



**ILLAWARRA COAL**

**DENDROBIUM MINE AND  
CORDEAUX COLLIERY**



**ANNUAL REVIEW  
FY17**



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# DENDROBIUM MINE AND CORDEAUX COLLIERY ANNUAL REVIEW


Table 1: Annual Review Overview

Name of operation	
Name of operator	South32 – Illawarra Coal – Dendrobium Mine and Cordeaux Colliery
Development consent / project approval #	DA 60-03-2001
Name of holder of development consent / project approval	Illawarra Coal Holdings Pty Ltd
Mining lease #	CCL768, ML1510, ML1566
Name of holder of mining lease	Illawarra Coal Holdings Pty Ltd, Endeavour Coal Pty Ltd
Water licence #	10WA1187772
Name of holder of water licence	Endeavour Coal Pty Ltd
MOP/RMP start date	01 October 2015
MOP/RMP end date	01 July 2022
Annual Review start date	01 July 2016
Annual Review end date	30 June 2017

I, Michelle Grierson, certify that this audit report is a true and accurate record of the compliance status of South32 – Illawarra Coal – Dendrobium Mine and Cordeaux Colliery for the period 01 July 2016 – 30 June 2017 and that I am authorised to make this statement on behalf of Illawarra Coal – Dendrobium Mine and Cordeaux Colliery.

Note.

- The Annual Review is an 'environmental audit' for the purposes of section 122B (2) of the Environmental Planning and Assessment Act 1979. Section 122E provides that a person must not include false or misleading information (or provide information for inclusion in) an audit report produced to the Minister in connection with an environmental audit if the person knows that the information is false or misleading in a material respect. The maximum penalty is, in the case of a corporation, \$1 million and for an individual, \$250,000.*
- The Crimes Act 1900 contains other offences relating to false and misleading information: section 192G (Intention to defraud by false or misleading statement—maximum penalty 5 years imprisonment); sections 307A, 307B and 307C (False or misleading applications/information/documents—maximum*

Name of authorised reporting officer Michelle Grierson  
 Title of authorised reporting officer Environmental Officer  
 Signature of authorised reporting officer   
 Date 22/08/2017

# 1. STATEMENT OF COMPLIANCE

**Table 2: Statement of Compliance**

Where all conditions of the relevant approval(s) complied with?				
Development Approval	Purpose	Issue Date	Expiry date	Compliant?
DA 60-03-2001	Dendrobium Underground Coal Mine and associated surface facilities and infrastructure	20/11/2002	21/12/2023	Yes
MOD-11-2-2002	Permitting the access of construction traffic to the Bradford Breaker Emplacement Area (Drift Spoil Emplacement Area 1) via Cordeaux Road and Benjamin Road, Mt Kembla.	28/02/2002	21/12/2023	Yes
MOD-36-5-2002-I	Application for commencement of vehicles accessing Benjamin Road.	15/08/2002	21/12/2023	Yes
60-03-2001 MOD3	Modification to Development Consent (Dept Planning)	28/08/2003	21/12/2023	Yes
60-03-2001 MOD4	Modification to Development Consent (Dept Planning)	05/4/2006	21/12/2023	Yes
60-03-2001 MOD5	Modification to Development Consent (Dept Planning)	30/11/2006	21/12/2023	Yes
60-03-2001 MOD6	Area 3 Consent Modification	08/12/2008	31/12/2030	Yes
60-03-2001 MOD7	Strategic Biodiversity Offset	02/04/2015	31/12/2030	Yes
<b>Mining Lease / Sub-Lease</b>	<b>Number</b>			
Mining lease	1510	24/04/2002	24/04/2023	Yes
Consolidated Coal Lease	768	05/12/2014	07/10/2029	Yes
Mining Lease	1566	07/09/2005	07/09/2026	Yes
<b>Water Licence</b>				
10WA118772	Groundwater Extraction Licence	09/02/2016	Continuing	Yes

The predictions and Statement of Commitments from the Dendrobium Environmental Assessment (EA) are incorporated into the state EP&A Approval conditions. Compliance with the state conditions being assessed in "Appendix C: Dendrobium Mine Consent Condition Compliance".

## 2. INTRODUCTION

### 2.1. BACKGROUND

This Annual Review for Dendrobium Mine and Cordeaux Colliery is for the period 1 July 2016 to 30 June 2017. The Annual Review is submitted to relevant agencies as per the requirements of Schedule 8, Condition 5 of the Dendrobium Development Consent. A copy of the report is publicly available via the South32 website under Dendrobium Mine: <https://www.south32.net/what-we-do/places-we-work/illawarra-metallurgical-coal/documents>.

### 2.2. OVERVIEW OF OPERATIONS

#### 2.2.1. Dendrobium Mine

Dendrobium Mine is an underground mining operation approved in November 2001 by the Minister of Department of Urban Affairs and Planning. The mine is owned and operated by Dendrobium Coal Pty Ltd, a wholly owned subsidiary of South32. It is operated on a continuous basis, 24 hours a day and 7 days a week.

The mining operations are located immediately adjacent to Mt Kembla, approximately 8 km west of Wollongong, NSW, on the Illawarra Escarpment. Mt Kembla village located within 500 m of the Pit Top site and has close historical links with coal mining.

Dendrobium Mine extracts coal from the No. 3 Seam (Wongawilli Seam) of the Southern Coalfields. Four mining areas make up the approved mine plan for Dendrobium and are named Areas 1, 2, 3A and 3B respectively. Longwall mining is currently being undertaken in Area 3B (refer to Plan 1a&b). The mine primarily produces hard coking coal and is approved to produce up to 5.2 million tonnes per annum until 31 December 2030. Dendrobium Mine is comprised of a number of sites as detailed below.

#### Dendrobium Pit Top

The Pit Top consists of:

- Administration buildings;
- Workshop, machinery and equipment storage areas;
- People and materials access to the underground workings via the Dendrobium tunnel;
- A sediment pond;
- A grey water treatment and oily water separation facility.

The Pit Top layout is shown in Plan 2.

#### Kemira Valley Coal Loading facility (KVCLF)

Coal is transported from the underground workings to KVCLF via a conveyor network, reaching the surface via the Kemira Valley Tunnel. The coal is then fed through a coal sizer, into a rill tower and deposited onto a 150,000 tonne capacity stockpile. Coal is loaded onto trains via an enclosed rail-loading chute. The Kemira Valley Layout is shown in Plan 3.

#### Kemira Valley Rail Line

The private rail line is used to transport the coal from KVCLF to the Dendrobium Coal Preparation Plant (DCPP).

## **Ventilation Shaft 1**

The fan housings associated with Ventilation Shaft 1 were decommissioned in October 2008 and relocated to Ventilation Shaft 3. This shaft now provides intake air to the underground workings. The Ventilation Shaft 1 site layout is outlined in Plan 4.

## **Ventilation Shaft 2/3 Site (Mining Lease 1566)**

Construction of Ventilation Shafts 2 and 3 commenced during 2006 and was completed in 2008. Ventilation Shaft 2 (downcast) and Shaft 3 (upcast) provide ventilation to the current and future underground workings in Area 3. The Ventilation Shaft 2/3 site layout is outlined in Plan 5.

## **Dendrobium Coal Preparation Plant (DCPP)**

The DCPP is located within the Port Kembla Steelworks. The plant provides washing facilities for Dendrobium coal product prior to being blended with the No. 1 Seam coal in the coke making process at the Port Kembla Steelworks. The Processing and Logistics Department at Illawarra Coal manages the DCPP.

### **2.2.2. Cordeaux Colliery**

Cordeaux Colliery is owned and operated by Endeavour Coal Pty Ltd, a wholly owned subsidiary of South32. Coal production ceased towards the end of March 2001 and recovery of longwall mining equipment was completed on 12 April 2001. Following cessation of mining, the Colliery was placed on "Care and Maintenance". Throughout this reporting period, Cordeaux Colliery maintained this status.

The Cordeaux Colliery Pit Top functions as office space and a storage facility.

Dendrobium Mine's future underground mining operations consider Cordeaux Colliery Pit Top and the Corrimal No. 3 shaft site to be of potential significant strategic value. Non-production sites that are of no strategic value are being progressively decommissioned and rehabilitated in line with planned arrangements.

The Cordeaux Colliery Pit Top is wholly contained within an area of approximately 11.9 ha located within the Sydney Catchment Area (Plan 11 and 12). Cordeaux Colliery was serviced by four vertical shafts consisting of:

- People and Materials access shaft.
- Bulk Coal Winder (BCW) shaft. The BCW shaft was also the second means of egress and contained the mine's two main ventilation fans.
- Corrimal No.3 Shaft – mine ventilation fan shaft (Ex-Corrimal Mine). This fan was used to complement ventilation flow through Cordeaux mine.
- Corrimal No.2 Shaft - mine ventilation fan shaft (Ex-Corrimal Mine). This fan was used to complement ventilation flow through Cordeaux mine.

Cordeaux Colliery is considered a "zero discharge site", prohibiting liquid discharge directly to the surface lands of the Sydney Catchment Area. Cordeaux Colliery Pit Top has approximately 40% of its area dedicated to surface water management (Plan 13).

As Cordeaux Colliery is currently deemed to be under 'care and maintenance', the following activities were not undertaken (or are not relevant) during the reporting period and therefore have been excluded from this report:

- Exploration
- Land Preparation
- Construction
- Mining
- Mineral Processing/Coal Wash
- Stockpiling of Ore and Product
- Blasting
- Spontaneous Combustion
- Mine Subsidence

- Air Pollution
- Operational Noise; and
- Community Relations.

### 2.3. MINE CONTACTS

**Table 3: Contacts.**

<b>Position</b>	<b>Name</b>	<b>Number</b>
Manager Production- Dendrobium	Bryony Andrew	(02) 4255 4468
Superintendent Brownfields Exploration Cordeaux	Richard Walsh	(02) 4286 3302
Environment Supervisor	Peter McMillan	(02) 42863 415
Environment Officer	Michelle Grierson	(02) 4255 4463



### 3. APPROVALS

Lists of current development consent approvals, leases and licences for Dendrobium Mine and Cordeaux Colliery are included in the table below.

**Table 4: Development Consent Approvals associated with Dendrobium Mine**

Development Approval	Purpose	Issue Date	Expiry date
DA 60-03-2001	Dendrobium Underground Coal Mine and associated surface facilities and infrastructure	20/11/2002	21/12/2023
MOD-11-2-2002	Permitting the access of construction traffic to the Bradford Breaker Emplacement Area (Drift Spoil Emplacement Area 1) via Cordeaux Road and Benjamin Road, Mt Kembla.	28/02/2002	21/12/2023
MOD-36-5-2002-1	Application for commencement of vehicles accessing Benjamin Road.	15/08/2002	21/12/2023
60-03-2001 MOD3	Modification to Development Consent (Dept Planning)	28/08/2003	21/12/2023
60-03-2001 MOD4	Modification to Development Consent (Dept Planning)	05/4/2006	21/12/2023
60-03-2001 MOD5	Modification to Development Consent (Dept Planning)	30/11/2006	21/12/2023
60-03-2001 MOD6	Area 3 Consent Modification	08/12/2008	31/12/2030
60-03-2001 MOD7	Strategic Biodiversity Offset	02/04/2015	31/12/2030

**Table 5: Mining Leases associated with Dendrobium Mine.**

Mining Lease / Sub-Lease	Number	Issue Date	Expiry Date	Mine Site
Mining lease	1510	24/04/2002	24/04/2023	Dendrobium
Consolidated Coal Lease	768	05/12/2014	07/10/2029	Dendrobium
Mining Lease	1566	07/09/2005	07/09/2026	Dendrobium

**Table 6: Licences associated with Dendrobium Operations.**

Licences/Consents	Number	Issue Date	Expiry Date
Licence to Store – Explosives (WorkCover)	XSTR100152	14/01/2008	10/01/2018
Radiation Licence (EPA)	RL30137	27/07/2016	27/07/2017*
Environment Protection Licence	3241	August 2000	n/a
Water Access Licence (Office of Water)	10WA118772	1/07/2013	27/06/2018
Exploration Licence	A143	28/07/1979	7/11/2018
Exploration Licence	A374	24/10/1986	24/10/2017
WaterNSW Access Consent	D2015/17013	13/03/2015	13/03/2020

\*Currently under renewal

**Table 7: Current Mining Approvals for the Dendrobium Operations.**

Licences/Consents	Number	Issue Date
SMP Approval - Longwalls 6-8 and 19	S03/01444	28/06/2010
SMP Approval-Longwalls 9 to 13	DGTO13/42	5/2/2013



## Cordeaux Colliery

Cordeaux Colliery is held under CCL 768. The relevant consents, leases, and licences for Cordeaux Colliery are presented in the table below.

**Table 8: Consents Leases and Licences for the Cordeaux Colliery.**

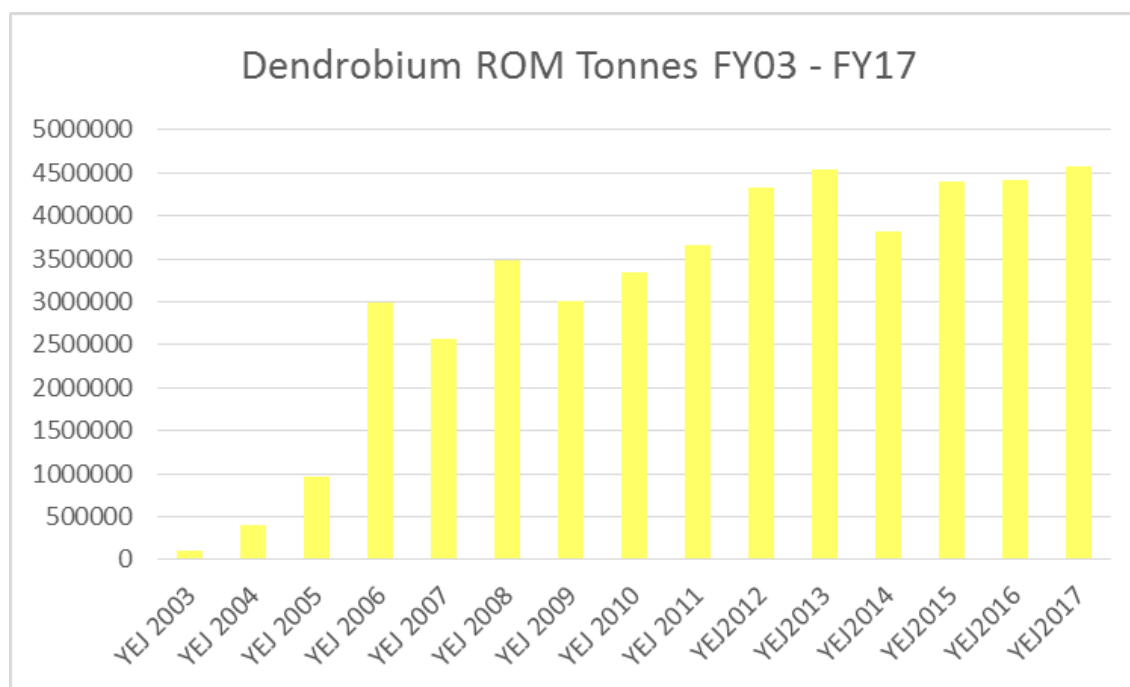
Facility/Document	Number	Issue Date	Expiry Date
Environment Protection Licence	611	1/12/99	n/a
Development Consent (Wollongong City Council)	D74/134	20/12/74	n/a
Exploration Licence	A338	08/10/1984	08/10/2019
SCA Access Consent	D2015/17013	13/03/2015	13/03/2020
Consolidated Coal Lease	768	29/10/91	07/10/2029
Mining Lease	ML25	31/10/1975	As per CCL768
Mining Lease	ML28	31/10/1975	As per CCL768
Mining Lease	ML23	02/09/1981	As per CCL768
Mining Lease	ML24	02/02/1976	As per CCL768
Mining Lease	ML30	18/10/1976	As per CCL768
Mining Lease	Lease No. 66 portion D1106	18/10/1976	As per CCL768
Mining Purposes Lease	MPL205	29/09/1982	As per CCL768
D74/134	Cordeaux Colliery Development Consent	20/12/1974	n/a

## 4. OPERATIONS DURING THE REPORTING PERIOD

### 4.1. MINING

#### Dendrobium Mine

The Run of Mine (ROM) product for the reporting period was 4,567,426.00 tonnes with a saleable product yield of 77%. A comparison showing the ROM production at Dendrobium Mine for past reporting periods is provided in Figure 1.



**Figure 1: ROM Production FY03 to FY17.**

The start and finish dates for longwalls in the current Dendrobium mining domain is provided in the table below.

### 4.2. MINERAL PROCESSING

**Table 9: Area 3 Longwall Start and Finish Dates.**

Longwall Number	Start Date	Finish Date
7	4 <sup>th</sup> May 2011	23 <sup>rd</sup> January 2012
8	24 <sup>th</sup> February 2012	29 <sup>th</sup> of December 2012
9	9 <sup>th</sup> February 2013	2 <sup>nd</sup> June 2014
10	20 <sup>th</sup> January 2014	20 <sup>th</sup> January 2015
11	18 <sup>th</sup> February 2015	26 <sup>th</sup> of January, 2016
12	22 <sup>nd</sup> of February 2016.	31 <sup>st</sup> January 2017
13	4 <sup>th</sup> of March 2017	Currently mining. As of the July 2017, Longwall 13 had extracted approximately 101.1 metres

#### Dendrobium Mine

Mineral processing of the ROM coal produced at Dendrobium Mine is undertaken at the DCP. Coal wash (or reject) is emplaced at the West Cliff Colliery Emplacement Area. Additional information on the emplacement operations is provided in the Bulli Seam Operation's Annual Review. The production and waste summary for Dendrobium Mine is outlined the table below.

**Table 10: Production Summary**

Material	Approved limit	Previous Reporting Period	This Reporting Period	End of Next Reporting Period (Estimate)
Waste Rock/Overburden	N/A	0	0	0
ROM Coal/Ore	5,200,000	4,421,181	4,567,426	5,200,000
Coarse reject (Coal Wash Tonnes)	N/A	1,135,404	1,205,821	1,000,000
Saleable product	N/A	3,285,777	3,361,605	4,200,000

# Refer to Bulli Seam Operation Annual Review for West Cliff emplacement operations

### 4.3. ORE AND PRODUCT STOCKPILES

#### Dendrobium Mine

A 150,000 tonne capacity stockpile, located at KVCLF, is used to store ROM coal prior to it being loaded into trains for transport to the DCP. Train movements are limited to between 6am and 11pm as required by the Dendrobium Development Consent.

During the reporting period, 2,836 trains were loaded at KVCLF and transported 4,733,241 tonnes of ROM coal to DCP. The difference between ROM production and coal transported tonnes occurs as ROM coal is measured at Dendrobium Mine prior to placement on the stockpile and coal transported is measured at the coal preparation plant (i.e. stockpile balance accounts for the difference).

### 4.4. EXPLORATION

#### Dendrobium Mine

##### Drilling Program

Prior to commencing any exploration, a Review of Environmental Factors (REF) within CCL768 is prepared and submitted to WaterNSW and the NSW Department of Planning – Resources & Geoscience for approval. In FY17, twenty three coal quality exploration boreholes were completed as part of either Bulli or Wongawilli Seam brownfields exploration program in Dendrobium areas. The purpose of the coal quality boreholes was to assess coal thickness, depth of seam, coal quality, gas content, and to assist in determining possible future mining conditions by conducting geotechnical tests on the core samples.

Furthermore, exploration were involved in the drilling of a series of other environmental holes for the purpose of groundwater and/or swamp monitoring. These included:

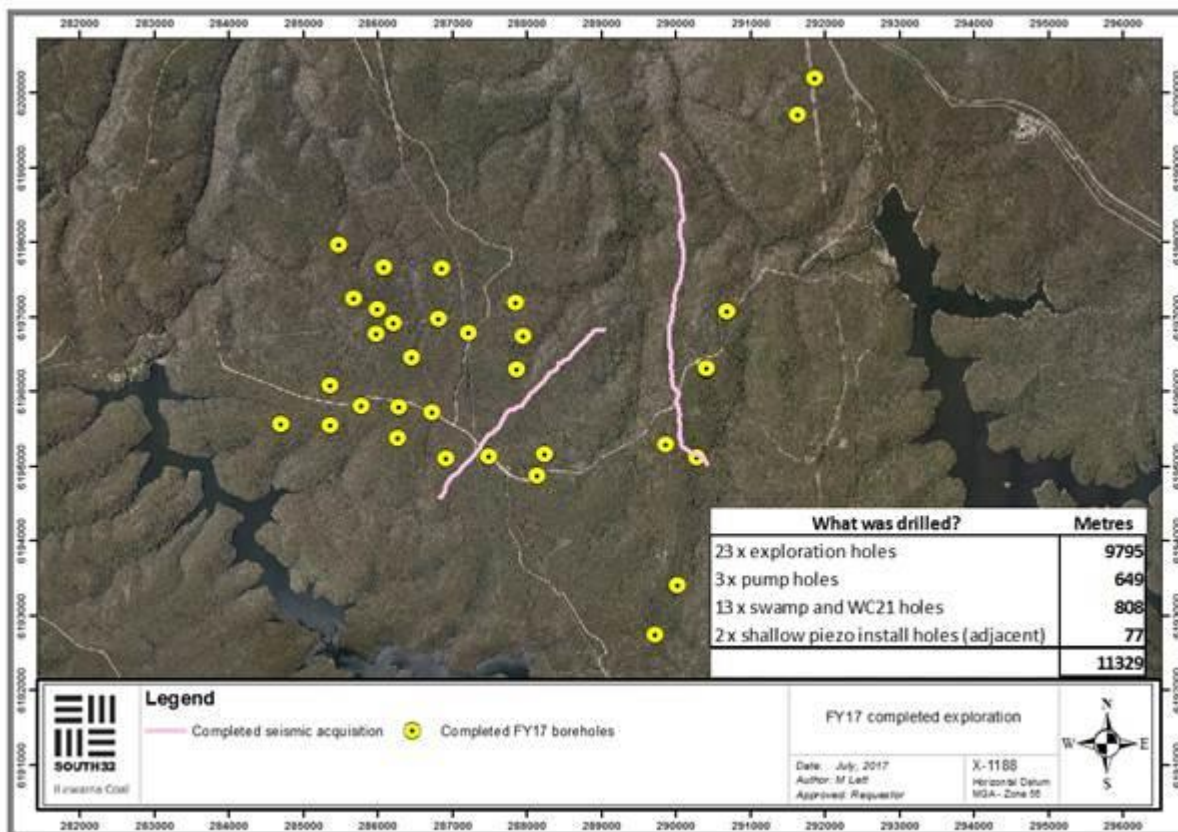
- 3 x 200m+ holes drilled adjacent to exploration holes, with pumps installed for groundwater monitoring.
- 2 x 50m shallow holes drilled adjacent to exploration holes, with piezometers installed for near-surface groundwater and swamp monitoring.
- 4 x shallow groundwater monitoring holes drilled above Longwalls 10 and 12 at Dendrobium Area 3B, to assess any possible mining influences on WC21 at the request of WaterNSW.
- 1 x shallow 50m hole drilled adjacent to Swamp 14 to monitor bedrock groundwater based on WaterNSW recommendations.
- 8 x 70m holes drilled across Area 5 and 6 Dendrobium domains, for ongoing swamp monitoring in proposed mining domains.

## Seismic Program

Seismic reflection surveys involve the use of artificially-generated sound ('seismic') waves to image sub-surface geological conditions. The sound reflects off the coal seam and receiving devices (geophones) are placed in a line on the surface to detect the seismic signal that is reflected back from subsurface geological features, such as changes in rock type or faults. The sound wave is generated by the initiation of a 500g charge, placed into a shot hole at a depth of 14m. The reason the shot holes are 14m deep is so that the sound wave is not affected by any subsurface weathering and that the safety of the seismic team can be assured. To ensure the high quality of data for the detection of seam displacement faults shot holes are drilled every 15m, with geophones placed every 7.5m.

In FY17, 2 seismic lines were acquired. The drilling of these lines occurred in FY16.

The below plan provides an overview of the locations of the exploration boreholes drilled and seismic lines acquired during the reporting period.



## Rehabilitation / Remediation

All of the exploration boreholes that were completed during the reporting period (shown in Plan 6) have been or are in the process of being rehabilitated. A small selection of these holes contain a piezometer string, used for groundwater monitoring. The piezometers are embedded in the sealing cement, attached to surface headworks or an in-ground pit with a data logger. Once monitoring is no longer required the sites are remediated and then rehabilitated. Remediation includes the removal of any monitoring headwork/standpipes and cutting off the surface casing to below ground level. During rehabilitation, erosion control works and re-vegetation is undertaken as required. In the rehabilitation cost estimation model (CCL768) the following items are covered:

- All material associated with the drilling activities removed from the site.
- Removal of above ground tanks.
- Filling in of any sumps and re-contouring/stabilising the site (if required) to prevent erosion;

- Top soil, rocks and logs, set aside from the site during initial setup, returned to site to arrest water flow over disturbed ground and provide structure for emergent seedlings.

### **Cordeaux Colliery**

No land preparation works occurred at the Cordeaux site as it is under 'care and maintenance'.

## **4.5. Construction**

### **Dendrobium Mine**

#### **Construction Activities**

No major construction activities took place during the reporting period.

Preliminary planning work to upgrade the existing compressor on site has begun (possible locations for the upgrade are being assessed).

#### **Emplacement Operations**

Activities associated with the West Cliff Emplacement Area (where the coal wash from the Dendrobium operations is emplaced) are addressed in the Bulli Seam Operation Annual Review. Where possible Illawarra Coal diverts coal wash for beneficial uses such as engineered fill with the aim to minimise the volume emplaced at the West Cliff Emplacement Area.

## 5. ACTIONS REQUIRED FROM PREVIOUS ANNUAL REVIEW

**Table 11: Arising Actions from Previous Dendrobium Annual Review**

Action Required	Where covered in this Report
Include the approval status of the mining operations plans in the "Approvals section"	Section 3 Approvals Table 7
Include the approval of exploration programs undertaken in the reporting period	Section 3 Approvals Table 8
Detail the specific weed controls undertaken in the reporting period	Section 6.6 Weeds
Provide more detail of planned activities relating to rehabilitation and exploration in the "Activities Proposed in the Next Reporting Period" section	Section 13 Activities Proposed in the Next Reporting Period
Plan of mining- show areas mined in the reporting period and areas proposed for the next reporting period	Plans 1B
Update Annual Report to include actions taken in response to triggers as outlined in TARPs.	Section 6.14 Table 22

## 6. ENVIRONMENTAL PERFORMANCE

### 6.1. Air Pollution

#### Dendrobium Mine

Air quality management is an environment aspect within the Environmental Management System for the Dendrobium operation. At the Dendrobium Pit Top site, the following dust controls were utilised during the reporting period:

- The use of a vacuum sweeper truck which operates on a regular basis; and
- The use of an automatic dust suppression spray system along the portal road.

At the Kemira Valley site, the following dust controls were utilised during the reporting period:

- The automatic dust suppression system on the stockpile. Eight sprays are located around the base of the stockpile whilst a further two sprays are located at the top of the rill tower. The spray system is programmed to activate if wind velocities exceed 10 m/s and/or when the coal moisture level drops below the trigger level of 8%. The sprays can also be activated by site personnel via a dial up system when required;
- A dust suppression system in the train loading chamber. This system ensures that the moisture level of the coal is adequate to minimise the potential for fugitive dust emissions whilst being transported from the Kemira Valley site to the DCPD via the Kemira Valley rail line;
- An enclosed train loading facility that enables coal to be loaded into the train without any fugitive emissions; and
- A dust suppression system on the Kemira Valley conveyor (including sprays at the top and bottom of the Sizer, the jib pulley, and also around the Nebo Mains transfer point) that ensures that the coal moisture content is adequate to prevent dust emissions from the conveyor; and
- Wind protection on conveyor gantries.

The dust suppression systems at both the Pit Top and Kemira Valley use recycled water.

#### Air Quality Monitoring System

During the reporting period, Dendrobium's air quality monitoring program consisted of five dust deposition gauge (DDG) sites and two high volume air samplers as required by the approved Air Quality Management Plan and Environmental Protection Licence (EPL).

The dust gauges (shown in Plan 7) are:

- Located around the site to monitor control effectiveness and throughout the community to determine amenity impacts;
- Measured on a monthly basis for ash content, combustible matter, total insoluble matter and total solids (analysis is performed at a NATA accredited laboratory);
- Compared to the EPA amenity goal of 4 g/m<sup>2</sup>/month for total insoluble solids as outlined in Table 12; and
- Visually analysed to determine the percentage contribution of dirt, coal, vegetation and insect matter.

Additional dust gauges can be deployed around the operations and throughout the community for investigative purposes.



Two High Volume Air Samplers (HVAS) measure total suspended particulates (TSP) and particulate matter less than 10 micrometres (PM10). The HVAS (shown on Plan 7) are:

- Located on site (Pit Top and Kemira Valley);
- Analysed for TSP and PM10 on a monthly basis over a 24-hour period in accordance with the approved Air Quality Management Plan and EPL requirements (samples are analysed by a NATA accredited laboratory); and
- Compared to the air quality standards (from the Dendrobium development consent) outlined in Table 12.

Results from the air quality monitoring program are reported:

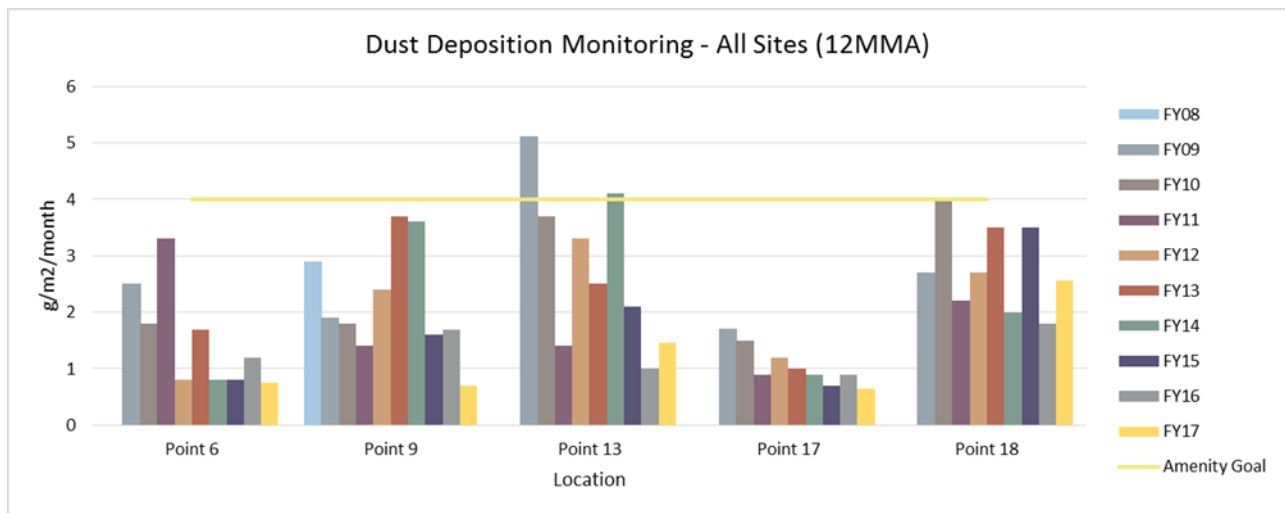
- Via the South32 website fortnightly and monthly; and
- Annually in the EPL Annual Return and Annual Review.

**Table 12: Relevant Standard for Air Quality.**

Pollutant	Goal	Averaging Period
Particulate matter < 10 µm (PM10)	50 µg/m <sup>3</sup>	24-hour maximum
	30 µg/m <sup>3</sup>	Annual mean
Total Suspended Particulates(TSP)	90 µg/m <sup>3</sup>	Annual mean
Deposited Dust (insoluble solids)	4g/m <sup>2</sup> /month	Annual mean

### Dust Deposition Results

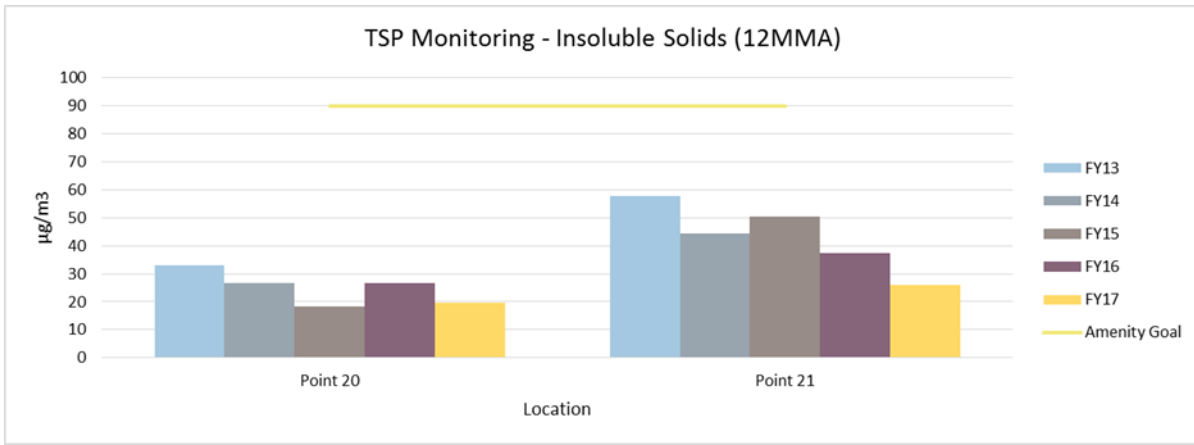
Dust levels measured in the dust deposition gauges located within the community (point 13&18 are operational control gauges) were below the amenity goal of 4 g/m<sup>2</sup>/month (Insoluble Solids). Figure 2 shows the 12 month averages for each of the licensed sites monitored since FY08.



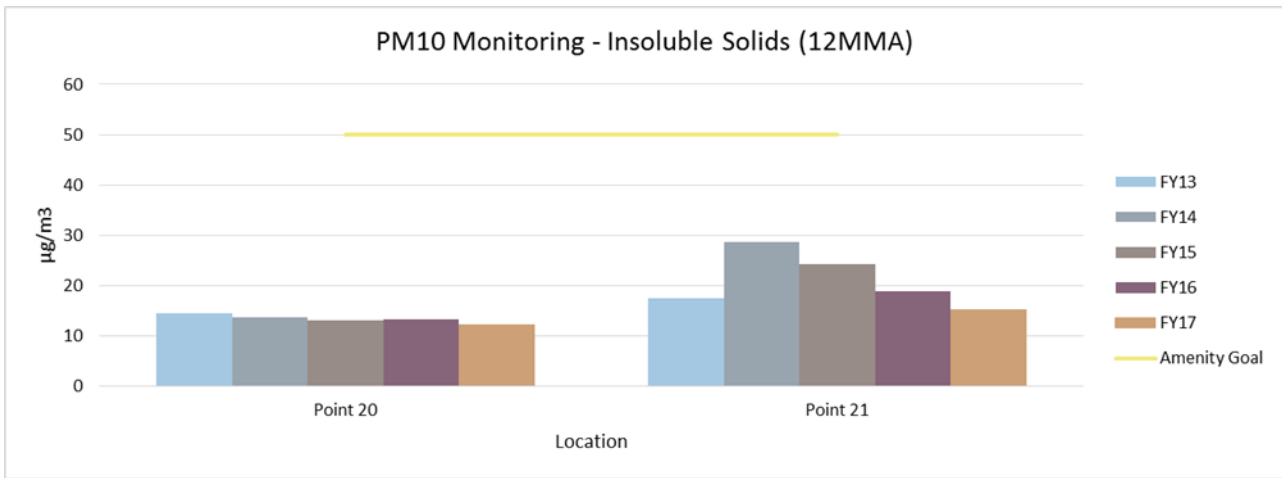
**Figure 2: EPL Dust Deposition Gauge, Average Results Summary.**

### HVAS Results

Dust levels from the High Volume Air Sampler (HVAS) for the reporting period complied with the relevant standards specified in Table 12. The monthly TSP results and PM<sub>10</sub> results for the Kemira Valley (Point 20) and the Pit Top sites (Point 21) are shown in Figure 3 and 4.



**Figure 3: HVAS TSP Results.**



**Figure 4: HVAS PM<sub>10</sub> Results.**

**Cordeaux Colliery**

Air pollution is not considered an issue at this site as there is no coal handling or coal transport from the site and traffic and storage areas are sealed.

**Vent Shaft 2/3**

No air pollution issues are considered relevant for the Vent Shaft 2/3 fan site as the site has been rehabilitated. Possible shale oil aromatics from mine activities have been considered, but due to low odour levels and the remote location of the fans no controls are currently in place. No complaints have been received.

**6.2. Erosion and Sediment**

**Dendrobium Mine**

Erosion and sediment control at Dendrobium is managed in accordance with the approved Water and Landscape Management Plans. This plan addresses erosion and sediment controls for the Dendrobium Pit Top, KVCLF, Ventilation Shaft 1 and 2/3 sites and the Kemira Valley Rail Line.

**Erosion Control**

Both the Dendrobium Mine Pit Top and KVCLF predominantly consist of sealed surfaces and vegetated areas. As limited soil is exposed, the potential for erosion is low.

## **Sediment Control**

Sediment control structures are inspected and maintained on a regular basis. Sediment is removed from drainage pits along the dirty water drainage system and the grey water treatment plant (GWTP) by an industrial vacuum tanker on an as required basis. The sediment pond assists in settling out suspended solids before surface water enters the GWTP.

## **Cordeaux Colliery**

Erosion is not a significant issue at the Cordeaux Colliery Pit Top site as the majority of the mine surface is sealed with stormwater run-off directed to appropriate holding dams and filter systems. There are minimal exposed earthen areas.

## **Vent Shaft 1 & 2/3**

Erosion is not a significant issue at the Vent Shaft sites as disturbed areas have been rehabilitated.

### **6.3. Surface Water Pollution**

#### **Dendrobium Mine**

##### **Mine Subsidence**

The surface water monitoring program enables Dendrobium to maintain a database of regional water quality and to determine any changes to surrounding water quality. Potential water quality impacts as a result of mining are described in Section 6.14.

##### **Mine Site Surface Facilities**

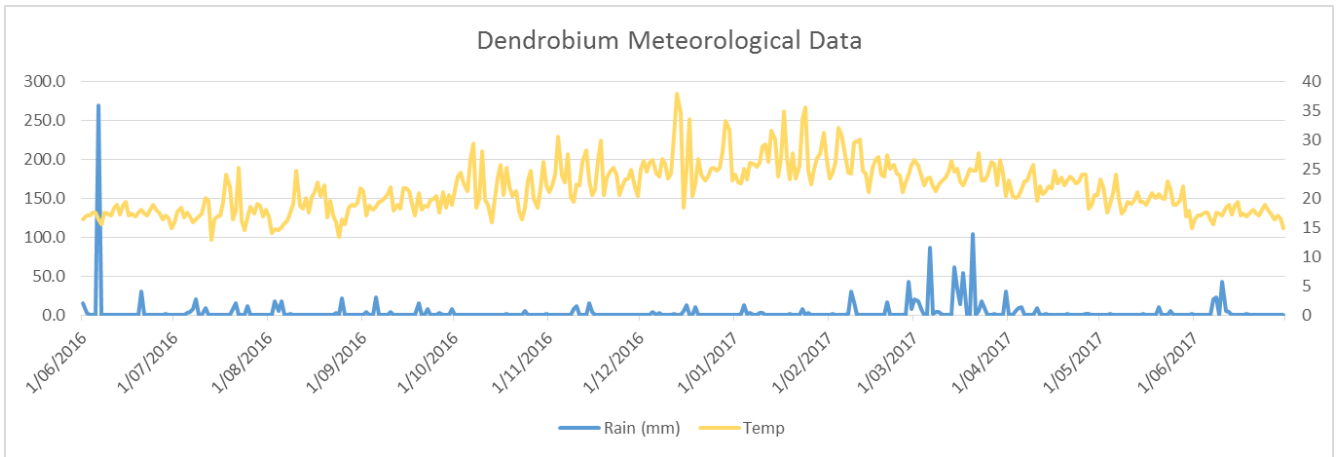
The surface water monitoring network consisted of five regular sites (see Plans 8A and 8B) which include sites upstream and downstream of both the Pit Top and Kemira Valley sites.

The monitoring program includes:

- Recording of field observations;
- In-situ monitoring for temperature, pH and conductivity; and
- Analysis of the water by a NATA accredited laboratory covering pH, conductivity, total suspended solids (TSS) metals specified for Point 5 and oil and grease.

##### **Monitoring and Results**

The majority of the monitoring sites are located in natural watercourses that surround the Dendrobium Pit Top and Kemira Valley sites, Brandy and Water Creek and American Creek. Variations in response to local geology and rainfall were within expectations during the reporting period. The results from the downstream sites are compared to the results from upstream sites at each location. These comparisons are discussed in detail below. Meteorological data for the year can be found below in Figure 5.



**Figure 5: Rainfall and temperature FY17**

*Kemira Valley Coal Loading Facility*

During the reporting period, there has been no significant difference between the upstream and downstream results for points Dend 7 and Dend 10. The results indicate that the water management system in operation at the Kemira Valley site is effective with minimal influence on the surrounding Brandy and Water Creek. Results are summarised in Table 13 and Table 14. Graphs depicting trends in water quality over previous years can be found in Appendix E.

**Table 13: Summary of Water Quality Results – Dend 7 (Upstream of KVCLF)**

Parameter	Units	Min	Max	FY17 Average
pH	pH units	8.1	8.4	8.2
Total Suspended Solids	mg/L	<5	20	9.7
Oil and Grease	mg/L	<5	<5	<5
Conductivity	µS/cm	283	554	447.3

**Table 14: Summary of Water Quality Results – Dend 10 (Downstream of KVCLF)**

Parameter	Units	Min	Max	FY17 Average
pH	pH units	8	8.4	8.3
Total Suspended Solids	mg/L	<5	16	27.1
Oil and Grease	mg/L	<5	<5	5
Conductivity	µS/cm	322	597	473.2

*Dendrobium Pit Top*

A comparison of the water quality results from Dend 12 (Table 15 upstream of Pit Top) and Dend 13 (Table 16 downstream of Pit Top) indicate that there is no significant variation in total suspended solids oil and grease levels or pH. Average water quality remained below the default trigger values from the Australian and New Zealand Guidelines for Fresh and Marine Water Quality 2000 for slightly disturbed ecosystems in south-east Australia. The results are summarised in Table 15 and Table 16. Graphs depicting trends in water quality over previous years can be found in Appendix E.

**Table 15: Summary of Water Quality Results – Dend 12 (Upstream of Pit Top)**

Parameter	Units	Min	Max	FY17 Average
pH	pH units	7.5	8	7.7
Total Suspended Solids	mg/L	<5	8	6.2
Oil and Grease	mg/L	<5	<5	<5
Conductivity	µS/cm	190	291	235.2

**Table 16: Summary of Water Quality Results – Dend 13 (Downstream of Pit Top)**

Parameter	Units	Min	Max	FY17 Average
pH	pH units	7.8	8.1	8.0
Total Suspended Solids	mg/L	<5	12	7.5
Oil and Grease	mg/L	<5	<5	<5
Conductivity	µS/cm	246	491.0	335.3

### Monitoring and Results – Licenced Discharge Point LDP5

Water from the old Kemira Mine workings and KVCLF sediment ponds (during and after rain events) is discharged through Licensed Discharge Point 5 (LDP5), located at Marley Place (refer to Plan 8B). Brine from Illawarra Coal's Appin West Desalination Plant is trucked down to Marley Place and discharged through LDP5. A total volume of 2,414ML (includes 63.6ML of Brine from Appin West Desalination Plant) was discharged in this reporting period. A summary of the monitoring requirements and limits for the reporting period for LDP5 are provided in Table 17. Graphs depicting trends in water quality over previous years can be found in Appendix E.

**Table 17: Monitoring Requirements and Prescribed Limits for LDP5**

Parameter	Units	Frequency	Sampling Method	Licence Limit
Arsenic	mg/L	Monthly	Grab sample	1.3
Conductivity	µS/cm	Monthly	Grab sample	---
Copper	mg/L	Monthly	Grab sample	0.08
Nickel	mg/L	Monthly	Grab sample	5
Oil and Grease	mg/L	Monthly	Grab sample	10
Total suspended solids	mg/L	Monthly	Grab sample	30
Zinc	mg/L	Monthly	Grab sample	0.4
pH	pH	Monthly	Grab sample	6.5-9.0

The monitoring results from the LDP5 sampling program are reviewed monthly. The monitoring results are reported to the relevant external stakeholders via the:

- EPL Annual Return (see appendix)
- Annual Review
- South32 website which is updated monthly.

A summary of monitoring results for the reporting period is provided in Table 18.

**Table 18: EPL Annual Return Monitoring Summary**

Parameter	Units	Min	Average	Max	EPL Limit
Arsenic	mg/L	0.013	0.015	0.018	1.3
Conductivity	µS/cm	1920	2011	2140	NA
Copper	mg/L	<0.001	0.001	0.003	0.08
Nickel	mg/L	0.007	0.009	0.015	5
Oil and Grease	mg/L	<5	5	7	10
pH	pH	7.7	8.0	8.5	6.5 - 9.0
Total suspended solids	mg/L	5	6	10	30
Zinc	mg/L	0.017	0.025	0.042	0.4

The Annual Return information is available online via the link: <http://www.epa.nsw.gov.au/prpoeoapp/> (EPA website). A copy of the 2016/17 EPA Annual Return has been provided as Appendix A.

### Pollution Reduction Programs

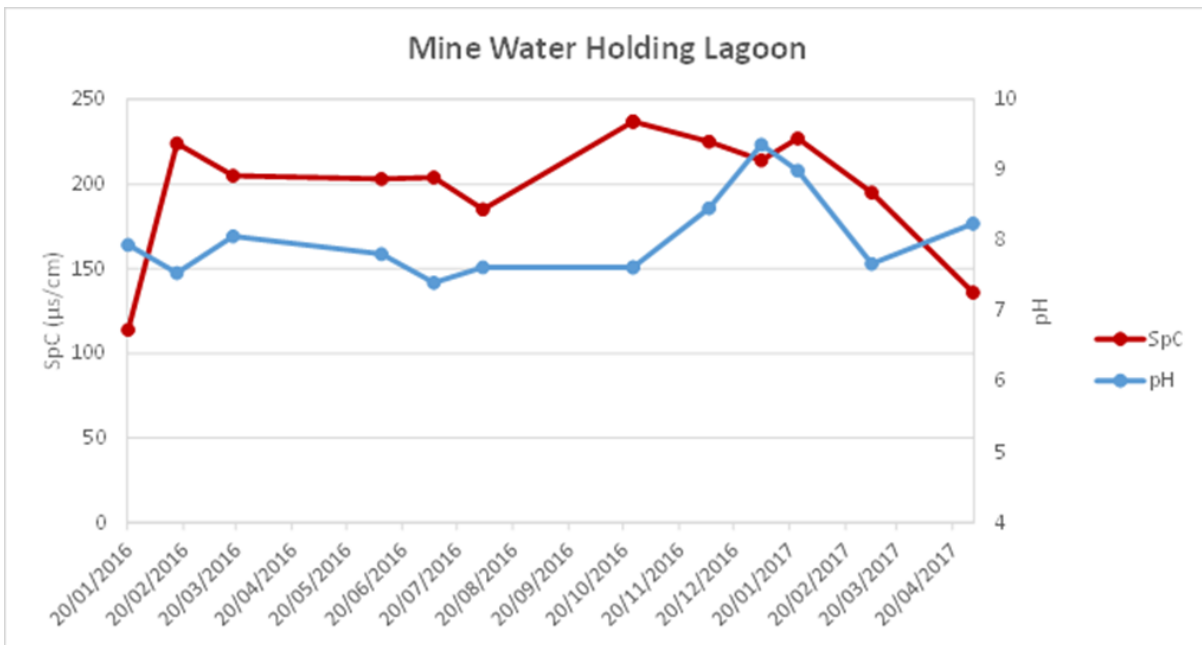
No pollution reduction programs were required to be carried out during the reporting period.

### Cordeaux Colliery

Due to the cessation of mining activities, the amount of dirty water generated at the surface of the mine has significantly reduced. Water from the catchment areas is captured in the dirty water lagoon then transferred using a pump to the upper level mine water holding lagoons for settlement. This water is then transferred to underground mine workings via a gravity fed pipeline, negating the need for surface discharge. The water returned to the mine is essentially of good quality containing no contaminants.

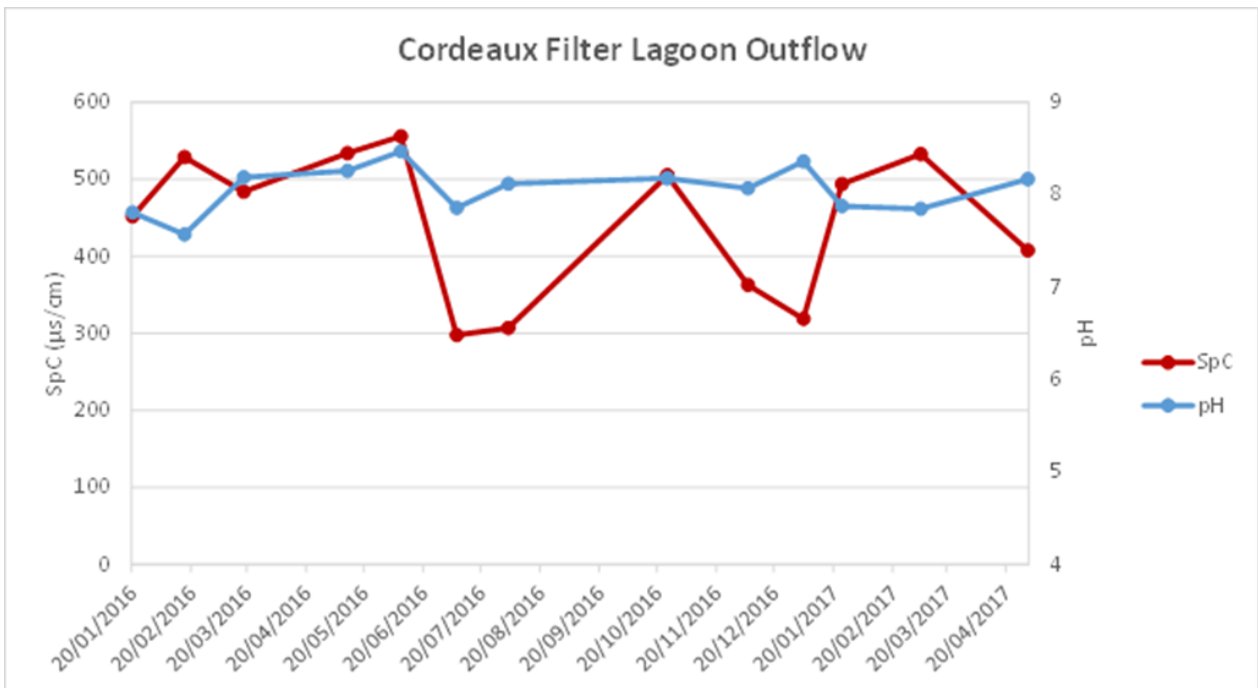
During the reporting period approximately 1.28 ML of water was discharged from the mine water holding lagoons to the underground workings.

Figure 6 shows the trends for water quality results for pH, Conductivity and Total Alkalinity of water within the mine holding lagoons from January 2016 to July 2017. Historical trends show that water quality in the lagoon has significantly improved since the cessation of underground pumping operations in September 2002. During the reporting period, monitoring results within the mine water holding lagoons continue to reflect good water quality. The pH typically ranged between 7 and 9 and conductivity ranged between 100 and 250 µS/cm.



**Figure 6: Water Quality Data from the Mine Water Holding Lagoon.**

The clean area catchment run-off from the Cordeaux pit top site (including the sealed employee car parking area) reports to the sand filter lagoon and leaves site to the local environment via the sand filter underflow. Water quality from this point is analysed on a nominal monthly basis. Water quality analysis for this reporting period shows the discharge water quality was between pH7- 8.5, with conductivity ranging between 290 and 600 µS/cm, and Oil & Grease (O&G) resulting <5 mg/L (ie: below the Limit of Reporting of 5 mg/L). Due to O&G being below the limit of reporting, O&G results are not displayed in Figure 7.



**Figure 7: pH and Conductivity at the Cordeaux Filter Lagoon Underflow.**

The long-term data suggests that the existing storage capacity and water management is adequate in managing the current activities and rainfall events.



## 6.4. Contaminated Polluted Land

### Dendrobium Mine

No significant land pollution events occurred during the reporting period for Dendrobium Mine. Basix Environmental Solutions (BES, 2010) undertook a preliminary contamination assessment of the Dendrobium Mine Pit Top and KVCLF in March 2010. The results of from subsequent soil sampling were provided in previous Annual Reviews and indicated the below;

- PAH levels were below the NEPM HIL criteria for parks, recreation open space and playing fields;
- TPH levels were below the Dutch Intervention Value of 5,000 mg/kg; and
- Minor oil staining of sealed surfaces occurred. For the majority of the Pit Top, it is likely that any potential contamination (existing under sealed surfaces or on unsealed road verges storage areas) is minor and not likely to export off site.

### Cordeaux Colliery

Cordeaux Colliery has a small localised area which has been affected by leaching from the slag base at the surface switch yard. This was first noted in 2005 as vegetation in the localised area appears to have been adversely affected. No increases in impacts have been observed in this reporting period.

Rehabilitation planning for sites will include investigations to identify land contamination. If areas of contamination are identified that require remedial works, this will then be completed in an appropriate manner in accordance with the requirement/agreement of stakeholders and relevant Government agencies.

### Corrimal No.3 Shaft

On the 4 of April 2017 IC identified that two transformers had been vandalised which resulted in the spilling of oil at the Corrimal No 3 Ventilation Shaft. The site is located north of Picton Road in proximity to Fire trail No. 8, Cataract NSW. The spill was reported to relevant Government agencies.

Notices of Clean-up Action were issued by WaterNSW which required, among other actions, an investigation of the extent of pollution and impacts to the environment as a result of the discharge of oil from the transformers and to make recommendations on what remedial actions are required.

IC has submitted a Remedial Action Plan (RAP) to WaterNSW and the NSW Resources Regulator. The RAP relates to the site of the spill, the transformer yard and adjacent areas. The RAP will be completed during the next annual review period.

## 6.5. Threatened Flora

### Dendrobium Mine

No threatened species were identified on the Dendrobium Pit Top site, KVCLF or Ventilation Shaft 1 or 2/3 sites during this reporting period. Results from the flora and fauna monitoring undertaken via the SMP process are detailed in section 6.14 of this report.

### Cordeaux Colliery

No activities have occurred at the Cordeaux Colliery that would affect threatened fauna species.

### Vent Shaft 2/3

Vent Shaft 2/3 has not taken part in any activities that could potentially affect threatened fauna species.

## 6.6. Weeds

### Dendrobium Mine

Weeds are managed in accordance with Illawarra Coal's Weed Management Plan. Dendrobium carried out regular maintenance which included weed control during the reporting period.

Within the Dendrobium Pit Top area, some of the more accessible areas were targeted for weed species removal. This included the removal and / or treatment of Crofton Weed, Lantana, Privet, Ginger Lily and other woody and herbaceous weeds. Kemira Valley operations targeted accessible areas for Mysore Thorne removal and / or treatment.

### Cordeaux Colliery

Weeds are controlled on a routine basis by the site contract gardener through targeted spray activities. Weed growth within the area of the boundary fire break zone is addressed on an as required basis.

### Vent Shafts 1, 2 & 3

Weed management is conducted at Vent Shaft 1 and Vent Shaft 2/3 in accordance with Illawarra Coal's Weed Management Plan.

## 6.7. Blasting

### Dendrobium Mine

No surface blasting activities were undertaken during the reporting period. Minor blasting activities underground are undertaken using approved management plans.

### Cordeaux Colliery

Blasting is not considered relevant as Cordeaux Colliery as the lease is under 'care and maintenance'.

## 6.8. Operational Noise

### Dendrobium Mine

#### Noise Management Strategies

Noise management is an important aspect of the Dendrobium operations as the Pit Top and Kemira Valley sites are located adjacent to residences in Mt Kembla and Kembla Heights. Quarterly noise monitoring is conducted to satisfy requirements of the Dendrobium Development Consent and the approved Noise Management Plan.

Noise management strategies in place include:

- Low frequency reversing alarms installed on all underground and surface based vehicles;
- Rail track related noise management program;
- Replacement of steel rollers with polyurethane coated rollers on the Kemira Valley conveyor;
- Removal of steel belt clips at Kemira Valley Tunnel;
- Self-imposed night time noise curfew limiting mobile equipment and ballast movements around the Dendrobium Pit Top (from 10pm to 6.15am);
- Employee/contractor environment and community awareness training;
- Replacement of old compressor units with quieter noise attenuated units; and
- Load Haul Dump Vehicles have been upgraded to quieter coal tram machinery.

Noise from the rail operations on the Nebo Main (Rail) Line has been raised as a community concern since the Environmental Impact Statement was prepared for the Dendrobium mine operations.

The rail line is located within 200 m of more than 500 receivers within the Mount Kembla, Cordeaux Heights and Unanderra communities. The track geometry consists of relatively tight curves which can increase the likelihood of squeal events caused by the wheel / track interface and / or brake related issues. Noise issues are addressed by the Rail Noise Working Group (RNWG) which meets regularly with the below objectives:

- review noise results and identify rail noise mitigation options;
- improve targeted track maintenance; and
- develop strategy for positive proactive community engagement.

Illawarra Coal's RNWG consists of Illawarra Coal employees (operational, community and environmental personnel) and our rail contract partners (Fluor and Pacific National). During the reporting period, the RNWG has undertaken numerous rail trials and noise monitoring campaigns to identify noise sources and minimise the rail noise generated in the local area.

Illawarra Coal has conducted the following Environmental Improvement Program / Rail Noise Investigation during FY16 and FY17:

- Stage 1(undertaken in FY16): undertake a study of rail noise factors to identify and differentiation in rail noise between assets; define proportion of noise contribution from brake, wheel, and flange sources; and establish any relationship between squeal and potential causal factors where possible. Stage 1 identified braking noise as the priority noise source to be further investigated.
- Stage 2: Development of a strategic plan to reduce rail noise based upon the evidence/findings from Stage 1. The Strategic Plan includes the following actions:
  - Pacific National undertook brake shoe dyno testing with the manufacturer & Transport NSW. The findings included:
    - Non-conforming fit (centre contact) between brake shoe and shoe chair (different radii) leads to vibration & brake noise generation;
    - Chocking the non-conforming shoe and shoe chair removes vibration and reduces brake noise generation;
    - Shoe key fitment was not a contributing factor;
    - With non-conforming fit of the brake shoe, an elevation in temperature made it easier to produce squeal (with a conforming fit, temperature made no difference); and
    - Position of the brake block on the wheel profile affected noise generation (tapering).
    - Wagon Fleet Testing: Measurement of wagon attributes across good and bad brake noise performers to determine if there is a difference in attributes including:
      - Brake force and brake cylinder pressure;
      - Shoe chair radii and brake shoe radii;
      - Shoe key fitment; and
      - Rotational resistance of shoe chair around brake beam.

Stage 1 identified that a non-conforming brake shoe fit was a contributing factor for nuisance noise (squeal) and a program of works was developed to complete on track testing of conforming brake shoes.

Modified Brake Shoes (larger version) with a more conforming fit were fitted to an entire train (22 wagons) in FY17 to allow for comparison of modified and unmodified trains. Track side and on board monitoring of the

modified and unmodified trains have shown that the conforming fit brake shoe is successful at reducing duration, loudness and frequency (number of squeal occurrences).

Further work on the Strategic Plan is progressing with results to be communicated to residents and the EPA when available.

### Noise Monitoring Program

The program includes noise monitoring of the Pit Top site, the KVCLF and the rail operations. Attended noise monitoring is carried out on a quarterly basis at three locations as outlined in Plan 9.

The rail haulage noise measurements are undertaken on an annual basis. This monitoring has been undertaken as per the approved Noise Management Plan.

The results from the attended noise monitoring are compared to the noise criteria for Dendrobium Mine and KVCLF for daytime, evening, and night time periods as set out in the Dendrobium Development Consent. The LAeq noise criteria are shown in the table below.

**Table 19: Monitoring Requirements and Prescribed Limits**

Location	Noise Criteria LAeq, 15 min (dBA)			Noise Criteria for Dendrobium Operations, LA1, 1min (dBA)
	Daytime (7am -6pm)	Evening (6pm-10pm)	Night time (10pm – 7am)	
R1	40	40	39	49
R6a	40	40	37	47
R39a	37	35	35	45

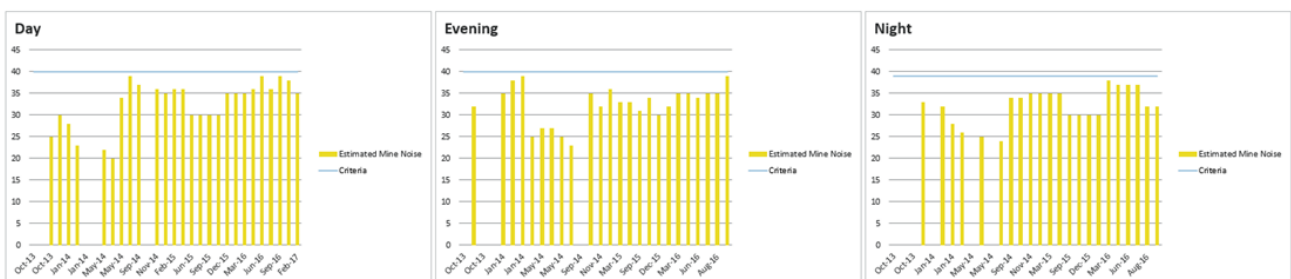
Attended noise monitoring was conducted on a quarterly basis throughout the FY17 period.

During the reporting period Dendrobium achieved 100% compliance against the LAeq, 15min criterion,

A summary of the results is provided below.

#### Location R1 (17 High Street)

R1 is located to the north of the Pit Top. There were no exceedances of the noise criteria. The LAeq 15 minute results for R1 are provided in Figure 8.



**Figure 8: Site R1 Noise Compliance (LAeq, 15 min).**

## Location R6a (374 Cordeaux Road)

R6a is located to the east of the Dendrobium Pit Top. There were no exceedances of the noise criteria. The LAeq 15 minute results for R1 are provided in Figure 9.

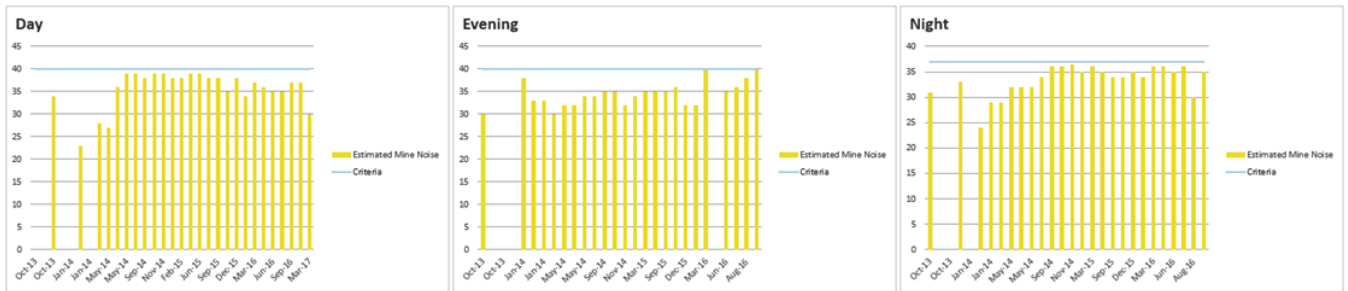


Figure 9: Site R6a Noise Compliance (LAeq, 15 min).

## Location R39a

R39a is located to the south-east of KVCLF at Figtree Farm. There were no exceedances of the noise criteria. The LAeq 15 minute results for R1 are provided in Figure 10.

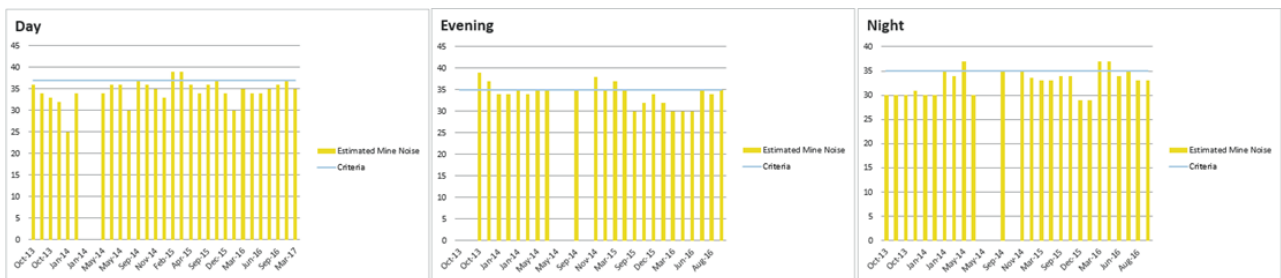


Figure 10: Site R39a Noise Compliance (LAeq, 15 min).

## Rail Haulage

A summary of the rail haulage noise criteria is presented in Table 20. The noise levels from all locomotives in use on the Kemira Valley Rail line are governed by these specific noise limits.

Table 20: Rail Haulage Noise Criteria.

Operating Conditions	Speed and Location of Measurement	Noise Limits LA1 (1 min) (dBA)
Idle with compressor radiator fans and air conditioning operating at maximum load occurring at idle	Stationary 15m contour	70dBA
All other throttle settings under self-load with compressor radiator fans and air conditioning operating	Stationary 15m contour	87dBA 95dBLin
All service conditions	0-50 km/h 15m from centreline of track	87dBA 95dBLin

Attended rail haulage noise measurements for the 82 class locomotive was conducted on the 14th of June 2017. No exceedances reported.

## **Cordeaux Colliery**

This aspect is not considered relevant as Cordeaux Colliery as site is in 'care and maintenance'.

### **6.9. Visual, Stray Light**

#### **Dendrobium Mine**

Lighting at Dendrobium is managed in accordance with the Lighting Management Plan. The Dendrobium Pit Top site is shielded by established vegetation with minimal stray light leaving the site.

The Kemira Valley site is shielded within the valley and the majority of the lighting is turned off during night-time operations unless work is being carried out on site. No complaints regarding lighting were received during the reporting period.

#### **Cordeaux Colliery**

Cordeaux Colliery is located in bushland with no immediate residential receivers. No complaints regarding lighting were received during the reporting period.

### **6.10. Aboriginal Heritage**

#### **Dendrobium Mine**

The Aboriginal Heritage Plan sets out the requirements to satisfy the Consent Conditions for Aboriginal Heritage management in Dendrobium Area 3. Aboriginal Heritage Impact Permit (AHIP) No: 1098243 was issued to Illawarra Coal on 27 March 2009. AHIP No: 1098243 allows for potential impacts (associated with subsidence movements from longwall mining) to Aboriginal archaeological sites within Dendrobium Area 3B. The management measures described in this Aboriginal Heritage Plan are the same as those to be implemented for AHIP No: 1098243.

#### **Cordeaux Colliery**

Sites of archaeological and natural significance were identified and assessed as part of previous longwall extraction approval processes. The assessments concluded that no significant effects would occur to the identified features as a result of longwall mining at Cordeaux Colliery.

Archaeological assessments and surveys were conducted in 2003 in relation to surface rehabilitation works planned for the Cordeaux sites. The assessments and surveys identified no items of aboriginal significance that will be disturbed by the potential rehabilitation activities.

### **6.11. Natural Heritage**

#### **Dendrobium Mine**

Items of natural heritage are identified in the SMP process. Details regarding natural heritage and European heritage are reported in Section 6.14 of this report.

#### **Cordeaux Colliery**

Aspect not considered relevant as Cordeaux Colliery is in 'care and maintenance'.

### **6.12. Spontaneous Combustion**

#### **Dendrobium Mine**

Spontaneous combustion has not been an issue at Dendrobium Mine. The coal and overburden characteristics at Dendrobium Mine are unlikely to lead to spontaneous combustion.

## Cordeaux Colliery

Aspect not considered relevant as Cordeaux Colliery site is under 'care and maintenance'.

### 6.13. Bushfire

#### Dendrobium Mine

During the reporting period, bushfire mitigation works were carried out in accordance with the Bushfire Management Plan. Asset protection and fire trails are maintained or established in the following areas:

- Asset Protection Zones maintained:
  - 28-38 Harry Graham Drive – Kembla Heights; and
  - Northern Side of Cordeaux Road – Mount Kembla
  - Dendrobium 1, 2 and 3 shaft
- Fire Trail Maintenance:
  - Containment Line southern side of Dendrobium Mine Pit Top;
  - Benjamin Road Fire Trail – Kembla Heights; and
  - Stones Road Fire Trail – Kembla Heights.
  - Access to Dendrobium 1, 2 and 3 shaft.

#### Cordeaux Colliery

Bushfire management at the Cordeaux Pit Top is achieved through the formation of a "fire break" around the site boundary, and the establishment of an extensive firefighting water pipeline (with booster pump facility) around the site. A tanker filling station for charging the fire line has been installed in proximity to the fire pump (Note: the fire line is not maintained in a charged state). Maintenance of fire line pressure was previously automated by a pressure controlled jockey pump.

Clearing of excessive vegetation from within the pit-top boundary fire break zone is undertaken on an as required basis, determined by annual inspections. To prevent the possibility of bush fires produced by contact with live power lines, line clearing is undertaken to selectively clear vegetation with the potential to encroach on power lines.

Prior to the onset of the summer months each year, Illawarra Coal undertakes inspections of its property boundaries to determine appropriate bush fire mitigation and hazard reduction works to be undertaken prior to the hotter drier summer months of the bushfire season.

The Rural Fire Service radio repeater is located in the M&M tower at the Cordeaux Pit Top site.

### 6.14. Mine Subsidence

#### Dendrobium Mine

Mining using the longwall method results in subsidence (lowering) of the land surface. Dendrobium Mine has an approved Subsidence Management Plan (SMP) and/or Extraction Plan (EP) for each of its mining areas (1, 2, 3A and 3B) which describes the ongoing program of subsidence monitoring and management at the mine. These SMPs were developed in accordance with Condition 7, Schedule 3 of the Dendrobium Mine Development Consent (DA- 60-03-2001).

The management of subsidence is undertaken in consultation with the Dendrobium Community Consultative Committee (DCCC), WaterNSW, Department of Resource and Energy, Department of Planning and Environment (DoPE), Dams Safety Committee (DSC), NSW Office of Water (NOW) and NSW Office of Environment and Heritage (OEH). The implementation of the plan relates to monitoring and management of:

Natural features, including:

- Surface and groundwater;



- Landscapes, including steep slopes, cliffs, land suitability and areas prone to erosion or flooding;
- Terrestrial and aquatic ecology;
- Aboriginal and European heritage; and
- Infrastructure (man-made features).

During the reporting period Longwall 12 extraction was completed on the 31<sup>st</sup> of January, 2017, and Longwall 13 extraction commenced on the 4<sup>th</sup> of March 2017. As of the 10<sup>th</sup> July 2017 2017, Longwall 13 had extracted approximately 155.7 metres. Mine subsidence monitoring and reporting was carried out in accordance with the approved SMP/EP for Area 3B and supporting management plans.

The monitoring program for Longwalls 12 and 13 is defined by the Area 3B SMP/EP and supporting management plans which include:

- Dendrobium Area 3B Asset Protection Plan;
- Dendrobium Area 3B Groundwater Management Plan;
- Dendrobium Area 3B Swamp Impact, Monitoring, Management and Contingency Plan; and
- Dendrobium Area 3B Watercourse Impact, Monitoring, Management and Contingency Plan.

A summary of monitoring commitments for this reporting period are provided in Table 21. Additional information can be found in the Longwall 12 End of Panel report, Area 3B SMP and EP and supporting management plans, which can be accessed from the South32 Website:

<http://www.south32.net/our-operations/australia/illawarra-coal/regulatory-document>

Table 21: Monitoring program for Dendrobium Mine.		
SMP Commitments for FY17	Monitoring Frequency	Monitoring Undertaken
<b>Subsidence Monitoring</b>		
Airborne Laser Scanning (ALS) over Areas 3A and 3B – including 3D Digital Terrain Model (DTM)	ALS to be undertaken at conclusion of each longwall and 12 months after extraction is complete in each area	As per SMP commitments
Area 3A and 3B 2D monitoring lines	<ul style="list-style-type: none"> <li>• Monthly for first 1000 m of extraction then 6 monthly</li> <li>• Monthly during mining for key features</li> </ul>	As per SMP commitments Two surveys were not undertaken as required in February and March 2014 - this was reported to Department of Trade and Investment May 2014
3D control survey	Conclusion of each longwall and 12 months after the completion of each area	As per SMP commitments
<b>Water Courses</b>		
<b>Observational, Photo Point and Water Monitoring</b>		
<ul style="list-style-type: none"> <li>• Native Dog, Wongawilli and Donalds Castle Creeks, WC21, WC15, LA4, DC13, LA6, ND1, WC6, WC7, WC8, WC9, WC12, WC16 and WC18</li> <li>• Swamps 5, 10, 11, 13, 14, 23, 35a, 35b, 1a, 1b, 8, 3 and 4</li> </ul>	<ul style="list-style-type: none"> <li>• 6 monthly baseline and reference site monitoring</li> <li>• Weekly monitoring when longwall is within 400m</li> <li>• 6 monthly monitoring for 2 years post mining</li> </ul>	As per SMP commitments
<b>Water Quality</b>		
<b>Wongawilli Creek</b>		
WWU1, WWU4, WC Pool 49, WWM1, WWM2, WWM3, WWL2, WC21_S1, WC21 Pools 30 and 53, WC15_S1	Monthly monitoring during and post mining for two years or until required	As per SMP commitments

Table 21: Monitoring program for Dendrobium Mine.

SMP Commitments for FY17	Monitoring Frequency	Monitoring Undertaken
<b>Lake Avon</b>		
LA4_S1 , LA4_S2, LA5_S1, LA5_S2, LA3 Pool 4, LA2 Pool 5, LA1, NDC4 and NDC1		
<b>Donalds Castle Creek</b>		
DCU3, DCL3, DC_S2, DC13_S1		
<b>Sandy Creek</b>		
SCU1, SCL		
<b>Flow</b>		
<b>Wongawilli Creek</b>		
WWU, WWL, WC21S1 and WC15S1		
<b>Donalds Castle Creek</b>		
DCU, DC13S1 and DCS2	Continuous 1 hour logging intervals	As per SMP commitments
<b>Lake Avon</b>		
LA4S1		
<b>Aquatic Ecology</b>		
<ul style="list-style-type: none"> <li>• Macroinvertebrate sampling and assessment using the AUSRIVAS protocol and quantitative sampling using artificial collectors</li> <li>• Individuals of the genus Austrocorduliidae and Gomphomacromiidae are identified to species level if possible</li> <li>• Fish are sampled using back-pack electrofisher and baited traps</li> </ul>	<ul style="list-style-type: none"> <li>• Two baseline monitoring campaigns prior to mining during autumn and spring</li> <li>• Monitoring during mining in autumn and spring</li> <li>• Monitoring post-mining for two years or as otherwise required</li> <li>• Monitoring target sites as mining progresses through the domain</li> </ul>	As per SMP commitments
<b>Terrestrial Fauna – Threatened Frog Species</b>		
<ul style="list-style-type: none"> <li>• Surveys are conducted along creeks with a focus on features susceptible to impacts</li> <li>• Potential breeding habitat for Littlejohn’s Tree Frog and Giant Burrowing Frog will be targeted</li> <li>• Standardized transects to record numbers of individuals between surveys for each site</li> </ul>	Surveys are undertaken in optimal periods over the season	As per SMP commitments
<b>Swamps</b>		
<b>Observational, Photo Point and Water Monitoring</b>		
<p>Impact Sites: Swamps 1A, 1B, 3, 4, 5, 8, 10, 11, 13, 14, 23,35A and 35B</p> <p>Reference Sites: Swamps 2, 7, 15a, 22,24, 25, 33, 84, 85, 86, 87 and 88</p>	<ul style="list-style-type: none"> <li>• Pre and post mining for 2 years, monthly when longwall is within 400m of monitoring site</li> <li>• Weekly inspection and pool water levels when longwall is within 400m of monitoring site</li> <li>• Reference sites 6 monthly</li> </ul>	As per SMP commitments
<b>Erosion Monitoring</b>		

Table 21: Monitoring program for Dendrobium Mine.

SMP Commitments for FY17	Monitoring Frequency	Monitoring Undertaken
<p>Impact Sites: Swamps 1A, 1B, 3, 4, 5, 8, 10, 11, 13, 14, 23, 35A and 35B</p> <p>Reference Sites: Swamps 2, 7, 15A, 22, 24, 25, 33, 84, 85, 86, 87 and 88</p>	<p>Ground based surveys to be completed for each longwall after each longwall or to define any new erosions identified by ALS survey</p>	<p>As per SMP commitments</p>
<b>Shallow Groundwater Level</b>		
<p><b>Impact Sites:</b></p> <ul style="list-style-type: none"> <li>Swamps 1A, 1B, 3, 4, 5, 8, 10, 11, 12, 13, 14, 23, 35A and 35B</li> </ul> <p><b>Reference Sites”</b></p> <ul style="list-style-type: none"> <li>Swamps 2, 7, 15A, 22, 24, 25, 33, 84, 85, 86, 87 and 88</li> </ul>	<p>For open hole sites:</p> <ul style="list-style-type: none"> <li>Monthly baseline monitoring</li> <li>Weekly monitoring during active subsidence</li> <li>Monthly monitoring post mining for two years to be reviewed annually</li> </ul> <p>For instrumented sites:</p> <ul style="list-style-type: none"> <li>Automatic groundwater level monitoring (4 hour interval or similar)</li> <li>Monitoring post mining for five years to be reviewed annually</li> </ul>	<p>As per SMP commitments</p>
<b>Soil Moisture</b>		
<p><b>Impact Sites:</b></p> <ul style="list-style-type: none"> <li>Swamps 3, 4, 5, 8, 10, 11, 13, 14, 23, 35A and 35B</li> </ul> <p><b>Reference sites:</b></p> <ul style="list-style-type: none"> <li>Swamps 2, 7, 15A, 22, 24, 25, 33, 84, 85, 86, 87 and 88</li> </ul>	<ul style="list-style-type: none"> <li>Monthly baseline for 2 years prior to mining</li> <li>Weekly monitoring when longwall is within 400m of swamp</li> <li>6 monthly monitoring for 2 years post mining</li> </ul>	<p>As per SMP commitments</p>
<b>Terrestrial Flora – Composition and Distribution of Species</b>		
<p>15m transects consisting of 30 0.5m X 0.5m quadrats. The monitoring records:</p> <ul style="list-style-type: none"> <li>Presence of all species within each quadrat</li> <li>Percentage foliage cover and vegetation height</li> <li>Observations of dieback or changes in community structure</li> <li>Photo point monitoring at each transect</li> </ul>	<p>Surveys are undertaken in spring and autumn each year</p>	<p>As per SMP commitments</p>
<b>Terrestrial Flora – Swamp Size and Ecosystem Function</b>		
<p>Detailed mapping including use of LiDAR data to indicate the location and extent of upland swamp boundaries followed by ground-truthing of these boundaries and vegetation sub-communities</p>	<ul style="list-style-type: none"> <li>Baseline mapping prior to mining</li> <li>Repeat mapping at 5 year intervals or as determined by observational monitoring</li> </ul>	<p>As per SMP commitments</p>
<b>Terrestrial Fauna – Threatened Frog Species</b>		

Table 21: Monitoring program for Dendrobium Mine.

SMP Commitments for FY17	Monitoring Frequency	Monitoring Undertaken
<ul style="list-style-type: none"> <li>Surveys are conducted along creeks with a focus on features susceptible to impacts</li> <li>Potential breeding habitat for Littlejohn's Tree Frog and Giant Burrowing Frog will be targeted</li> <li>Standardized transects to record numbers of individuals between surveys for each site</li> <li>Tadpole counts to be undertaken as part of the breeding habitat monitoring transects</li> </ul>	Surveys are undertaken in optimal periods over the season	As per SMP commitments
<b>Landscape</b>		
<b>Targeted Sites</b>		
<ul style="list-style-type: none"> <li><b>Cliffs</b> <ul style="list-style-type: none"> <li>A3-CL1, A3-CL2, A3-CL3, A3-CL4, A3-CL5, DA3-CF19, DA3-CF20, DA3-CF21, DA3-CF22, DA3-CF23, DA3-CF24, DA3-CF25, DA3-CF26, DA3-CF41, DA3-CF42, DA3-CF43</li> </ul> </li> <li><b>Steep Slopes</b> <ul style="list-style-type: none"> <li>A3-SL1, A3-SL2, A3-SL3, A3-SL4, A3-SL5, A3-SL6, A3-SL7, A3-SL8, A3-SL9</li> </ul> </li> <li><b>Watercourses / Swamps</b> <ul style="list-style-type: none"> <li>Refer to Dendrobium Area 3 Watercourse and Swamp Monitoring TARP's</li> </ul> </li> <li><b>Fire Trails</b> A3-FR1, A3-FR2, Fire Roads 6A, 6N and 6Q</li> </ul>	<ul style="list-style-type: none"> <li>Baseline monitoring campaign prior to mining</li> <li>Monthly monitoring during subsidence</li> <li>Monitoring to continue 6 monthly for 2 years following the completion of mining</li> </ul>	As per SMP commitments
<b>Inspection of Active Mining Area – Landscape Features, Vegetation, Watercourses</b>		
<ul style="list-style-type: none"> <li>All mapped cliff, steep slopes, and watercourse, swamp and fire trail sites in subsidence area. Refer to Dendrobium Area 3B SMP Figure 5.3, 15.1 and 18.1 for location of sites</li> <li>General observation of active mining areas.</li> <li>During mining recording includes impacts to: <ul style="list-style-type: none"> <li>Drainage</li> <li>Disturbance of site erosion</li> <li>Aggradations</li> <li>Inundation</li> <li>Rock fracturing</li> <li>Changes in runoff</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Weekly monitoring when longwall extraction is within 400m</li> </ul>	As per SMP commitments

Table 21: Monitoring program for Dendrobium Mine.

SMP Commitments for FY17	Monitoring Frequency	Monitoring Undertaken
<ul style="list-style-type: none"> <li>- Changes in vegetation</li> <li>- Impacts to fauna / fish</li> <li>- Rockfalls</li> <li>- Soil cracking</li> </ul> <p>Slumping</p>		
<b>Terrestrial Fauna</b>		
<ul style="list-style-type: none"> <li>• A number of sites located across and around Areas 2, 3A and 3B. Refer to Dendrobium Area 3A SMP Figures 21.1, 21.2 and 21.3 and 3B Figure 20.1</li> <li>• Monitoring parameters include:               <ul style="list-style-type: none"> <li>- Vegetation communities</li> <li>- Vegetation condition</li> <li>- Changes in vegetation</li> <li>- Tree health</li> <li>- Swamp vegetation</li> <li>- Threatened species</li> </ul> </li> <li>• Control sites</li> </ul>	<ul style="list-style-type: none"> <li>• Two baseline monitoring campaigns 1 year prior to mining during autumn and spring</li> <li>• 6 monthly monitoring during mining in autumn and spring</li> <li>• 6 monthly monitoring post mining for two years or as otherwise required</li> </ul>	As per SMP commitments
<ul style="list-style-type: none"> <li>• A number of sites located across and around Areas 2, 3A and 3B. Refer to Dendrobium Area 3A SMP Figures 21.1, 21.2 and 21.3 and 3B Figure 20.1</li> <li>• Monitoring parameters include:               <ul style="list-style-type: none"> <li>○ Species and habitat characteristics</li> </ul> </li> <li>• Targeted surveys and monitoring of known populations of threatened frog species</li> </ul>	<ul style="list-style-type: none"> <li>• Two baseline monitoring campaigns 1 year prior to mining</li> <li>• 6 monthly monitoring during mining</li> <li>• 6 monthly monitoring post mining for two years or as otherwise required</li> </ul>	As per SMP commitments
<b>Aboriginal Archaeology</b>		
<ul style="list-style-type: none"> <li>• Re-recording of the principal components identified by Sefton (Sefton 2000)</li> <li>• Macro and micro recording using digital photography (Navin Officer (2003)</li> <li>• Detailed elevation plans of shelter walls recording structural and surface features including but not limited to the art, graffiti, joints, bedding planes, exfoliation scars, cracks, mineral and microorganism growth, drip line and water seepage locations</li> </ul>	<ul style="list-style-type: none"> <li>• Baseline archival recording: prior to longwall mining</li> <li>• First impact assessment recording: following initial subsidence movement of the site</li> <li>• Sandstone shelter aboriginal sites will be monitored during mining</li> <li>• Further impact assessment recording: 12 months after undermining or final subsidence movement of the site</li> </ul>	As per SMP commitments

## **Subsidence Movements**

Subsidence movements resulting from the extraction of Longwall 12 were measured at the following survey points and lines:

- Wongawilli Creek Closure Lines;
- Dendrobium Area 3B 3D monitoring points;
- Wongawilli Creek Tributary Cross Lines;
- Donalds Castle Creek Cross Lines;
- Swamp 1a, 1b and 5 Cross Lines; and
- Airborne Laser Scan of the area.

The subsidence parameters measured during the extraction and at the completion of Longwall 12 were generally similar to or less than what was predicted within the Area 3B SMP. For further detail on the subsidence movements measured for Longwall 12, refer to the Longwall 12 End of Panel Report. This report can be accessed via the South32 website:

<http://www.south32.net/our-operations/australia/illawarra-coal/regulatory-document>

The Subsidence Monitoring Program for Longwall 12 includes:

- Wongawilli Creek and Avon Dam Closure Lines;
- Area 3B and Avon Dam 3D Monitoring Points;
- Tributary Cross Lines;
- Swamp Cross Lines
- Swamps 3, 4 and 10 3D surveys;
- Donalds Castle Creek, WC21 and Wongawilli Creek Tributary Cross Lines; and
- Dendrobium Area 3B Airborne Laser Scan.

## **Landscape Features**

The Illawarra Coal Environmental Field Team (ICEFT) have conducted detailed monitoring and inspections on landscape features including swamps, watercourses, rock outcrops and the general area within Dendrobium Area 3B. This monitoring was conducted in accordance with the Dendrobium Area 3B SMP, Dendrobium Area 3B Watercourse Impact, Monitoring, Management and Contingency Plan (WIMMCP) (versions dated December 2013 and June 2015) and the Dendrobium Area 3B Swamp Impact, Monitoring, Management and Contingency Plan (SIMMCP) (versions dated December 2013 and June 2015). During the period of extraction updated Trigger Action Response Plans, for the WIMMCP and SIMMCP, were developed in consultation with relevant government agencies.

Monitoring of water levels, water flow, water quality and key landscape features were also conducted by specialist consultants.

Nineteen surface impacts were identified by the ICEFT. Two of these impacts were observed within watercourses, and seventeen impacts were observed to landscape features such as access tracks, cliff lines and steep slopes. For further information please refer to the Longwall 12 End of Panel Report or relevant impact reports.

## **Surface Water and Shallow Groundwater**

HGEO (hydrogeologist consultants) assessed pre, during and post-mining data after the completion of Longwall 12 on the 31<sup>st</sup> of January 2017. There were four TARP triggers to tributaries during the reporting period. Measured levels of Dissolved Oxygen (DO) were below trigger levels on two non-consecutive

occasions in Donalds Castle Creek (FR6) during Longwall 12. Although these represent a Level 2 TARP, they are not considered to reflect significant water quality impacts from mining.

TARP trigger levels were met on two non-consecutive occasions at Wongawilli Creek (FR6), once for DO and once for Electrical Conductivity (EC). The elevated EC value is considered to reflect evaporative concentration in isolated pools due to the unusually dry conditions, rather than a mining impact.

Measured levels of DO at Lake Avon tributary site LA4\_S1 were below the TARP trigger on two non-consecutive occasions during Longwall 12. These represent a Level 2 TARP.

Flow and catchment yield modelling assessment indicates that the headwater catchments at sites within DC13, Donalds Castle Creek and WC21 have been affected by under-mining. Effects are not clearly observed in downstream catchments of both Donalds Castle and Wongawilli Creeks; this suggests that some or all flow lost in the headwater catchments is returned downgradient, but is not conclusive, as evapotranspiration (ET) might account for some fraction of that.

There is now a discernible loss of flows along the watercourse LA4, which is a tributary of Lake Avon. The previously determined TARPs have not been triggered, however flow behaviour during Longwall 12 was anomalous, including the occurrence of cease-to-flow conditions, indicative of a mining effect.

Assessment of shallow groundwater levels indicates that Level 2 TARPs were triggered within swamps 01b and 8; and Level 3 TARPs were triggered within Swamps 01a, 3, 5 and 10. It should be noted that most of these swamps had been triggered before based on the assessment in the previous Longwall 11 End of Panel report.

Soil moisture sites at Swamps 05 and 08 were mined under by Longwall 12, and two of the three Swamp 11 sites (S01 and S02) were within 400 m of Longwall 12. Sites from Swamp 8 are not within mapped swamp boundaries and therefore not subject to the TARP. Hydrographs show that average soil moisture has fallen below baseline levels in all sites that have been mined under or are within 400 m of the longwall. However, it should be noted that baseline data for those sites is less than 2 years and may not be representative of normal variability over the long term. In addition, the latter part of Longwall 12 was characterised by unusually dry summer conditions during which soil moisture at reference sites and sites yet to be mined under also fell below the limited baseline range (e.g. Swamps 11 and 13).

For further information, refer to the HGEO *End of Panel Surface Water and Shallow Groundwater Assessment: Longwall 12 (Area 3B)*.

## **Aquatic Ecology**

The aquatic ecology monitoring program is based on a Before, After, Control, Impact (BACI) design that provides a measure of variability at Potential Impact and Control Sites before, during and after extraction. This enables changes in the key indicators associated with mining-related impacts to be distinguished from natural variability.

Monitoring is undertaken in Wongawilli and Sandy Creeks in Dendrobium Area 3A and 3B and at comparable control sites established on Wongawilli, Sandy, Donalds Castle and Kentish Creeks.

The fracturing of bedrock and reductions of pool water levels and flow in WC21 following the extraction of DA3B Longwalls 9, 10, 11 and 12 represents a local loss of aquatic habitat and biota. This represents a significant impact to aquatic ecology associated with this tributary. However, due to the impacts observed during extraction of Longwalls 9, 10 and 11, it is difficult to quantify what proportion of the observed impacts are associated with extraction of Longwall 12. The reach of WC21 above Longwall 12 may be less susceptible to fracturing induced flow diversions and habitat loss, due to increased amounts of loose sediment and detritus and reduced valley depth resulting in reduced valley closure movements. Nevertheless, it is likely that extraction of Longwall 12 has increased impacts to WC21, particularly as the length of creek affected by this longwall increased during extraction. At this stage, and following the April 2017 observation of water at

monitoring site X3 located just downstream of Longwall 12, no TARPs have been triggered with respect to Longwall 12 as there does not appear to have been a loss in aquatic habitat here for longer than 1 year.

### Terrestrial Ecology and Swamps

Following the 2016 terrestrial monitoring it was found that an ecological response had been detected at several impact sites within Dendrobium Areas 2, 3A and 3B where physical impacts have been observed. The impacts remain within predicted impact levels identified within relevant Environmental Impact Statements for Dendrobium Areas 2, 3A and 3B. However, observed ecological responses of upland swamps and threatened frogs at some monitoring locations result in TARP trigger levels for relevant Dendrobium mining areas.

### Cultural Heritage

The assessment of cultural heritage and archaeological sites potentially impacted by Longwall 12 was conducted by Niche. Two shelters with art and three shelters with deposit were inspected as part of the assessment. These sites were inspected because they were within the zone of possible subsidence associated with Longwall 12. There were no European heritage sites identified as being potentially affected by the extraction of Longwall 12. There were no observed impacts to monitored Aboriginal archaeological sites as a result of Longwall 12 extraction. For more information please refer to the Longwall 12 End of Panel Report.

### Summary of Impacts

The observed impacts to natural features and Aboriginal heritage above Longwalls 12 and 13 were generally less than or consistent with those predicted in the assessments undertaken prior to mining. A summary of the observed impacts is provided in **Table 22**. For further detail on impacts associated with Longwall 12, refer to the Longwall 12 End of Panel Report. For details on impacts associated with Longwall 13, refer to the relevant impact report.

**Table 22: Impacts identified during FY17**

Site	Identification Date	Activating Longwall	Type	Trigger Level	Comment	Actions Taken
DA3B_LW12_014	22/07/2016	LW12	Soil Cracking/ uplift	Level 1	Surface movement/ uplift	Remediation works completed
DA3B_LW12_015	04/10/2016	LW12	Soil Cracking/ uplift	Level 1	Soil crack to AT6000	Report impacts to key stakeholders
DA3B_LW12_016	04/10/2016	LW12	Soil Cracking	Level 1	Soil crack to AT6000	Report impacts to key stakeholders
DA3B_LW12_017	11/10/2016	LW12	Soil Cracking	Level 1	Soil cracking to AT6000	Report impacts to key stakeholders
DA3B_LW12_018	11/10/2016	LW12	Soil Cracking	Level 1	Soil cracking to AT6000	Remediation works completed
DA3B_LW12_019	09/11/2016	LW12	Rock Fracturing	Level 1	Rock fracturing in WC21	Report impacts to key stakeholders
DA3B_LW12_020	15/11/2016	LW12	Soil Cracking	Level 1	Soil crack to access track	Report impacts to key stakeholders
DA3B_LW12_021	15/11/2016	LW12	Soil Cracking	Level 1	Soil crack to access track	Report impacts to key stakeholders
DA3B_LW12_022	15/11/2016	LW12	Soil Cracking	Level 1	Soil crack to access track	Report impacts to key stakeholders



DA3B_LW12_023	24/11/2016	LW12	Soil Cracking	Level 1	Soil crack to access track	Report impacts to key stakeholders
DA3B_LW12_024	24/11/2016	LW12	Soil Cracking	Level 1	Soil crack to access track	Report impacts to key stakeholders
DA3B_LW12_025	24/11/2016	LW12	Soil Cracking	Level 2	Soil crack to access track	Remediation works completed
10_01	24/11/2016	LW12	Groundwater Trigger	Level 3	Trigger for level and rate of recession	Report impacts to key stakeholders
DA3B_LW12_026	20/01/2017	LW12	Rock Fracturing	Level 2	Rock fracture to outcrop	Report impacts to key stakeholders
Wongawilli Ck (FR6)	23/01/2017	LW12	Water Quality Trigger	Level 1	Water Quality Trigger	Report impacts to key stakeholders
Swamp 11	28/02/2017	LW12	Soil Moisture Trigger	Level 3	Soil Moisture Below Baseline-Sites S11_S01 and S11_S02	Report impacts to key stakeholders
DA3B_LW13_001	19/04/2017	LW13	Rock Fracturing	Level 2	Rock Fracturing with Flow Diversion	Report impacts to key stakeholders. Impact assessment of surface flow by specialist
DA3B_LW13_002	22/05/2017	LW13	Soil Cracking	Level 1	Soil cracking on access track	Report impacts to key stakeholders
DA3B_LW13_003	26/06/2017	LW13	Soil Cracking	Level 2	Soil cracking of FR6A	Remediation works completed
11_H1	27/06/2017	LW13	Shallow Groundwater	Level 1	Rate of recession below baseline	Report impacts to key stakeholders
DA3B_LW13_004	14/07/2017	LW13	Soil Cracking	Level 1	Soil cracking and uplift on FR6A	Remediation works completed
DA3B_LW13_005	19/07/2017	LW13	Soil Cracking	Level 2	Soil cracking on access track 6AA	Remediation works completed
11_H1	19/07/2017	LW13	Shallow Groundwater	Level 1	Water level below baseline	Report impacts to key stakeholders

### Cordeaux Colliery

Aspect not considered relevant as Cordeaux Colliery is in 'care and maintenance'.

## 6.15. Hydrocarbon Contamination

### Dendrobium Mine

Specifically designed hydrocarbon banded areas utilised during the reporting period were located as follows:

- along the Pit Top portal road;
- at the rear of the workshop; and
- at the diesel refuelling area.

Bunded areas are checked on a weekly basis and are pumped out when required to maintain sufficient capacity. In addition to the permanent bunded areas, portable bunds are used for transient storage or transportation of oils and fuels around the site. Various spill kits and/or bins containing oil absorbent material are located around the site in areas where there is a high potential for spillage. Surface personnel are made aware of the locations of these spill kits and absorbent material bins in their work area. The contents of the spill kits and the oil absorbent material bins are checked on a regular basis.

There were no reportable incidents of hydrocarbon contamination in the reporting period associated with Dendrobium Mine.

## **Cordeaux Colliery**

### **Corrimal No. 3 Shaft**

IC will be implementing a Remedial Action Plan (RAP) following a transformer oil spill as a result of vandalism at the Corrimal No 3 Ventilation Shaft.

## **6.16. Hazardous Material Management**

### **Dendrobium Mine**

#### **Explosives**

A Licence to Store Explosives is in place for the Dendrobium premises. Limited quantities of explosives were stored at Dendrobium over the reporting period.

#### **Dangerous Goods**

The Dangerous Goods kept at Dendrobium Mine include compressed gases, flammable and combustible liquids, and corrosive substances. Volumes stored are below the manifest quantities to require a Dangerous Goods Licence to be issued by SafeWork NSW

A Site Emergency Information Container is installed adjacent to the front gate in accordance with legislative requirements. This information box includes the site manifest along with Safety Data Sheets (SDS's) for each of the dangerous goods kept on site.

#### **Combustible Liquids**

Dendrobium Pit Top has two bulk chemical storage containers, one for diesel storage and one for hydraulic oil storage (~16100 L) that are delivered to site by tanker. These are stored in accordance with the requirements of AS 1940-2004 *The storage and handling of flammable and combustible liquid*.

#### **Other Substances**

Illawarra Coal assesses new substances before their use on site by completing a Substance Evaluation Form and a risk assessment. SDS's and substance evaluation are available electronically from ChemAlert. The Hazardous Materials Coordinator is responsible for the overall coordination of the hazardous materials system on site whilst the Materials Controller is responsible for the day-to-day management of hazardous materials. Regular inspections of the storage sites are undertaken to ensure compliance with relevant standards.

### **Cordeaux Colliery**

Cordeaux has one bulk storage tank (underground diesel tank 42,000 L holding capacity) and minor volumes of gas cylinders, and transient stores of oils/lubricants. The diesel fuel is brought to site by fuel tankers. A bulk diesel fuel system has been installed utilising underground tank storage with locked bowser delivery. The majority of fuel used is for exploration equipment and field vehicles. An Environmental Protection Plan (EPP) has been developed for the below ground diesel fuel storage system (May 2011) in accordance with Underground Petroleum Storage Systems (UPSS) Regulations 2008 requirements. Tank integrity testing and

an analysis of the surrounding groundwater has been completed, the results confirm the absence of any leaks/contamination.

## 6.17. Methane Ventilation

### Dendrobium Mine

During the reporting period, the underground mine workings were ventilated by drawing fresh air into the mine (intake air) via the Dendrobium Mine Portal Tunnel, Kemira Valley Portal Tunnel, and air intake Shafts No.1 and 2. The ventilation air drawn through the mine was extracted via the No.3 Shaft Main Mine Ventilation Fans. Three mine ventilation fans are installed at the No.3 Shaft site with two fans operating at any one time. Mine ventilation air was drawn through the mine at an average rate of 245.31 m<sup>3</sup>/s with the discharge air (mine vent air) having an average concentration of methane (CH<sub>4</sub>) of 0.12% and an average concentration of carbon dioxide (CO<sub>2</sub>) of 0.16%.

Currently there are no mine methane abatement technologies or opportunities available which are viable due to the low methane concentration of the mine vent air.

### Cordeaux Colliery

Cordeaux Colliery had no methane drainage extraction plant to support its underground gas management activities. Following cessation of mining, the emissions to the atmosphere via the main mine ventilation fans significantly decreased. The mine ventilation fans were shut down and the shafts temporarily sealed in December 2003.

## 6.18. Public Safety

Public and workplace safety is a major consideration for Illawarra Coal. Site safety risks and control mechanisms associated with the Dendrobium operations are provided in Table 23.

**Table 23: Site Safety Risks and Control Mechanisms**

Potential Safety Risk	Control Mechanism
Safety on site	<p>All personnel, including employees and contractors, are required to undertake a site induction prior to working on the site. This induction outlines a number of areas of importance, including their responsibilities in regards to safety. In addition to the site induction, awareness material is presented in a number of different ways, which include:</p> <ul style="list-style-type: none"> <li>• safety scrums/training days that are attended by all persons working on site and which allow for two way communication between management and the workforce;</li> <li>• Toolbox talks;</li> <li>• Posters located around the site; and</li> <li>• Periodic business updates.</li> </ul> <p>The Dendrobium facilities are fenced and the Pit Top site has 24 hour surveillance of the front car park and entry areas. Fencing of the sediment ponds at both the Pit Top and Kemira Valley sites minimises the potential for injury to the public. Prior to visitors entering the main Pit Top area they are required to sign in at reception in the administration building, located closest to the car park. From this point the visitor can make enquiries and collect equipment, such as PPE, if required. Cordeaux Colliery pit top area is enclosed by a chain wire security fence around the perimeter of the site. The site access gates are locked at all times that Illawarra Coal personnel are not in attendance</p>
Road Safety	<p>A Drivers' Code of Conduct is in place at Dendrobium to ensure appropriate driver behavior by all those who drive through the village to the mine including employees, contractors and truck transports, as required by the Dendrobium Development Consent and Traffic Management Plan. The Code of Conduct is communicated to all employees and contractors during the site induction and copies are periodically distributed to major suppliers and transport companies. Compliance with the Code of Conduct is strictly enforced.</p>

	Lane alignment and roadway markings have been upgraded at the Cordeaux Colliery entrance on Picton Road to provide for safer traffic movements when entering and exiting the site.
Rail Safety	Rail facilities are fenced, with the main sites patrolled on a regular basis by a contracted security firm. Signage and security cameras are in place. Critical Risk Observations and site inspections are undertaken to maintain safety systems Community announcements, newsletters and letter box drops are used to communicate relevant safety information to the public.

## Public Safety around mining areas

The current Dendrobium Longwall mining is occurring within WaterNSW land. Illawarra Coal has developed procedures for working around and accessing potentially unstable ground. The controls are outlined in "Working around Rock falls, cliff lines and unstable areas" (ICHP0145). The controls currently in place are listed in the table below.

**Table 24: Site Safety Risks and Control Mechanisms**

Potential Safety Risk	Control Mechanism
Rock falls	<ul style="list-style-type: none"> <li>Signs installed around potentially unstable areas that may be impacted by mining</li> <li>Illawarra Coal employees and contractors working around potentially unstable areas (Site Induction, Emergency Response Training, 4WD training, active communications, sign-in and sign-out process).</li> </ul>

## Cordeaux Colliery

The Cordeaux Colliery Pit Top area is enclosed by a chain wire security fence around the perimeter of the site. The site access gates are locked at all times that Illawarra Coal personnel are not in attendance. The current condition of the site poses no threat to the general public. As various areas are decommissioned and rehabilitated, the sites will be left in a permanently safe condition to the satisfaction of relevant authorities. Remote sites have remained fenced and locked during this reporting period.

In consideration of the time elapsed since the last longwall panels were extracted, the continued effects of subsidence will be negligible to nil and pose no threat to the safety of infrastructure or the public.

## 6.19. Waste Management

### Dendrobium Mine

#### General Waste

General waste bins are transported from Dendrobium pit top to Cleanaway's depot at Charcoal Place, Unanderra. The waste is then tipped onto a sorting pad and waste is directed into its correct waste stream for recycling or disposal. Dendrobium Mine's main solid waste streams and volumes are listed in Table 25. Recycled volumes for Dendrobium Pit top are listed in Table 26.

**Table 25: Waste Streams and Total Volumes.**

Waste Stream	Treatment / Disposal	Volume (tonnes)
Timber	Recycled off site	65.23
Cardboard and paper	Recycled off site	217.992
Steel and Scrap Metal	Recycled off site	110.517
Commingle	Recycled off site	6.399
Particulate (diesel) filters	Off-site treatment and disposal	63.29

General Waste	Landfill	297.82
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Table 26: Recycle Volumes for Reporting Period.

Year	Total Recycled (tonnes)	Total Disposed (tonnes)	% Recycled
FY17	400.138	761.253	52.56

## Oil and Grease Containment and Disposal

Oil and Grease produced onsite is transported from the pit top for processing by a licenced contractor. Oil sumps and traps are in place and are periodically inspected by site personnel and emptied as required by a licensed contractor.

Table 27: Oil and Grease Volumes.

Waste Stream	Volume (tonnes)
Oil	23.5
Oily Water/Sludge	2.68
Hydraulic Oil	24.89

## Coal Wash Management

During FY17, Illawarra Coal diverted approx. 860,000T of coal wash for beneficial uses in the local region (i.e. as an engineered fill, and for the development of arterial and agricultural roads), with over 3Mt diverted since 2009. Illawarra Coal currently has a long-term contract in place with Lend Lease to provide large volumes of engineered fill for a new housing estate at Calderwood. In the near future, Illawarra Coal is also looking to provide Coal Wash as an engineered fill for a major RMS road infrastructure project, starting in 2018.

Illawarra Coal is continuing with its Coal Wash Road Base project, which utilises coal wash with other recycled materials such as fly ash to produce a material suitable for a variety of applications. In late 2014, the RMS published a specification of this material based on the success in trials of this product, and local councils have undertaken trials of this product in their respective areas. Following on from the success of these trials, Illawarra Coal has aligned itself with three universities (University of Wollongong, University of Sydney and University of Newcastle) and 4 other industry partners (RMS, Douglas Partners, Infratech and Stabilco) and has been successful in securing an ARC-Linkage Project grant of \$590k to conduct research into the long term performance of this material in roads and railways. The project kicked off in 2017, and will take 3 years to complete.

Illawarra Coal will continue to research, develop and implement alternative uses for coal wash and in order to minimise the volume emplaced at the West Cliff (Appin North) site in future.

## Cordeaux Colliery

### General Waste

General waste produced at Cordeaux Colliery was negligible throughout the reporting period due to the inactivity of the mine and the small number of personnel utilising offices on site. Periodically, Trans-Pacific Cleanaway waste management services attend site to remove general waste from the bins. The amount of waste from Cordeaux Colliery is shown in Table 28. Waste such as cardboard, paper and batteries are set aside for recycling or reuse.

Table 28: General Waste Volumes for Reporting Period.

Waste Stream	Treatment / Disposal	Volume (tonnes)
Commingle	Recycled off site	1.2
General Waste	Landfill	13.92
Cardboard	Recycled off site	0
Steel	Recycled off site	9.02

### Sewage Treatment / Disposal

All bathhouse and sewerage effluent is contained on site. Bathhouse water is treated and the pumped underground through an old goaf area. The sewage is transported off site by a licensed contractor for treatment and disposal.

### Oil and Grease Containment and Disposal

No bulk oils or greases are stored on site. Oil sumps and traps remain in place and are periodically inspected by site personnel and emptied as required by a licensed contractor. No maintenance activities are undertaken on site which would potentially generate industrial waste or remnant oils.

Security barricading and shielding have been installed around and above the oil separator at the Pit Top workshop to prevent the entrapment of animals in the separator.

### Vent Shaft 2/3

During the reporting period, any waste brought to Vent Shaft 2/3 site was taken off site and disposed of through the Dendrobium Mine processes.

# 7. WATER MANAGEMENT

## 7.1. Groundwater

### Dendrobium Mine

The Dendrobium groundwater monitoring program was undertaken during the reporting period as defined in the approved Groundwater Management Plan. The purpose of the program is to analyse the water quality and quantity within the mine and mining area to satisfy health, safety and environmental aspects of the Development Consent and South32 Policies and Standards. The Plan was developed in consultation with the DSC, SCA, Department of Planning and Environment, NSW Water, Department of Resources and Energy.

Monthly water sampling is performed underground with samples analysed onsite and at NATA accredited laboratories. Mine water usage, water flows and volumes within the mine are analysed and reported on regularly (i.e. on a daily to weekly basis). Surface and underground vibrating wire piezometers are utilised to monitor groundwater response to mining. Monthly reports are prepared and submitted to the DSC, WaterNSW, Department of Resources and Energy summarising water quality and the water balance at Dendrobium. During the reporting period, Dendrobium operated under a Principal Trigger Action Response Plan (TARP) as outlined in the “Avon and Cordeaux Reservoir DSC Notification Area Contingency Plan”. During this period the mine operated at ‘Normal’ in the Principal Response Flowchart (Figure 11).

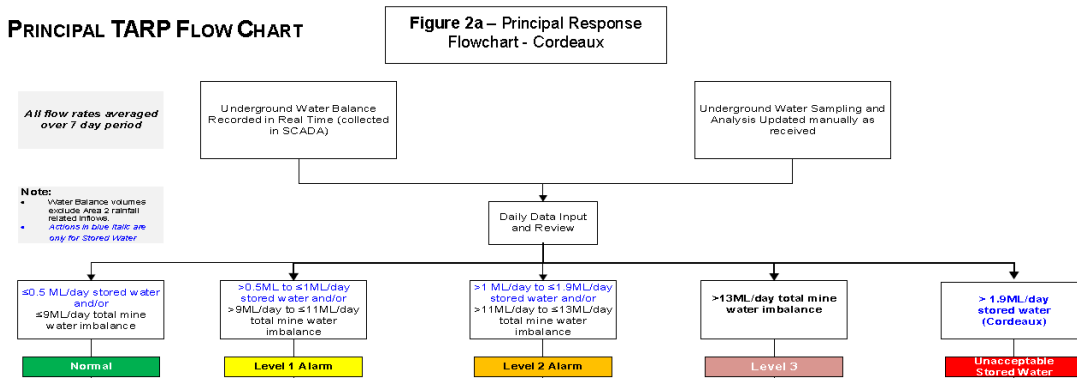


Figure 11: Principal Response Flowchart in “Cordeaux Reservoir DSC Notification Area Contingency Plan”.

A summary of the mine water balance for the reporting period is provided in Figure 12.

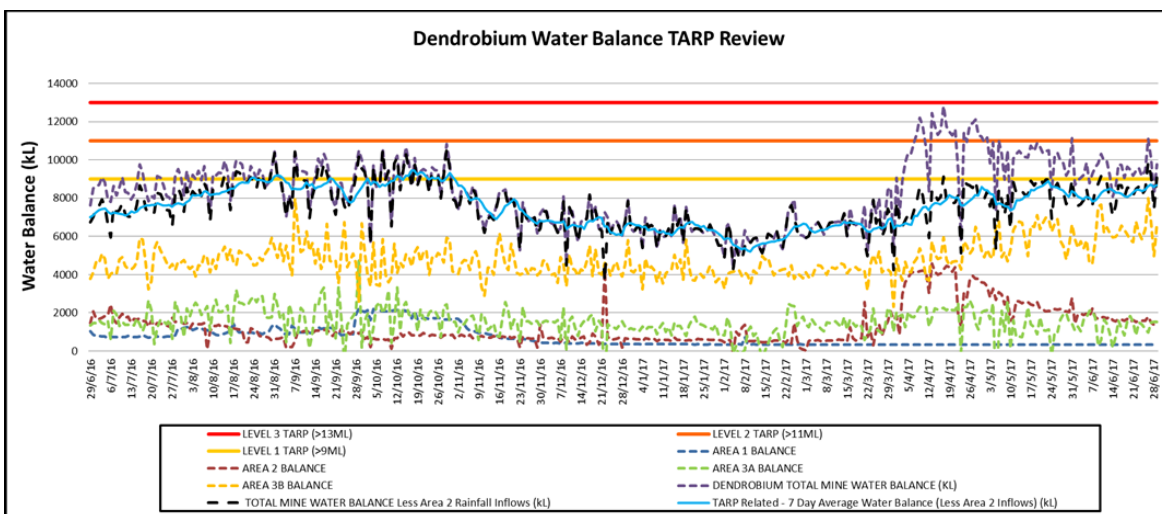


Figure 12: Mine Water Balance FY17

The groundwater reporting to the mine workings during normal conditions is characteristic of coal measure water; this is determined to be relatively higher in salinity and age based on water chemistry and isotope analysis. Water samples from inflow events have been typical of near seam coal and shale water. Geochemistry, algal and isotope analysis is conducted monthly to determine probabilistic proportions of any modern rain or dam water entering the working.

**Table 29: Water Balance Statistics for the period 1 July 2016 – 30 June 2017.**

<b>Statistic</b>	<b>Total Water Balance</b>	<b>7 Day average Water Balance Less Area 2 Inflows (TARP related)</b>	<b>Units</b>
Mean	8298.8	7549.2	kL/day
Maximum	12817.1	9446.0	kL/day
Minimum	4189.1	5194.0	kL/day
Total	3029080.2	2755449.1	kL

Mining of longwall 12 resulted in continued depressurisation of the target coal seam and overlying strata. The observed changes in groundwater levels are in line with numerical model predictions that support mining approvals.

As expected, the greatest depressurisation is within the Wongawilli Coal Seam, and decreases with height above the seam. Incremental drawdown in the Scarborough and Bulgo Sandstones is apparent in the areas immediately to the south-west of Longwall 12 and extending to S2194, located 1.8 km to the south of Longwall 12. Drawdown in the Hawkesbury Sandstone is spatially variable but largest above and immediately adjacent to Longwall 12, with some drawdown also evident at S2001, located 790 m to the south. For other groundwater monitoring sites (not over the goaf) the observed drawdown is negligible.

The numerical model developed by Hydrosimulations in 2014 and updated in 2016 was assessed to be accurate with respect to estimated deep groundwater levels at the end of Longwall 12. The model has a tendency to overestimate drawdown impacts in the Bulgo and Scarborough Sandstones and is therefore conservative.

Estimates based on the numerical model are that the net induced loss from Lake Avon at the end of Longwall 12 is less than 0.4 ML/d and within the tolerable loss limit of 1 ML/day prescribed by the Dams Safety Committee (DSC).

### **Cordeaux Colliery**

Refer to the Surface Water Management Section.

## **7.2. Surface Water**

### **Dendrobium Mine**

#### **Water Supply and Use**

Underground and surface operations at Dendrobium utilise a combination of potable and recycled mine water.

#### **Potable Water use**

Potable mains water, is currently used for the longwall hydraulic roof supports (emulsions used underground require high quality water for batching) and surface amenities such as the kitchen and bathhouse facilities. Potable water usage for the reporting period was 27.82ML, a 4% decrease compared to the previous reporting period.

#### **Recycled Water use**



Recycled water is sourced from the Nebo Workings and used for various purposes on surface and underground operations:

- Surface Operations:
  - Portal Road dust suppression;
  - Wash down bay;
  - General hose down; and
  - Cleaning and firefighting.
- Underground Operations:
  - Secondary support;
  - Development and production units; and
  - Dust suppression and firefighting.

**Surface Water Management**

Surface water runoff is separated into three streams at the Pit Top Site. The three runoff streams include:

- Clean water – This system collects runoff originating from the surrounding undisturbed land on the upstream (western) side of the site. This water is piped via sealed drains through the site into American Creek;
- Oily Water – This system captures potentially contaminated water runoff from the workshop area and diesel fuel dispensing area. This is diverted into the oily water separator and then into the grey water treatment plant. Treated water is then pumped into the old Nebo Mine workings; and
- Dirty Water – This system captures general site runoff from site roads and the car park. This runoff is directed into the Pit Top sediment pond via a series of drains and pits that are cleaned out on a regular basis using an industrial vacuum truck. Settled water is pumped from the sediment pond into the grey water treatment plant based on pond level. The treated water is then pumped into the old Nebo Mine Workings.

At the Kemira Valley site, surface water is separated into two streams, which include:

- Clean Water – This system captures clean runoff originating from the upstream side of the site. The runoff is diverted around the western side of the site and through a culvert beneath the rail line and into Brandy and Water Creek.
- Dirty Water – This system captures all site runoff. The runoff is treated and reused in the site dust suppression system and/or the firefighting system. If there is excess water in the sediment ponds, water may be disposed via the mine water discharge pipeline into Allans Creek via Licensed Discharge Point 5.

The Pit Top Sediment Pond and Kemira Valley Sediment Ponds are managed in accordance with the Water Management Plan. The stored water for the reporting period is provided in Table 30.

Runoff from the Corrimal shaft sites and O'Briens drift is classified as clean storm water runoff therefore runoff is diverted into the natural drainage systems.

Table 30: Stored Water - Dendrobium.

Water Type	Start of Reporting Period	End of Reporting Period	Storage Capacity
Clean Water (ML) – Pit Top Tank	0.35	0.35	0.35
Dirty Water (ML) - Kemira Valley Main Sedimentation Pond	6	6	14
Dirty Water (ML) - Pit Top Sedimentation Pond	0.4	0.4	1.1
Dirty Water (ML) - Kemira Valley Buffer Dam	1	1	3.9

Dirty Water (ML) - Kemira Valley Fire Tank	0.5	0.5	0.5
Controlled Discharge Water (salinity trading schemes)	NA		
Contaminated Water	NA		

\*Levels are largely dependent on rainfall. Ponds are generally maintained at low levels for maximum storage potential for rainfall events.

## Rainfall

Dendrobium rainfall recorded during the reporting period was 931 mm, a decrease when compared to the previous reporting period in which 1064 mm rainfall was recorded. Table 31 presents the rainfall for this reporting period and the six previous reporting periods.

Table 31: Rainfall at Dendrobium FY11 to FY17.

Year	Total Rainfall (mm)
FY11	1299
FY12	1318
FY13	1532
FY14	1482
FY15*	1303
FY16*	1064
FY17*	931

\* Rainfall recorded at Dendrobium Vent Fan Site.

## Cordeaux Colliery

### Water Supply and Use

Potable water use at Cordeaux Colliery is generally for personal consumption, showering and toilet facilities. Potable water is brought to site by road tanker as required basis. During the reporting period the average potable water use by site was 25 kL per month.

### Surface Water Management

The surface facilities at Cordeaux Colliery have been designed to prevent dirty water run-off from the site entering the Sydney Catchment Authority land. The design ensured effective treatment of run-off from potentially dirty areas such as the coal bins, workshop area and machinery hard-stand areas. Drainage from these areas is still directed to a dirty water holding lagoon. The clean and dirty water surface drainage circuits of the site remain in place.

Due to the cessation of mining activities the amount of dirty water generated at the surface of the mine has significantly reduced. Water from hardstand areas is captured in the dirty water lagoon then transferred by pump to the upper level mine water holding lagoons for settlement. The water is then transferred to underground mine workings via a gravity fed pipeline. This arrangement negates any surface discharge. The water returned to the mine is essentially of good quality, containing no contaminants. Details of the monitoring and pumping volumes are provided in Section 7.1 of this report. A summary of the stored water for the reporting period is provided in the table below.

Table 32: Stored Water - Cordeaux.

Water Type	Start of Reporting Period	End of Reporting Period	Storage Capacity
Clean Water (ML) – Surface Storage Tank	0.2	0.2	0.225
Dirty Water (ML) – Dirty Water Area Lagoon	0.85	0.85	1.0
Controlled Discharge Water (ML): Mine Water / Storm water Lagoon	2.0	2.0	5.5
Controlled Discharge Water (ML): Sand Filter Lagoon	0	0	0
Contaminated Water	NA		

### Rainfall

Rainfall for the Cordeaux surface facilities is recorded on a daily basis from a rainfall gauge located at Cordeaux Mine. The Cordeaux site received a total of 1375.7 mm of rainfall during the reporting period, which was an increase from the previous reporting period (1013.7 mm). The table below shows the total recorded rainfall for the past six reporting periods.

Table 33: Rainfall at Cordeaux FY11 to FY17.

Year	Total Rainfall (mm)
FY11	1203.1
FY12	1396.2
FY13	1277.6
FY14	885.5
FY15	1493.1
FY16	1013.7
FY17	1375.7

### 7.3. Vent Shaft 2/3

No water usage occurs on the Vent Shaft 2/3 site. Due to its location within the Sydney Catchment Area, the surface facilities at the vent shaft have been designed to control sediment entering the surrounding Sydney Catchment Authority land by:

- Capturing stormwater from disturbed areas and directing this water to sediment ponds; and
- Rehabilitation of disturbed areas.

## 7.4. Water Licence

**Table 34: Water Take Dendrobium Mine**

Approval Number	Water Act 1912 licence No.	Reference No.	Water Access Licence (WAL) No.	Approval Kind	Water Sharing Plan	Water Source	Entitlement	Total
10WA118772	10BL161946	10AL118771	36473	Water Supply Works	Greater Metropolitan Region Groundwater Sources	Sydney Basin Nepean Groundwater Source	75 Units	1469.5 Units
		10AL119249	37465	Water Supply Works	Greater Metropolitan Region Groundwater Sources	Sydney Basin Nepean Groundwater Source	3962 Units	

## 8. REHABILITATION

### 8.1. Rehabilitation for Reporting Period

#### Dendrobium Mine

The rehabilitation security cost estimate for the Dendrobium operations was reviewed in FY17. No major changes to the existing security estimate were identified (a minor increase associated with Survey 15 exploration program will be incorporated in the next reporting period). A copy of the revised security cost estimate is provided as Appendix B. A rehabilitation summary associated with the Dendrobium operation is provided below.

**Table 35: Dendrobium Mine and Cordeaux Colliery Rehabilitation Summary.**

Location	Area Affected/Rehabilitation (ha)		
	To date	FY2016 (Last Report)	FY2017 (estimated)
A: Total Mine Footprint	18,816	18,816	18,816
B: Total Active Disturbance	29.46	0	0
C: Land being prepared for rehabilitation	0	0	0
D: Land under active rehabilitation	0	0	0
E: Completed rehabilitated area	7.978	0	0

Weed species in the Ventilation Shaft 2/3 area remain at very low densities and are generally located in disturbed areas or highly trafficked such as road ways. Inspections will continue to monitor the presences of weed species.

The integrity of sediment and erosion control structures is regularly inspected. Adequate sediment control structures are in place to reduce the risk of off-site contamination. A clean water diversion bund has been constructed to divert clean water around the site, and drainage channels have been established within the site to divert seepage around infrastructure areas.

The agreed post rehabilitation land use is native bushland. Further rehabilitation will be undertaken at mine closure following decommissioning of site infrastructure.

#### Mount Kembla Rehabilitation Project

The Mount Kembla Rehabilitation Project site was the original train haulage route from the historic Mount Kembla and Nebo Colliery sites to the Port Kembla steelworks. In addition to the rail line, coal bins were located in the corridor from which trains were loaded moved to Port Kembla Steelworks. The line and associated infrastructure was decommissioned in the early 1990s, however only minimal rehabilitation was undertaken at the time.

In 2002, with the development of Dendrobium Mine, a commitment was made by Illawarra Coal to provide an area of land for the establishment of the Mount Kembla Mine Memorial Pathway (the Pathway). The Pathway was planned to be completed in three stages; Stage 1 commencing at the start of Mount Kembla to Stones Road and was completed in 2008; Stage 2 incorporating an area of land between Stones Road and Benjamin Road and was completed in April 2013, and Stage 3 from Benjamin Road to the old Bradford Breaker station was completed towards the end of 2016.

The area of Stage 2 of the pathway has been removed from the Consolidated Coal lease at the renewal of the mine lease in 2014. An environmental contracting firm was hired to maintain and monitor the rehabilitation

works conducted at the Stage 2 pathway project until June 2016. A rehabilitation completion report was submitted and freehold ownership of Stage 2 has been transferred to Wollongong City Council.

### **Further Development of the Final Rehabilitation Plan**

A Landscape Management Plan has been developed to meet the requirements of the Development Consent. This document outlines rehabilitation and closure requirements for the sites associated with Dendrobium Mine. As referenced in the Landscape Management Plan, the Dendrobium Mine Conceptual Closure Plan has been developed in line with the Department of Planning Resources and Geoscience and internal South32 requirements. The Conceptual Closure Plan document outlines areas that are required to be rehabilitated after the closure of the mine.

### **Cordeaux Colliery**

Please see section 6.4 for more information on the Corrimal No 3 Shaft rehabilitation.

## 9. BIODIVERSITY OFFSETS

### Maddens Plains

A proposal has been put forward by South32 to provide an offset for mining impacts from the Dendrobium Coal Mine and Bulli Seam Operations Project through the conservation of a 598 hectare site at Maddens Plains near Helensburgh.

The Department and the Office of Environment and Heritage (OEH) support South32's intention to secure the Maddens Plains site in perpetuity by transferring this land to the National Park estate.

The area of land meets the offset requirements for any impacts on:

- The upland swamps at the Dendrobium Coal Mine; and
- The vegetation communities at the Bulli Seam Operations Project.

The land also has additional offsetting values as it would:

- Secure land with significant ecological value in perpetuity within the National Park estate; and
- Improve habitat corridors between the Illawarra Escarpment State Conservation Area, the Dharawal Nature Reserve and the WaterNSW Special Area.

Consequently, the Department has approved the Strategic Biodiversity Offset document in relation to Maddens Plains, in accordance with condition 15 of Schedule 2 of the development consent for the Dendrobium Coal Mine and condition 14 of Schedule 2 of the project approval for the Bulli Seam Operations Project. Plan 14 shows the area of Maddens Plains.

# 10. COMMUNITY

## 10.1. Community Complaints

### Dendrobium Mine

Illawarra Coal operates a 24hr Community Call Line (free call 1800 102 210) and a general email address [ICEnquiries@south32.net](mailto:ICEnquiries@south32.net). The call line and email address enables the community to request and provide feedback about operational activities and lodge complaints on any aspect of the Dendrobium operations. The call line number and email address have been advertised throughout the reporting period in all correspondence distributed to the community.

All complaints are investigated and the details, including any follow up actions required, are recorded in the internal event reporting system. Complaint information is provided to the DCCC, Dendrobium mine site and Illawarra Coal management, and government agencies on a regular basis.

A total of 26 community complaints were received during the reporting period (Compared to 44 received in FY16). Complaints made and the resolutions are reported each month on the South32 website. A summary of the complaints recorded is provided in Appendix D. Figure 13 displays the complaints for FY17.

As discussed in section “Noise Management Strategies”, the Rail Noise Working Group has undertaken numerous rail trials and noise monitoring campaigns to identify noise sources and minimise the rail noise generated in the local area.

Additional noise investigations have been undertaken during this reporting period to identify feasible initiatives to further reduce noise emissions from the rail line and site to minimise the likelihood of community complaints. An overview of the identified initiatives is provided in Noise Management Strategies.

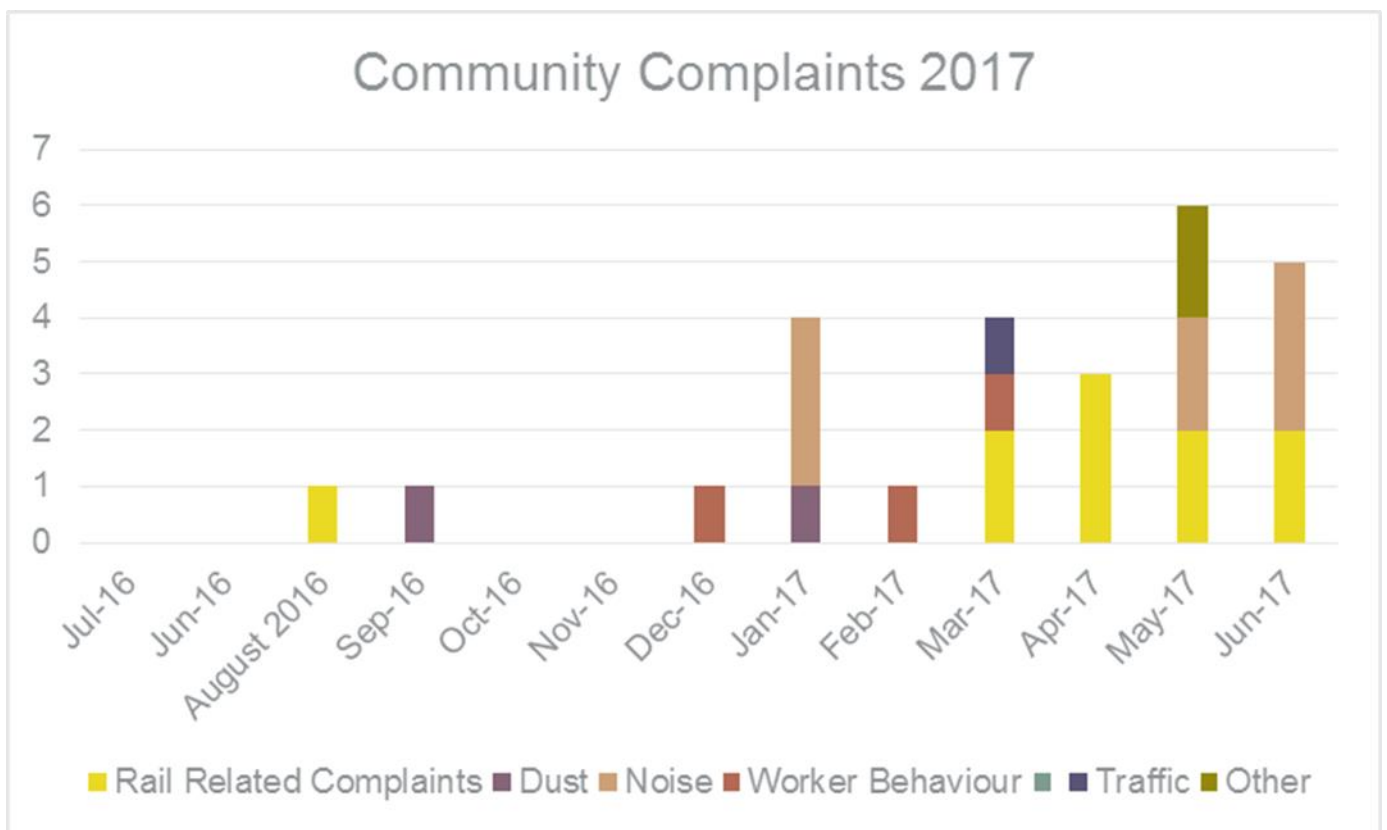


Figure 13: Dendrobium Community Complaints FY17.



## Cordeaux Colliery

There were no community complaints received during the reporting period.

## 10.2. Community Liaison

### Dendrobium Mine

#### Community Consultation

Due to the location of the Dendrobium Pit Top facilities and KVCLF, it is essential that frequent and effective communication occurs between the mine personnel and the residents of Mt Kembla and surrounding areas. Illawarra Coal takes a proactive approach to community consultation by advising residents of issues in advance, including scheduled construction activities or unusual traffic movements. The consultation occurs using a variety of methods including:

- Community newsletters and other letterbox drops;
- Dendrobium Community Consultative Committee;
- Dendrobium Community Consultative Committee Plan for the Future working group
- Dendrobium Community Enhancement Committee meetings are held every two months;
- Dendrobium section on the South32 'Regulatory Information' webpage;
- Participation in community events and activities;
- Community Perception Surveys; and
- Attendance at community meetings.

#### Dendrobium Community Consultative Committee

The DCCC was established in January 2002 in accordance with the Dendrobium Development Consent. The committee provides a mechanism to bring the community, environmental groups, local councils and South32 together:

- To establish good working relationships between the company, the community and other stakeholders in relation to Dendrobium Mine.
- For the ongoing communication of information and discussion of mining operations and the environmental performance of the mine.
- To discuss community concerns and review the resolution of community complaints.
- To discuss communication of relevant information on the mine and its environmental performance to the wider community, including results of environmental monitoring, environmental management reports and the results of audits.
- To work together towards outcomes of benefit to the mine, immediate neighbours and the local and regional community.

The committee is comprised of an independent Chairperson, up to five community members, two environmental group representatives, one representative from the Wollongong City Council and South32 representatives as outlined in Table 36.

**Table 36: Membership of the DCCC at 30 June 2017.**

<b>Name</b>	<b>Member Category</b>
Mike Archer	Independent Chairperson
Alex Beccari	Community Representative
Phil Diamond	Community Representative
Phil Grant	Community Representative
Vivien Twyford	Community Representative
Chris Haley	Community Representative

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Phill Clunas	Environmental Group Representative
Ann Young	Environmental Group Representative
Ron Zwicker	Wollongong City Council
Michelle Grierson	Illawarra Coal (appointed Environmental Representative)
Bryony Andrew	Illawarra Coal – Dendrobium Mine
Amber Cleary	Illawarra Coal- Community

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The Independent Chairperson Mike Archer was appointed to the Chair in October 2013 and reappointed in October 2015.

Committee meetings cover discussions on the Longwall, Development, Subsidence Management Plans/Extraction Plans, Approval Processes, Environmental Compliance, End of Panel Reports and Community Programs.

### **Newsletters and Information Sheets**

During the reporting period, Dendrobium distributed community newsletters to the local community (Mt Kembla, Kembla Heights and communities located along the KVRL) covering a range of topics including:

- Operations updates, including longwall progress and development
- Environmental improvement works
- Events and organisations supported by Dendrobium Mine
- DCCC and DCEC activities, including information on inspections and projects supported.

### **Community Partnerships Program**

The Dendrobium Community Enhancement Program (DCEP) was established in 2002 to facilitate funding for community projects with a vision to create a strong community and positive environment for the residents in the zone of influence of Dendrobium Mine. Since inception, Illawarra Coal has contributed over \$1.4 million to the fund, and continues to contribute three cents per saleable tonne of coal from the Dendrobium operations (adjusted for CPI).

The program is administered by the Dendrobium Community Enhancement Committee (DCEC) which comprises of an independent Chairperson, community representatives and Illawarra Coal representatives. The committee met regularly during the reporting period, with extraordinary meetings also convened to conduct business planning and review of operations.

Individuals and organisations in the local community are encouraged to apply for funding. Applications for funding under the DCEP are assessed against a range of selection criteria, which can be viewed at:

<https://www.south32.net/what-we-do/places-we-work/illawarra-metallurgical-coal/documents>

## 11. INDEPENDENT AUDITS

During this reporting period the performance of Dendrobium's Environmental Management System (EMS) and overall HSEC Management System was assessed in a comprehensive series of audits (shown in Table 37). SAI Global has endorsed a "governance check" process as a part of the ISO14001 certification. This process involves reviewing relevant environmental management plans annually and incorporates both a desktop review and in-field verification.

**Table 37: Environmental Audits Undertaken During reporting Period**

Date	Type	Internal	External	Comments
Annually	Governance Check	X		Governance Checks are conducted internally as a part of ISO14001 certification.
Annually	ISO14001		X	ISO14001 certification.

If non-conformances are identified during audits, they are recorded and tracked via the event reporting system utilised by Illawarra Coal operations.

The next independent environmental audit is scheduled to take place before 31<sup>st</sup> of December 2017.

### 11.1. Environmental Risk Register

Environmental risks associated with the site operations are recorded in the Environmental Aspects and Impacts Register. The Environmental Aspects and Impacts Register are reviewed on an annual basis and is the basis of the Environmental Improvement Plan.

## **12. INCIDENTS AND NON-COMPLIANCES DURING THE REPORTING PERIOD**

### **12.1. Consent Condition Compliance**

During the reporting period Dendrobium Mine complied with 100% of the required conditions. Dendrobium Mine Compliance report is attached in as Appendix C.

## **13. ACTIVITIES PROPOSED IN THE NEXT REPORTING PERIOD**

### **Dendrobium Mine**

During the next reporting period (FY18), Dendrobium will continue Longwall mining in Area 3B with Longwall 13 scheduled to be complete in December 2017 & Longwall 14 extraction to start in January 2018. Development will continue in Area 3B Main Gates and Wonga Mains.

### **Construction Activities**

Electricity for Dendrobium Mine is currently supplied via a 33kV line originating from BlueScope Steel, Port Kembla. Dendrobium has commenced preliminary planning to upgrade this surface electrical infrastructure to draw pit top power supply from the Endeavour Energy network. Illawarra Coal is in the early stages of assessing the requirements and timing of this project.

Preliminary planning work to upgrade the existing compressor on site has begun. Possible locations for the upgrade include the existing compressor shed at Dendrobium Pit Top and also Vent Shaft 1.

### **Environmental Management**

#### **Erosion and Sediment Control**

Erosion and sediment control improvements planned to be undertaken during the next reporting period at the Dendrobium Pit Top include:

- Improvements and ongoing maintenance to drainage and greywater treatment systems;
- Continued sealing of unsealed areas.

#### **Noise Management**

Additional monitoring is planned during the next reporting period using real-time and handheld noise monitoring units to identify feasible noise reduction initiatives.

#### **Environmental Management System**

Dendrobium Mine is planning to continue the environmental management in accordance with ISO14001. Environmental Management Plans will be updated as needed during the next reporting period.

#### **Rehabilitation**

South32 is currently reviewing the prioritisation of rehabilitation activities. No rehabilitation activities of significance are confirmed for the next report period other than the Corrimal No. 3 Shaft works (see section 6.4). It is intended that the site activities and nature of the sites will be maintained throughout the next period.

## 14. REFERENCES

### Dendrobium Mine

Air Quality Management Plan

Bushfire Management Plan

Landscape Management Plan

Lighting Management Plan

Noise Management Plan

Waste Management Plan

Water Management Plan

Environmental Protection Licence 3241

Australian and New Zealand Guidelines for Fresh and Marine Water Quality- Volume 1, Chapter 3 (2000)

Cardno, Dendrobium Area 3B Subsidence Management Plan. Prepared for IC.

Cardno, Swamp Impact, Monitoring, Management and Contingency Plan, Dendrobium Area 3B. Prepared for IC.

Cardno, Watercourse Impact Monitoring, Management and Contingency Plan, Dendrobium Area 3B.

South32 Illawarra Coal. Swamp Impact, Monitoring, Management and Contingency Plan.

Dendrobium 3B, Longwall 13 End of Panel Report

### Cordeaux Colliery

Cordeaux Colliery - Locality Plan

Cordeaux Colliery - Regional Context Plan

Cordeaux Colliery – Leases, Colliery Holding and Location

Cordeaux Colliery – Pit Top Infrastructure Plan

Cordeaux Colliery – Extent of Underground Workings at Time of Closure – DP-3086

Cordeaux Colliery Pit Top Surface Water Management

Illawarra Coal - Remedial Action Plan - Corrimal No 3 Ventilation Shaft Picton Road, NSW (Rev 3)  
JBS&G

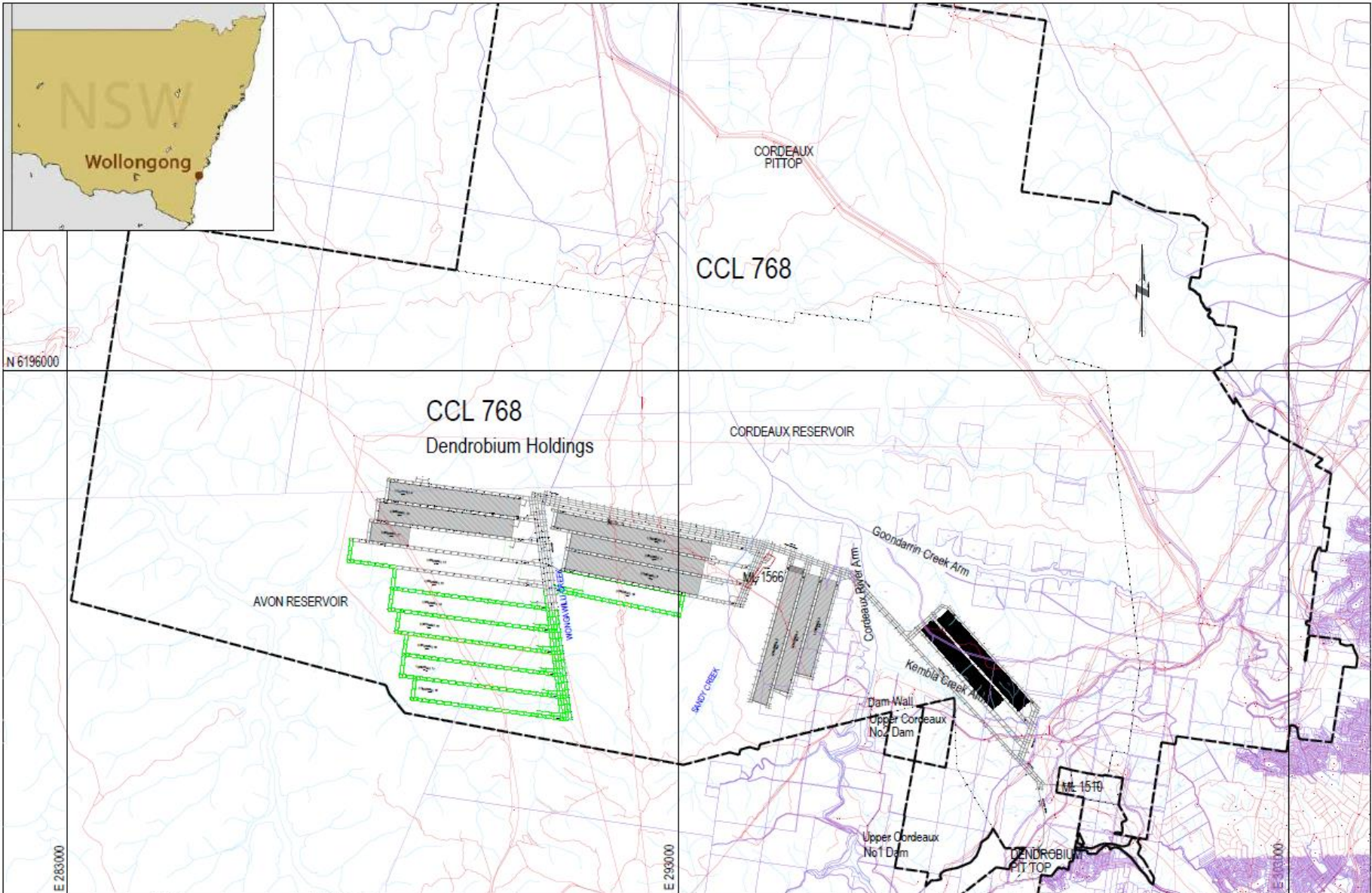
**PLANS CONTINUED**

## **15. PLANS**

**PLAN 1A - LOCATION OF MINING DOMAIN**

**PLAN 1B - LW STATUS AS AT END OF FY17**





Authorisation Holder \_\_\_\_\_ Date \_\_\_\_\_

**NOTES**  
 Cadastre from D.C.D.B  
 Infrastructure/Water from LPI  
 Datum - MGA 94 Coordinate System  
 Datum - Aust. Height Datum (AHD)

LEGEND	
	SURFACE INFRASTRUCTURE
	LEASE BOUNDARIES
	COLLIERY HOLDING
	CADASTRE
	CURRENT WORKINGS
	PROPOSED MINE WORKINGS
	MINING LEASE
	SURFACE WATER FEATURES

**Dendrobium Mine**  
 Illawarra Coal  
 Cordeaux Rd, Mt Kembia, NSW, 2526, Australia  
 ABN 85 098 744 088

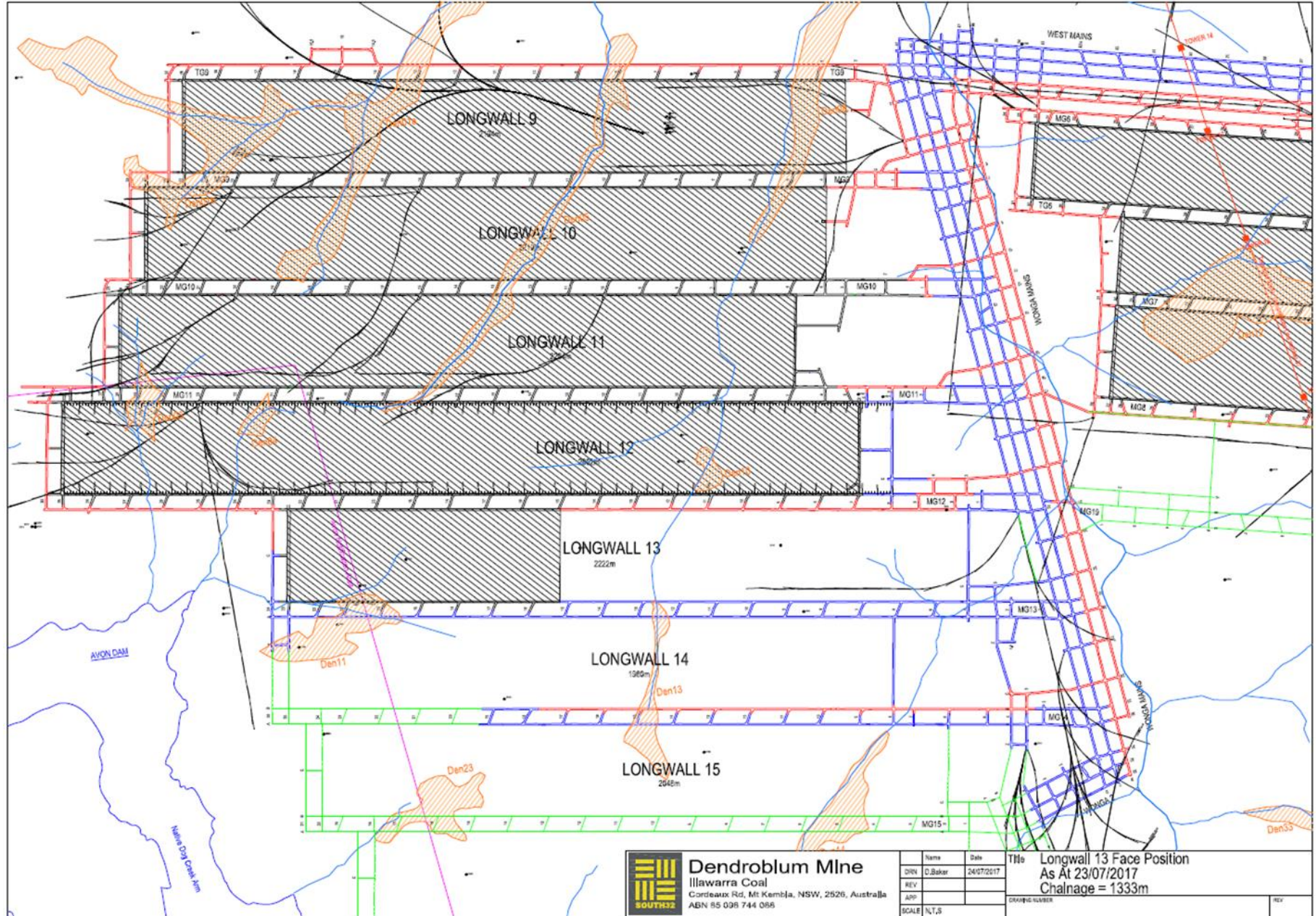
Name	Date
DRN D. Baker	03/05/2015
REV	
APP	
SCALE	N.T.S

Title Pre Mining Environment - Project Locality  
 Plan 1, Sheet 1  
 Mine and Context  
 DRAWING NUMBER: DEN-01-4483

REV 6

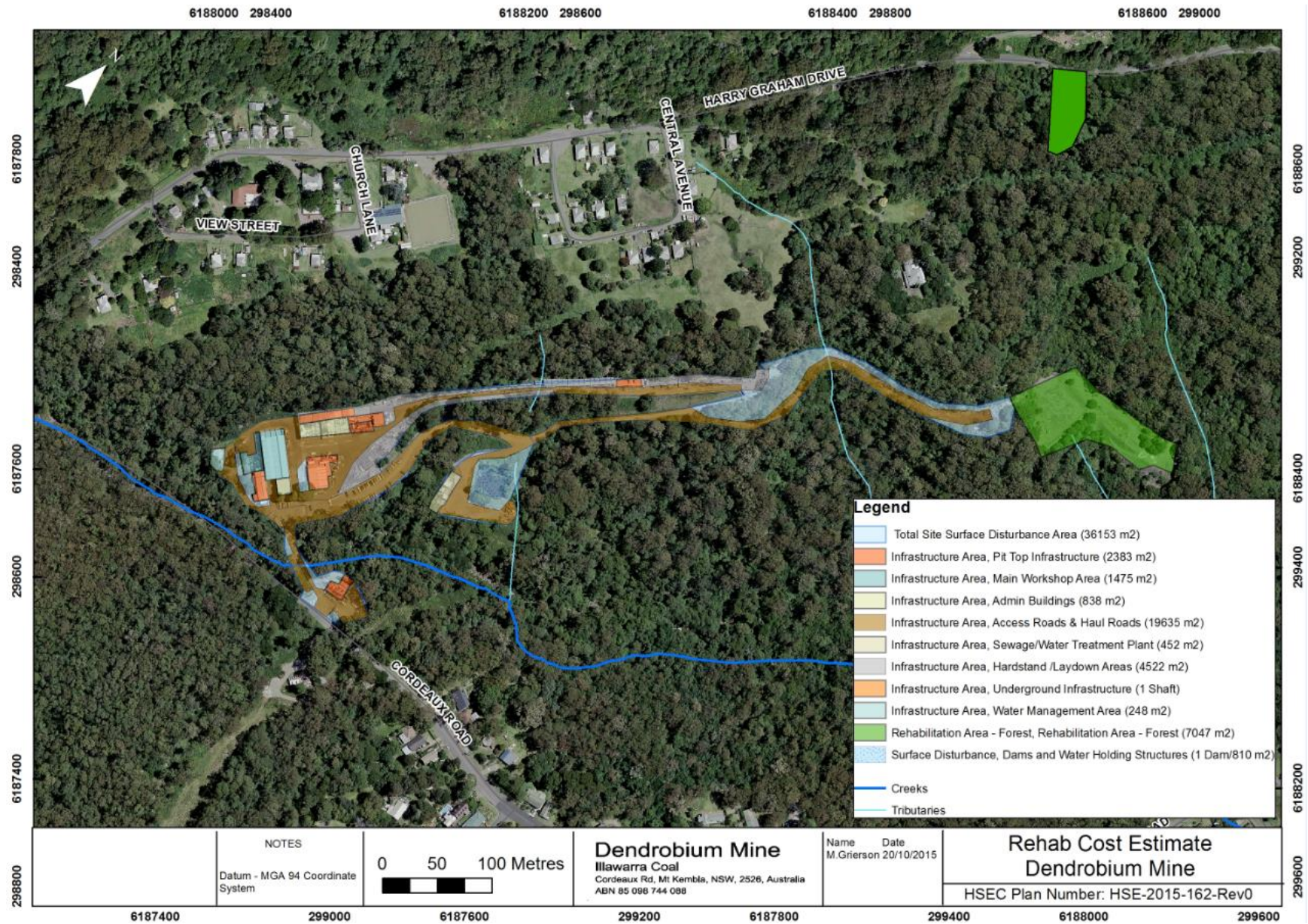


PLANS CONTINUED



**PLAN 2 – DENDROBIUM MINE SITE**

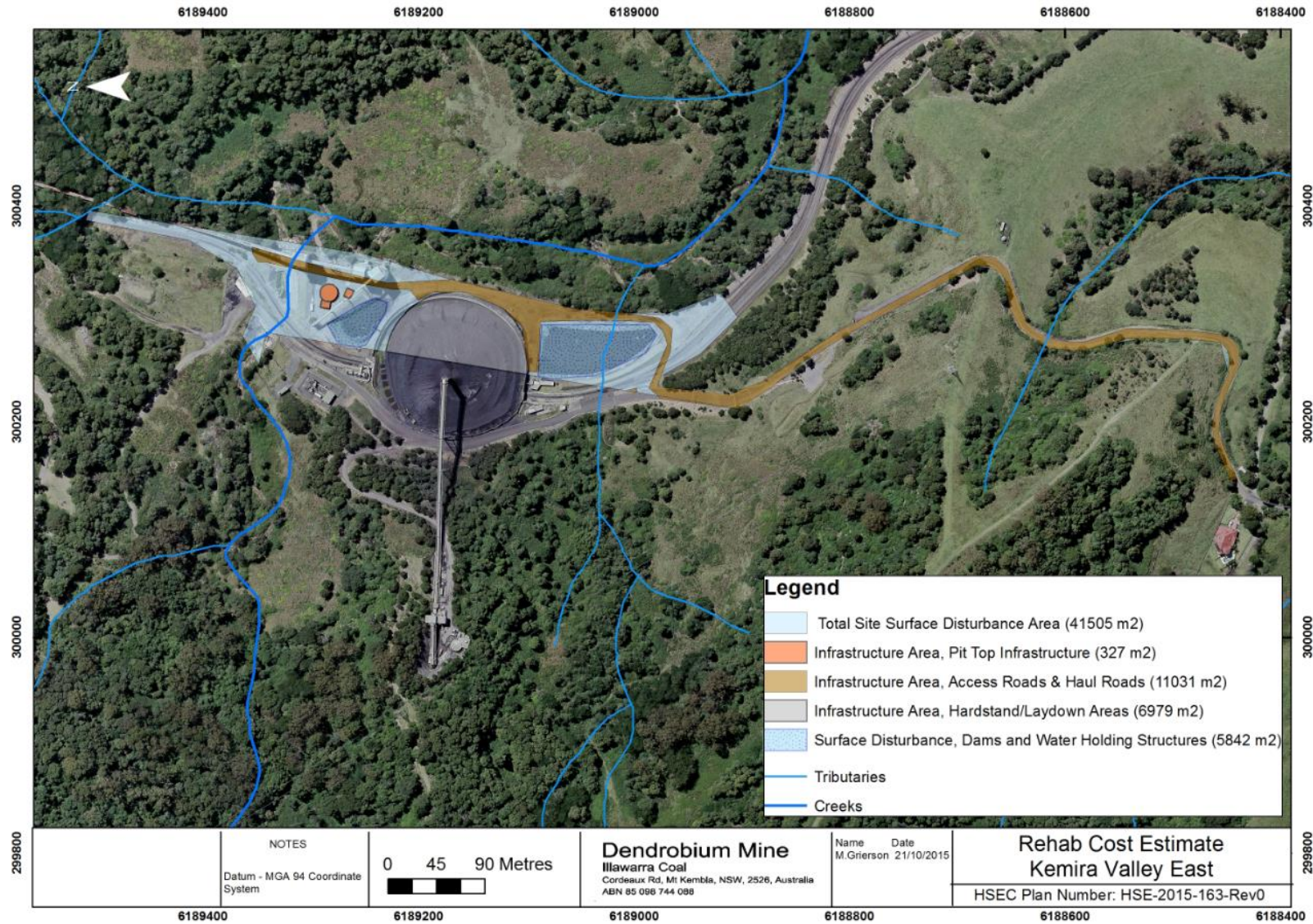




**PLAN 3 – SITE LAYOUT – KEMIRA VALLEY**



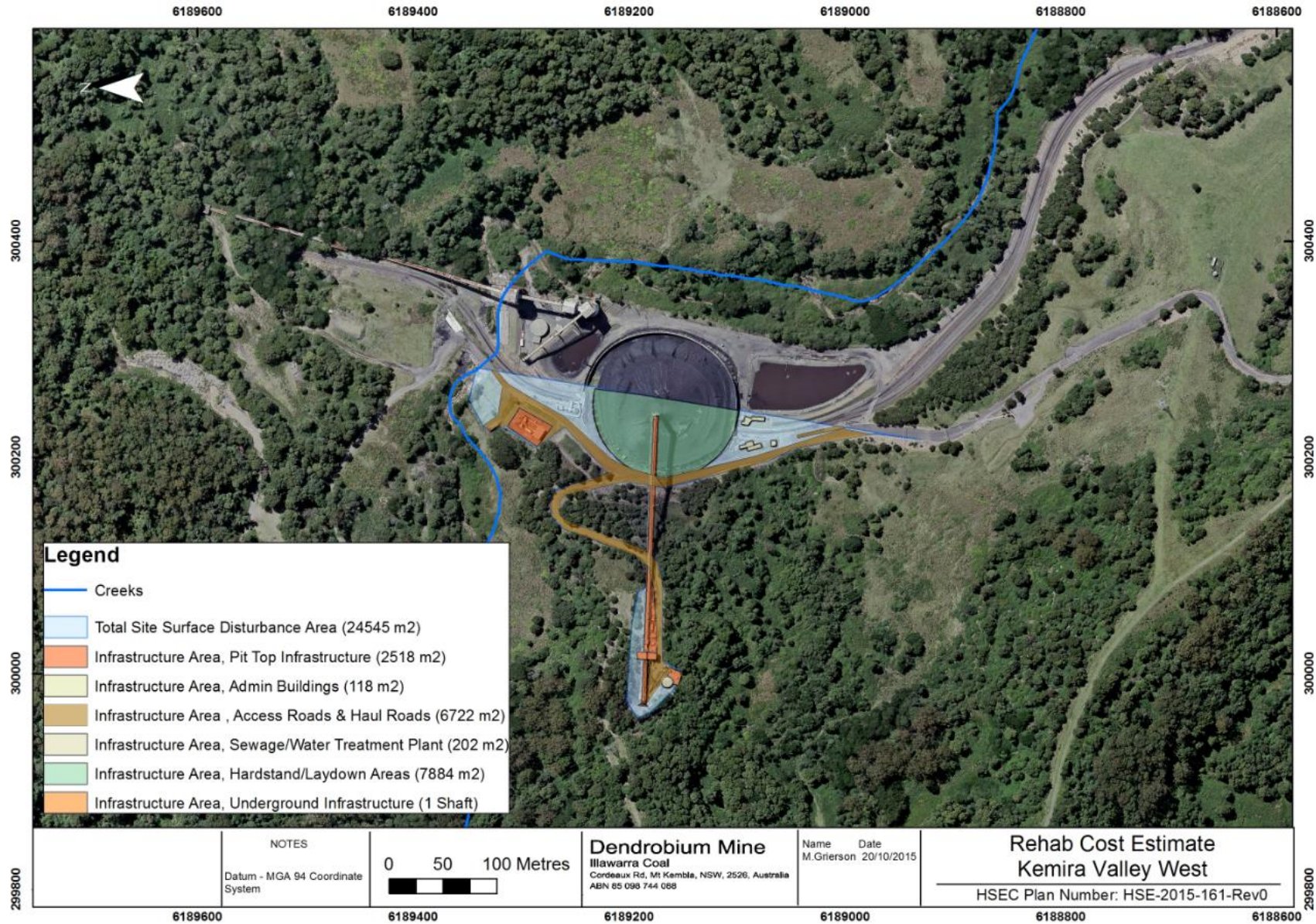
A)





PLANS CONTINUED

B)



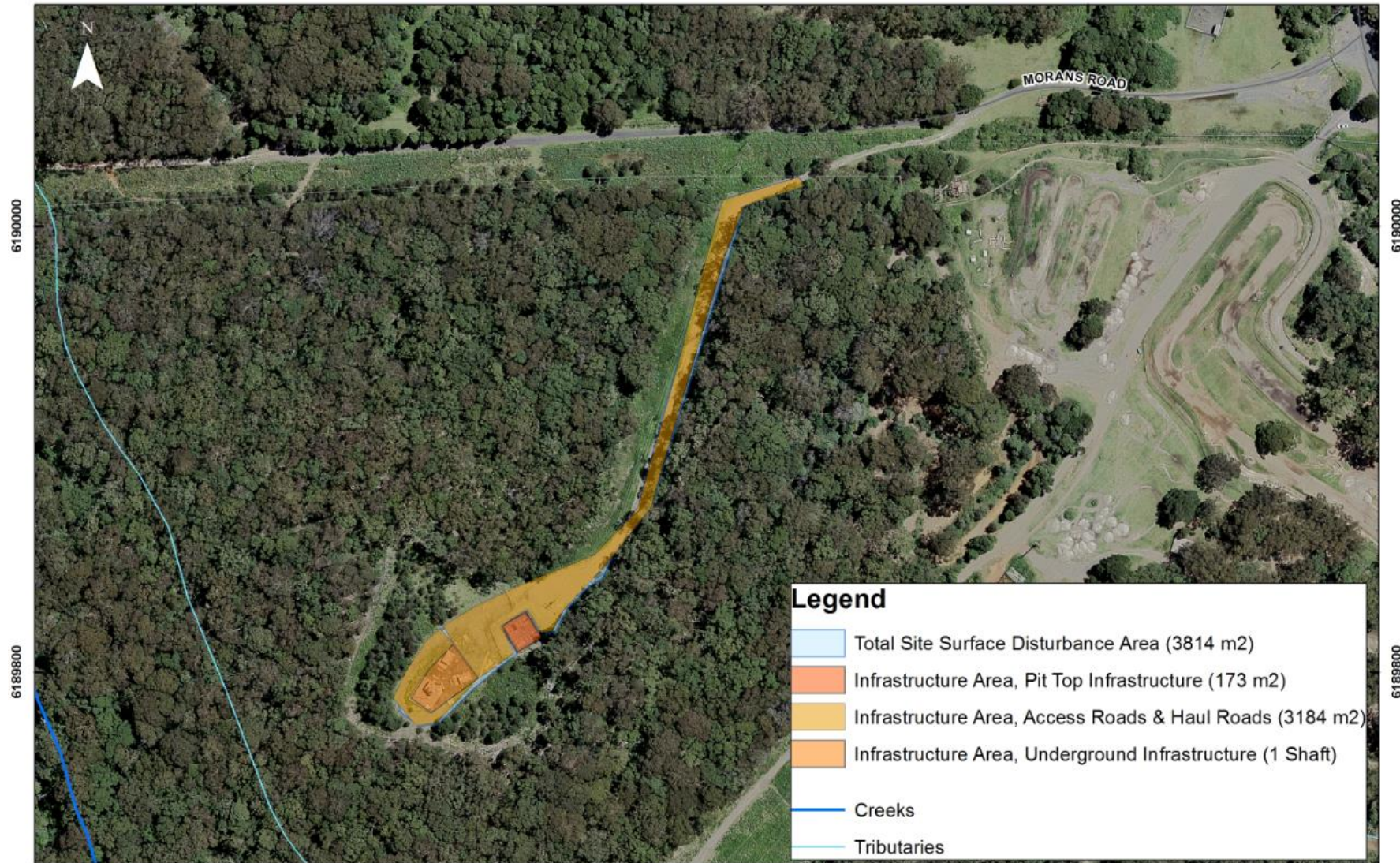
**PLAN 4 – NO. 1 VENTILATION SHAFT SITE LAYOUT**



298600

298800

299000



### Legend

- Total Site Surface Disturbance Area (3814 m<sup>2</sup>)
- Infrastructure Area, Pit Top Infrastructure (173 m<sup>2</sup>)
- Infrastructure Area, Access Roads & Haul Roads (3184 m<sup>2</sup>)
- Infrastructure Area, Underground Infrastructure (1 Shaft)
- Creeks
- Tributaries

#### NOTES

Datum - MGA 94 Coordinate System

0 25 50 Metres



#### Dendrobium Mine

Illawarra Coal  
Cordeaux Rd, Mt Kembla, NSW, 2526, Australia  
ABN 85 088 744 088

Name Date  
M.Grierson 21/10/2015

#### Rehab Cost Estimate Vent Shaft 1

HSEC Plan Number: HSE-2015-164-Rev0

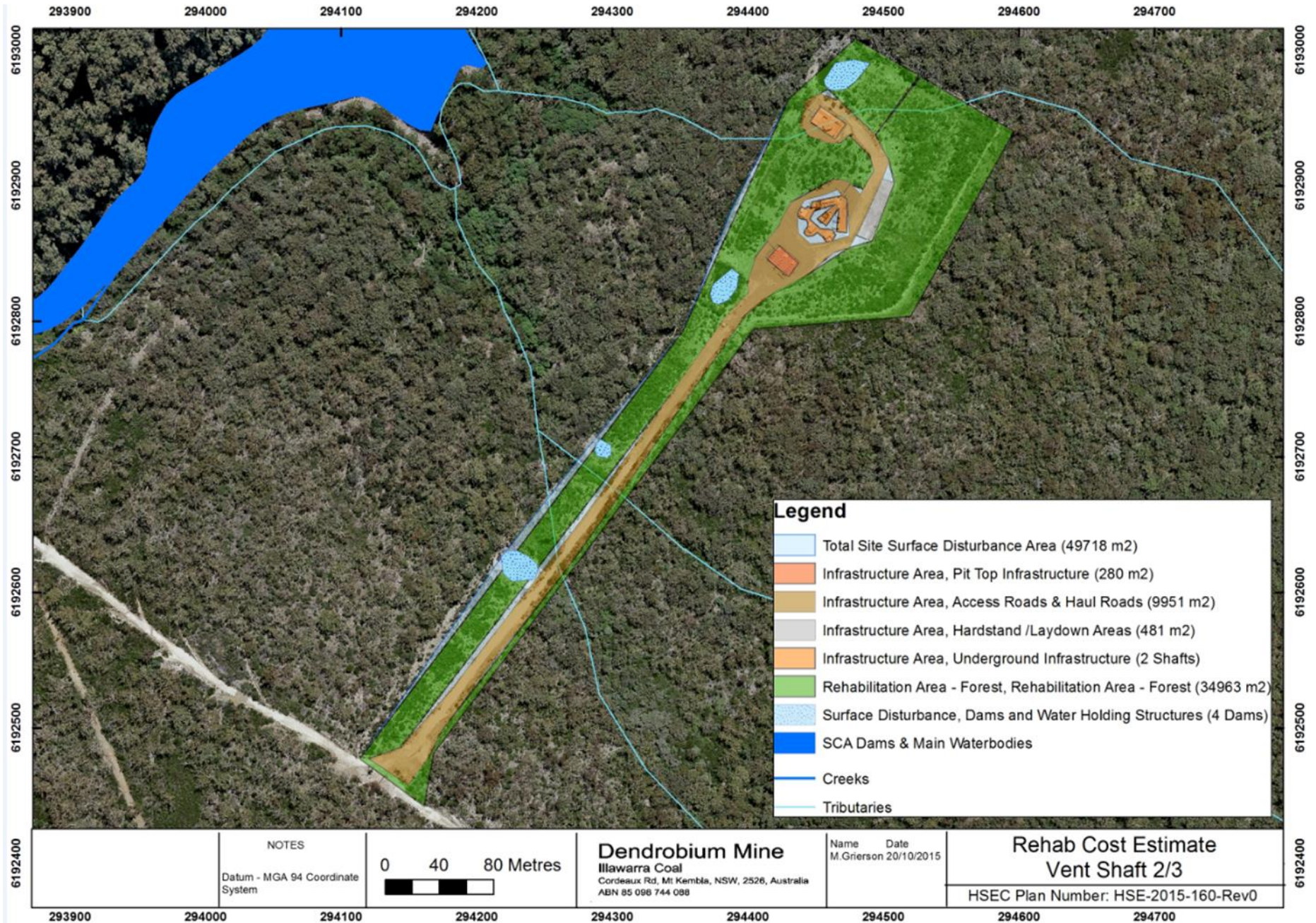
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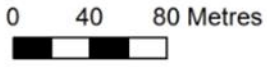
299000



**PLAN 5 – NO.2 AND 3 VENTILATION SHAFT SITE LAYOUT**



NOTES  
Datum - MGA 94 Coordinate System



**Dendrobium Mine**  
Illawarra Coal  
Cordeaux Rd, Mt Kembla, NSW, 2526, Australia  
ABN 85 096 744 098

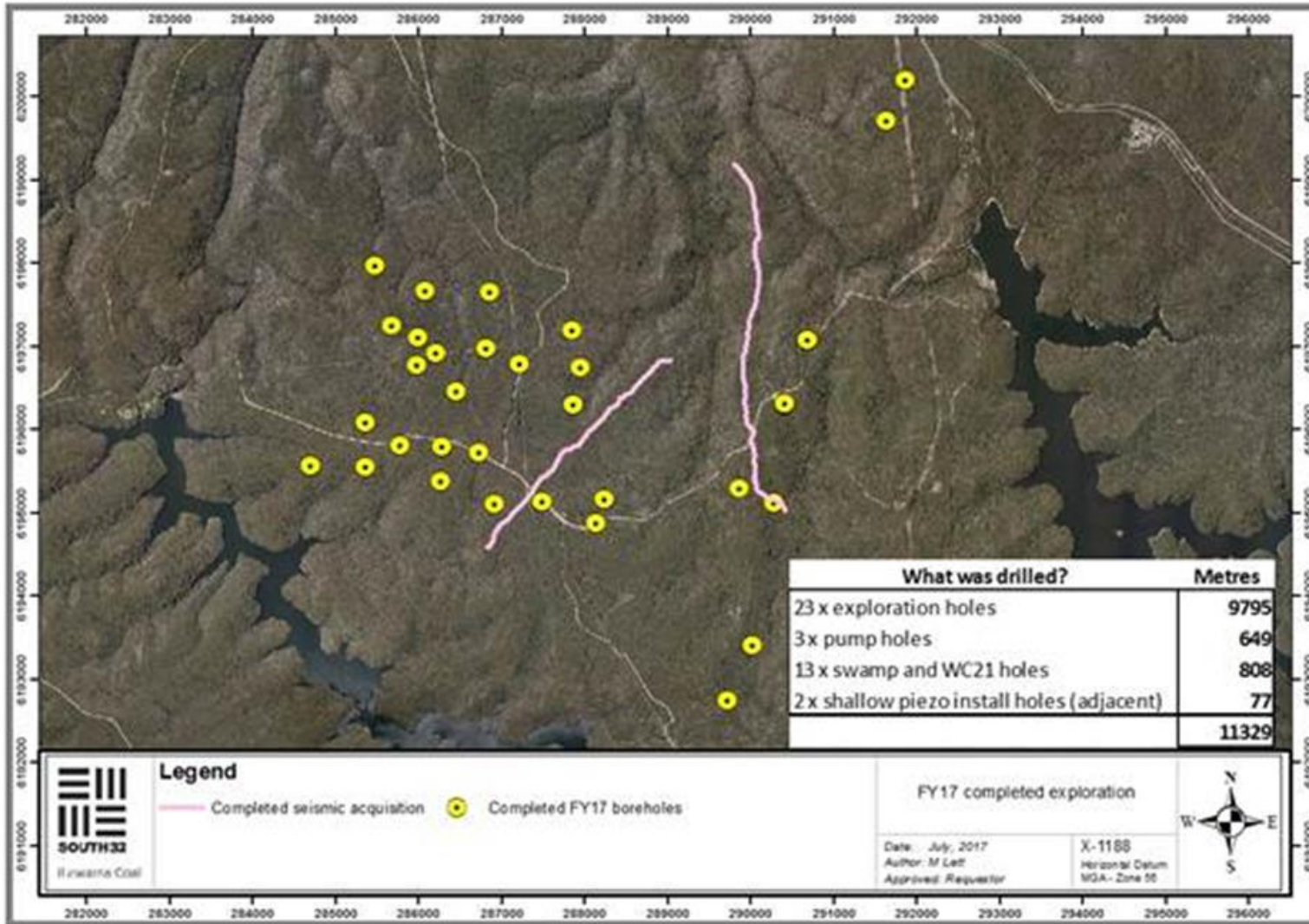
Name Date  
M. Grierson 20/10/2015

**Rehab Cost Estimate**  
**Vent Shaft 2/3**

HSEC Plan Number: HSE-2015-160-Rev0

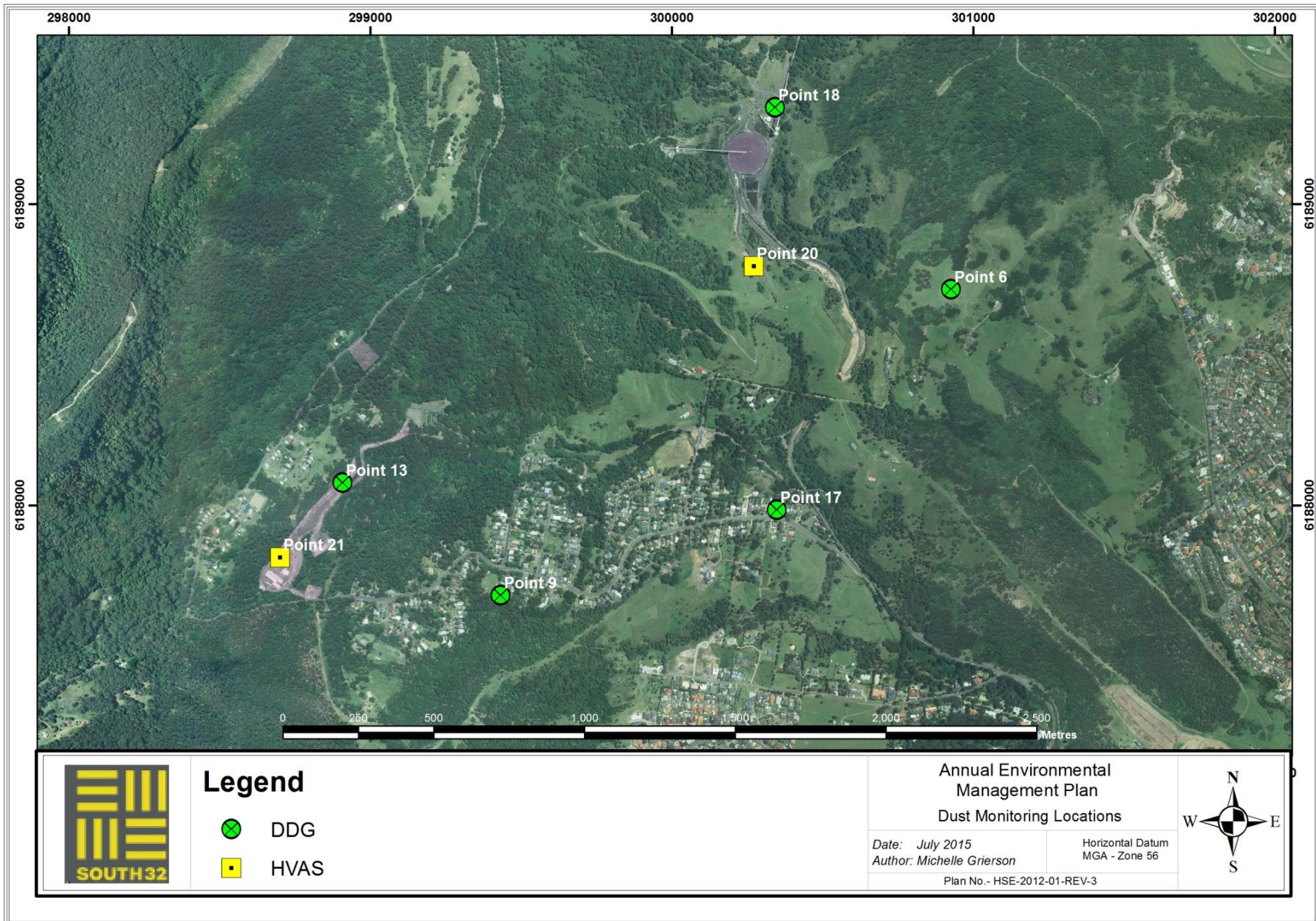
**PLAN 6 – EXPLORATION ACTIVITIES – DENDROBIUM MINE**





## PLAN 7 – AIR QUALITY MONITORING LOCATIONS



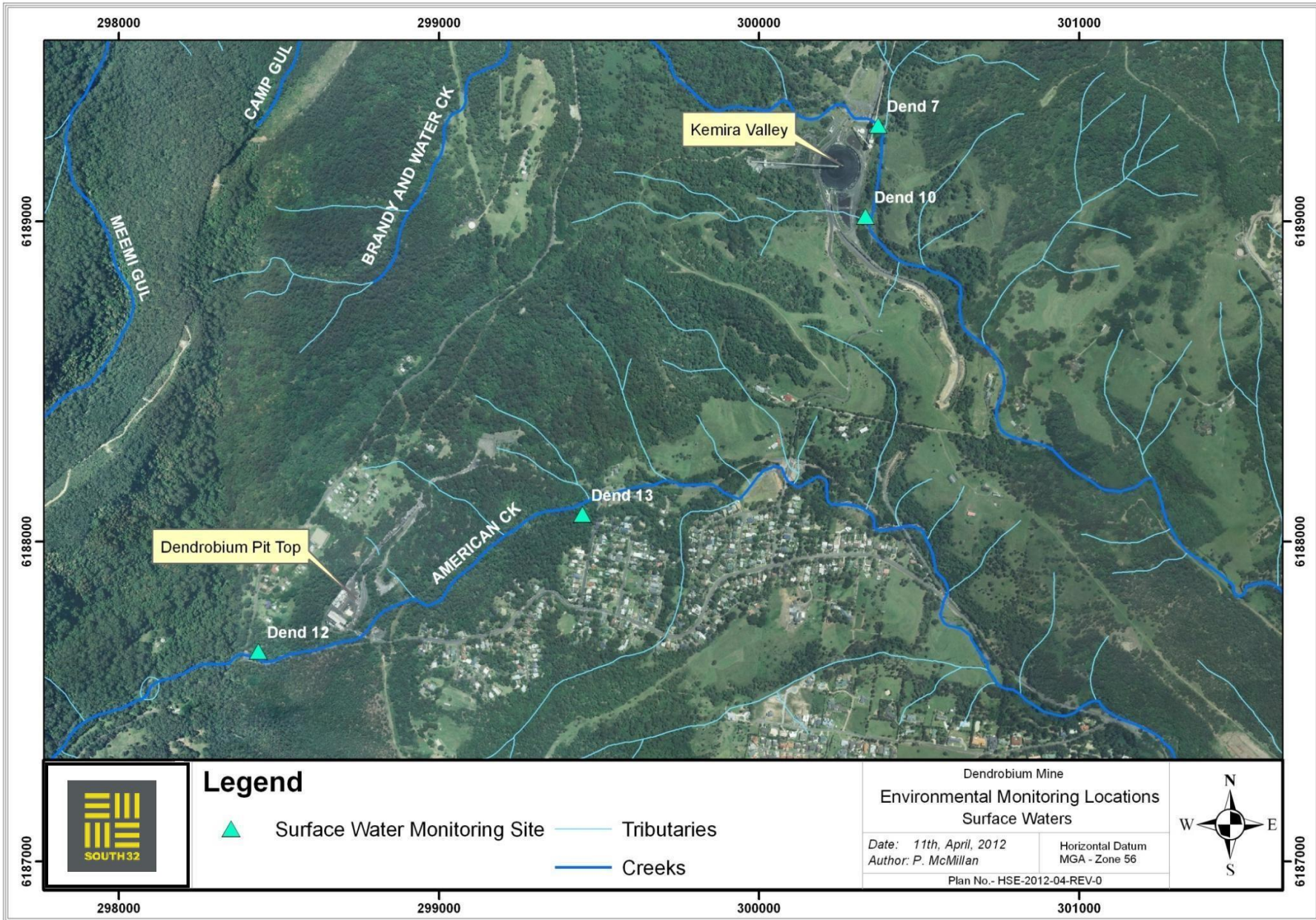


**PLAN 8 – DENDROBIUM SURFACE WATER**

**A – Surface Water Quality Monitoring Locations**

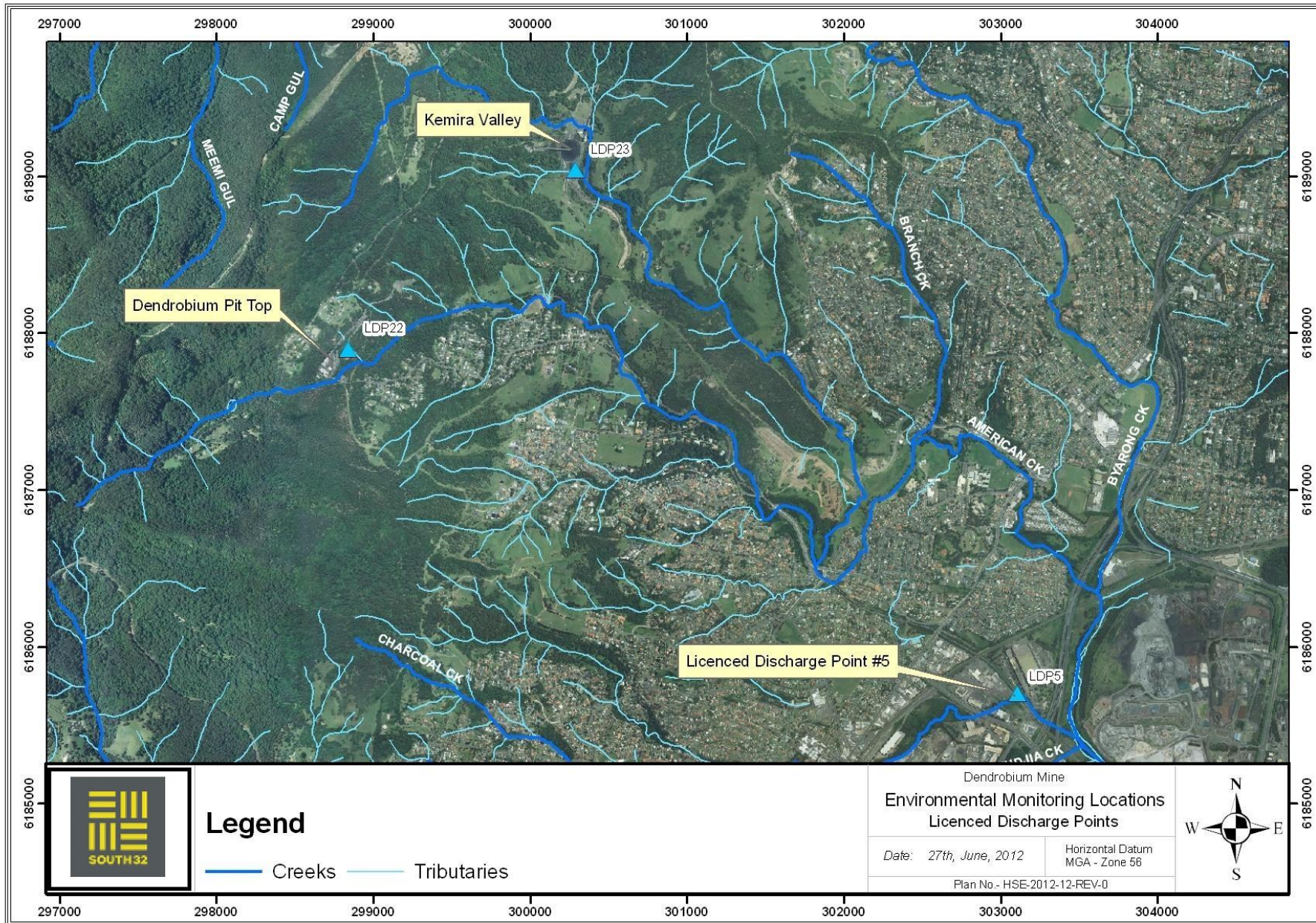
**B – LDP Location**





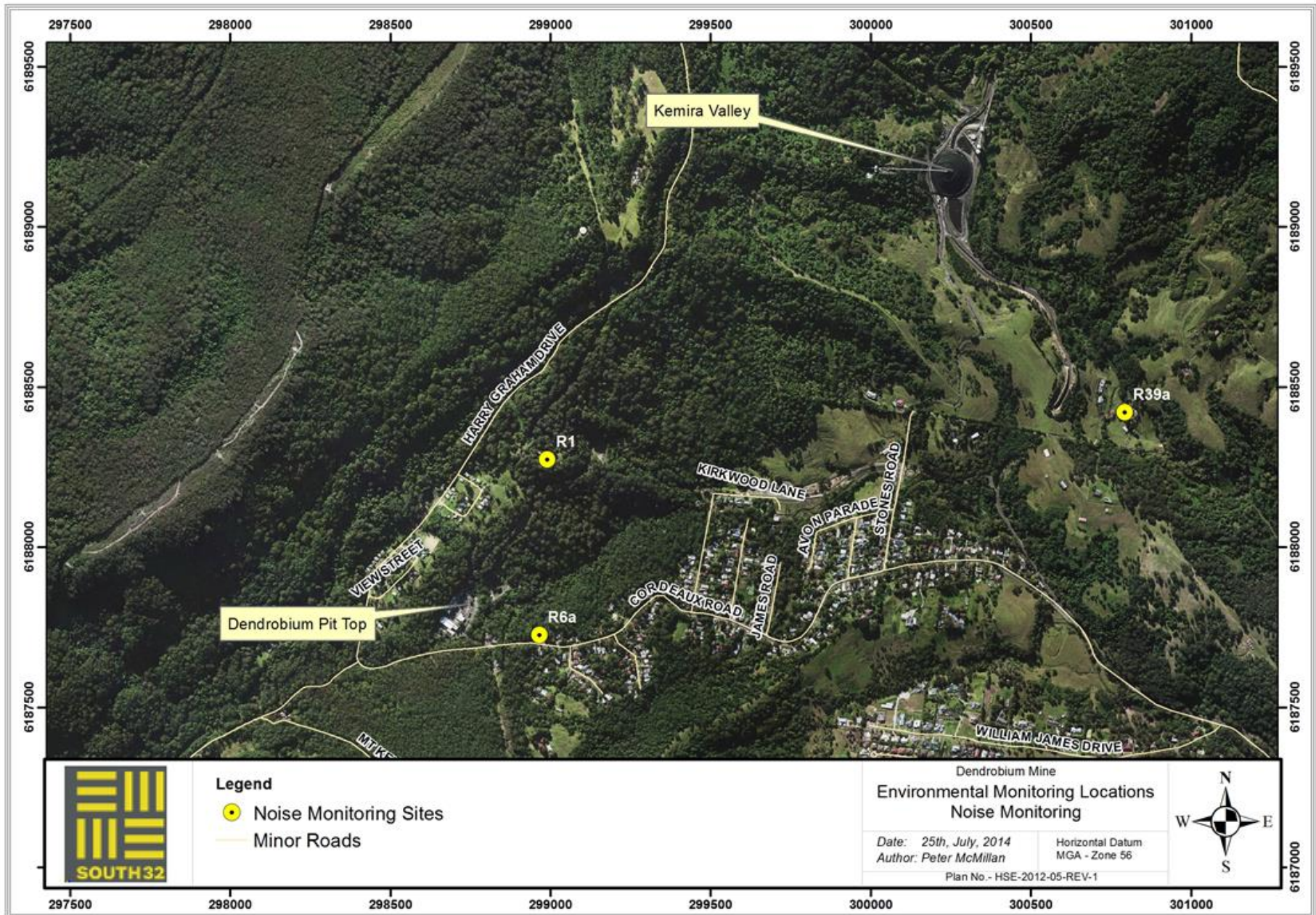


PLANS CONTINUED



## PLAN 9 – NOISE MONITORING LOCATIONS

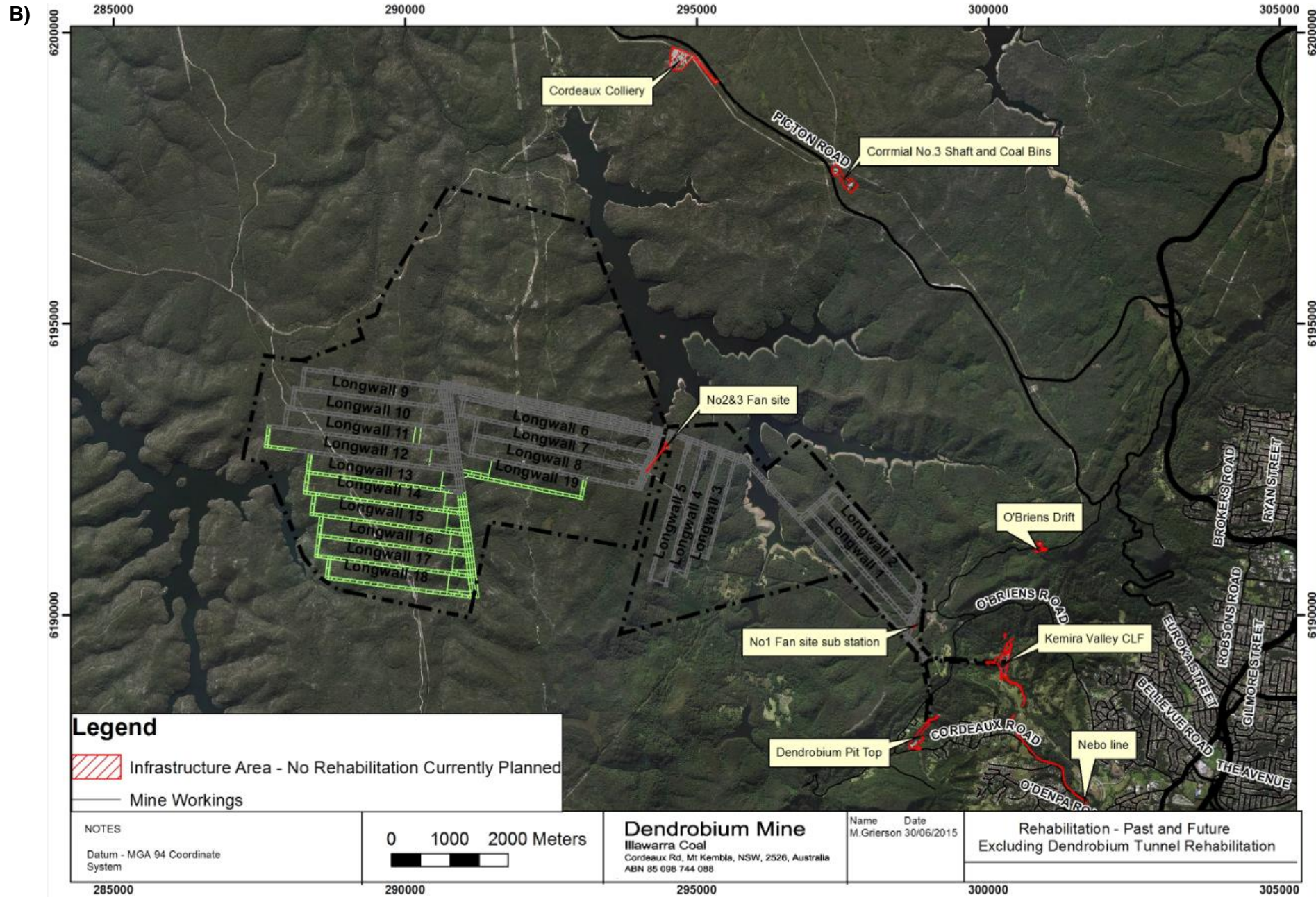




**PLAN 10 – REHABILITATION AREAS**

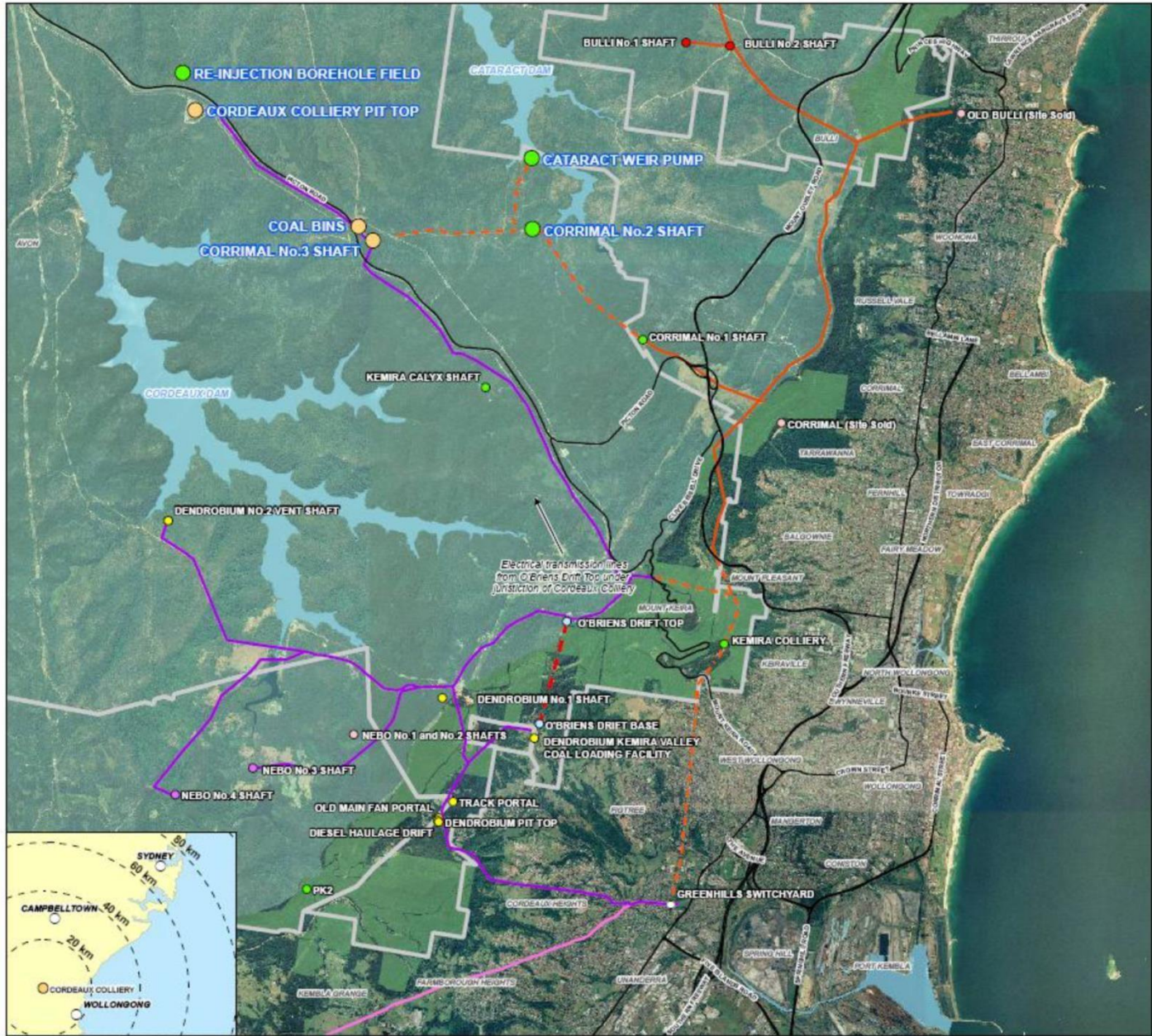
**Planned Rehabilitation – All other Areas**





**PLAN 11 – CORDEAUX COLLIERY LOCALITY PLAN**





### Locality Plan

#### CORDEAUX COLLIERY CLOSURE PLAN

- Legend**
- Care and Maintenance Sites
  - Non Operational Site
  - Operational Site
  - Rehabilitated Site
  - Sealed (Not Rehabilitated)
  - Site Sold (Not Rehabilitated)
  - Site Sold (Rehabilitated Site)
  - Greenhills Switchyard
  - 33kV Conductors (Dendrobium)
  - Disused Overhead Power Lines
  - Overhead Power Lines Rehabilitated/Ownership Transferred
  - Other 33kV Conductors
  - Kemira Tunnel
  - Major Roads (LPMA)
  - BHP/BC Mining Leases
  - NPWD Reserve (LPMA)
  - Major Waterbodies (LPMA)
  - DCA Special Areas (Sydney Catchment Authority)

[CORDEAUX COLLIERY SITES](#)



FIGURE 2.1

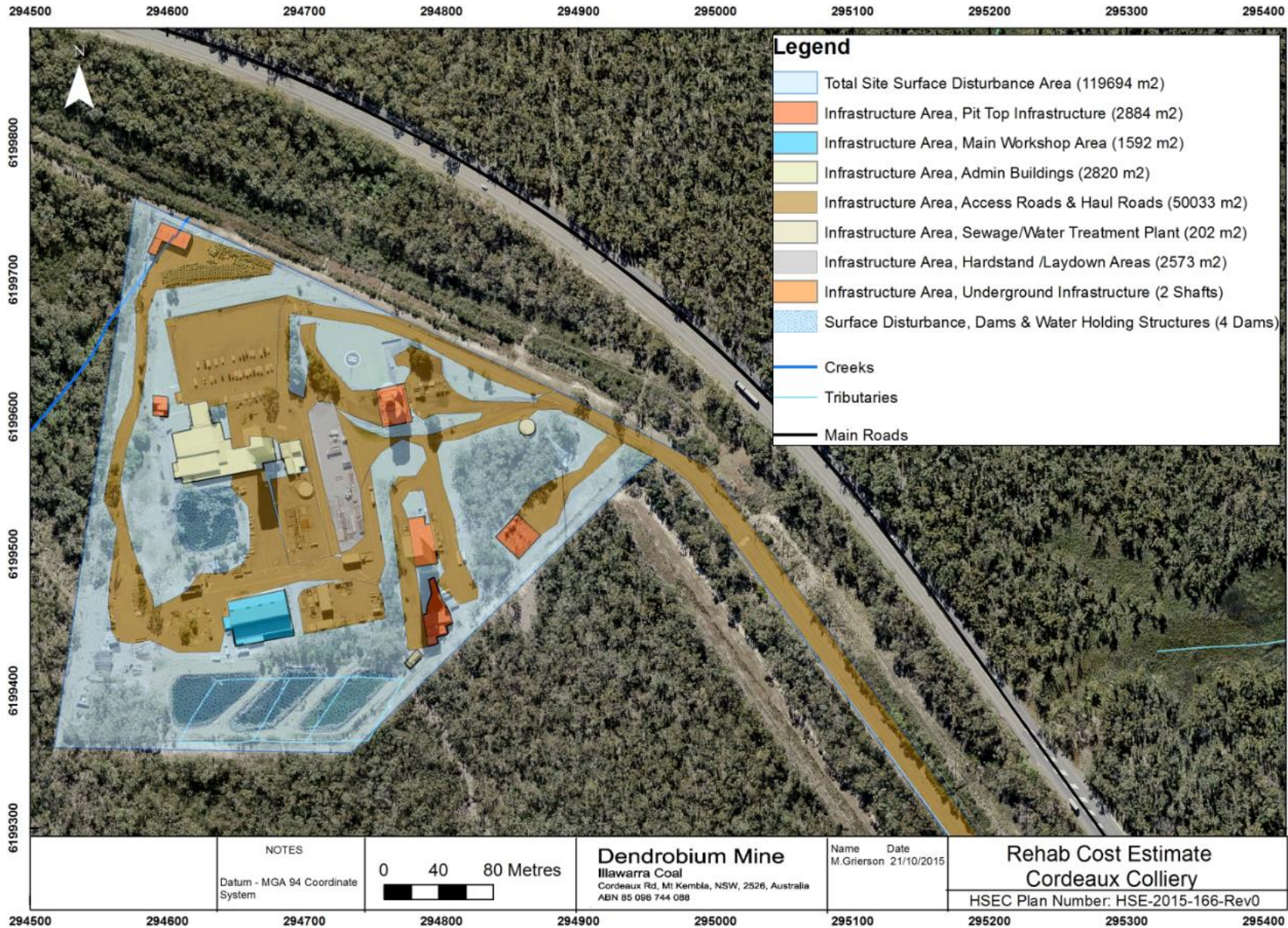
Scale 1:60,000 (at A3)



Map Produced by Cardno Forbes Rigby Pty Ltd  
 Date: 04 December 2009  
 Coordinate System: Zone 58 MGA/GDA94  
 GIS MAP REF: 110225-01\_1801\_LocalityPlan\_Cordeaux.mxd 04

**PLAN 12 – CORDEAUX COLLIERY PIT TOP INFRASTRUCTURE**





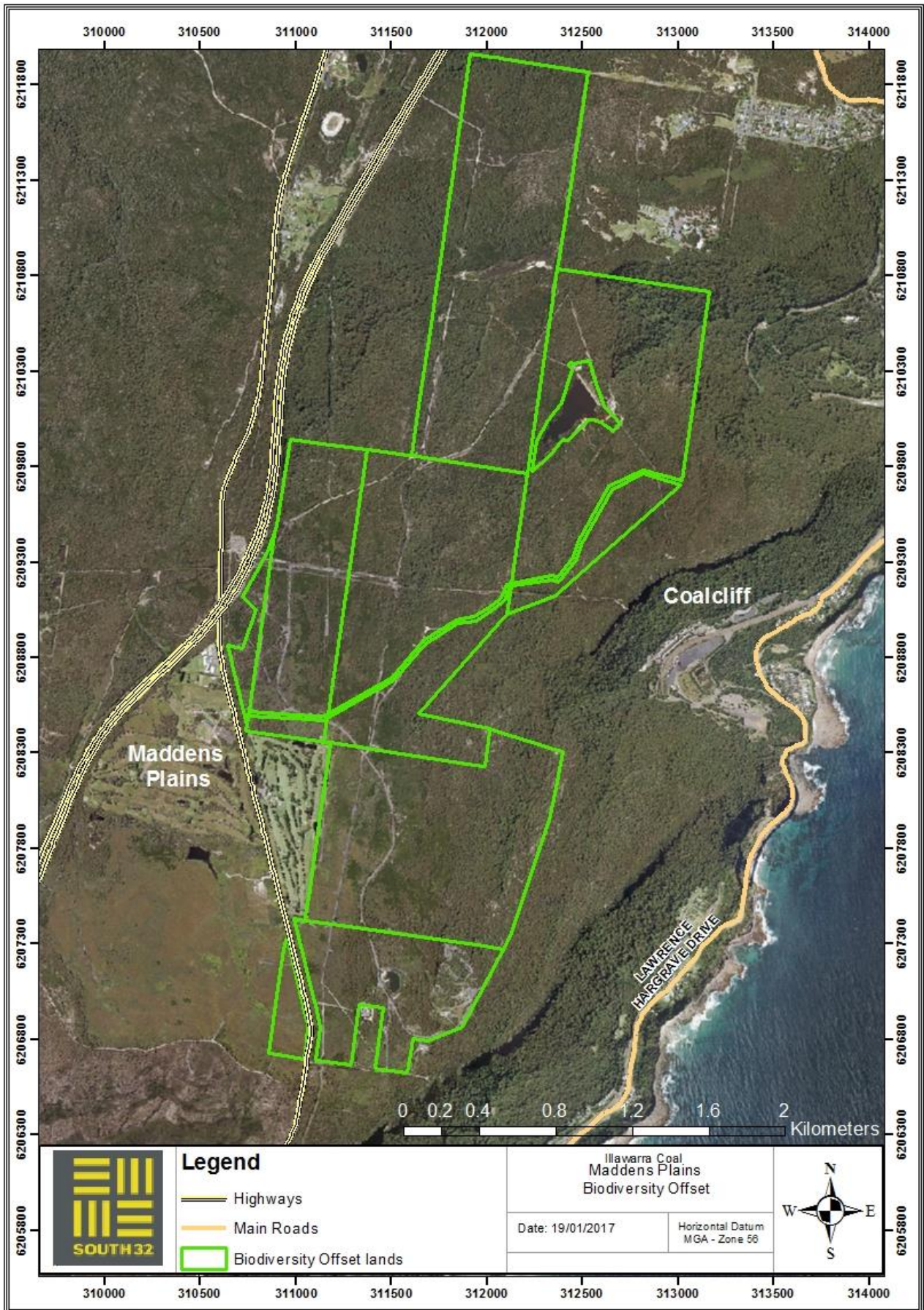
**PLAN 13 – CORDEAUX COLLIERY PIT TOP SURFACE WATER MANAGEMENT**



**PLANS CONTINUED**

**PLAN 14 – BIODIVERSITY OFFSET – MADDENS PLAINS**





## **16. APPENDICES**

### **APPENDIX A: EPA ANNUAL RETURN**

**APPENDICES CONTINUED**

**APPENDIX B: REHABILITATION SECURITY COST ESTIMATE - DEPARTMENT OF  
RESOURCES AND GEOSCIENCE ONLY**

**APPENDICES CONTINUED**

**APPENDIX C: DENDROBIUM MINE CONSENT CONDITION COMPLIANCE**



**APPENDICES CONTINUED**

**APPENDIX D: COMMUNITY COMPLAINTS REPORT**

**APPENDICES CONTINUED**

**APPENDIX E: DENDROBIUM MONITORING DATA**



**APPENDICES CONTINUED**

**APPENDIX F: CLOSURE PLANS**