ha.

Sheoak trees

Plains Woodland (EVC 803) typically contains *Allocasuarina luehmannii* (Buloke) in the tree canopy, while Shallow Sands Woodland (EVC 882_61) typically contains *Allocasuarina verticillata* (Drooping Sheoak) in the understorey tree layer. Drooping Sheoak was present at the two Shallow Sands Woodland analogue survey sites, and while Buloke was not present at the analogue survey sites, it was observed in the broader area in Youngs State Forest. Given that Buloke is listed as threatened under the *Flora and Fauna Guarantee Act 1988* and that the intended use of the revegetation area is conservation, it is considered appropriate to reinstate this species in the revegetation.

The NVRPS indicates a target for revegetation of understorey trees as 50 plants/ha for the Shallow Sands Woodland (EVC 882_61). An appropriate target Sheoak density (Buloke and Drooping Sheoak combined) was therefore determined to be 50 plants/ha.

Medium shrubs

The revegetation will focus on reinstating trees and shrubs from the two appropriate EVCs. Species recorded in the analogue sites that are unsuitable for revegetation due to being very difficult or expensive to either propagate, establish or keep alive were excluded from consideration. Five medium shrub species were selected to be reinstated. Three of these species, *Acacia myrtifolia* (Myrtle Wattle), *Bursaria spinosa* (Sweet Bursaria), and *Calytrix tetragona* (Common Fringe-myrtle) were recorded at one or more of the analogue sites. The other two species selected, *Acacia acinacea* (Gold-dust Wattle) and *Acacia pycnantha* (Golden Wattle) were observed elsewhere locally in the Red Hill State Forest or the Youngs State Forest. All species are appropriate for either Plains Woodland (EVC 803) and/or Shallow Sands Woodland (EVC 882_61) and suitable for revegetation.

The density target for medium shrubs was based on the NVRPS, rather than the analogue sites, to reflect the fact that the revegetation will be designed to be shrubbier than the analogue sites. The NVRPS indicates a target for revegetation of medium shrubs as 600 plants/ha for Higher Rainfall Shallow Sands Woodland (EVC 882_61).

Small shrubs and climbers

The revegetation will focus on reinstating trees and shrubs from the two appropriate EVCs. Species recorded in the analogue sites that are unsuitable for revegetation due to being very difficult or expensive to either propagate, establish or keep alive were excluded from consideration. Four small shrub or climber species were selected to be reinstated. Two of these species, *Dillwynia sericea* (Showy Parrot-pea) and *Kennedia prostrata* (Running Postman) were recorded at one or more of the analogue sites. The other two species selected, *Eutaxia microphylla* (Common Eutaxia) and *Clematis microphylla* (Small-leaved Clematis) are known to occur in the local area and are appropriate for either Plains Woodland (EVC 803) and/or Shallow Sands Woodland (EVC 882_61), and suitable for revegetation.

The density target for small shrubs and climbers was based on the NVRPS, rather than the analogue sites, to reflect the fact that the revegetation will be designed to be shrubbier than the analogue sites. The NVRPS indicates a target for revegetation of small shrubs as 1000 plants/ha for Higher Rainfall Shallow Sands Woodland (EVC 882_61).

Tufted Graminoids

The NVRPS indicates a target for revegetation of large tufted graminoids as 1000 plants/ha for Plains Woodland (EVC 803). *Austrostipa mollis* (Supple Spear-grass) and *Dianella revoluta* (Black-anther Flax-lily) were recorded at one or more of the analogue sites, and are two of the more robust tufted graminoids suitable for revegetation.

9.4.4 Provenance

Naturally occurring remnant vegetation is usually the best source of material for revegetation. Locally indigenous seed is to be sourced, where possible, from within 50 km of the site. Local collection will ensure that the seedlings will be naturally adapted to local conditions, and that the genetic integrity and unique characters of local remnants are maintained, enhancing biodiversity. The following should be adopted where possible:

- local plants that are in healthy and viable natural populations and that are large enough to provide sufficient seed;
- the target species is uniformly distributed, with a mature seed crop;
- correct plant identification;
- collect seed from at least 10 to 20 widely spaced, healthy parent plants across the population, collecting similar quantities from each plant; and
- aim to collect from genetically unrelated plants, i.e. from plants that are unlikely to be breeding with one another. Collect seed from plants that are separated by a distance of at least twice the plant height.

9.4.5 Native vegetation establishment

As a result of the agricultural land use prior to mining, the replaced topsoil is likely to have significant levels of agricultural and weed species seed present. Weed control work will be undertaken in the summer and prior to planting. Weed control measures are described in section 9.4.7.

Planting of native vegetation will comprise of 200 cm^3 tubestock, with seedlings to have a minimum stem height of 25 cm, and a well-developed, healthy root system that occupies the full pot volume. Note the minimum stem height criterion does not apply to *Kennedia prostrata* and *Clematis microphylia*.

Planting will be carried out in late autumn or early spring to allow plants to become established prior to the dry summer months. Planting will occur at the density required to achieve the targets provided in Table 5.

If soil moisture levels are considered to be too low to support plant survival, the revegetated area will be watered as required during the first summer after planting.

9.4.6 Sourcing tubestock

A list of suitable example nurseries, in operation at the present time, for provision of tubestock is provided in Table 6. Contact with nurseries will be made well in advance of planting requirements to ensure that a suitable supply of the required species is available. These specialist indigenous plant nurseries can be contacted to provide advice on seed collection, storage, and germination requirements.

Table 6: Indigenous nurseries of the region

Names	Address	Contact	Email
Arboline Pty Ltd	124 Lodge Road Hamilton, Victoria	Jenny Hurse or Keith Cumming 03 5572 4018 or 03 5572 5044	arborline@bigpond.com www.arborline.com.au
ERA Nurseries	PO Box 684 Hamilton, 3300	Ted Allender or Peter Sando 03 5572 2123	eranurs@bigpond.net.au www.eranurseries.com.au
Wail Nursery	PO Box 620 Horsham, 3402	Vern Hallam 03 5389 1733	wail@ozist.com.au
Hamilton Farm Trees	Kennedy Steet Hamilton, 3300	John Betts 03 5572 1232	

9.4.7 Weed control

The weed species identified as present in the local area and posing the highest threat to the revegetation success are *Phalaris aquatica* (Toowoomba Canary-grass), *Dittrichia graveolens* (Stinkwort), *Helminthotheca echioides* (Ox-tongue), *Chrysanthemoides monilifera* (Boneseed) and *Asparagus asparagoides* (Bridal Creeper). Stinkwort and Ox-tongue are early colonising species of bare ground which will compete with seedlings for water and nutrients. Boneseed and Bridal Creeper are highly invasive environmental weeds of national significance. Toowoomba Canary-grass commonly spreads from pastures, road verges and drainage ditches into adjacent indigenous vegetation where it can exclude the ground flora and impede recruitment.

Weeds will be managed in the implementation phase by the following means:

- three months prior to planting, the entire area destined for native revegetation will be sprayed with herbicide by a suitably qualified operator. The initial spraying will be followed up by spraying four weeks prior to planting;
- cleaning and inspection of vehicles prior to travelling to the site; and
- herbicide spraying or scalping of weeds from operational areas, and from topsoil stockpiles.

To limit any potential of spray drift and impact to native plants through the root zones, only Glyphosate formulations will be used to control weeds in the operational areas.

The monitoring and management actions for weeds described within section 9.2 of the EMP apply during the rehabilitation phase at the site.

Monitoring for weeds will include site inspections to identify potential weed infestations, provide the scope for weed control programs, and to assess the success of such programs (see Section 11.2).

Vehicle hygiene requirements are detailed within section 9.3 of the EMP.

9.4.8 Feral animal control

The monitoring and management actions for feral animals described within section 9.4 of the EMP apply during the rehabilitation phase at the site.

9.4.9 Protection of established vegetation

The boundary of the native vegetation established across the Pit 23 footprint and surrounding buffer area will be fenced to exclude stock and rabbits. The fencing will consist of 100 mm galvanised steel pipe strainer posts with steel pipe stays, steel picket posts, four plain wires and rabbit netting.

Steel farm-style gates will be included within the fence alignment to enable vehicular access for monitoring and management activities. The gates will also have rabbit netting installed to prevent rabbit ingress.

9.4.10 Land use restrictions

As outlined in Section 5.1, the land use of the revegetated Pit 23 area will be restricted to biodiversity conservation through an agreement made under Section 173 of the PE Act. The status of the revegetated area will be reinforced through signage to inform the general public of the conservation status of the area and restrictions on activities such as collecting firewood and removing organic material.

9.4.11 Bushfire risk reduction

Prior to establishment of native vegetation across the Pit 23 footprint and associated buffer area a Bushfire Risk Assessment of the proposed revegetation area will be conducted in collaboration with representatives of the Responsible Authority, the Country Fire Authority (CFA) and DELWP.

9.5 Decommissioning

9.5.1 Overview

Plant, equipment and infrastructure associated with development and use will be retained during the rehabilitation phase until no longer required. These plant, equipment and infrastructure comprise:

- mobile equipment (trucks and earthmoving equipment);
- the truck washing facility that includes pumps, pipes, sprays, tanks, steelwork and concrete;
- office;
- an ablutions block;
- roads, car parks and hard stand areas;
- surface water diversion, direction and collection facilities such as bunds, channels, pipes, pumps and ponds.

Prior to decommissioning, the Responsible Authority and neighbouring landowners will be consulted to determine if any plant, equipment or infrastructure is of value to the proposed end use. All items of plant, equipment and infrastructure not required for the proposed end use will be decommissioned as described in Sections 9.5.2 to 9.5.5. The land formerly occupied by plant, equipment and infrastructure will then be rehabilitated to enable agricultural use.

9.5.2 Mobile equipment

Decommissioning of mobile equipment will include:

- thorough cleaning to remove any by-products and other potential sources of contamination;
- testing for the presence of radioactive materials in accordance with the requirements of the Radiation Management Plan approved under the *Radiation Act 2005* ; and
- removal from site.

9.5.3 Fixed equipment

Decommissioning of fixed equipment will include:

- complete dismantling and thorough washing;
- sorting into the following categories:
  - suitable for reuse within Iluka's operations;
  - suitable for sale (reuse);
  - suitable for sale as scrap (recycle); and

- requiring disposal, either:
  - concrete or steel contaminated with NORM. Such material will be disposed of into Pit 23 or otherwise in accordance with the *Radiation Act 2005* with the approval of the DHHS; or
  - concrete or steel not contaminated with NORM. Such material will be disposed of at a suitably licenced facility off-site;

- removal from site of all items suitable for reuse, sale, recycle or disposal to an off-site facility;
- testing of the area for NORM contamination and, if material is found to produce a dose greater than the prescribed limit, removal for disposal into Pit 23 or otherwise in accordance with the *Radiation Act 2005* with the approval of the DHHS;
- ripping of compacted areas;
- placement of subsoil and topsoil; and
- re-vegetation.

Following completion of disposal of materials from off-site locations, the level of activity at the site will reduce significantly and the office, ablution facilities and parking area at the locations shown in Figure 4 will no longer be required. From this point in time the office functions will be performed at house known as “Chadwick’s” that is located on Wombelano Road. This will enable the land occupied by the office and ablution facilities to be decommissioned as described above and the associated parking areas to be decommissioned as described below.

9.5.4 Roads, car parking areas and hardstand areas

Decommissioning of roads, car parking areas and hardstand areas not required for the end use will include:

- testing of the area for NORM contamination and, if material is found to produce a dose greater than the prescribed limit, removal for disposal into Pit 23 or otherwise in accordance with the *Radiation Act 2005* with the approval of the DHHS;
- ripping of compacted areas;
- placement of subsoil and topsoil; and
- re-vegetation.

9.5.5 Water diversion bunds, channels and ponds

Decommissioning of water diversion bunds, channels and ponds not required for the end use will include:

- controlled discharge of water from collection ponds to transfer all water to the Fresh Water Dam;
- testing of the areas for NORM contamination and, if material is found to produce a dose greater than the prescribed limit, removal for disposal into Pit 23 or otherwise in accordance with the *Radiation Act 2005* with the approval of the DHHS;
- reshaping of bunds and filling of channels;
- as far as practical, reinstating pre-mining flow paths;
- ripping of compacted areas;
- placement of subsoil and topsoil; and
- re-vegetation.

10 Completion criteria

Completion criteria have been established for evaluating the progress and success of rehabilitation. Completion criteria for aspects other than native flora revegetation have been developed based on Iluka's experience in undertaking rehabilitation elsewhere on the Douglas Mine site and on similar sites elsewhere in Australia. These completion criteria consider:

- approval conditions;
- Iluka's rehabilitation objectives;
- site-specific characteristics and limitations; and
- baseline environmental data and/or analogue site data.

The completion criteria for rehabilitation, excluding those for native revegetation and landform function, are shown in Table 7.

The completion criteria for the assessment of native flora revegetation and landscape function have been defined by ecological consultant, GHD, as described in Sections 10.1 and 10.2, respectively.

Table 7: Rehabilitation completion criteria, monitoring and remedial actions excluding native vegetation

Aspect	Objective	Completion criteria	Evidence required to demonstrate achievement	Monitoring regime	Relevant section in Management Plan	Remedial actions (if required)
Landform	The restored landform is structurally stable, resists erosion (comparable to surrounding landscape) and is visually compatible with the surrounding landscape	CC01: No point on the finished surface higher than the highest point of the pre-mining surface	Post-rehabilitation survey of landform shape and slope	Topographical survey to be completed at any time following completion of overburden, subsoil and topsoil replacement. Annual survey of rehabilitated Pit 23 to detect movement or subsidence that results in any completion criteria not being met.	R&VMP Section 7.1	Remedial earthworks as required to establish design landform until criteria are met
		CC02: Landform shapes are compatible with surrounding topography				
		CC03: No slope >10% variance from landform design	'As constructed' survey of final landform compared with design			
		CC04: Erosion rates comparable with pre-mining landscape as vegetation establishes	Comparison of surface erosion features with surrounding geomorphologic features as measured by LFA	Annual monitoring of erosion as part of LFA. Event based monitoring (e.g after significant storm rainfall event) as required.	R&VMP Section 10.2	Remedial earthworks as required to stabilise erosion
Soil	Soil characteristics do not pose an unacceptable risk to human health, the environment or existing local land uses	CC05: Replaced topsoil and subsoil profile and function are established in reference to original conditions	Records of subsoil and topsoil placement and thickness Soil sampling and analysis	Soil profile assessment at rehabilitated areas and relevant analogue sites within first 12 months of replacing topsoil.	R&VMP Section 7.3	Remedial earthworks as required to achieve design topsoil and subsoil function
				Final assessment of rehabilitated soil profile several years after the establishment of vegetation to record root distribution through the profile.		
		CC06: Rainfall infiltration and topsoil and subsoil moisture content within 10% to analogue sites	Survey of topsoil and subsoil moisture at rehabilitation and analogue sites	Annual measurement of topsoil and subsoil moisture content at rehabilitation and relevant analogue sites	R&VMP Section 7.3	Remedial earthworks as required to reduce runoff and promote infiltration

Aspect	Objective	Completion criteria	Evidence required to demonstrate achievement	Monitoring regime	Relevant section in Management Plan	Remedial actions (if required)
		CC07: Surface soil function is re-established and is comparable to analogue sites	Survey of soil function as measured by LFA	Annual monitoring of soil surface conditions along transects orientated down-slope as part of LFA.	R&VMP Section 10.2	Remedial earthworks as required to achieve topsoil and subsoil function
Surface water	Surface water runoff does not adversely affect uses of surface waters or the environment or existing local land uses	CC08: Surface water run-off to be such that receiving waters are in in compliance with State Environment Protection Policy (SEPP) - Waters of Victoria	Sampling and analysis of surface water runoff	Following the establishment of vegetation, runoff from rehabilitated areas will be collected during and after rainfall events in accordance with the SWMMP (Section 7.6 of the EMP).	EMP Section 7	Refer to EMP Section 7.7.3.
Groundwater	Groundwater quality does not adversely affect groundwater uses, the environment or existing local land uses.	CC09: Groundwater quality adjacent to (downstream of) Pit 23 is confidently predicted to remain consistent with the Segment C protected beneficial uses of the State Environment Protection Policy (SEPP) – Groundwaters of Victoria	Sampling and analysis of groundwater	Groundwater sampling and analysis in accordance with the GWMMP (Section 6 of the EMP)	EMP Section 6	Refer to EMP Section 6.6
Agricultural production	Agricultural productivity is comparable to pre-operational levels and/or analogue sites and can be maintained though standard agricultural practices	CC10: Pasture growth rates equal to that of analogue sites	Third-party agronomic report	Annual pasture production (t/ha) for three years or until criterion met	R&VMP Section 7.4.1	Agronomic assessment of pasture establishment and fertiliser application regime
			Soil survey report	Soil survey three years after earthworks completed	R&VMP Section 7.4.1	Soil amelioration if required

Aspect	Objective	Completion criteria	Evidence required to demonstrate achievement	Monitoring regime	Relevant section in Management Plan	Remedial actions (if required)
Public health and safety	The site does not pose an unacceptable risk to the public, native fauna and domestic livestock	CC11: Infrastructure removed (or retained in accordance with agreed plan)	Audit/inspection report by the Responsible Authority	Audit/inspection of infrastructure by the Responsible Authority following decommissioning	EMP Section 9.6	Refer to EMP Section 9.6.2
Radiation	Doses following final site rehabilitation, are below the prescribed limit	CC12: Surface radiation levels resulting in doses below that prescribed under the *Radiation Act 2005*	Post-rehabilitation surface gamma radiation survey and radon monitoring data indicating that *Radiation Act 2005* criteria has been met	Surface gamma radiation measured following final topsoil replacement. Radon monitoring conducted for at least one year after the replacement of topsoil	Section 7.5	Consultation with DHHS to determine any remediation requirements

10.1 Native revegetation completion criteria

This subsection R&VMP was prepared by ecological consultant, GHD.

Analogue survey sites have been established in remnant vegetation in Red Hill State Forest to allow comparison of rehabilitated areas with sites of 'undisturbed' native vegetation of the appropriate EVCs. (see Figure 18) Revegetation progress at the mine site will then be assessed against these 'benchmark' analogue sites.

Analogue sites were established in areas identified as Plains Woodland (EVC 803) and Higher Rainfall Shallow Sands Woodland (EVC 882_61) in the Red Hill State Forest in May 2017 (see section 9.4.3). Five sites were established, with three in Plains Woodland (EVC 803) and two in Shallow Sands Woodland (EVC 882_61) Figure 18). The sites were surveyed according to the design and method shown in section 7.4.2.3.

Flora species present at the sites are provided in Appendix B, and were used as input into the revegetation completion criteria. The goal is that the revegetated area will meet the objective of:

> Establish a vegetation community that is self-sustaining and resembling the Ecological Vegetation Communities (EVC) Plains Woodland (EVC 803) and Higher Rainfall Shallow Sands Woodland (EVC 882_61).

The completion criteria (CC) against which revegetation will be assessed is described below, detailed incrementally for a ten year period in Table 8 and summarised in Table 9.

10.1.1 Foliage cover

Eucalypt trees

The benchmark tree canopy cover of the Plains Woodland (EVC 803) and Higher Rainfall Shallow Sands Woodland (EVC 882_61) are both 15%. As such, to be progressing towards this level, after 10 years it is appropriate for the revegetation to have a eucalypt tree cover of 10%.

CC13: 10-year Eucalypt foliage cover ≥ 10%

Other trees

The benchmark percentage cover of understorey trees in Higher Rainfall Shallow Sands Woodland (EVC 882_61) is 5%. Given that one of the two species of Sheoak to be reinstated is a canopy tree, after 10 years it is appropriate for the revegetation to have a Sheoak cover [*AIIocasuarina luehmannii* (Buloke) and *Allocasuarina verticillata* (Drooping Sheoak) combined] of 5%.

CC14: 10-year Sheoak foliage cover ≥ 10% 5%

Shrubs and other understorey

The average foliage cover of native (non-tree) understorey species was 18.5 ± 1.8% across the five analogue survey sites. Site T1 had the highest cover of native (non-tree) understorey species of 26.5 ± 3.0%. The 10-year completion criterion for native (non-tree) understorey species was determined to be 25%. This is slightly higher than the mean value from the analogue sites and reflects the fact that the revegetation will be designed to be shrubbier than the analogue sites, and that the survey of the analogue sites was conducted in autumn when the cover contribution of ephemeral species was not captured.

CC15: 10-year Native (non-tree) understorey species foliage cover ≥ 25%

Bare ground cover

The average cover of bare ground across the five analogue survey sites was 1.5 ± 0.3%. This low level of bare ground was consistent across the analogue survey sites and indicative of the stable community and landform. Given that the revegetation area is commencing with 100% bare ground cover, a reasonable goal is that the 10-year completion criterion for bare ground cover was determined to be ≤ 10%.

CC16: 10-year bare ground cover ≤ 10%.

Litter cover

The average cover of organic litter across the five analogue survey sites was 78.7 ± 2.1 %. A high level of litter cover is indicative of a stable vegetation community and landform. Given that the revegetation area is commencing with 100% bare ground cover, and a litter layer will take a number of years to establish, a reasonable goal is that the 10-year completion criterion for organic litter be set at 70%.

CC17: 10-year organic litter cover ≥ 70%.

Cryptogam-crust-bryophyte cover

The average cover contribution of cryptogam-crust-bryophytes across the five analogue survey sites was 17.3 ± 2.9%. The cover of Cryptogam-crust-bryophytes varied substantially between analogue survey sites, and between quadrats. The presence of cryptogam-crust-bryophytes cover can be indicative of a stable vegetation community and landform. Given that the revegetation area is commencing with 100% bare ground cover, and a cryptogamic crust/bryophyte layer will take a number of years to establish, a reasonable goal is that the 10-year completion criteria for cryptogram-crust-bryophytes was determined to be 10%.

CC08: 10-year cryptogram-crust-bryophytes cover ≥ 10%.

Weed cover

The average cover of weeds across the five analogue survey sites was 2.9 ± 0.9%. Given that the survey of the analogue sites was conducted in autumn, when the cover contribution of weed species is reduced, this is considered an unrealistic target. Site T1 was established in a degraded area where weed cover was noticeably reducing the condition of the area, and had an average weed cover of 13.2 ± 3.3%. As such, the aim for the revegetation area should be to have weed cover below this. The 10-year completion criteria for weed cover was determined to be ≤ 10%.

CC19: 10-year Weed species foliage cover ≤10%

10.1.2 Species richness

Species richness has not been included in the completion criteria, but rather as a revegetation goal. The native species richness across the five analogue survey sites was 39.6 ± 17.7 per site quadrat (40 m x 10 m). The site quadrat native species richness of the revegetation should be compared against this number to show that regeneration/colonisation is occurring and species diversity is increasing over time.

10.1.3 Seedling mortality

The average density of planted seedlings will be counted across the 40 x 10m quadrats in the revegetation area. Given the target of planting 2,250 seedlings per hectare, there should be at least 90 seedlings per 400 m^2 quadrat. If seedling numbers are below this level during any of the 1, 2, 3, 5 and 10-year monitoring events, then infill planting will be undertaken to increase plant density to the required amount.

CCO20: 10-year seedling density ≥ 90 per 400 m^2

Table 8: Revegetation completion criteria for two, five and ten years post revegetation

Completion criteria and measurement	2-year completion criteria	5-year completion criteria	10-year completion criteria
CC13 – Eucalypt foliage cover *Measured as average cover of all Eucalyptus species per quadrat, across all sites,*	Foliage cover ≥ 1%	Foliage cover ≥ 3%	Foliage cover ≥ 10%
CC14 – Sheoak foliage cover *Measured as average cover of all Allocasuarina species per quadrat, across all sites,*	Foliage cover ≥ 1%	Foliage cover ≥ 2%	Foliage cover ≥ 5%
CC15 – Understorey species foliage cover *Measured as average cover of all native (non-tree) understorey species foliage cover per quadrat, across all sites.*	Foliage cover ≥ 5%	Foliage cover ≥ 10%	Foliage cover ≥ 25%
CC16 – Bare ground cover *Measured as average cover of bare ground per quadrat, across all sites.*	Bare ground cover ≤ 95%	Bare ground cover ≤ 50%	Bare ground cover ≤ 10%
CC17 – Organic litter cover *Measured as average cover of organic litter per quadrat, across all sites*	Organic litter cover ≥ 5%	Organic litter cover ≥ 30%	Organic litter cover ≥ 70%
CC18 – Cryptogram-crust-bryophyte cover *Measured as average cover of cryptogram-crust-bryophytes per quadrat, across all sites.*	N/A	Cryptogram-crust-bryophytes cover ≥ 3%	Cryptogram-crust-bryophytes cover ≥ 10%
CC19 – Weed cover *Measured as average cover of weeds per quadrat, across all sites.*	Weed species foliage cover ≤ 5%	Weed species foliage cover ≤ 10%	Weed species foliage cover ≤ 10%
CC20 – Seedling density *Measured as number of seedlings per site quadrat (400 m^2)*	≥ 90 seedlings	≥ 90 seedlings	≥ 90 seedlings

Table 9: Native flora revegetation completion criteria, monitoring and remedial action

Aspect	Objective	Completion criteria	Evidence required to demonstrate achievement	Monitoring regime	Relevant section in Management Plan	Remedial actions (if required)
Native flora revegetation	Establish a vegetation community that is self-sutaining and resembling the EVCs Plains Woodland (EVC 803) and Higher Rainfall Shallow Sands Woodland (EVC 882_61)	CC13: Eucalypt foliage cover minimum met	Third party revegetation monitoring report	Revegetation will be monitored annually for the first three years following planting, then at 5-year and 10-year points. Monitoring will comprsie of revegetation montoring sites as described in Sections 7.4.2.3, 10.2 and 11.2	R&VMP Sectiions 7.4.2, 10.1, 10.2 and 11.2	Infill planting and/or seeding and/or removal until completion criteria met.
		CC14: Sheoak foliage cover minimum met				
		CC15: Native (non-tree) understorey speices foliage cover mininmum met				
		CC16: Bare ground cover maximum met				
		CC17: Organic litter cover minimum met				
		CC18: Cryptogram-crust-bryophytes minimum met				
		CC19: Weed specise foliage cover maxium met				
		CC20: Seedling density minimum met				

10.2 Landscape Function Analysis completion criteria

Landscape Function Analysis (LFA) is a recognised method for assessing the long-term sustainability of rehabilitated landforrns. LFA will be undertaken at five randomly placed locations across the revegetated site to monitor progress of the revegetation over time. The LFA will involve measuring the following soil characteristics:

- soil cover- an indicator of vulnerability to rain splash erosion;
- basal cover of perennial plants - an indicator of the contribution of below-ground organs to nutrient cycling;
- litter cover, origin and degree of decomposition - an indicator of the availability of organic matter for nutrient cycling;
- cryptogam cover - an indicator of surface stability, resistance to erosion and nutrient availability;
- crust brokenness - an indicator of erosion susceptibility of loose crusted material;
- erosion features - an indicator of the nature and severity of current soil erosion features;
- deposition materials - an indicator of soil deposition;
- micro-topography - an indicator of surface roughness for water infiltration, flow disruption and seed lodgement;
- surface resistance to erosion - an indicator of soil mobilisation by mechanical disturbance; and
- slake test - an indicator of soil stability when wet

Monitoring these parameters over time will indicate whether the landscape function is sustainable (accumulating resources such as topsoil, organic matter, seeds, water) or likely to fail (losing resources). Metrics for these parameters will be developed with reference to analogue sites and incorporated into the completion criteria for erosion and soil function. LFA Monitoring sites will be established and monitoring will be conducted at the following intervals after revegetation: one, two, three, five and 10 years.

11 Monitoring and maintenance

11.1 General (not native revegetation)

11.1.1 Monitoring

The rehabilitation monitoring program, excluding those of the aspect of native vegetation, is shown in Table 7 which includes monitoring of the following aspects:

- landform;
- soil;
- surface water;
- groundwater;
- agricultural production;
- public health and safety; and
- radiation.

Rehabilitated areas will be inspected at least quarterly for:

- evidence of erosion, sedimentation or subsidence;
- success of initial cover establishment;
- weed infestation;
- pest animal infestations
- integrity of banks, diversion drains and catchment dams; and
- general stability.

11.1.2 Maintenance

Table 7 outlines remedial actions that may be necessary if monitoring indicates that the completion criteria are unlikely to be met. Remedial actions may include:

- Earthworks to:
    - ensure compliance with final landform design;
    - repair and prevention of erosion;
    - maintenance of subsoil and topsoil function; and
    - reduce run-off and promote infiltration;
- implementing farm management practices (sowing, fertilizer application, harvesting, animal husbandry);
- weed control;
- upgrading or replacing drainage controls if they are found to be inadequate or compromised.

Maintenance activities will be implemented to support rehabilitation processes until the completion criteria are met.

11.2 Native flora revegetation

This subsection of the R&VMP was prepared by ecological consultant, GHD.

11.2.1 Monitoring

Revegetation will be monitored annually for the first three years following planting, then at the five-year and 10-year marks. Monitoring will comprise the establishment and subsequent monitoring of revegetation monitoring sites, as described in Section 7.4.2.3. A minimum of five revegetation monitoring sites will be established in the revegetated area..

The revegetation monitoring program is shown in Table 9. The program has been developed specifically to collect data relevant to the completion criteria.

Monitoring of revegetated areas will include seedling survival counts and densities to assess progress towards completion criteria, enabling replacement planting, if required.

Monitoring for weeds will include regular site inspections to identify potential weed infestations, provide the scope for weed control programs, and to assess the success of such programs.

Revegetation areas will be inspected quarterly in year one, twice in year two, then annually thereafter for:

- success of initial cover establishment;
- weed infestation; and
- pest animal infestations.

Particular focus will be on the high threat weeds identified in section 9.4.7, in order to detect and control infestations before they become widespread.

Based on the outcomes of monitoring, the monitoring program may be reviewed and amended further as part of the R&VMP review process (Section 15).

11.2.2 Maintenance

Table 9 outlines remedial actions that may be necessary if monitoring indicates that the completion criteria are unlikely to be met Where issues are detected that may compromise revegetation success, maintenance works will be undertaken and, depending on the issue, may include:

- re-seeding, re-topsoiling or in-fill planting;
- use of materials such as composted mulch in areas with poor vegetation establishment;
- installation of tree guards or temporary fencing to exclude grazing by fauna;
- maintaining fences to control livestock and feral animals;
- controlling weeds via e.g. spot spraying of identified weed infestations within revegetated areas; and
- maintaining signage.

Weed control will be conducted by appropriately qualified and trained specialist with the ability to identify native species from weed species.

Maintenance activities will be implemented to support rehabilitation processes until the completion criteria are met.

12 Rehabilitation schedule

Rehabilitation will commence once disposal has been completed. Decommissioning and removal of associated plant and equipment will occur when no longer needed to support rehabilitation, monitoring and maintenance activities. Monitoring will continue until the completion criteria have been met to the satisfaction of the Responsible Authority.

Table 10 presents the indicative schedule for rehabilitation.

It should also be noted that the indicative monitoring period shown in Table 10 has nominally been set at 10 years. In practice, monitoring will be carried out until the completion criteria have been met. For some criteria, this may be less than ten years, for others it may be longer.

Table 10: Indicative rehabilitation schedule

Activity	Years after completion of disposal activities														
	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Disposal operations															
Rehabilitation planning															
Overburden placement															
Subsoil and topsoil placement															
Vegetative cover – Pit 23															
Pasture establishment															
Native revegetation – Pit 23															
Rehabilitation monitoring & maintenance															
Infrastructure decomissioning and rehabilitation															

13 Rehabilitation bond

The Permit requires that the owner of the subject land, Basin Properties Pty Ltd, enters into an agreement with the Responsible Authority, under Section 173 of the PE Act, in regard to the lodgement of a rehabilitation bond. In broad terms, the agreement must:

- require the owner of the land to lodge a bond, the condition of which is that the land is rehabilitated in accordance with this R&VMP to the satisfaction of the Responsible Authority;
- specify that the form and amount of the bond are to be to the satisfaction of the Responsible Authority, having regard to the policies and procedures adopted by the Minister for Energy and Resources and the Department of Economic Development, Jobs, Transport and Resources (DEDJTR) in respect of rehabilitation bonds under the *Mineral Resources (Sustainable Development)* Act 1990, including the use of the DEDJTR Earth Resources Bond Calculator;
- provide the Responsible Authority with option to require the owner of the land to provide an audited rehabilitation liability assessment; and
- provide the mechanism for the staged retirement of the bond when rehabilitation has been completed in accordance with this R&VMP, including certification by an auditor of such completion.

This arrangement will ensure that, at all times, sufficient funds will be available to complete the works as detailed in this plan.

14 Stakeholder Engagement

In accordance with the requirements of the Permit:

- contact details will be provided of a person or people for the receipt and actioning of complaints and other comments relating to activity on the site;
- a register of complaints and other comments will be maintained; and
- EMP and Rehabilitation performance reports, which will be provided to the Responsible Authority and published in Iluka's website, will include a "complaints statement" summarising the complaints register and actions taken in response to complaints.

15 Plan review

This R&VMP will be reviewed, at least, every two years to enable:

- refinement of completion criteria and monitoring methodologies for native vegetation;
- refinement of monitoring methodologies for LFA; and
- account to be taken of:
    - additional information gathered as a result of the monitoring program;
    - advances in knowledge and technology pertaining to mine rehabilitation;
    - changes in applicable legislation or standards; or
    - changes in Iluka's EHS standards applying to mine rehabilitation.

Plan reviews may result in proposals for amendment and such proposals will be prepared to the satisfaction of the Responsible Authority.

16 Acronyms

ALARA	As Low As Reasonably Achievable
AQDCP	Air Quality/Dust Control Plan
ARI	Average Recurrence Interval
CA	Crown Allotments
CC	Completion criteria
CFA	Country Fire Authority
cm	Centimetre
cm^2	Square centimetre
DEDJTR	Department of Economic Development, Jobs, Transport and Resources
DELWP	Department of Environment, Land, Water and Planning
DHHS	Department of Health and Human Services
EMP	Environmental Management Plan
EP Act	Environment Protection Act 1970
EVC	Ecological Vegetation Classes
GWMMP	Groundwater Monitoring and Management Plan
ha	Hectare
Iluka	Iluka Resources Limited
IWMP	Incoming Waste Monitoring Plan
LFA	Landform Function Analysis
m	metre
m^2	square metre
m^3	cubic metre
MRSDA	Mineral Resources (Sustainable Development) Act 1990
MSP	Mineral Separation Plant
NORM	Naturally Occurring Radioactive Material
NVRPS	Native Vegetation Revegetation Planting Standards
PE Act	Planning and Environment Act 1987
PP	Planning Permit
R&VMP	Rehabilitation and Vegetation Management Plan
RML	Radiation Management Licence
SEPP	State Environment Protection Policy
SWMMP	Surface Water Monitoring and Management Plan
the Permit	Planning Permit No. 15-105
t/ha	Tonnes per hectare
V:H	Vertical to Horizontal

APPENDIX A

Flora Species recorded at revegetation analogue sites and incidental observations in Red Hill State Forest and Youngs State Forest, May 2017

Provided by ecological consultant, GHD

Species name	Common name	T1	T2	T3	T4	T5
Acacia acinacea	Gold-dust Wattle					
Acacia myrtifolia	Myrtle Wattle					
Acacia pycnantha	Golden Wattle					
Acaena echinata	Sheep's Burr	X	X			
Allocasuarina luehmannii	Buloke					
Allocasuarina vertictllata	Drooping Sheoak				X	X
Anthosachne scabra s.l.	Common Wheat-grass		X	X	X	X
Arthopodium sp.	Vanilla-lily	X	X	X	X	X
?Asteraceae sp.	?Asteraceae sp.				X	X
Asteraceae sp.	Asteraceae sp.		X	X	X	X
Astroloma conostephioides	Flame Heath				X	X
Astroloma humifusum	Cranberry Heath		X	X	X	X
Austrostipa ?scabra	Rough Spear-grass	X				
Austrostipa mollis	Supple Spear-grass		X	X	X	X
Austrostipa scabra	Rough Spear-grass		X	X	X	X
Austrostipa sp.	Spear-grass	X	X	X		
Bossiaea prostrata	Creeping Bossiaea		X			
Brachyloma daphnoides	Daphne Heath				X	X
Bursana spmosa	Sweet Bursaria					X
Calytnx tetragona	Common Fringe-myrtle					X
Carex brevicutmis	Common Grass-sedge				X	
Centrotepis aristata	Pointed Centrolepis				X	X
Centrolepis strigosa subsp. *strigosa*	Hairy Centrolepis			X	X	X
?Chamaescilla corymbosa	Blue Stars			X		
Cheitanthes austrotenuifolia	Green Rock-fern			X		
Chrysocephalum apicutatum s.l.	Common Everlasting		X	X	X	X
Convolvulus angusfissimus subsp. *Fililobus*	Blushing Bindweed		X			
Craspedia sp.	Billy-buttons		X			
Cryptandra tomentosa	Prickly Cryptandra				X	
Cyperaceae sp.	Sedge		X			
Daucus glochidiatus	Australian Carrot	X		X		
Dianella revoluta	Black-anther Flax-lily	X	X	X	X	X
Dichelachne sp.	Long-hair Plume-grass				X	
Dillwynia sericea	Showy Parrot-pea		X		X	X
Distichlis dlsflchophylla	Australian Salt-grass	X				
Drosera sp,	Sundew			X	X	
Eucalyptus baxteri	Brown Stringybark					X
Eucalyptus leucoxylon	Yellow Gum	X	X	X	X	X
Eucalyptus melliodora	Yellow Box	X				
Eucalyptus microcarpa	Grey Box	X				
Euchiton sphaericus	Annual Cudweed			X		
Geranium sp.	Crane's-bill	X				
Gonocarpus tetragynus	Common Raspwort					X
Hakea sp.	Hakea				X	
Hibbertia ?ripana	Erect Guinea-flower					X
Hibberlia virgata	Twiggy Guinea-flower					X
Hydrocotyle laxiflora	Stinking Pennywort		X	X	X	X
Isopogon Ceratophyllus	Horny Cone-bush					X
Juncus subsecundus	Finger Rush	X				

Species name	Common name	T1	T2	T3	T4	T5
Kennedia prostrata	Running Postman				X	
Lachnagrostis ?aemula	Leafy Blown-grass					X
Lagenophora huegelii	Coarse Bottle-daisy	X		X	X	
Lepidosperrna canescens	Hoary Rapier-sedge				X	
Lepidosperrna carphoides	Black Rapier-sedge		X	X	X	X
Lepidosperrna longitudinale	Pithy Sword-sedge	X				X
Lepidosperma sp.	Sedge		X	X		
Lepidosperma viscidum	Sticky Sword-sedge				X	
?Leptorhynchos tenuifolius	Wiry Buttons					X
Levenhookia dubia	Hairy Stylewort					X
Leucopogon sp.	Beard-heath					X
?Liliaceae sp.	?Liliaceae sp.		X			
Lomandra ?micrantha	Small-flower Mat-rush					
Lomandra ?multiflora	Many-flowered Mat-rush			X		
Lomandra filiformis	Wattle Mat-rush			X	X	
Lomandra micrantha	Small-flower Mat-rush			X	X	
Lomandra nana	Dwarf Mat-rush	X	X	X	X	X
Lomandra sp.	Mat-rush			X	X	X
Maireana enchytaenoides	Wingless Bluebush				X	X
Microlaena stipoides	Weeping Grass	X		X		X
Monocot sp.	Monocot sp.	X				
Native species (annual)	Native species (annual)			X		
Neurachne altopecuroidea	Fox-tail Mulga-grass				X	X
Oxalis perennans	Grassland Wood-sorrel			X	X	
Petargonium rodneyanum	Magenta Stork's-bill		X			
Pimelea humilis	Common Rice-flower					X
Poa sieberiana	Grey Tussock-grass	X	X	X	X	X
Poa sp.	Tussock-grass		X	X	X	
Poaceae sp.	Grass			X	X	X
Pterostylis sp.	Greenhood				X	
Pultenaea ?laxiflora	Loose-flower Bush-pea				X	X
Rytidosperma ?racemosa	Slender Wallaby-grass	X			X	
Rytidosperma ?setaceum	Bristly Wallaby-grass				X	X
Rytidosperma sp.	Wallaby-grass	X			X	
Rytidosperma sp.2	Wallaby-grass	X	X	X	X	X
Rytidosperma sp.3	Wallaby-grass	X	X	X		X
Rytidosperma sp.4	Wallaby-grass		X	X		
?Schoenus sp.	Sedge		X		X	
Senecio quadridentatus	Cotton Fireweed	X	X	X		X
Senecio sp.	Fireweed		X	X		X
Thelymitra sp.	Sun Orchid			X	X	X
Themeda triandra	Kangaroo Grass		X	X		
Thysanotus patersonii	Twining Fringe-lily			X	X	X
?Tricoryne sp	Rush-lily			X		
Viftadmia cuneafa	Fuzzy New Holland Daisy				X	
Viffadinia gracilis	Woolly New Holland Daisy	X		X	X	X
Wahlenbergia sp.	Bluebell	X				
Xanfhonhoea minor	Small Grass-tree			X		
Xerochrysum viscosum	Sticky Everlasting			X		

Species name	Common name	T1	T2	T3	T4	T5
INTRODUCED SPECIES						
Aira caryophyllea	Silvery Hair-grass	X	X	X		X
Arctotheca calendula	Cape weed	X				
Asparagus asparagoides	Bridal Creeper	X				
Avena sp.	Oat	X	X	X		
Briza maxima	Large Quaking-grass	X	X			
Briza minor	Lesser Quaking-grass	X	X	X		
Bromus diandrus	Great Brome	X				
?Caryophyllaceae sp.	NA			X	X	X
Centaurium erythraea	Common Centaury	X		X	X	
Ehrharla calycina	Perennial Veldt-grass	X				
Hypochaeris sp.	Smooth Cat's-ear	X	X	X	X	X
Introduced sp. (annual)	NA	X				
Lagurus ovatus	Hare's-tail Grass	X				
Lolium sp.	Rye Grass	X		X		X
Petrorhagia dubia	Velvety Pink	X				
Poaceae sp.	Grass species	X	X	X		
Romulea rosea	Onion Grass	X			X	
Seedlings	Unknown	X				
Sonchus asper	Rough Sow-thistle	X				
Sonchus oleraceus	Common Sow-thistle	X				X
Taraxacum officinale spp. agg.	Garden Dandelion		X			
Trifolium sp.	Clover	X				
Vulpia sp	Fescue					X

NB. Species included in this list but with no record at an analogue site indicates that it was observed in the Red Hill State Forest or Youngs State Forest but was not present at a site.

NB. ? indicates that a species was unable to be identified due to immature size, and/or a lack of fruiting or flowering material

APPENDIX B

Flora Species recorded, and nuber of quadrats recorded in, at revegetation analogue sites in Red Hill State Forest, May 2017

Provided by ecological consultant, GHD

Species name	Common name	T1	T2	T3	T4	T5
Bare Ground	NA	14	14	14	14	14
Coarse Woody	NA	14	14	14	14	14
Crust/crypto	NA	14	14	14	14	14
Litter	NA	14	14	14	14	14
Acacia myrtifolia	Myrtle Wattle					3
Acaena echinata	Sheep's Burr	3	1			
Allocasuarina vertictllata	Drooping Sheoak				12	1
Anthosachne scabra s.l.	Common Wheat-grass		2	4		1
Arthopodium sp.	Vanilla-lily	2	13	9	8	6
?Asteraceae sp.	?Asteraceae sp.				6	4
Asteraceae sp.	Asteraceae sp.		2		1	1
Astroloma conostephioides	Flame Heath				2	2
Astroloma humifusum	Cranberry Heath		3	2	13	12
Austrostipa ?scabra	Rough Spear-grass	2				
Austrostipa mollis	Supple Spear-grass		4	4	3	5
Austrostipa scabra	Rough Spear-grass		2	4	4	3
Austrostipa sp.	Spear-grass	2	1	1		
Bossiaea prostrata	Creeping Bossiaea		2			
Brachyloma daphnoides	Daphne Heath					3
Bursana spmosa	Sweet Bursaria					1
Calytnx tetragona	Common Fringe-myrtle					4
Carex brevicutmis	Common Grass-sedge				4	
Centrotepis aristata	Pointed Centrolepis				7	5
Centrolepis strigosa subsp. *strigosa*	Hairy Centrolepis					2
?Chamaescilla corymbosa	Blue Stars			4		
Cheitanthes austrotenuifolia	Green Rock-fern			5		
Chrysocephalum apicutatum s.l.	Common Everlasting		3		1	
Convolvulus angusfissimus subsp. *fililobus*	Blushing Bindweed		1			
Cyperaceae sp.	Sedge		1			
Daucus glochidiatus	Australian Carrot	1		1		
Dianella revoluta	Black-anther Flax-lily	4	1		9	
Dichelachne sp.	Long-hair Plume-grass				2	
Dillwynia sericea	Showy Parrot-pea				6	3
Distichlis dlsflchophylla	Australian Salt-grass	11				
Drosera sp,	Sundew			1	1	
Eucalyptus leucoxylon	Yellow Gum	3	13	13	6	10
Eucalyptus microcarpa	Grey Box	8				
Euchiton sphaericus	Annual Cudweed			1		
Geranium sp.	Crane's bill	1				
Gonocarpus tetragynus	Common Raspwort					1
Hibbertia ?ripana	Erect Guinea-flower					4
Hydrocotyle laxiflora	Stinking Pennywort		9	14	1	8
Juncus subsecundus	Finger Rush	1				
Kennedia prostrata	Running Postman				2	
Lachnagrostis ?aemula	Leafy Blown-grass					1
Lagenophora huegelii	Coarse Bottle-daisy			5	10	
Lepidosperrna carphoides	Black Rapier-sedge		7	7	1	11
Lepidosperrna longitudinale	Pithy Sword-sedge					6
Lepidosperma sp.	Sedge		6	4		

Species name	Common name	T1	T2	T3	T4	T5
?Leptorhynchos tenuifolius	Wiry Buttons					1
Levenhookia dubia	Hairy Stylewort					1
?Liliaceae sp.	?Liliaceae sp.		1			
Lomandra ?micrantha	Small-flower Mat-rush			2		
Lomandra ?multiflora	Many-flowered Mat-rush		1			
Lomandra filiformis	Wattle Mat-rush			2	8	
Lomandra micrantha	Small-flower Mat-rush			5	3	
Lomandra nana	Dwarf Mat-rush	3	10	10	4	3
Lomandra sp.	Mat-rush			1	2	11
Microlaena stipoides	Weeping Grass	5		1		1
Monocot sp.	Monocot sp.	1				
Native species (annual)	Native species (annual)			1		
Neurachne altopecuroidea	Fox-tail Mulga-grass				1	9
Oxalis perennans	Grassland Wood-sorrel			2	4	
Pimelea humilis	Common Rice-flower					5
Poa sieberiana	Grey Tussock-grass	1	4	2	2	11
Poa sp.	Tussock-grass		3	3	1	
Poaceae sp.	Grass			1	2	1
Pterostylis sp.	Greenhood				1	
Pultenaea ?laxiflora	Loose-flower Bush-pea				3	2
Rytidosperma ?racemosa	Slender Wallaby-grass	2			2	
Rytidosperma ?setaceum	Bristly Wallaby-grass				6	8
Rytidosperma sp.	Wallaby-grass	1			5	
Rytidosperma sp.2	Wallaby-grass	5	7	1	1	1
Rytidosperma sp.3	Wallaby-grass	9	7	8		5
Rytidosperma sp.4	Wallaby-grass		1	1		
?Schoenus	Sedge		2		4	
Senecio quadridentatus	Cotton Fireweed	13	6	7		3
Senecio sp.	Fireweed		2	7		3
Thelymitra sp.	Sun Orchid			1	1	1
Thysanotus patersonii	Twining Fringe-lily			1	9	3
?Tricoryne sp	Rush-lily		3			
Viffadinia gracilis	Woolly New Holland Daisy	9		3	3	2
Xerochrysum viscosum	Sticky Everlasting		2	2		

NB. ? indicates that a species was unable to be identified due to immature size, and/or a lack of fruiting or flowering material

Species name	Common name	T1	T2	T3	T4	T5
INTRODUCED SPECIES						
Aira caryophyllea	Silvery Hair-grass	2	3	1		1
Arctotheca calendula	Cape weed	3				
Asparagus asparagoides	Bridal Creeper	5				
Avena sp.	Oat	7	6	7		
Briza maxima	Large Quaking-grass	2	1			
Briza minor	Lesser Quaking-grass	5	2	4		
Bromus diandrus	Great Brome	4				
?Caryophyllaceae sp.	NA			4	1	2
Centaurium erythraea	Common Centaury	1		1	4	
Ehrharla calycina	Perennial Veldt-grass	3				
Hypochaeris sp.	Smooth Cat's-ear	11	9	7	1	1
Introduced sp. (annual)	NA	2				
Lagurus ovatus	Hare's-tail Grass	4				
Loliumsp.	Rye Grass	3		1		1
Petrorhagia dubia	Velvety Pink	13				
Poaceae sp.	Grass species	12	6	4		
Romulea rosea	Onion Grass	3			3	
Seedlings	Unknown	12				
Sonchus asper	Rough Sow-thistle	1				
Sonchus oleraceus	Common Sow-thistle	3				1
Taraxacum officinale spp. agg.	Garden Dandelion		1			
Trifolium sp.	Clover	5				
Vulpia sp	Fescue					1

NB. ? indicates that a species was unable to be identified due to immature size, and/or a lack of fruiting or flowering material