



ILLAWARRA COAL

**DENDROBIUM MINE AND
CORDEAUX COLLIERY**



**ANNUAL REVIEW
FY18**



CONTENTS

Dendrobium Mine and Cordeaux Colliery Annual Review	4
1. Statement of Compliance	5
2. Introduction	6
3. Approvals	9
4. Operations During the Reporting Period	11
5. Actions required from previous Annual Review	15
6. Environmental Performance	17
7. Water Management	53
8. Rehabilitation	59
9. Biodiversity Offsets	60
10. Community	61
11. Independent audits	64
12. Incidents and Non-compliances during the reporting period	66
13. Activities Proposed in the Next Reporting Period	67
14. References	68
15. Plans	69
Plan 1a - Location of Mining Domain	69
Plan 1b - LW Status as at end of Financial Year	69
Plan 2 – Dendrobium Mine Site	72
Plan 3 – Site Layout – Kemira Valley	74
Plan 4 – No. 1 Ventilation Shaft Site Layout	77
Plan 5 – No.2 and 3 Ventilation Shaft Site Layout	79
Plan 6 – Exploration Activities – Dendrobium Mine	81
Plan 7 – Air Quality Monitoring Locations	83
Plan 8 – Dendrobium Surface Water	85
Plan 9 – Noise Monitoring Locations	88
Plan 10 – Rehabilitation Areas	90
Plan 11 – Cordeaux Colliery Locality Plan	93
Plan 12 – Cordeaux Colliery Pit Top Infrastructure	95
Plan 13 – Cordeaux Colliery Pit Top Surface Water management	97
Plan 14 – Biodiversity Offset – Maddens Plains	99
16. Appendices	101
Appendix A: EPA Annual Return	101
Appendix B: Rehabilitation Security Cost Estimate - Department of Resources and Geoscience Only	102
Appendix C: Dendrobium Mine Consent Condition Compliance	103
Appendix D: Community Complaints Report	104
Appendix E: Dendrobium Monitoring Data	105
Appendix F: Closure Plans	106

Appendix G : Dendrobium Mine Cordeaux Colliery Compliance Audit Program – Catchment Special Areas	107
Appendix H: Dendrobium Mine Triennial Independent Audit Report FY18	108
Figure 1: ROM Production.....	11
Figure 2: Exploration Locations	13
Figure 3: EPL Dust Deposition Gauge, Average Results Summary.	18
Figure 4: HVAS Results.....	19
Figure 5: Rainfall and temperature	21
Figure 6: Water Quality Data from the Mine Water Holding Lagoon.....	24
Figure 7: pH and Conductivity at the Cordeaux Filter Lagoon Underflow.	24
Figure 8: Site R1 Noise Compliance (LAeq, 15 min).....	29
Figure 9: Site R6a Noise Compliance (LAeq, 15 min).....	29
Figure 10: Site R39A Noise Compliance (LAeq, 15 min).	29
Figure 11: Subsidence impacts observed during the Reporting Period.	47
Figure 12: Principal Response Flowchart in “Cordeaux Reservoir DSC Notification Area Contingency Plan”	53
Figure 13: Mine Water Balance	53
Figure 14: Dendrobium Community Complaints.	61
Table 1: Annual Review Overview	4
Table 2: Statement of Compliance.....	5
Table 3: Contacts.	8
Table 4: Development Consent Approvals associated with Dendrobium Mine.....	9
Table 5: Mining Leases associated with Dendrobium Mine.....	9
Table 6: Licences associated with Dendrobium Operations.....	9
Table 7: Current Mining Approvals for the Dendrobium Operations.	9
Table 8: Consents Leases and Licences for the Cordeaux Colliery.	10
Table 9: Area 3 Longwall Start and Finish Dates.....	11
Table 10: Production Summary	12
Table 11: Arising Actions from Previous Dendrobium Annual Review and Triennial Audit	15
Table 12: Relevant Standard for Air Quality.....	18
Table 13: Summary of Water Quality Results – Dend 7 (Upstream of KVCLF).....	21
Table 14: Summary of Water Quality Results – Dend 10 (Downstream of KVCLF)	21
Table 15: Summary of Water Quality Results – Dend 12 (Upstream of Pit Top)	22
Table 16: Summary of Water Quality Results – Dend 13 (Downstream of Pit Top).....	22
Table 17: Monitoring Requirements and Prescribed Limits for LDP5	22
Table 18: EPL Annual Return Monitoring Summary	23
Table 19: Monitoring Requirements and Prescribed Limits	28
Table 20: Rail Haulage Noise Criteria.....	30
Table 21: Monitoring program for Dendrobium Mine.....	33
Table 22 Impacts identified during the Reporting Period.....	42

Table 23: Site Safety Risks and Control Mechanisms.....	49
Table 24: Site Safety Risks and Control Mechanisms.....	50
Table 25: Waste Streams and Total Volumes.....	51
Table 26: Recycle Volumes for Reporting Period.	51
Table 27: Oil and Grease Volumes.....	51
Table 28: General Waste Volumes for Reporting Period.	52
Table 29: Water Balance Statistics for the reporting period.	54
Table 30: Stored Water - Dendrobium.	56
Table 31: Rainfall at Dendrobium	56
Table 32: Stored Water - Cordeaux.	57
Table 33: Rainfall at Cordeaux	57
Table 34: Water Take Dendrobium Mine	58
Table 35: Dendrobium Mine and Cordeaux Colliery Rehabilitation Summary.	59
Table 36: Environmental Audits Undertaken During Reporting Period.....	64
Table 37: Summary of Triennial Audit Findings	65

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	Dendrobium Coal Pty Ltd (ML1510 and ML1566) and Illawarra Coal Holdings Pty Ltd (CCL768).
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 2017
Annual Review end date	30 June 2018

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 2017 – 30 June 2018 and that I am authorised to make this statement on behalf of Illawarra Coal – Dendrobium Mine and Cordeaux Colliery.

Note.

- a) 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.
- b) 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 penalty 2 years imprisonment or \$22,000, or both).

Name of authorised reporting officer	Michelle Grierson
Title of authorised reporting officer	Environmental Specialist
Signature of authorised reporting officer	
Date	26/09/2018

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
Mining Lease / Sub-Lease	Number			
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
Water Licence				
10WA118772	Groundwater Extraction Licence	09/02/2016	Under Renewal	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 2017 to 30 June 2018. 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 WaterNSW Special Areas (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 WaterNSW Special Areas. 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.

Position	Name	Number
Operations Manager	Wayne Bull	(02) 4255 4468
Superintendent Brownfields Exploration Cordeaux	Richard Walsh	(02) 4286 3302
Environment Supervisor	Peter McMillan	(02) 4286 3324
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-I	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	5/03/2018	10/01/2023
Radiation Licence (EPA)	RL30137	27/07/2017	27/07/2019
Environment Protection Licence	3241	August 2000	n/a
Water Access Licence (Office of Water)	10WA118772	1/07/2013	Under Renewal
Exploration Licence	A143	28/07/1979	7/11/2018
Exploration Licence	A374	24/10/1986	Under Renewal
WaterNSW Access Consent	D2015/17013	13/03/2015	13/03/2020

Table 7: Current Mining Approvals for the Dendrobium Operations.

Licences/Consents	Number	Issue Date
SMP Approval-Longwalls 9 to 13	DGTO13/42	5/2/2013
SMP Approval-Longwalls 14 to 15	N/A	16/12/2016
SMP Approval-Longwall 16	N/A	30/05/2018
Mining Operations Plan	MCV15/466	28/09/2015

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
WaterNSW Access Consent	D2018/39689	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.

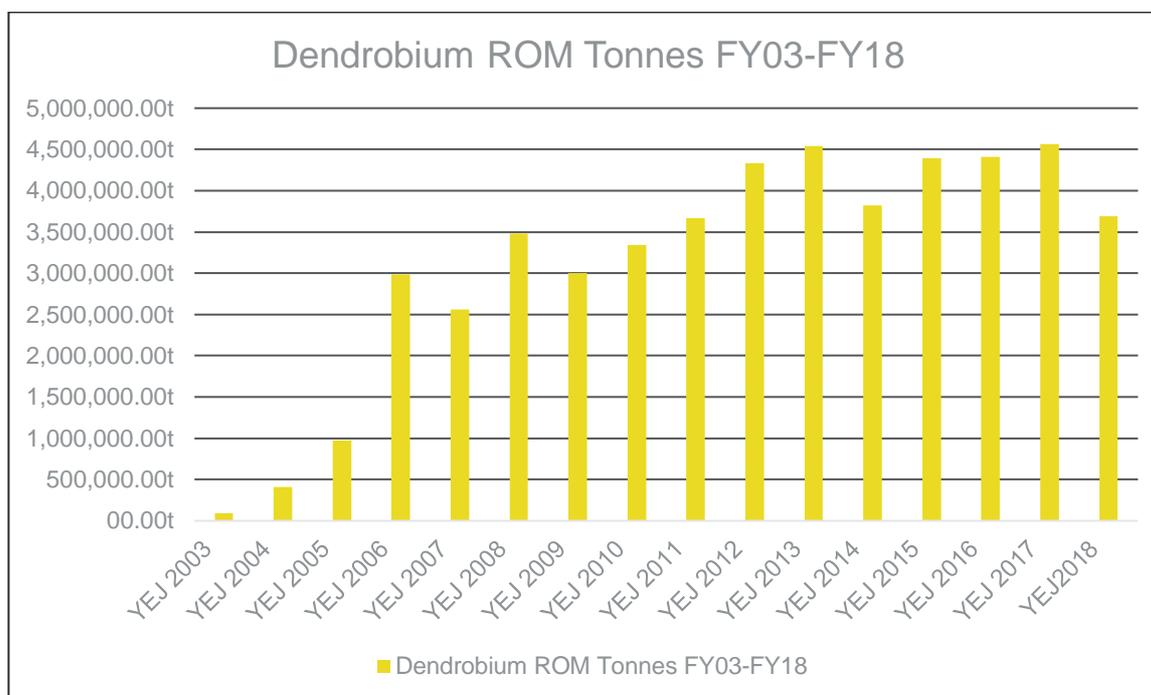


Figure 1: ROM Production.

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 th May 2011	23 rd January 2012
8	24 th February 2012	29 th of December 2012
9	9 th February 2013	2 nd June 2014
10	20 th January 2014	20 th January 2015
11	18 th February 2015	26 th of January, 2016
12	22 nd of February 2016.	31 st January 2017
13	4 th of March 2017	19 th April 2018
14	22 nd May 2018	Estimated Q3 FY19

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	4,567,426	3,691,454	5,200,000
Coarse reject (Coal Wash Tonnes)	N/A	1,205,821	956,278	1,000,000
Saleable product	N/A	3,361,605	2,735,176	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, 2271 trains were loaded at KVCLF, transporting 3,702,872 tonnes of coal.

4.1. 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 FY18, thirty-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 was involved in the drilling of a series of other environmental holes for the purpose of groundwater and/or swamp monitoring. These included:

- 3 x 300m+ holes drilled for pre-mining groundwater baseline data.
- 5 x 100-200m holes drilled for groundwater monitoring around the Avon Dam reservoir.
- 13 x shallow 30-120m holes drilled adjacent to Swamps to monitor bedrock groundwater based on WaterNSW recommendations.

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 FY18, 2 seismic lines were acquired. The below plan provides an overview of the locations of the exploration boreholes drilled and seismic lines acquired during the reporting period.

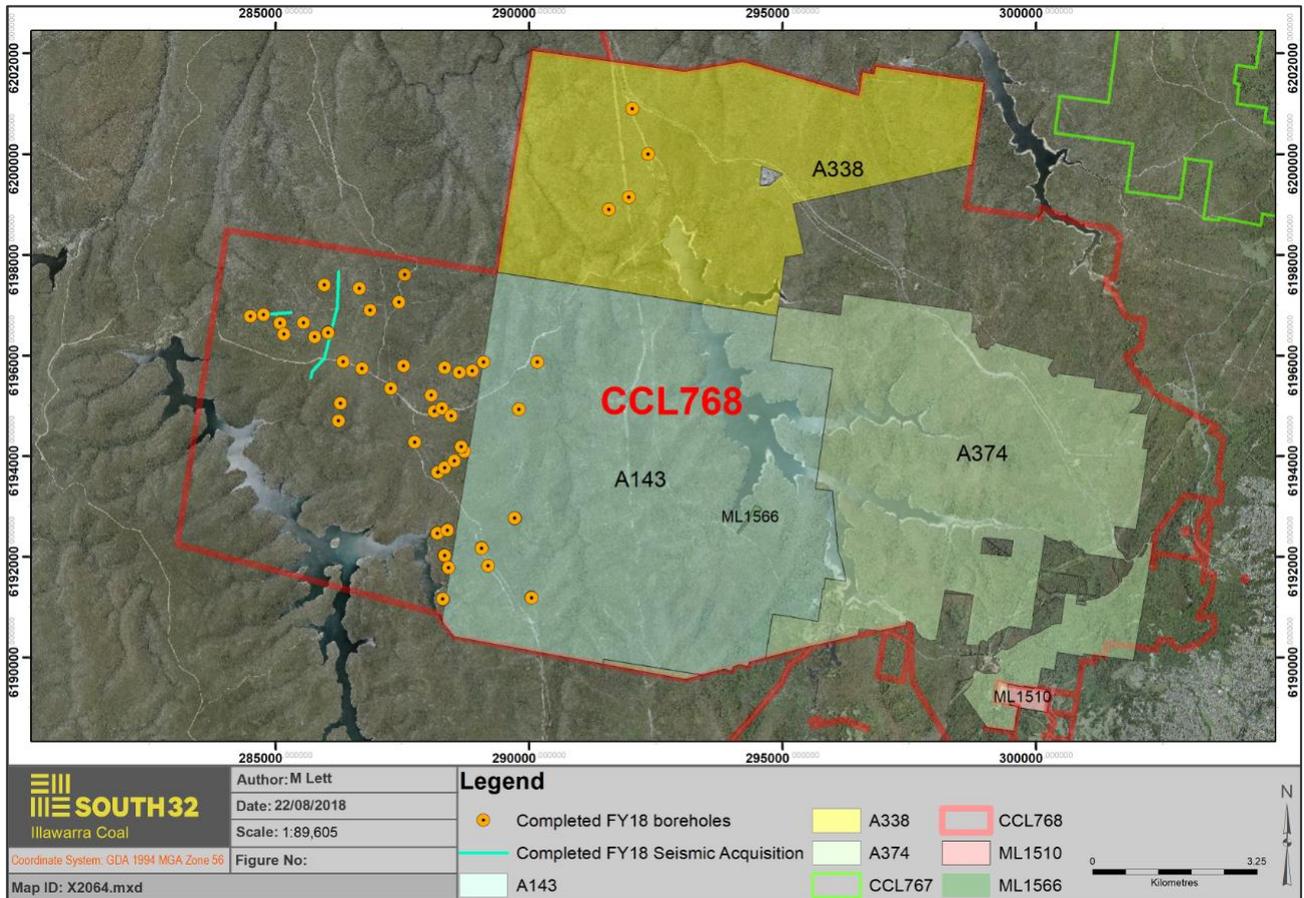


Figure 2: Exploration Locations

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 contains 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'.

4.2. 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 and Triennial Audit

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
In the Title Block please ensure titleholders are correct; Department records indicate the holders are Dendrobium Coal Pty Ltd (ML1510 and ML1566) and Illawarra Coal Holdings Pty Ltd (CCL768).	Table 1: Annual Review Overview
A detailed Plan of the Corrimal No 3 shaft and Coal Bins site needs to be included, noting there is significant infrastructure and rehabilitation liability associated with this site. It will be expected that any works undertaken in the next reporting period are detailed in the subsequent AEMR.	Plan 10B
Update the Rehabilitation Summary Table (Table 35 of the 2016/17 AEMR) to show data for the 'last report' and 'estimated' columns to allow comparison over time.	Table 35, Section 8.1
The Rehabilitation Section (Section 8) needs to clearly explain any changes to rehabilitation areas. The 2016/17 AEMR showed a reduction in 'Completed Rehabilitation Area' compared to the 2015/2016 AEMR (7.978ha reduced from 8.489ha) but the reason for this is not stated in this section. It would also be preferable if the breakdown of the 'Completed Rehabilitation Area' was explained in this section.	Table 35, Section 8.1
Ensure that any stated Appendices/Attachments are included in the submitted document. Appendix B and F were included in the Contents but not provided to this Department (formerly Resources and Geoscience) in the submitted 2016/17 AEMR.	See Appendix B and F.
Include an overview of the March 2018 joint agency audit of mining infrastructure in the Catchment Area, which covered the Cordeaux Pit	Section 11 and Appendix G

Top, Dendrobium 2/3 shaft and Corrimal No 3 shaft and Coal bins site. Include any outcomes proposed by the company to progress the rehabilitation of redundant infrastructure following assessment of the audit findings and outcomes.

Include a location plan of subsidence impacts identified in the reporting period (as listed in Table 22 of the 2016/17 AEMR). Figure 10

A current or updated Rehabilitation Cost Estimate (RCE) needs to be submitted with the next AEMR. Appendix B

Dendrobium Independent Triennial Audit Findings 2018

Include a section in the AEMR/AR providing the status of subsidence impact CMAs (complete or proposed), noting this could be tabulated. A remediation and CMA works register on the website would also assist future auditors. Table 21

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 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/m²/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 ³	24-hour maximum
	30 µg/m ³	Annual mean
Total Suspended Particulates(TSP)	90 µg/m ³	Annual mean
Deposited Dust (insoluble solids)	4g/m ² /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/m²/month (Insoluble Solids). Figure 3 shows the 12-month averages for each of the licensed sites monitored since FY08.

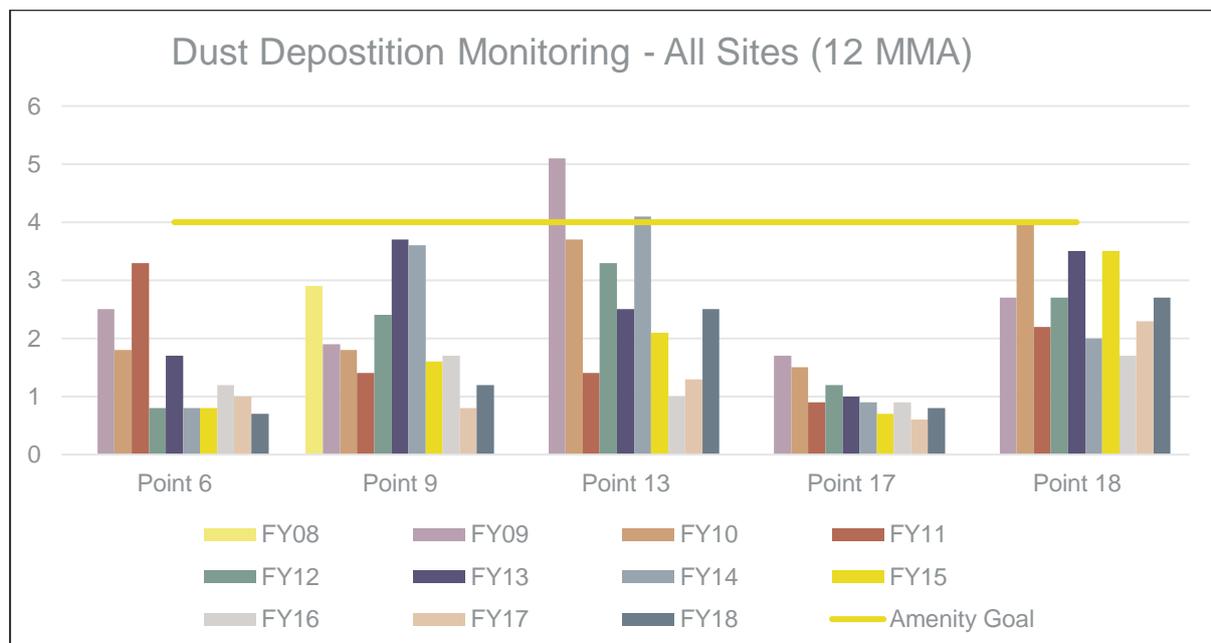


Figure 3: EPL Dust Deposition Gauge, Average Results Summary.

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 PM₁₀ results for the Kemira Valley (Point 20) and the Pit Top sites (Point 21) are shown in Figure 4.

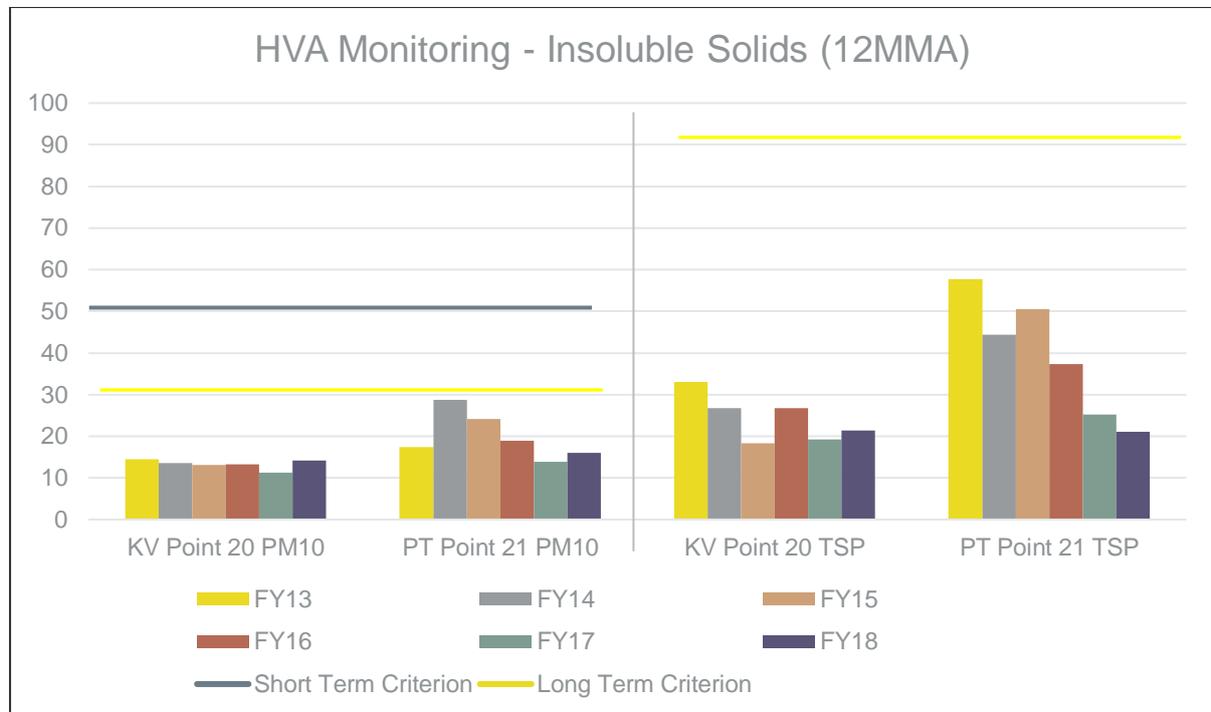


Figure 4: HVAS Results.

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 as required. 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. 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.

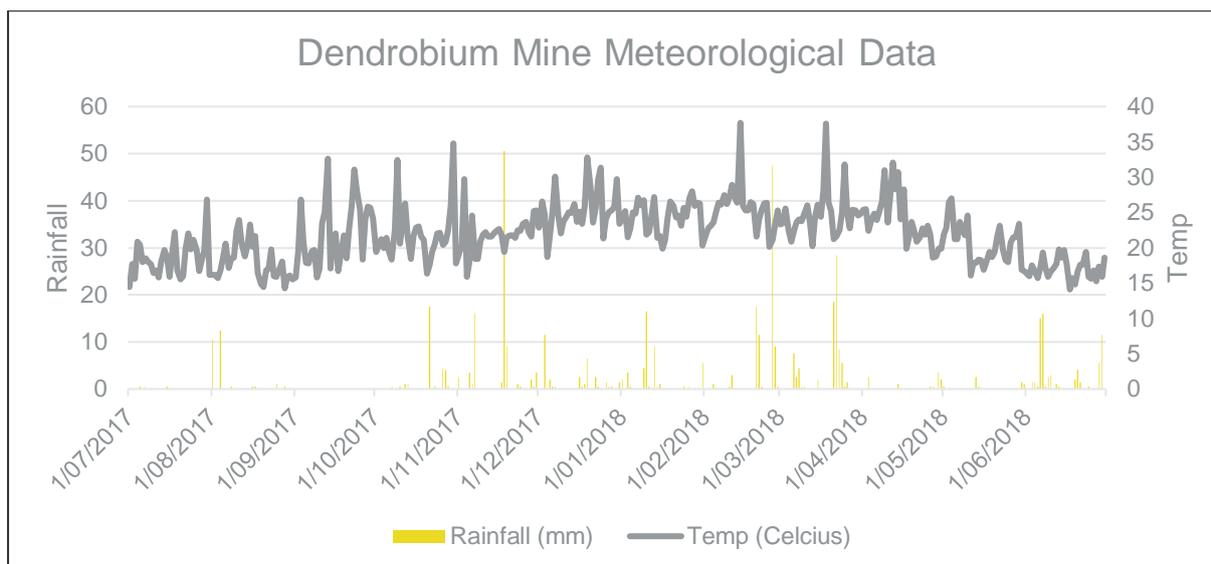


Figure 5: Rainfall and temperature

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. 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. The 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	FY Average
pH	pH units	7.9	8.5	8.3
Total Suspended Solids	mg/L	<5	334.0*	60.8*
Oil and Grease	mg/L	<5	<5	<5
Conductivity	µS/cm	473.0	675.0	553.3

*Influenced by upstream source and was not related to the Mine Operations.

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

Parameter	Units	Min	Max	FY Average
pH	pH units	8	8.53	8.31
Total Suspended Solids	mg/L	<5	338*	87.17*
Oil and Grease	mg/L	<5	<5	5
Conductivity	µS/cm	503	690	585.5

*Influenced by upstream source and was not related to the Mine Operations.

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	Average
pH	pH units	7.72	8.05	7.95
Total Suspended Solids	mg/L	<5	11	6
Oil and Grease	mg/L	<5	<5	<5
Conductivity	µS/cm	277	340	307.33

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

Parameter	Units	Min	Max	Average
pH	pH units	7.94	8.13	8.03
Total Suspended Solids	mg/L	<5	6	5.17
Oil and Grease	mg/L	<5	<5	<5
Conductivity	µS/cm	381	687	490.17

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 2,471.44ML (includes 62.64ML 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 A)
- 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	0.011	0.031	0.199	1.3
Conductivity	µS/cm	1840	4096	20000	NA
Copper	mg/L	<0.001	0.001	0.007	0.08
Nickel	mg/L	0.008	0.091	0.627	5
Oil and Grease	mg/L	<5	5	5	10
pH	pH	8	8.34	8.62	6.5 - 9.0
Total suspended solids	mg/L	5	6.13	18	30
Zinc	mg/L	0.018	0.041	0.110	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 2017/18 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 0.33 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 July 2017 to June 2018. 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 8.5 and conductivity ranged between 100 and 500µS/cm.

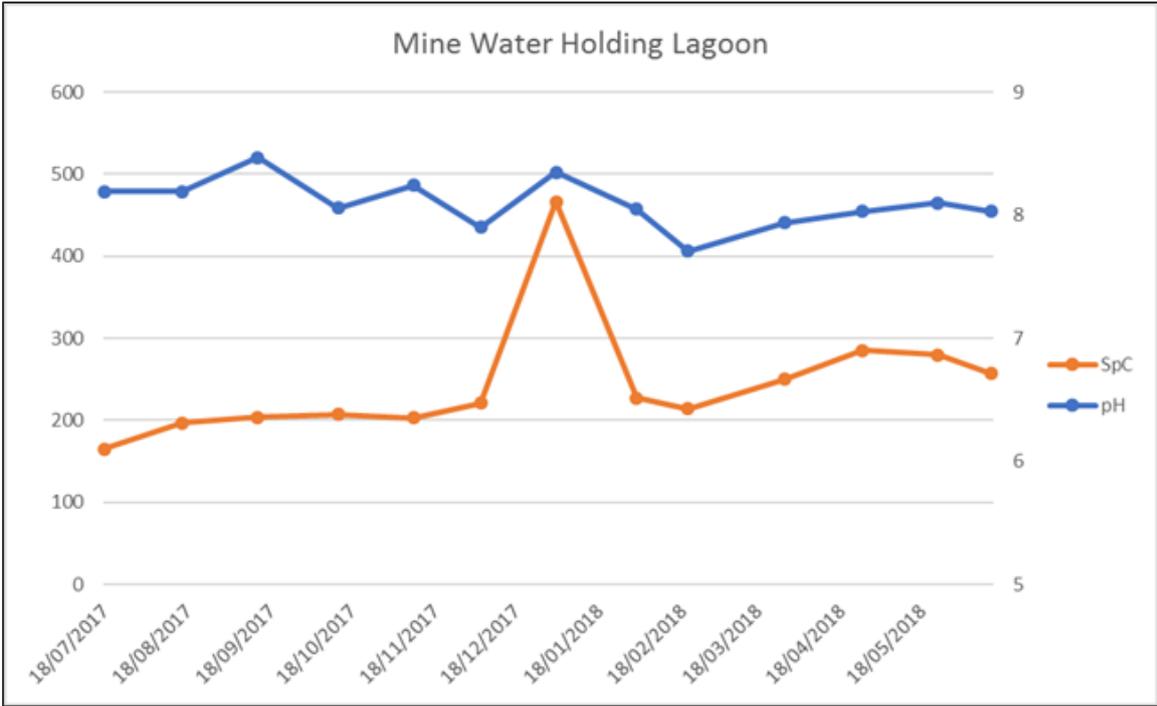


Figure 6: Water Quality Data from the Mine Water Holding Lagoon.

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 pH 7.5 and 8.5, with conductivity ranging between 200 and 600 µS/cm, and Oil & Grease (O&G) resulting <5 mg/L (i.e.: 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.

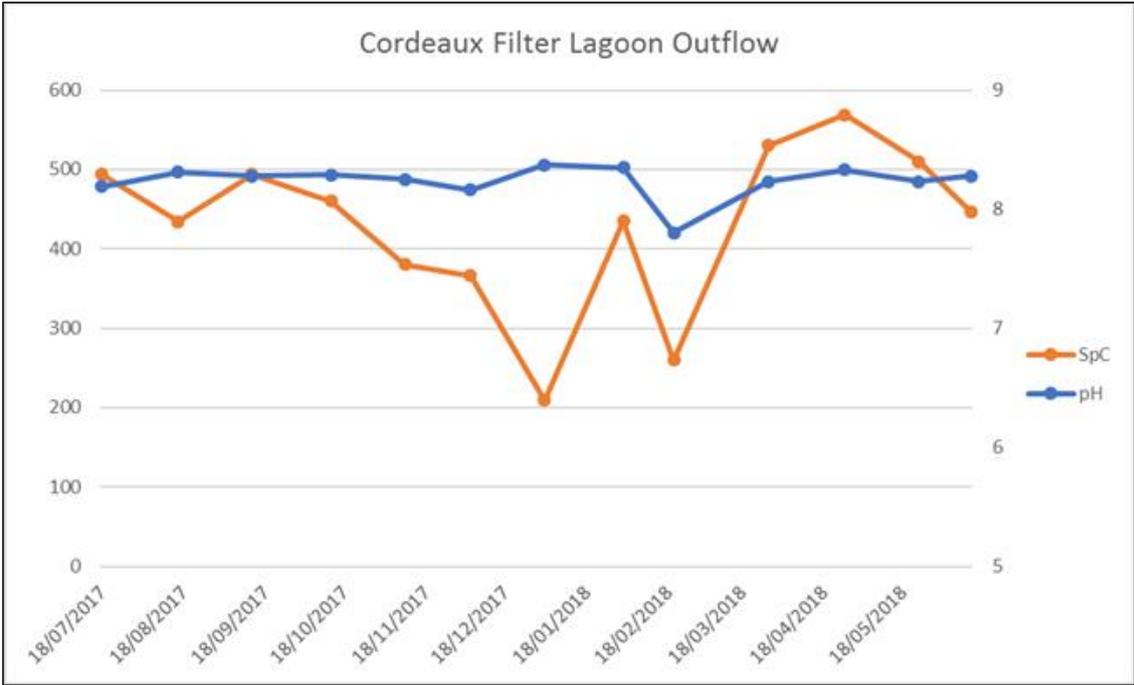


Figure 7: pH and Conductivity at the Cordeaux Filter Lagoon Underflow.

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) completed 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 4th 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.

A Remedial Action Plan (RAP) was prepared and submitted to WaterNSW and the NSW Resources Regulator. Remediation works associated with the RAP commenced on the 7th of November 2017 and were completed on the 22nd of December 2017. The works mainly consisted of removal of some of the above ground structures, removal of transformer bunds and footings, removal of impacted soils and sediments.

Validation works associated with the RAP were completed in the transformer yard and associated areas of the site and the report submitted to WaterNSW. On the 5th of June WaterNSW advised that they consider the requirements under the Clean Up Notice 4/2017 to be fully discharged.

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 as required.

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 in the past, 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 have been addressed by the Rail Noise Working Group (RNWG) through the below objectives:

- Review noise results and identify rail noise mitigation options;
- Improve targeted track maintenance; and
- Develop strategy for positive proactive community engagement.

During previous reporting periods, 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 conducted the following Environmental Improvement Program / Rail Noise Investigation during FY16, FY17 & FY18:

- 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).

During FY18 the large version backing plate radius brake shoes were installed on all NHBH-type coal wagons operating on the Kemira Valley line. Monitoring undertaken in February 2018 confirmed that there was a sustained reduction in mid frequency brake noise using the larger backing plates.

Rail related noise complaints have since dropped considerably since the introduction of the modified brake shoe.

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 quarterly at three locations as outlined in Plan 9.

The rail haulage noise measurements are completed annually. 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 LA_{eq} noise criteria are shown in the table below.

Table 19: Monitoring Requirements and Prescribed Limits

Location	Noise Criteria LA _{eq} , 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 reporting period.

During the reporting period Dendrobium achieved 100% compliance against the LA_{eq}, 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 LA_{eq} 15-minute results for R1 are provided in Figure 8.

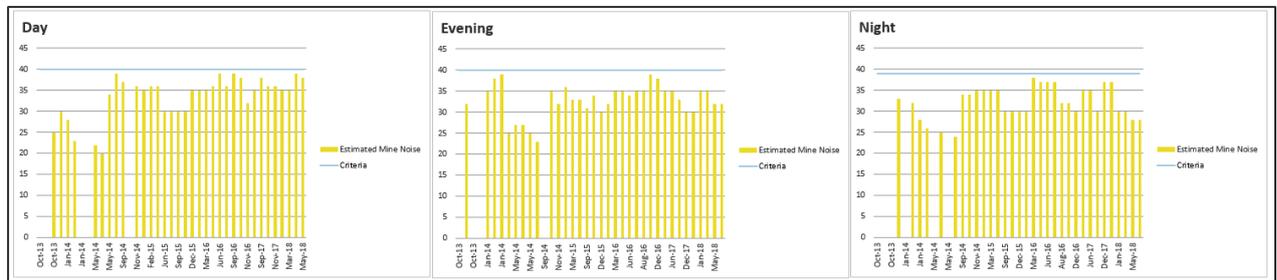


Figure 8: Site R1 Noise Compliance (LA_{eq}, 15 min).

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 LA_{eq} 15-minute results for R1 are provided in Figure 9.

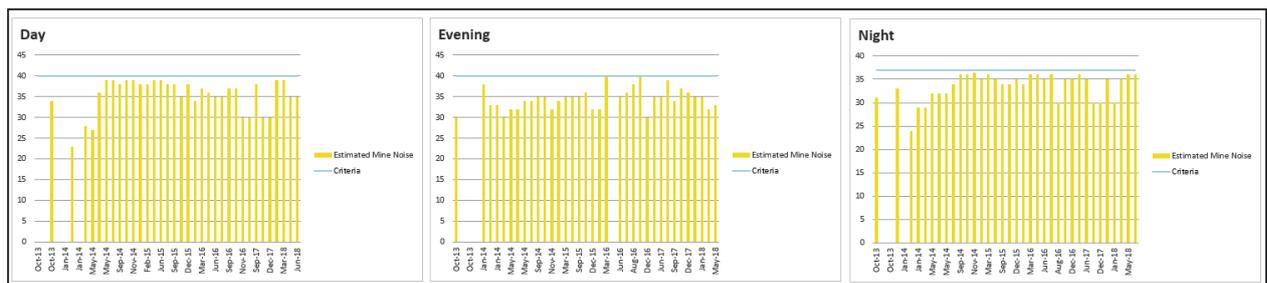


Figure 9: Site R6a Noise Compliance (LA_{eq}, 15 min).

Location R39a

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

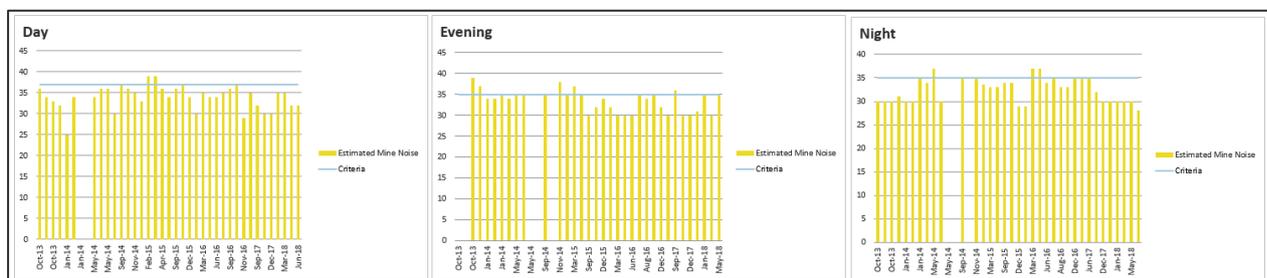


Figure 10: Site R39a Noise Compliance (LA_{eq}, 15 min).

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 19th of September 2018. 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. Solar lighting along the sediment pond road has been installed this reporting period and adhere to Lighting Management Plan.

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;
 - Northern Side of Cordeaux Road – Mount Kembla; and
 - Dendrobium 1, 2 and 3 shafts.
- Fire Trail Maintenance:
 - Containment Line southern side of Dendrobium Mine Pit Top;
 - Benjamin Road Fire Trail – Kembla Heights;
 - Stones Road Fire Trail – Kembla Heights; and
 - Access to Dendrobium 1, 2 and 3 shafts.

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 completed as required, 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 13 extraction was completed on the 19th of April 2018. Longwall 14 extraction commenced on the 22nd of May 2018, and, as of the 30th of June 2018, had extracted approximately 294.8 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 13 and 14 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 **Error! Reference source not found.** Additional information can be found in the Longwall 13 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 the Reporting Period	Monitoring Frequency	Monitoring Undertaken
Subsidence Monitoring		
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"> Monthly for first 1000 m of extraction then 6 monthly Monthly during mining for key features 	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
Water Courses		
Observational, Photo Point and Water Monitoring		
<ul style="list-style-type: none"> Native Dog, Wongawilli and Donalds Castle Creeks, WC21, WC15, LA4, DC13, LA6, ND1, WC6, WC7, WC8, WC9, WC12, WC16 and WC18 Swamps 5, 10, 11, 13, 14, 23, 35a, 35b, 1a, 1b, 8, 3 and 4 	<ul style="list-style-type: none"> 6 monthly baseline and reference site monitoring Weekly monitoring when longwall is within 400m 6 monthly monitoring for 2 years post mining 	As per SMP commitments
Water Quality		
Wongawilli Creek		
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
Lake Avon		
LA4_S1 , LA4_S2, LA5_S1, LA5_S2, LA3 Pool 4, LA2 Pool 5, LA1, NDC4 and NDC1		
Donalds Castle Creek		

Table 21: Monitoring program for Dendrobium Mine.

SMP Commitments for the Reporting Period	Monitoring Frequency	Monitoring Undertaken
DCU3, DCL3, DC_S2, DC13_S1 Sandy Creek SCU1, SCL		
Flow		
Wongawilli Creek WWU, WWL, WC21S1 and WC15S1 Donalds Castle Creek DCU, DC13S1 and DCS2 Lake Avon LA4S1	Continuous 1 hour logging intervals	As per SMP commitments
Aquatic Ecology		
<ul style="list-style-type: none"> • Macroinvertebrate sampling and assessment using the AUSRIVAS protocol and quantitative sampling using artificial collectors • Individuals of the genus Austrocorduliidae and Gomphomacromiidae are identified to species level if possible • Fish are sampled using back-pack electrofisher and baited traps 	<ul style="list-style-type: none"> • Two baseline monitoring campaigns prior to mining during autumn and spring • Monitoring during mining in autumn and spring • Monitoring post-mining for two years or as otherwise required • Monitoring target sites as mining progresses through the domain 	As per SMP commitments
Terrestrial Fauna – Threatened Frog Species		
<ul style="list-style-type: none"> • Surveys are conducted along creeks with a focus on features susceptible to impacts • Potential breeding habitat for Littlejohn’s Tree Frog and Giant Burrowing Frog will be targeted • Standardized transects to record numbers of individuals between surveys for each site 	Surveys are undertaken in optimal periods over the season	As per SMP commitments
Swamps		

Table 21: Monitoring program for Dendrobium Mine.

SMP Commitments for the Reporting Period	Monitoring Frequency	Monitoring Undertaken
Observational, Photo Point and Water Monitoring		
Impact Sites:		
Swamps 1A, 1B, 3, 4, 5, 8, 10, 11, 13, 14, 23, 35A and 35B	<ul style="list-style-type: none"> Pre and post mining for 2 years, monthly when longwall is within 400m of monitoring site Weekly inspection and pool water levels when longwall is within 400m of monitoring site 	As per SMP commitments
Reference Sites:	<ul style="list-style-type: none"> Reference sites 6 monthly 	
Swamps 2, 7, 15a, 22, 24, 25, 33, 84, 85, 86, 87 and 88		
Erosion Monitoring		
Impact Sites:		
Swamps 1A, 1B, 3, 4, 5, 8, 10, 11, 13, 14, 23, 35A and 35B	Ground based surveys to be completed for each longwall after each longwall or to define any new erosions identified by ALS survey	As per SMP commitments
Reference Sites:		
Swamps 2, 7, 15A, 22, 24, 25, 33, 84, 85, 86, 87 and 88		
Shallow Groundwater Level		
	For open hole sites:	
Impact Sites:	<ul style="list-style-type: none"> Monthly baseline monitoring Weekly monitoring during active subsidence Monthly monitoring post mining for two years to be reviewed annually 	As per SMP commitments
<ul style="list-style-type: none"> Swamps 1A, 1B, 3, 4, 5, 8, 10, 11, 12, 13, 14, 23, 35A and 35B 		
Reference Sites:	For instrumented sites:	
<ul style="list-style-type: none"> Swamps 2, 7, 15A, 22, 24, 25, 33, 84, 85, 86, 87 and 88 	<ul style="list-style-type: none"> Automatic groundwater level monitoring (4-hour interval or similar) Monitoring post mining for five years to be reviewed annually 	
Soil Moisture		
Impact Sites:	<ul style="list-style-type: none"> Monthly baseline for 2 years prior to mining 	As per SMP commitments

Table 21: Monitoring program for Dendrobium Mine.

SMP Commitments for the Reporting Period	Monitoring Frequency	Monitoring Undertaken
<ul style="list-style-type: none"> Swamps 3, 4, 5, 8, 10, 11, 13, 14, 23, 35A and 35B <p>Reference sites:</p> <ul style="list-style-type: none"> Swamps 2, 7, 15A, 22, 24, 25, 33, 84, 85, 86, 87 and 88 	<ul style="list-style-type: none"> Weekly monitoring when longwall is within 400m of swamp 6 monthly monitoring for 2 years post mining 	
Terrestrial Flora – Composition and Distribution of Species		
<p>15m transects consisting of 30 0.5m X 0.5m quadrats. The monitoring records:</p>		
<ul style="list-style-type: none"> Presence of all species within each quadrat Percentage foliage cover and vegetation height Observations of dieback or changes in community structure Photo point monitoring at each transect 	<p>Surveys are undertaken in spring and autumn each year</p>	<p>As per SMP commitments</p>
Terrestrial Flora – Swamp Size and Ecosystem Function		
<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"> Baseline mapping prior to mining Repeat mapping at 5-year intervals or as determined by observational monitoring 	<p>As per SMP commitments</p>
Terrestrial Fauna – Threatened Frog Species		
<ul style="list-style-type: none"> Surveys are conducted along creeks with a focus on features susceptible to impacts Potential breeding habitat for Littlejohn’s Tree Frog and Giant Burrowing Frog will be targeted Standardized transects to record numbers of individuals between surveys for each site Tadpole counts to be undertaken as part of the breeding habitat monitoring transects 	<p>Surveys are undertaken in optimal periods over the season</p>	<p>As per SMP commitments</p>
Landscape		

Table 21: Monitoring program for Dendrobium Mine.

SMP Commitments for the Reporting Period	Monitoring Frequency	Monitoring Undertaken
Targeted Sites		

- Cliffs
 - 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
- Steep Slopes
 - A3-SL1, A3-SL2, A3-SL3, A3-SL4, A3-SL5, A3-SL6, A3-SL7, A3-SL8, A3-SL9
- Watercourses / Swamps
 - Refer to Dendrobium Area 3 Watercourse and Swamp Monitoring TARP's
- Fire Trails

- Baseline monitoring campaign prior to mining
- Monthly monitoring during subsidence As per SMP commitments
- Monitoring to continue 6 monthly for 2 years following the completion of mining

A3-FR1, A3-FR2, Fire Roads 6A, 6N and 6Q

Inspection of Active Mining Area – Landscape Features, Vegetation, Watercourses

- 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
- General observation of active mining areas.
- During mining recording includes impacts to:
 - Drainage
 - Disturbance of site erosion
 - Aggradations
 - Inundation
 - Rock fracturing
 - Changes in runoff
 - Changes in vegetation
 - Impacts to fauna / fish
- Weekly monitoring when longwall extraction is within 400m As per SMP commitments

Table 21: Monitoring program for Dendrobium Mine.

SMP Commitments for the Reporting Period	Monitoring Frequency	Monitoring Undertaken
<ul style="list-style-type: none"> - Rockfalls - Soil cracking - Slumping 		
Terrestrial Fauna		
<ul style="list-style-type: none"> • 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 • Monitoring parameters include: <ul style="list-style-type: none"> - Vegetation communities - Vegetation condition - Changes in vegetation - Tree health - Swamp vegetation - Threatened species • Control sites 	<ul style="list-style-type: none"> • Two baseline monitoring campaigns 1 year prior to mining during autumn and spring • 6 monthly monitoring during mining in autumn and spring • 6 monthly monitoring post mining for two years or as otherwise required 	As per SMP commitments
<ul style="list-style-type: none"> • 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 • Monitoring parameters include: <ul style="list-style-type: none"> ○ Species and habitat characteristics • Targeted surveys and monitoring of known populations of threatened frog species 	<ul style="list-style-type: none"> • Two baseline monitoring campaigns 1 year prior to mining • 6 monthly monitoring during mining • 6 monthly monitoring post mining for two years or as otherwise required 	As per SMP commitments
Aboriginal Archaeology		
<ul style="list-style-type: none"> • Re-recording of the principal components identified by Sefton (Sefton 2000) • Macro and micro recording using digital photography (Navin Officer (2003) • 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 	<ul style="list-style-type: none"> • Baseline archival recording: prior to longwall mining • First impact assessment recording: following initial subsidence movement of the site • Sandstone shelter aboriginal sites will be monitored during mining • Further impact assessment recording: 12 months after undermining or final subsidence movement of the site 	As per SMP commitments

Subsidence Movements

Subsidence movements resulting from the extraction of Longwall 13 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.

Subsidence parameters measured during the extraction and at the completion of Longwall 13 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 13, refer to the Longwall 13 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 13 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.

Thirty-Four surface impacts were identified by the ICEFT during the 2018 financial year. Seventeen of these impacts were observed within watercourses, and Twenty-One impacts were observed to landscape features such as access tracks, cliff lines and steep slopes. For further information please refer to the Longwall 13 End of Panel Report or relevant impact reports.

Surface Water and Shallow Groundwater

HGEO (hydrogeologist consultants) completed an assessment of pre, during and post-mining data after the completion of Longwall 13.

There were five TARP triggers to watercourses during the reporting period. At Wongawilli Creek (FR6), during the extraction of Longwall 13, measured levels of Dissolved Oxygen (DO) were below trigger levels on three consecutive occasions; measured levels of Electrical Conductivity (EC) were below

trigger levels on two consecutive occasions. These readings were assessed as being attributed to the prevailing low-rainfall conditions, and associated low pool water levels, rather than mining related effects. Thus, these readings represent two Level 3 TARP triggers (rather than 'Exceeding Predictions') in accordance with the WIMMCP.;

Flow and catchment yield modelling analyses indicate that the headwater catchments at sites within DC13 (DC13S1: -7 % change; Level 1 Trigger), Donalds Castle Creek (DCS2: -21 % change; Level 3 Trigger) and WC21 (WC21S1: -2% change; No Trigger) have been affected by the extraction of Area 3B longwalls. Yield changes remained below trigger levels at both Donalds Castle and Wongawilli Creeks, which suggests that some (or all) flow lost in the headwater catchments is returned downgradient. However, analyses detected an increase (6 %) in cease-to-flow conditions at Donalds Castle Creek (DCU) during the extraction of Longwalls 11 to 13. Furthermore, analyses detected a yield change of -6 % at LA4, a tributary to Lake Avon, which represents a Level 1 trigger.

Wongawilli Creek

On 20/11/2017, it was noted during a site visit that water levels in Pool 43a on Wongawilli Creek were below the baseline (impact number DA3B_LW13_015, dated 28/11/2017). The observation triggered a TARP Level 3 because a previously reported fracture (first observed on 18/12/2013) is present in the sandstone forming the pool base.

Assessment of the declining water levels in Pool 43 has been hindered by the unusually dry conditions during the extraction of Longwall 13 compared with the baseline period. Observations at other pools that are outside the influence of mining certainly suggest that the dry conditions contribute to the low water levels during Longwall 13. However, the steady decline in water levels at Pool 43a since 2012 appears independent of the rainfall trends and may indicate progressive local flow diversion and/or baseflow reduction. Based on the information reviewed here, the latter mechanism (baseflow reduction) may be dominant.

Groundwater monitoring bores located on both sides of Wongawilli Creek in the broad vicinity of Pool 43a (S1879, S1892, S1927, S1930, S1931), show depressurisation of the Bulgo Sandstone to piezometric levels below the creek bed and, to a lesser extent, the lower Hawkesbury Sandstone as a result of mining in Areas 3A and 3B. Depressurisation of groundwater level in the groundwater bearing formations exposed in and adjacent to the creek is likely to result in a gradual decline in groundwater discharge to the stream, which would be most noticeable during low-flow conditions and flow recessions.

Upland Swamps – Shallow Groundwater and Soil Moisture

Longwall 13 passed within 400 m of shallow groundwater and soil moisture sites within two swamps: Swamps 11 and 13.

Analysis of shallow groundwater levels indicated that a Level 1 TARP was triggered at S11_H1 within Swamp 11; which exhibited a decline in shallow groundwater level to below baseline, and an increase in the water level recession rate.

At all soil moisture monitoring sites within Swamps 11 and 13, soil moisture decreased to below baseline levels during the extraction of Longwall 13, which contributed to Level 3 TARP triggers at both sites. Further monitoring during and after heavy rainfall events is required to determine whether, and to what extent, soil moisture levels at Swamps 11 and 13 have been affected by mining.

For further information, refer to the HGEO End of Panel Surface Water and Shallow Groundwater Assessment: Longwall 13 (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 reductions of pool water levels and flow in Wongawilli Creek, WC21, WC15 and LA4 following the extraction of DA3B Longwalls 9 to 13 represent a local loss of aquatic habitat and biota. The loss of habitat in WC21 and Wongawilli Creek are relatively severe at the scale of individual pools / watercourses. The loss of aquatic habitat in these watercourses is expected to have resulted in a reduction in connectivity of remaining habitat and a loss of aquatic biota. Due to the impacts observed during extraction of Longwalls 9, 10, 11 and 12, it is difficult to quantify what proportion of the observed impacts are associated with extraction of Longwall 13 alone. Nevertheless, it is likely that extraction of this longwall has contributed to the observed physical mining impacts, reductions in aquatic habitat and assumed loss of some associated aquatic biota. No TARPs have been triggered with respect to Wongawilli Creek as there has not been a loss in aquatic habitat for longer than 1 year. The reductions in aquatic habitat for over 2 years in WC21 and Donalds Castle Creek constitute two level 3 TARP triggers.

Terrestrial Ecology and Swamps

Following the 2017 terrestrial ecology 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. For more information please refer to the Longwall 13 End of Panel Report.

Cultural Heritage

The assessment of cultural heritage and archaeological sites potentially impacted by Longwall 13 was conducted by Niche. Five Aboriginal archaeological sites were inspected as part of the assessment. These sites were inspected because they were within the zone of possible subsidence associated with Longwall 13. There were no European heritage sites identified as being potentially affected by the extraction of Longwall 13. There were no observed impacts to monitored Aboriginal archaeological sites during the extraction of Longwall 13. For more information please refer to the Longwall 13 End of Panel Report.

Summary of Impacts

The observed impacts to natural features and Aboriginal heritage above Longwalls 13 and 14 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 **Error! Reference source not found.** For further detail on impacts associated with Longwall 13, refer to the Longwall 14 End of Panel Report. For details on impacts associated with Longwall 13, refer to the relevant impact report.

Table 22 Impacts identified during the Reporting Period

Site ID	Impact Type	Identification Date	Impact Level	Description	Actions Taken
DA3B_LW13_004	Surface Cracking	14/07/2017	1	Discontinuous surface cracking on <i>FR6A</i> , 3m length, 0.01m width, uplift of 0.2m.	No remediation required.
DA3B_LW13_005	Surface Cracking	19/07/2017	2	Surface cracking on <i>Access Track 6AA</i> , 2.3m long, average width 0.05m, 0.2m max width, 2.34m depth.	No remediation required.
DA3B_LW13_006	Rock Fracturing	25/09/2017	2	Rock fracture to the base of <i>WC21_Pool 48</i> . 5m length, 0.03m width. Also associated with an absence of water in pool.	Specialist report completed. Remediation Plan to be approved.
DA3B_LW13_007	Iron Staining	03/10/2018	1	Iron staining at subsurface outflow, downstream from <i>WC21_Pool 38</i> , at BF37.	No remediation required.
DA3B_LW13_008	Surface Cracking	10/10/2017	1	Consists of two small zones of surface cracking and uplift on access track adjacent to <i>WC21</i> . Max length 1.4m, width 0.06m, depth 0.1m.	No remediation required.
DA3B_LW13_009	Rock Fracturing	23/10/2017	1	Rock fracturing to the downstream extent of <i>WC21_Pool 54</i> , 0.38m long, 0.22m wide, 0.37m deep.	No remediation required.
DA3B_LW13_010	Rock Fracturing	23/10/2017	2	Rock fracturing to the step at the upstream extent of <i>WC21_Pool 53</i> , 2.5m long, 0.01m wide, and 0.03m deep.	Specialist report completed. Remediation Plan to be approved.
DA3B_LW13_011	Rock Fracturing	23/10/2017	2	Rock fracturing to the base of <i>WC21_Pool 47</i> .	Specialist report completed. Remediation Plan to be approved.
DA3B_LW13_012	Surface Cracking	30/10/2017	1	Surface cracking on access track adjacent to <i>WC21</i> . Max 1m long, 0.05m wide and 0.12m wide.	No remediation required.
DA3B_LW13_013	Surface Cracking	30/10/2017	1	Surface cracking on access track adjacent to <i>WC21</i> . Max 2m long, 0.02m wide and 0.1m wide.	No remediation required.
DA3B_LW13_014	Surface Cracking	13/11/2017	1	Surface cracking on access track adjacent to <i>WC21</i> . Max 0.64m long, 0.1m wide and 0.16m deep.	No remediation required.
DA3B_LW13_015 (Wongawilli Creek) (Addressed in	Pool Level	20/11/2017	3	<i>WC_Pool 43a</i> water level below baseline. Fracture was identified in the pool during LW9.	Specialist report completed. Additional assessment

Surface and Shallow Groundwater Assessment)					presented in Longwall 13 End of Panel Report
DA3B_LW13_016	Surface Cracking	20/11/2017	1	Surface cracking and minor slumping on access track adjacent to WC21. Max 2m long, 0.03m wide and 0.1m deep.	No remediation required.
DA3B_LW13_017	Rock Fracturing	08/01/2018	2	Rock fracturing across Pool 45 in tributary WC21, 2m long, 0.03m wide and 0.22m at its deepest measurable point.	Specialist report completed. Remediation Plan to be approved.
DA3B_LW13_018	Rock Fracturing	12/02/2018	2	Rock fracturing across Pool 46 in tributary WC21. Max, 0.5m long, 0.01m wide and 0.05m.	Specialist report completed. Remediation Plan to be approved.
DA3B_LW13_019	Surface Cracking	02/03/2018	2	Surface cracking on FR6P, 8.5m long, 0.45m max depth 0.45m, max width 0.15m.	Remediation works completed – cracking filled in.
DA3B_LW13_020	Surface Cracking	16/03/2018	1	Soil cracking on seismic track adjacent to FR6P, 0.35m long, 0.12m max depth, 0.07m width.	No remediation required.
DA3B_LW13_021	Rock Fracturing	29/03/2018	2	Rock fracturing to the upstream extent of WC15_Rockbar 18, 5.7m long, up to 0.015m wide, depth 0.06m.	Specialist assessment included in the LW13 End of Panel Report.
DA3B_LW13_022	Rock Fracturing	29/03/2018	2	Rock fracturing to WC15_Rockbar 18. Comprised of approx. 10 fractures. Max 3m long, up to 0.015m wide, depth 0.04m.	Specialist assessment included in the LW13 End of Panel Report.
DA3B_LW13_023	Rock Fracturing	29/03/2018	2	Rock fracturing to WC15_Rockbar 18. Max 5.6m long, up to 0.03m wide, depth 0.16m.	Specialist assessment included in the LW13 End of Panel Report.
DA3B_LW13_024	Surface Cracking	04/04/2018	2	Soil cracking on access track adjacent to FR6P, 40m length, 0.2m wide, 0.85m depth.	Remediation works completed – cracking filled in.
DA3B_LW13_025	Surface Cracking	04/04/2018	1	Soil cracking on access track adjacent to FR6P, 5.7m length, 0.08m wide, 0.16m depth.	No remediation required.
DA3B_LW13_026	Surface Cracking	04/04/2018	1	Soil cracking on access track adjacent to FR6P, 0.95m length, 0.01m wide, 0.01m depth.	No remediation required.
DA3B_LW13_027	Surface Cracking	04/04/2018	1	Soil cracking on access track adjacent to FR6P, 2.1m length, 0.02m wide, 0.01m depth.	No remediation required.

DA3B_LW13_0 28	Rock Fracturing	05/04/2018	1	Rock fracturing to <i>WC15_Pool 18</i> . Max 1.4m long, up to 0.018m wide. No evidence of flow diversion.	No remediation required. Continuation of routine monitoring.
DA3B_LW13_0 29	Surface Cracking	09/04/2018	2	Surface cracking on access track adjacent to <i>FR6P</i> , 9m length, 0.15m wide, 5m depth.	Remediation works completed – cracking filled in.
DA3B_LW13_0 30	Surface Cracking	09/04/2018	2	Surface cracking on access track adjacent to <i>FR6P</i> , 10m length, 0.15m wide, 0.25m depth.	Remediation works completed – cracking filled in.
DA3B_LW13_0 31	Surface Cracking & Rock Fracturing	09/04/2018	1	Surface cracking and rock fracturing on <i>FR6P</i> , 4.8m length, 0.06m width, 2.2m depth.	No remediation required.
DA3B_LW13_0 32	Surface Cracking	09/04/2018	1	Surface cracking on <i>FR6P</i> , 3.2m length, 0.1m width, 0.4m depth.	No remediation required.
DA3B_LW13_0 33	Surface Cracking	09/04/2018	1	Surface cracking on <i>FR6P</i> , 4.1m length, 0.1m width, 0.4m depth.	No remediation required.
DA3B_LW13_0 34	Surface Cracking	09/04/2018	1	Surface cracking on <i>FR6P</i> , 1.5m length, 0.04m width, 0.8m depth.	No remediation required.
DA3B_LW13_0 35	Rock Fracturing	23/04/2018	1	Rock fracturing to <i>WC15_Rockbar 21</i> . Max 1.6m long, up to 0.002m wide. Small section of uplift and plating. No evidence of flow diversion.	No remediation required.
DA3B_LW13_0 36	Rock Fracturing	23/04/2018	1	Rock fracturing to sandstone outcrop. Max 5.5m long, 0.05m width. 1.64m depth.	No remediation required.
DA3B_LW13_0 37	Surface Cracking	23/04/2018	1	Soil cracking on access track adjacent to <i>FR6P</i> , 2.1m length, 0.09m width, 0.34m depth.	No remediation required.
DA3B_LW13_0 38	Surface Cracking	23/04/2018	1	Soil cracking on access track adjacent to <i>FR6P</i> , 1.96m length, 0.03m width, 0.11m depth.	No remediation required.
DA3B_LW13_0 39	Surface Cracking	23/04/2018	1	Soil cracking on access track adjacent to <i>FR6P</i> , 2.12m length, 0.025m width, 0.46m depth.	No remediation required.
DA3B_LW13_0 40	Rock Fracturing	07/05/2018	2	Rock fracturing and uplift zone of 20m. Longest continuous fracture is 5.5m, 0.05m width, 0.24m depth.	No CMAs required due to nature of impact. Impact site will continue to be monitored.
DA3B_LW13_0 41	Rock Fracturing & Rock Fall	07/05/2018	2	Rock fracturing across step on <i>WC15</i> , 12m length, 0.05m width. Rockfall 3m x 3m x 0.2m. Ironing staining present	Specialist assessment included in the LW13 End of Panel Report.

DA3B_LW13_042	Rock Fracturing & Rock Fall & Iron Staining	16/05/2018	2	Impacts to WC15_Rockbar 7. Combination of rock fracturing, iron staining and a rock fall. Max length of fracturing is 4.5, depth 0.19m and width 0.01m. Multiple rock fractures under rockbar. Estimated to be 1m x1 mx 0.3m.	Specialist assessment included in the LW13 End of Panel Report.
DA3B_LW13_043	Rock Fracturing & Rock Fall & Iron Staining	16/05/2018	2	Rock fracturing, rockfall and iron staining evident to the base of LA4_Step 0 on LA4. Fracture is 2m length, 0.02m width. rock fragment is 1.5m in length, 0.5m in width and 0.3m in height.	Specialist assessment included in the LW13 End of Panel Report.
11_H1	Shallow Groundwater	01/06/2017	1	Rate of recession greater than baseline.	Continue routine monitoring.
11_H1	Shallow Groundwater	16/07/2018	1	Water level below baseline.	Continue routine monitoring.
Wongawilli Creek (FR6)	Water Quality	23/01/2018, 12/02/2018	3	Dissolved oxygen trigger.	Continue routine monitoring.
Wongawilli Creek (FR6)	Water Quality	23/01/2018, 12/02/2018	3	Electrical conductivity trigger.	Continue routine monitoring.
DCS2	Catchment Yield	2018	3	-21 % yield change during the extraction of Longwall 13.	Remediation plan to be approved. Continue routine monitoring.
DC13S1	Catchment Yield	2018	1	-7 % yield change during the extraction of Longwall 13.	Continue routine monitoring.
LA4	Catchment Yield	2018	1	-6 % yield change during the extraction of Longwall 13.	Continue routine monitoring.
SC10C	Terrestrial Ecology (Fauna)	2018	1	Significant impacts to local populations of Littlejohn's Tree Frog.	Continue monitoring to investigate whether CMAs for related watercourse TARPs may address some impacts to threatened frog habitats.
DC(1)	Terrestrial Ecology (Fauna)	2018	1	Significant impacts to local populations of Littlejohn's Tree Frog.	Continue monitoring. Review of survey frequency.
DC13	Terrestrial Ecology (Fauna)	2018	3	Significant impacts to local populations of Littlejohn's Tree Frog.	Continue monitoring. Remediation works to be considered.
WC21	Terrestrial Ecology (Fauna)	2018	3	Significant impacts to local populations of Littlejohn's Tree Frog.	Continue monitoring. Remediation works to be considered.

Donalds Castle Creek	Aquatic Ecology	2018	3	Reduction in aquatic habitat for >2 years or complete loss of habitat following the active subsidence period.	Remediation plan to be approved.
WC21	Aquatic Ecology	2018	3	Reduction in aquatic habitat for >2 years or complete loss of habitat following the active subsidence period.	Remediation plan to be approved.
Swamp 1A	Terrestrial Ecology (Flora)	2018	1	Trending decline in the extent of subcommunity MU43 for two consecutive monitoring periods greater than the mean (\pm SE) decline of MU43 in the control group.	Investigate practical remediation measures, or offset if remediation deemed to be ineffective after 5 years.
Swamp 1B	Terrestrial Ecology (Flora)	2018	1	Trending decline in the extent of subcommunity MU44c for two consecutive monitoring periods greater than the mean (\pm SE) decline in the control group.	Groundtruth and assess MU44c at S1B compared with S15B (control) to determine drivers of change, to determine adequacy of practical remediation measures.
Swamp 5	Terrestrial Ecology (Flora)	2018	2	Trending decline in the extent of subcommunity MU43 for three consecutive monitoring periods greater than the mean (\pm SE) decline in the control group.	Ground-truth decline in MU43 to determine requirement of practical remediation measures.

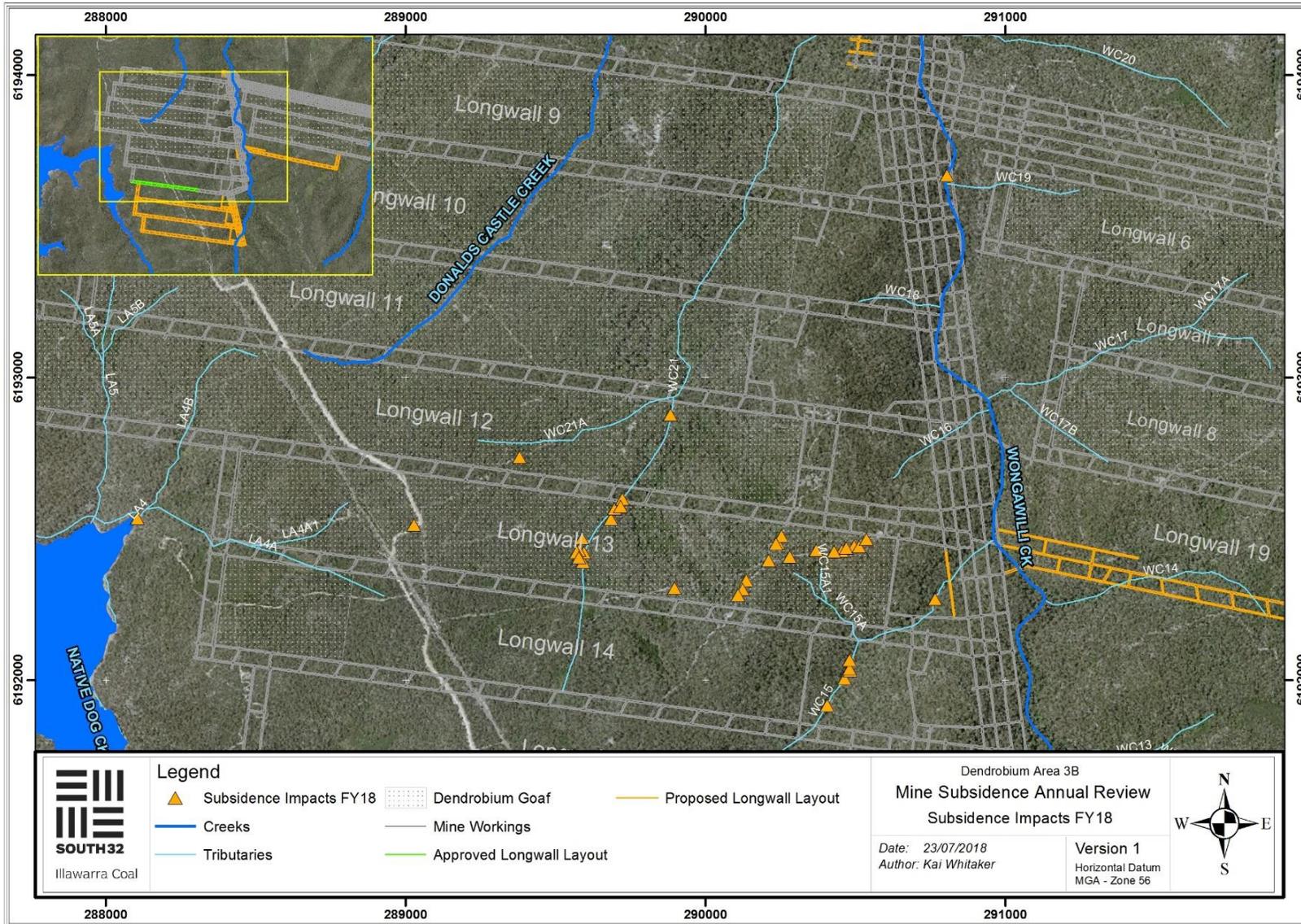


Figure 11: Subsidence impacts observed during the Reporting Period.

6.15. Hydrocarbon Contamination

Dendrobium Mine

Specifically designed hydrocarbon bunded 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 weekly 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 has implemented and actioned 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. 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. New signage has been installed during the reporting period to comply with the current standard.

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 270 m³/s with the discharge air (mine vent air) having an average concentration of methane (CH₄) of 0.16% and an average concentration of carbon dioxide (CO₂) of 0.24%.

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 regard 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"> • 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; • Toolbox talks; • Posters located around the site; and • Periodic business updates. <p>The Dendrobium facilities 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.</p>

	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
Road Safety	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. 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" (ICAP0145). 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"> Signs installed around potentially unstable areas that may be impacted by mining 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).

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	80.72
Cardboard and paper	Recycled off site	5.57
Steel and Scrap Metal	Recycled off site	174.75
Commingle	Recycled off site	6.71
Particulate (diesel) filters	Off-site treatment and disposal	58.63
General Waste	Landfill	358.63

Table 26: Recycle Volumes for Reporting Period.

Total Recycled (tonnes)	Total Disposed (tonnes)	% Recycled
267.75	417.26	64.17

Oil and Grease Containment and Disposal

Oil and Grease produced onsite is transported from the pit top for processing by a licensed 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	7.00
Oily Water/Sludge/Grease	313.92
Hydraulic Oil	9.48

Coal Wash Management

During the reporting period, Illawarra Coal diverted approx. 83,000T 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 was unable to provide coal wash for its long-term contract with Lend Lease in FY18 due to council approvals holding up the development, however it is envisaged that deliveries will resume in late 2018. Illawarra Coal is also looking to provide Coal Wash as an engineered fill for two major local RMS road infrastructure projects, starting in 2018/2019.

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	0.915
General Waste	Landfill	34.32
Brick	Recycled off site	44.8
Cardboard	Recycled off site	0.18
Timber	Recycled off site	2.42
Steel	Recycled off site	32.42

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.

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, and the 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 12).

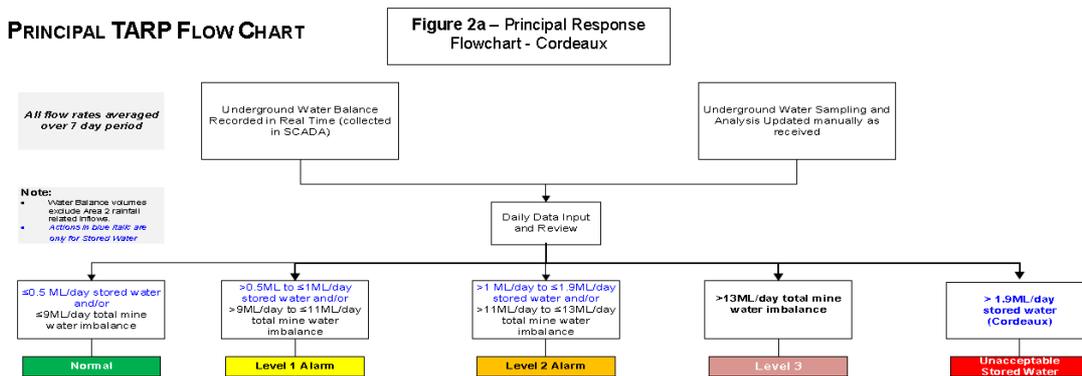


Figure 12: Principal Response Flowchart in “Cordeaux Reservoir DSC Notification Area Contingency Plan”.

A summary of the mine water balance for the reporting period is provided in Figure 13.

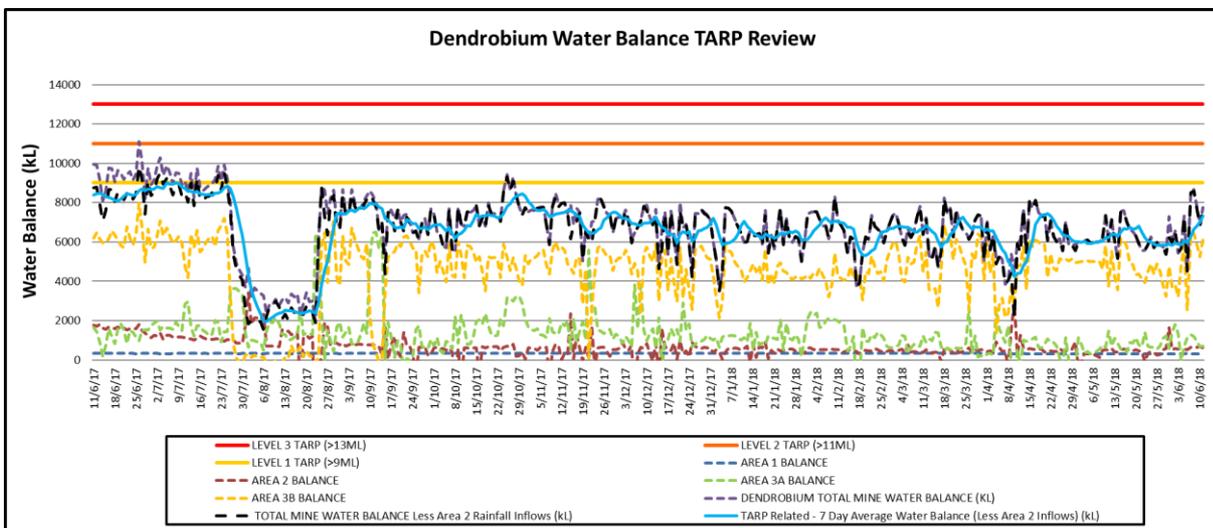


Figure 13: Mine Water Balance

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 reporting period.

Statistic	Total Water Balance	7 Day average Water Balance Less Area 2 Inflows (TARP related)	Units
Mean	6660.1	6515.1	kL/day
Maximum	10288.6	9007.7	kL/day
Minimum	1892.2	1948.7	kL/day
Total	2430921.2	2378010.5	kL

Mining of Longwall 13 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 13 and extending to S2194, located 1.4 km to the south of Longwall 13. Drawdown in the Hawkesbury Sandstone is greatest above and immediately adjacent to Longwall 13, with some drawdown also evident 435 m to the south of Longwall 13.

Observations at monitoring bores installed above mined longwalls indicate that the Hawkesbury Sandstone undergoes fracturing to the ground surface, accompanied by depressurisation of most shallow strata. There is evidence that drainage of the Hawkesbury Sandstone above goafs is not complete in all areas and some perched groundwater horizons remain.

Starting in 2015, a series of monitoring bores was installed along the barrier zone between Lake Avon reservoir and Area 3B. Observations at those bores indicate depressurisation of the upper Colo Vale Sandstone in response to longwall extraction, but only variable drawdown in the Hawkesbury Sandstone. A hydraulic gradient towards the lake is preserved in the Hawkesbury Sandstone at S2313, whereas at S2314 and S2376 the hydraulic gradient is locally reversed towards the mine, implying movement of groundwater from the lake to the mine. It is estimated that seepage loss between Lake Avon and Longwalls 12 to 16 would be less than 0.28 ML/day (or 0.17 ML/day/km of shoreline adjacent to extracted longwalls). This estimate is consistent with numerical modelling predictions (<0.4 ML/day) and within the tolerable loss limit of 1 ML/day prescribed by the Dams Safety Committee (DSC).

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 13, particularly in the critical area between Lake Avon and Area 3B. The model tends to overestimate drawdown impacts in the Bulgo and Scarborough Sandstones and is therefore conservative.

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 3.93ML, a slight increase 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 480 mm, a decrease when compared to the previous reporting period in which 931 mm rainfall was recorded. Table 31 presents the rainfall for this reporting period and the seven previous reporting periods.

Table 31: Rainfall at Dendrobium

Year	Total Rainfall (mm)
FY11	1299
FY12	1318
FY13	1532
FY14	1482
FY15	1303
FY16	1064
FY17*	931
FY18*	480

* Rainfall recorded at Dendrobium Area 3B Gauge

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. 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 WaterNSW 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 455.5 mm of rainfall during the reporting period, which was a decrease from the previous reporting period (1375.7 mm). The table below shows the total recorded rainfall for the past seven reporting periods.

Table 33: Rainfall at Cordeaux

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
FY18	455.5

7.3. Vent Shaft 2/3

No water usage occurs on the Vent Shaft 2/3 site. Due to its location within WaterNSW Special Areas, the surface facilities at the vent shaft have been designed to control sediment entering the surrounding WaterNSW 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	2167.12 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. No major changes to the existing security estimate were identified (a minor increase associated with the addition of redundant sites, and Survey 16 exploration program have been incorporated). A copy of the revised security cost estimate is provided as Appendix B. A rehabilitation summary associated with the Dendrobium operation is provided below.

Location	Area Affected/Rehabilitation (ha)				Reason for Variation
	To date	FY2017 (Last Report)	FY2018 (This Report)	FY2019 (estimated)	
A: Total Mine Footprint	18,816	18,816	18,816	18,816	NA
B: Total Active Disturbance	29.46	0	0	0	NA
C: Land being prepared for rehabilitation	0	0	0	0	NA
D: Land under active rehabilitation	0	0	0	0	NA
E: Completed rehabilitated area (Areas previously completed, currently includes Corrimal No. 1 and 2 Shafts, Vent Shaft 2/3, Dendrobium Subsidence Event, Bradford Breaker, and Stage 2 Pathway).	7.97	7.97	7.97	7.97	NA

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 roadways. 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 channel 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.

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 Panning 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 was put forward by Illawarra Coal 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) supported South32's intention to secure the Maddens Plains site in perpetuity by transferring this land to the National Park estate.

The area of land met 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 had 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 Areas.

Consequently, the Department 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. Maddens Plains was transferred to the Minister Administering the National Parks and Wildlife on in May 2018. Plan 14 shows the area of Madden 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. 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 Dendrobium Community Consultative Committee (DCCC), Illawarra Coal management, and government agencies on a regular basis.

A total of 18 community complaints were received during the reporting period (Compared to 26 received in FY17). 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 the reporting period.

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.

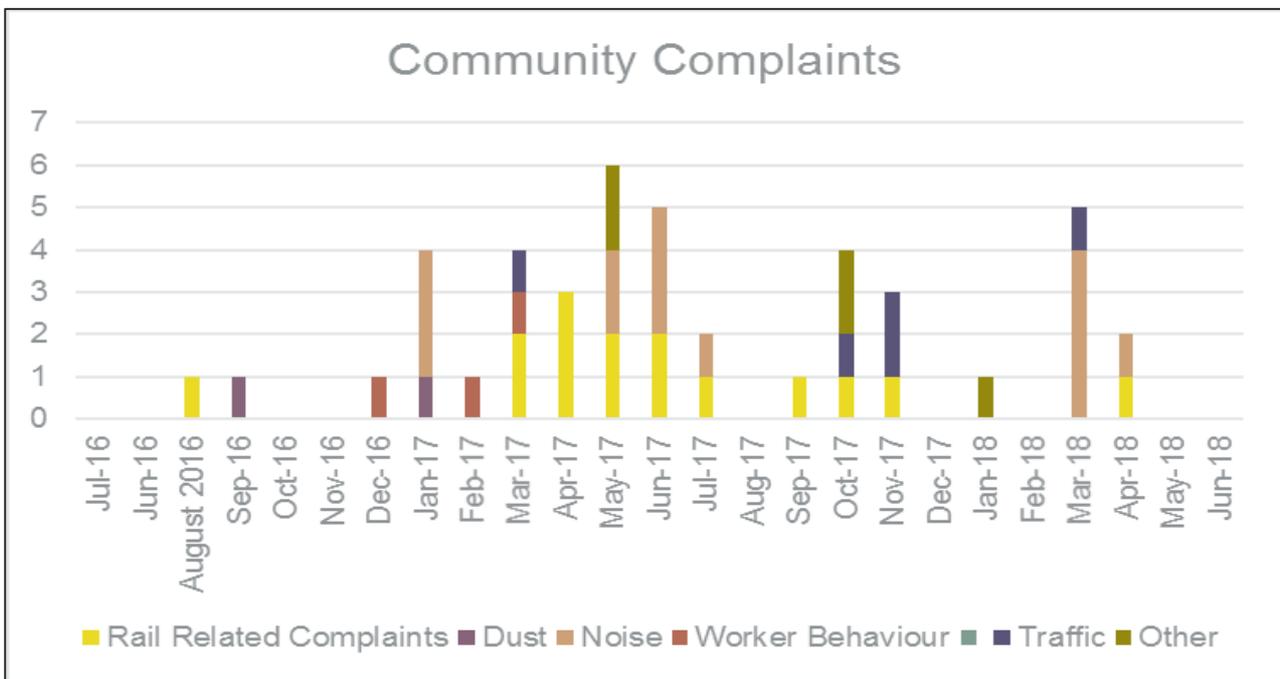


Figure 14: Dendrobium Community Complaints.

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 Kemira Valley Coal Loading Facility, 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 meetings;
- Dendrobium Community Consultative Committee Plan for the Future working group meetings;
- Dendrobium Community Enhancement Committee meetings;
- Dendrobium section on the South32 Regulatory Information webpage;
- Participation in community events and activities;
- Community Perception Surveys; and
- Individual landholder visits/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; and
- 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, local community members, environmental group representatives, representatives from Wollongong City Council and Wollondilly Shire Council and South32 representatives as outlined in Table 36.

Table 36: Membership of the DCCC at 30 June 2018.

Name	Member Category
Mike Archer	Independent Chairperson
Alex Beccari	Community Representative
Phil Diamond	Community Representative
Phil Grant	Community Representative
Vivien Twyford	Community Representative
Chris Haley	Community Representative
Phill Clunas	Environmental Group Representative
Ron Zwicker	Wollongong City Council
Noel Lowry	Wollondilly Shire Council
Michelle Grierson	Illawarra Coal
Wayne Bull	Illawarra Coal
Amber Cleary	Illawarra Coal

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, Community Complaints 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; and
- DCCC and DCEC activities, including information on inspections and projects supported.

Dendrobium Community Enhancement 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 \$1.5 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 36). 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. 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 31st of December 2020.

Table 36: 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	ISO140001		X	ISO14001 certification.
Triennially	Development Consent		X	Development Consent Compliance

Triennial Independent Audit

Environmental Resources Management Australia Pty Ltd (ERM) was commissioned to perform an independent environmental audit (IEA) of the Dendrobium Mine Development (DMD) located in Mount Kembla, NSW on behalf of South 32 – Illawarra Coal. The primary purpose of the audit was to satisfy the Department of Planning and Environment (DPE) Ministers’ Conditions of Approval (MCoA) the DMD development approval 60-30-2001 (Modification 7) April 2015, which requires the commissioning of an independent audit every 3 years, unless the Director General directs otherwise. The most recent audit was completed in May 2018.

The audit included a review of:

- Conditions of consent of Develop Approval - DA 60-03-2001 (Modification 7 issued April 2017);
- Environmental Protection Licence - EPL No. 3241;
- Subsidence Management Plan Approval (Are 3B, 2013);
- Consolidated Coal Lease 768;
- Mining Leases 1510 & 1566; and
- Implementation of Management Plans developed as part of the Ministers Conditions of Approval.

Overall, compliance was achieved with the audit documents that were reviewed. A qualitative risk assessment was also completed on the findings, consistent with AS/NZS 4360:2004 Risk management and HB 436:2004 Risk Management Guidelines Companion to AS/NZS 4360:2004 and as described in the Department of Planning & Environment publication “Independent Audit Guidelines” issued October 2015. The number of non-compliances with the statutory conditions is summarised in Table below and Appendix H for full Audit Report.

Table 37: Summary of Triennial Audit Findings

Number of Conditions	Non- Compliances	Administrative Non- Compliances	Observations
Statutory Instruments			
204	8 (High (0), Medium (7), Low (1))	2	15

Dendrobium Mine and Cordeaux Colliery Compliance Audit Program – Catchment Special Areas

As part of the compliance audit program being undertaken by the Department of Planning & Environment (DPE) – Resources Regulator (the Regulator), an audit of the Endeavour Coal Pty Ltd Dendrobium Mine and Cordeaux Colliery was undertaken on Wednesday 7 March 2018. The program was conducted jointly by the Regulator, DPE Compliance, NSW Environmental Protection Authority (EPA) and WaterNSW. See Appendix G for Audit Report.

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 annually 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 was compliant with of the required consent conditions with the exception of an Administrative Non Compliance associated Schedule 8 condition 7 (The independent environmental audit report was not submitted within the 6 weeks of completing the audit). 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, Dendrobium will continue Longwall mining in Area 3B. 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; and
- 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 has prioritised rehabilitation activities for the redundant sites and is in the process of appointing a project manager to manage the rehabilitation in the order of priority. Rehabilitation activities are expected for the next report period. 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

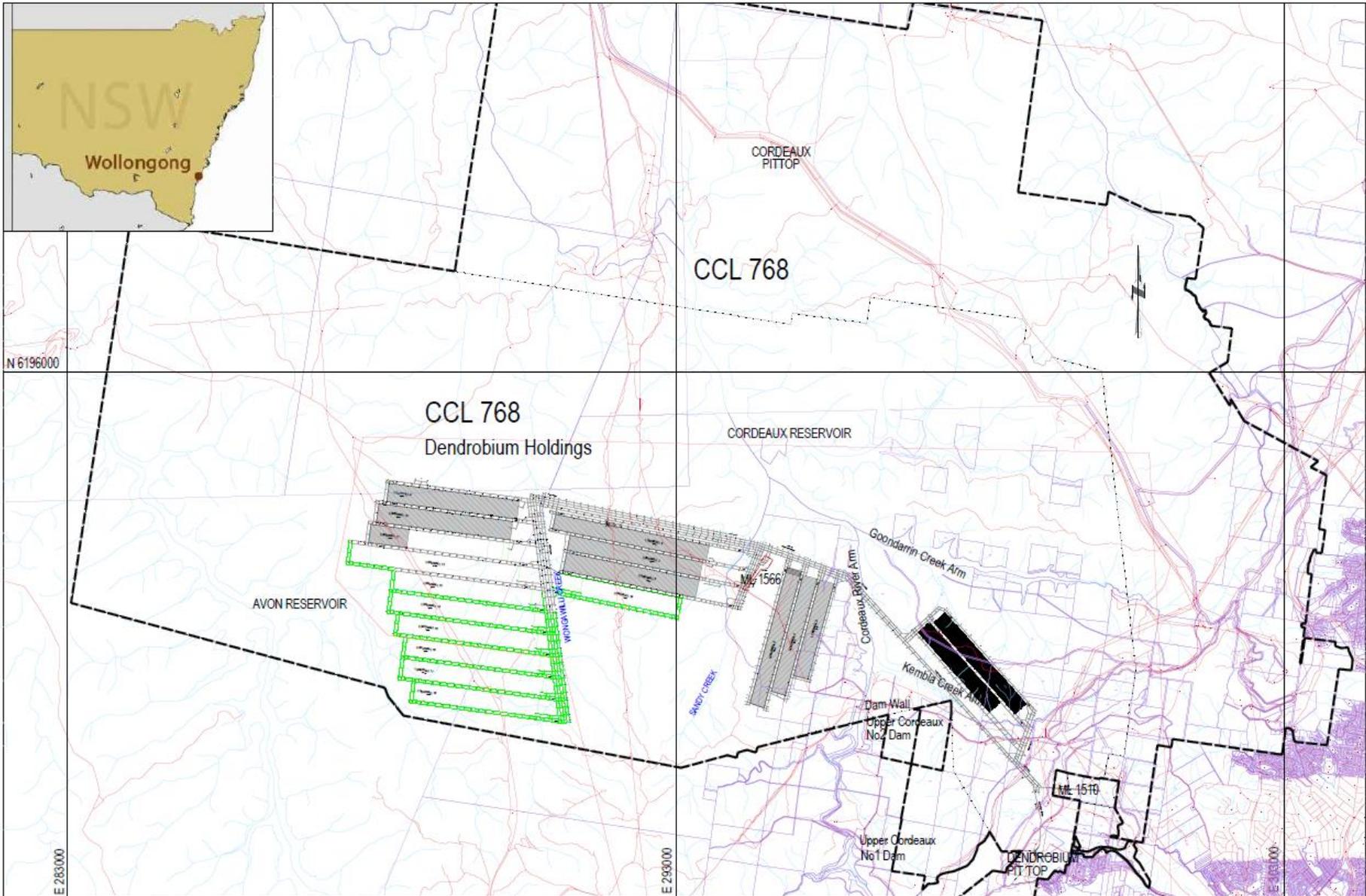
Illawarra Coal - Remedial Action Plan - Corrimal No 3 Ventilation Shaft Picton Road, NSW (Rev 3)
JBS&G

PLANS CONTINUED

15. PLANS

PLAN 1A - LOCATION OF MINING DOMAIN

PLAN 1B - LW STATUS AS AT END OF FINANCIAL YEAR



Authorisation Holder _____ Date _____

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

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

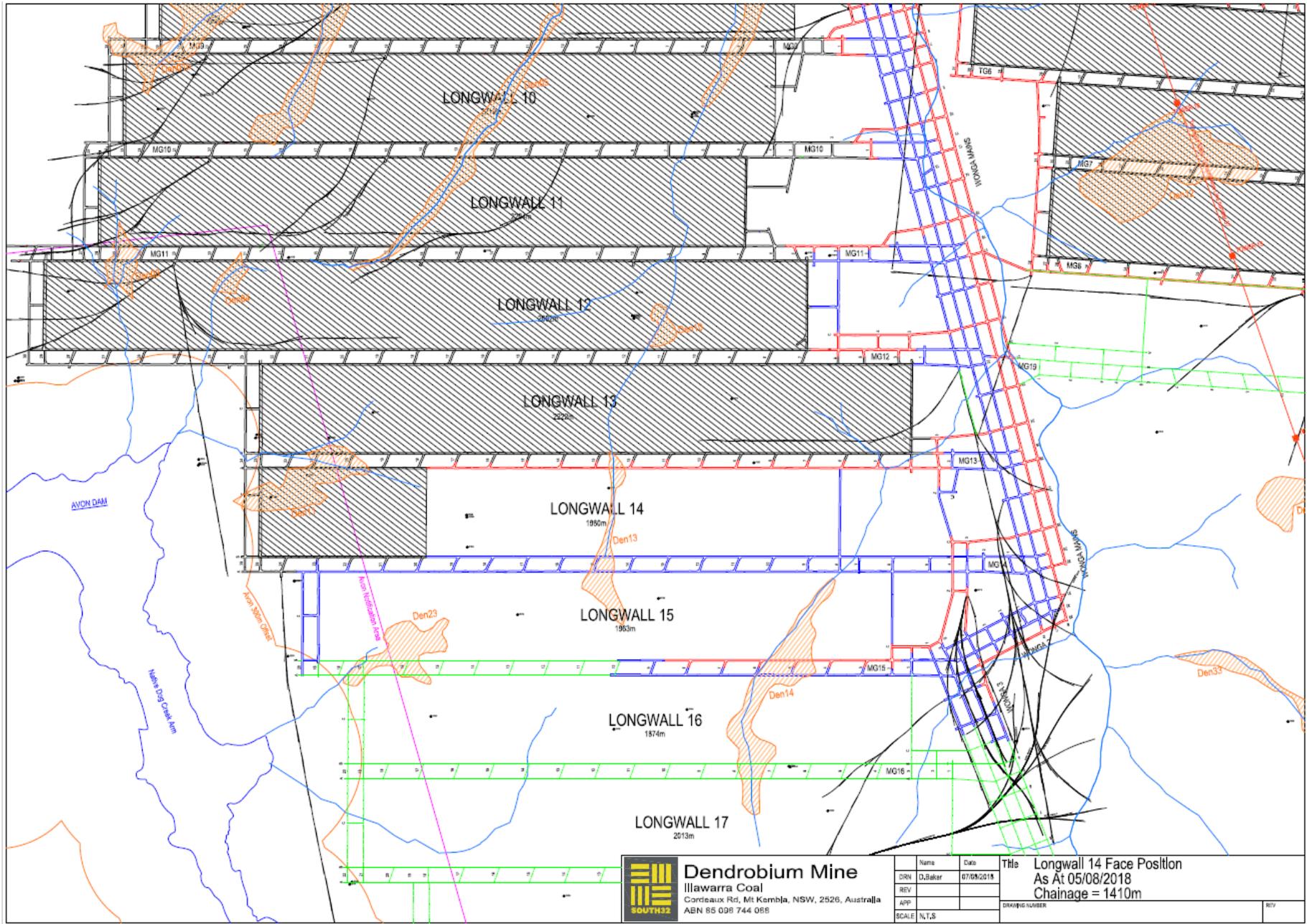
Dendrobium Mine
 Illawarra Coal
 Cordeaux Rd, Mt Kembla, NSW, 2526, Australia
 ABN 85 098 744 088

Name	Date
DRN	D. Baker 03/06/2015
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

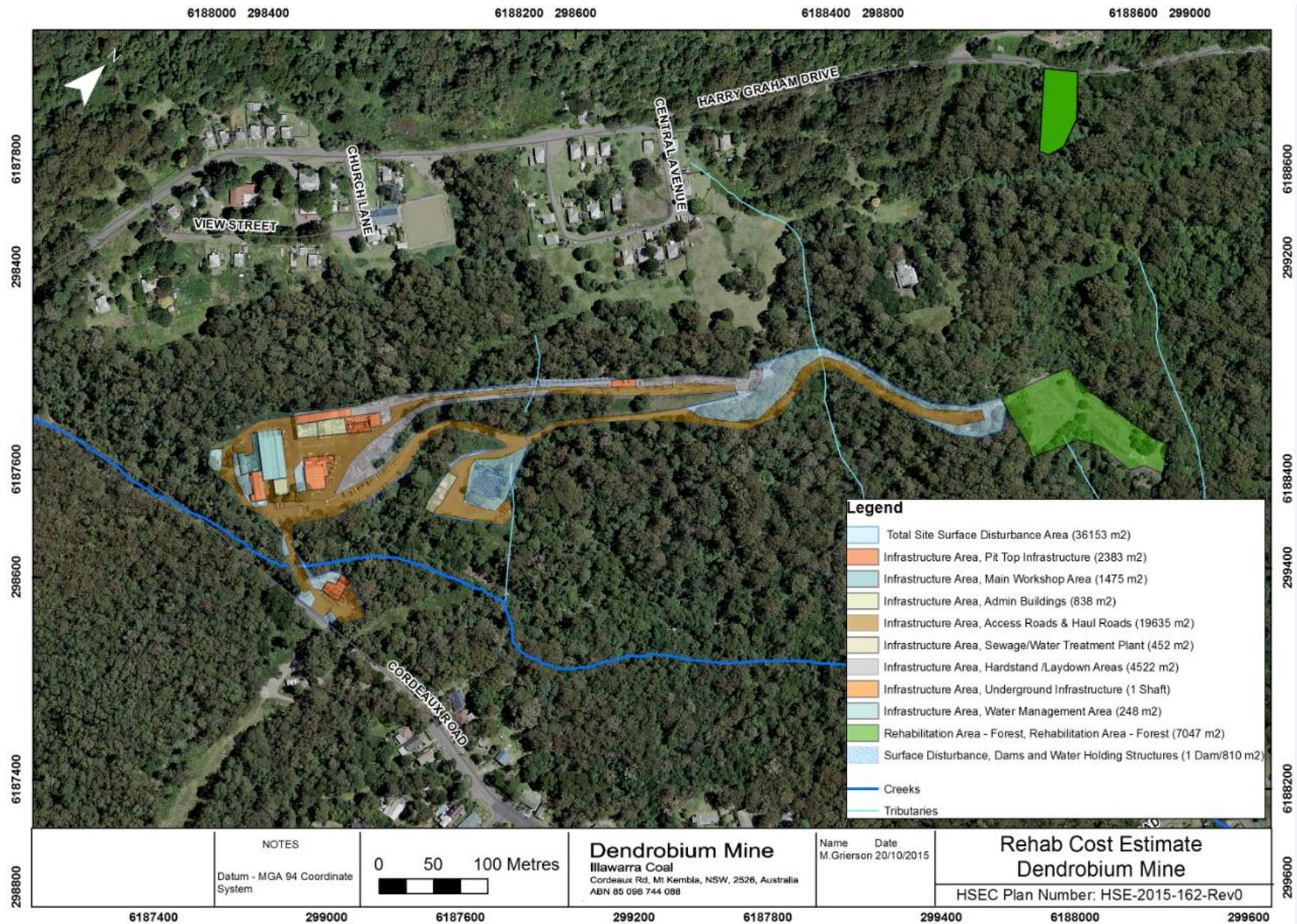



Dendrobium Mine
 Illawarra Coal
 Cordeliers Rd, Mt Kembla, NSW, 2526, Australia
 ABN 85 008 744 088

Name	Date
DRN	D.Baker 07/08/2015
REV	
APP	
SCALE	N.T.S

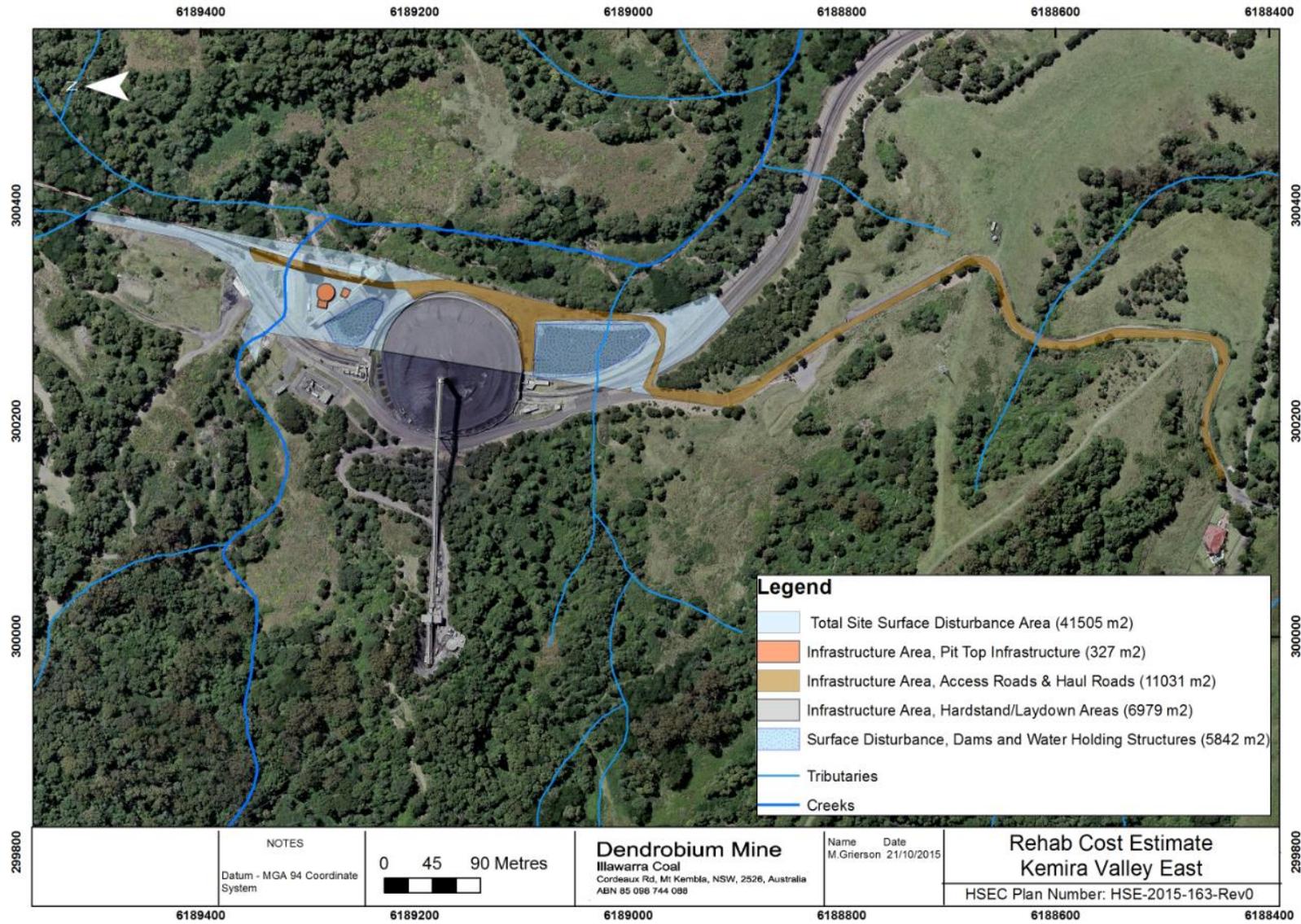
Title Longwall 14 Face Position
 As At 05/08/2018
 Chainage = 1410m
DRAWING NUMBER

PLAN 2 – DENDROBIUM MINE SITE



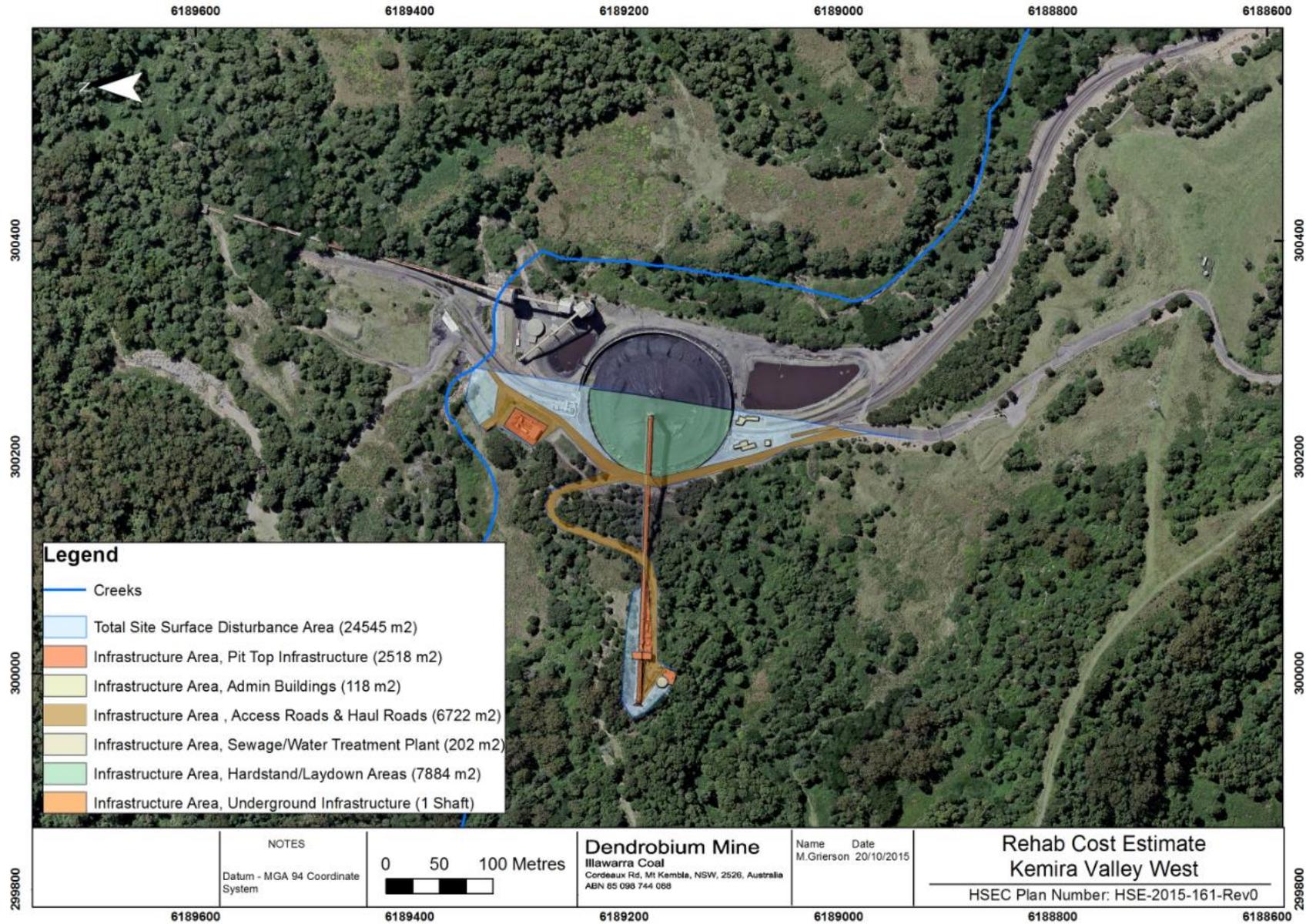
PLAN 3 – SITE LAYOUT – KEMIRA VALLEY

A)



PLANS CONTINUED

B)

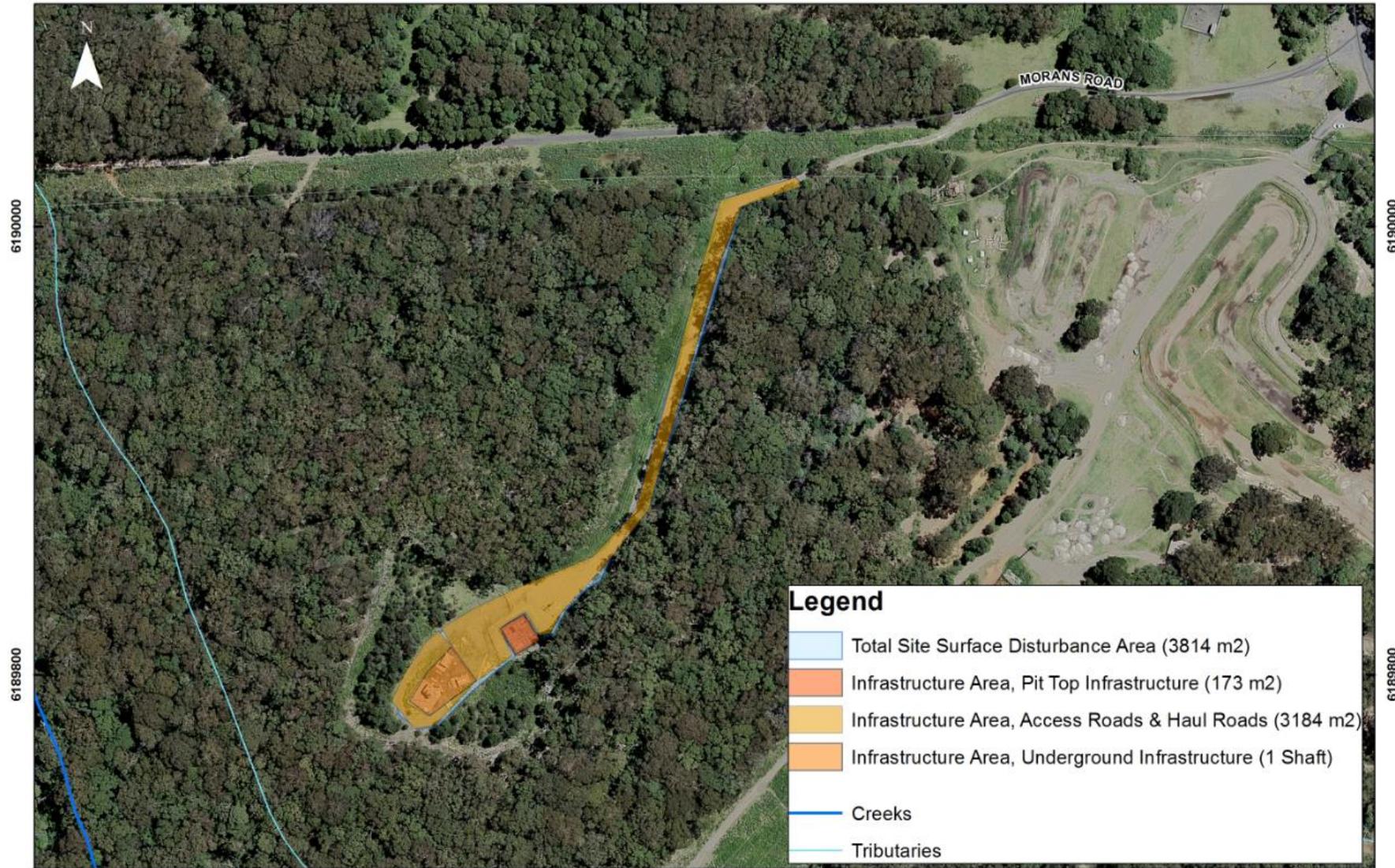


PLAN 4 – NO. 1 VENTILATION SHAFT SITE LAYOUT

298600

298800

299000



Legend

- Total Site Surface Disturbance Area (3814 m²)
- Infrastructure Area, Pit Top Infrastructure (173 m²)
- Infrastructure Area, Access Roads & Haul Roads (3184 m²)
- 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

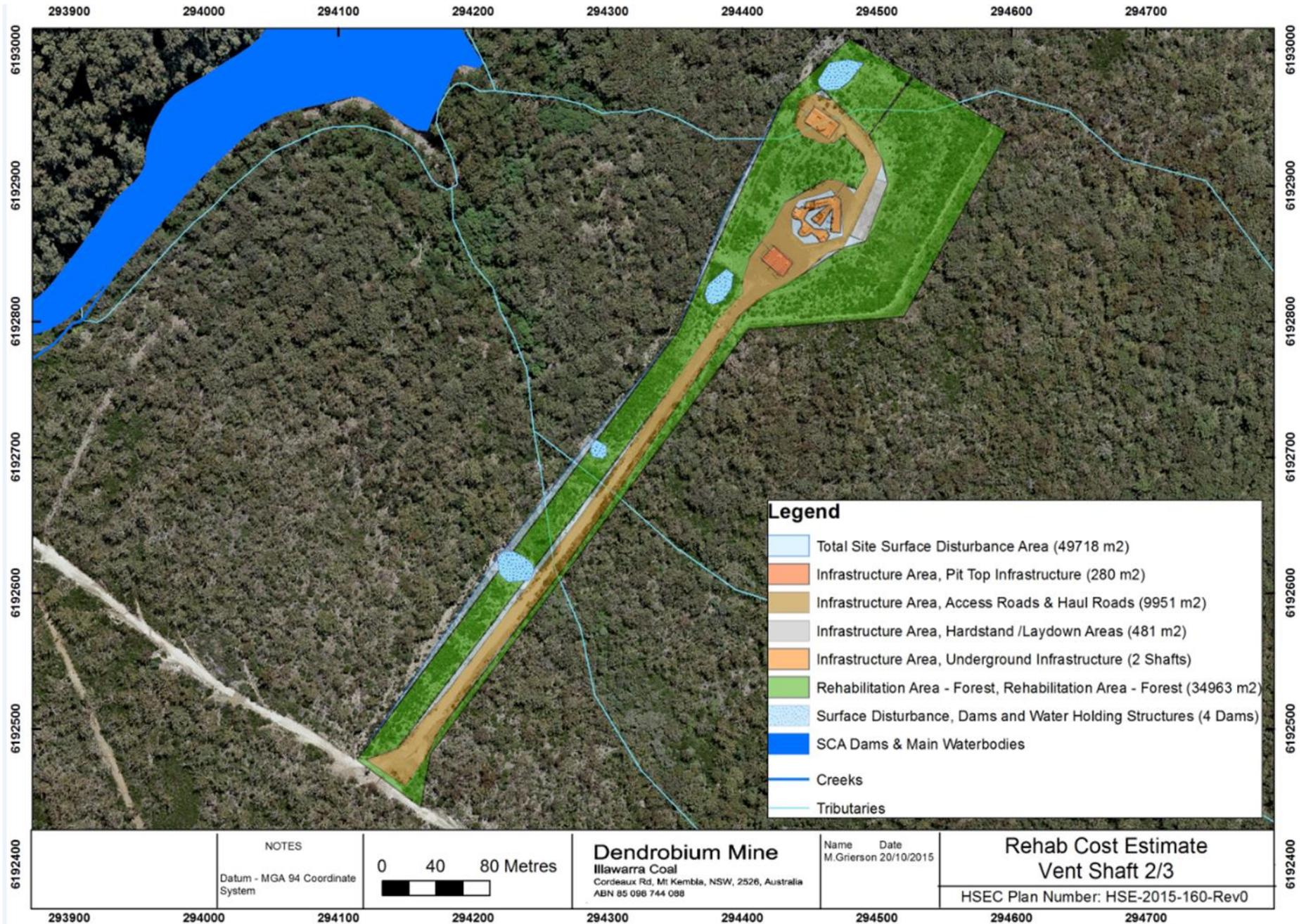
HSEC Plan Number: HSE-2015-164-Rev0

298600

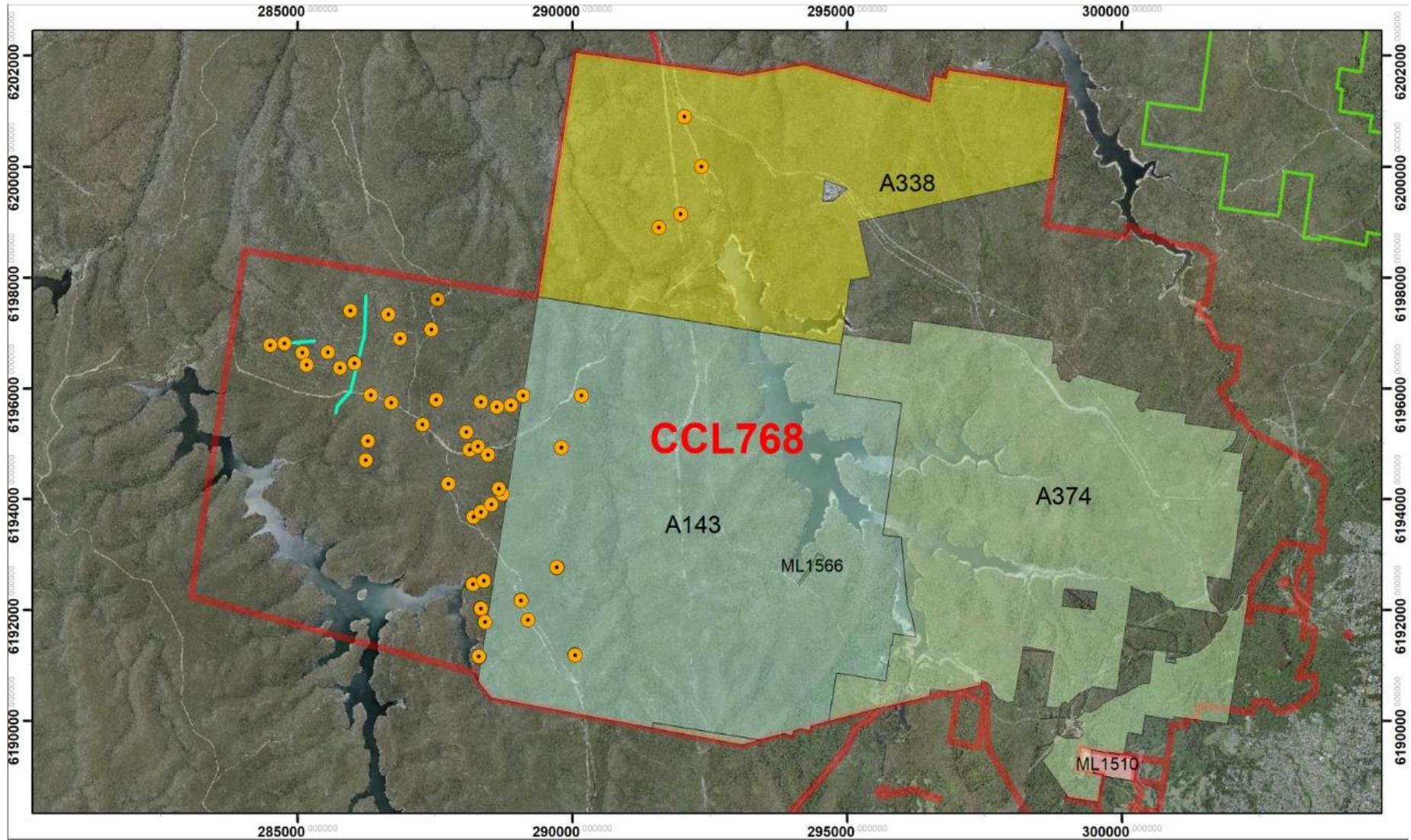
298800

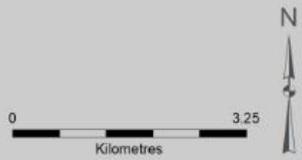
299000

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

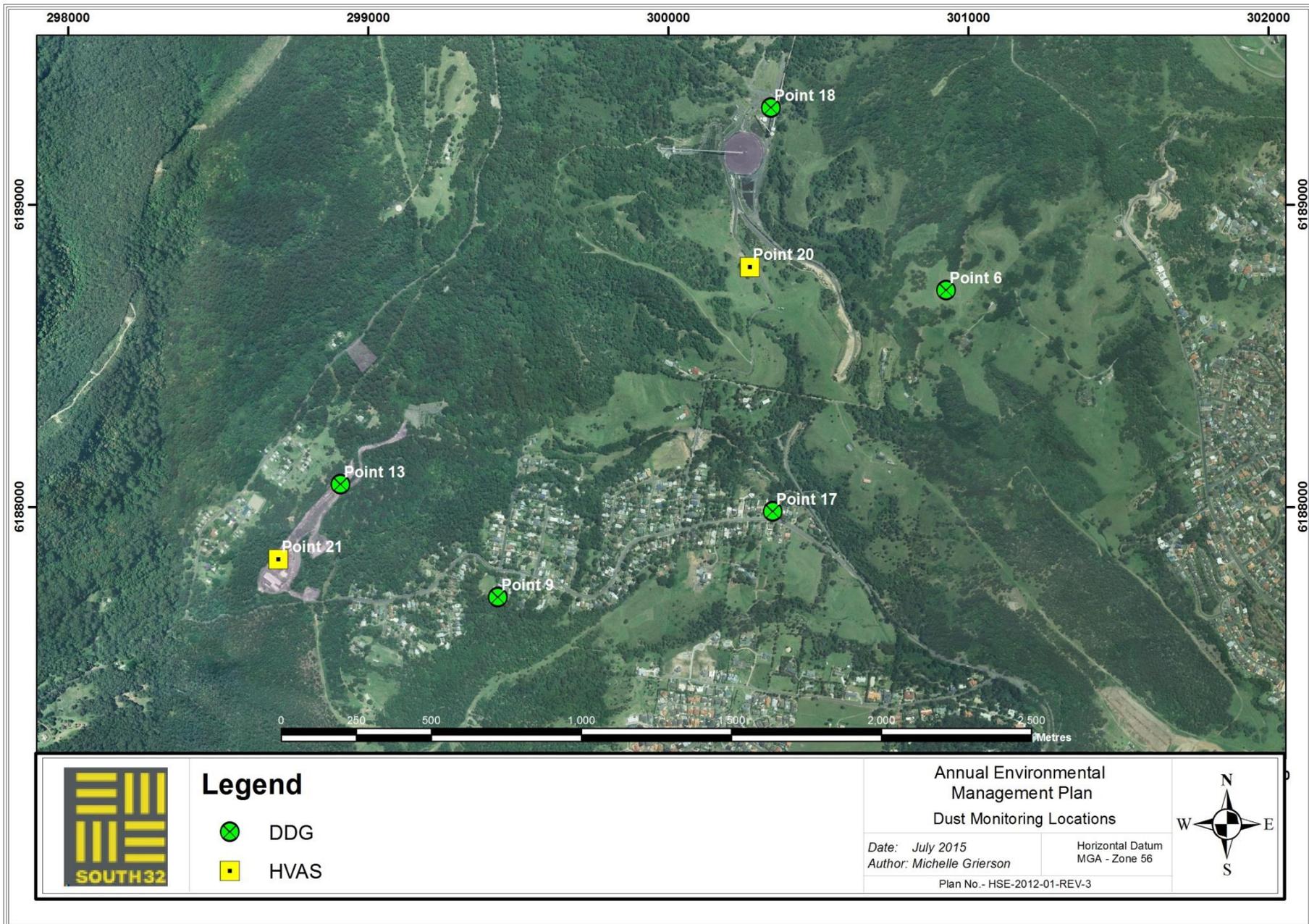


PLAN 6 – EXPLORATION ACTIVITIES – DENDROBIUM MINE



 <p>Coordinate System: GDA 1994 MGA Zone 56</p> <p>Map ID: X2064.mxd</p>	Author: M Lett	<h3>Legend</h3> <ul style="list-style-type: none"> ● Completed FY18 boreholes — Completed FY18 Seismic Acquisition A338 A374 CCL767 CCL768 ML1510 ML1566 	
	Date: 22/08/2018		
	Scale: 1:89,605		
	Figure No:		

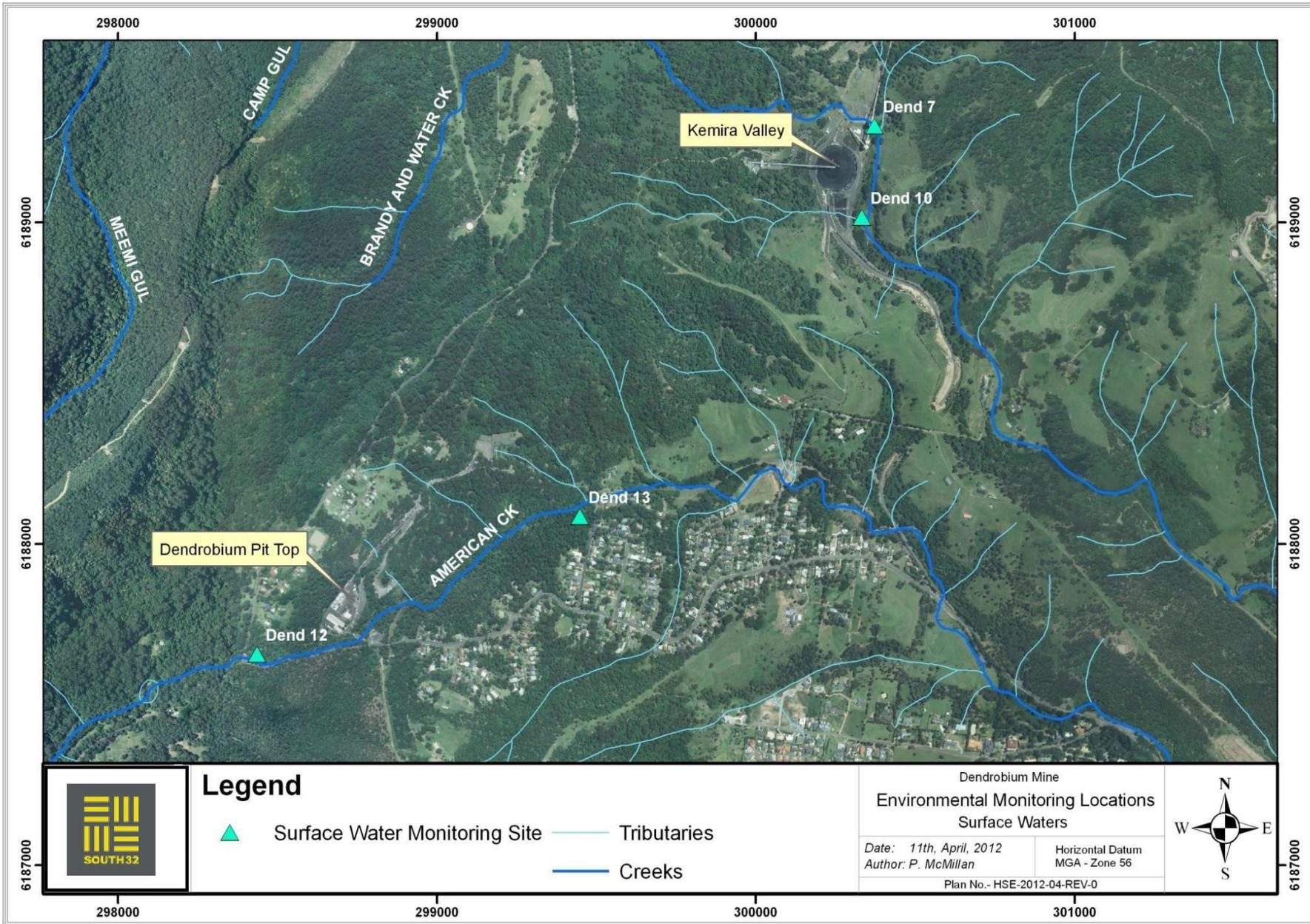
PLAN 7 – AIR QUALITY MONITORING LOCATIONS



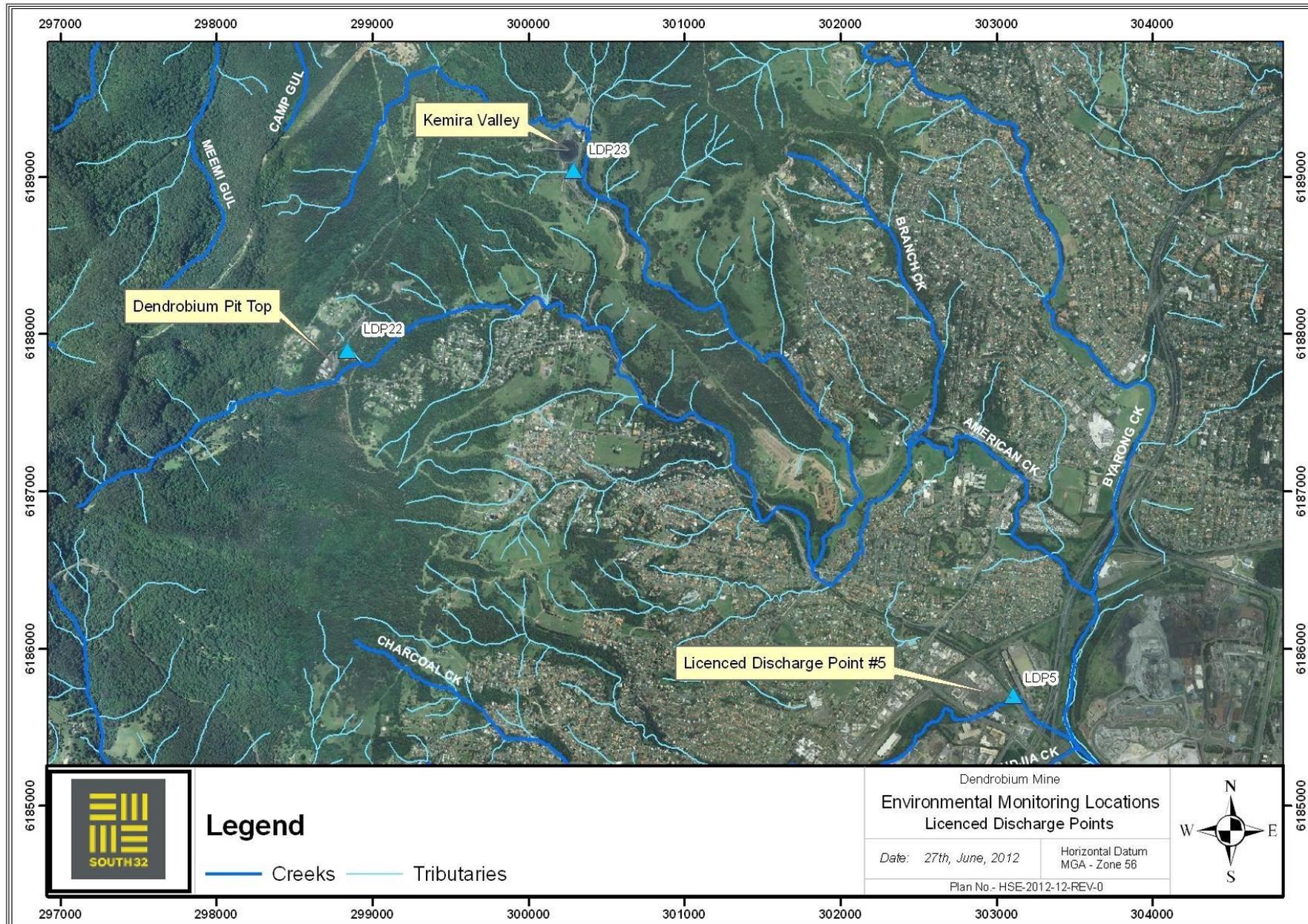
PLAN 8 – DENDROBIUM SURFACE WATER

A – Surface Water Quality Monitoring Locations

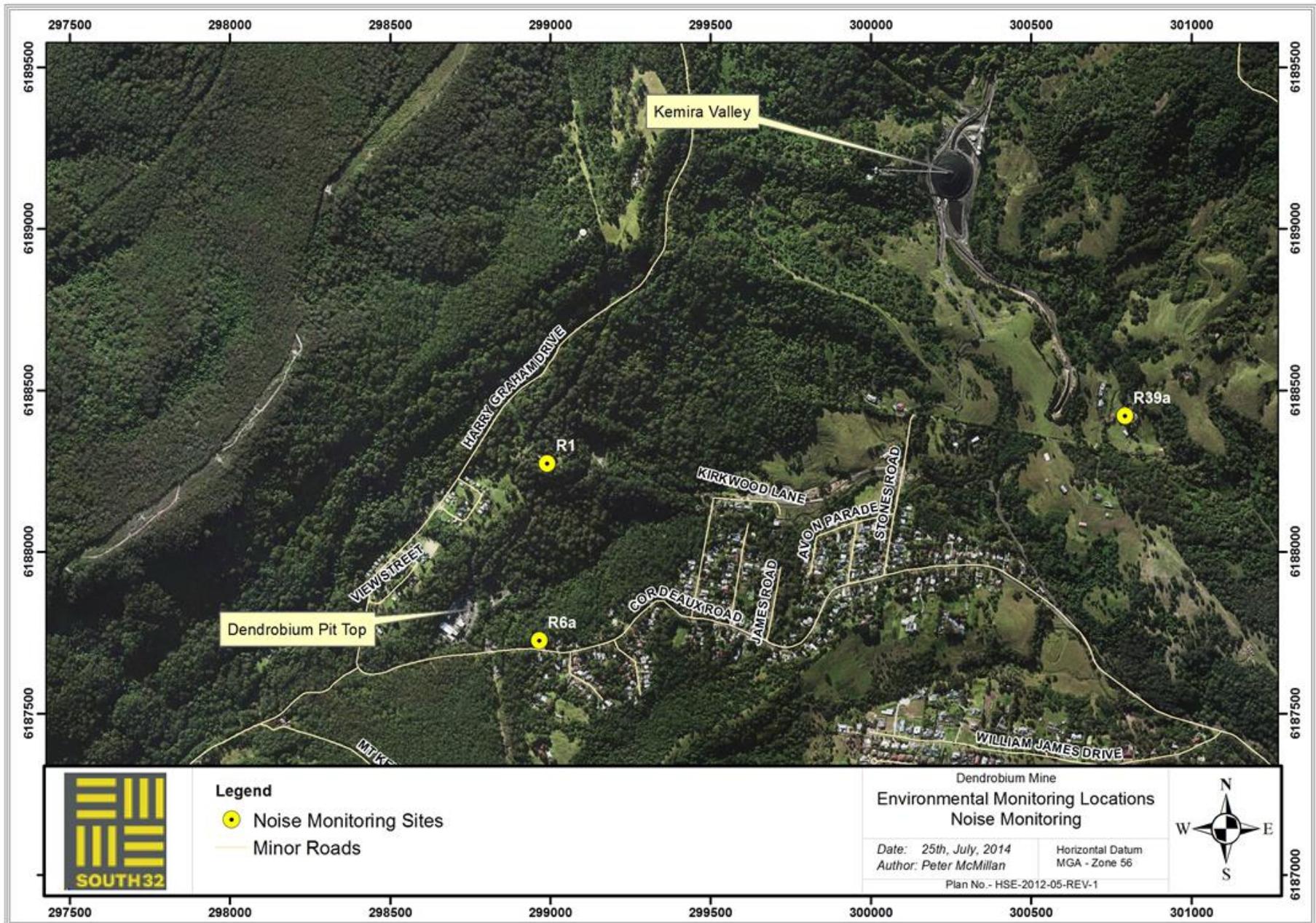
B – LDP Location



PLANS CONTINUED

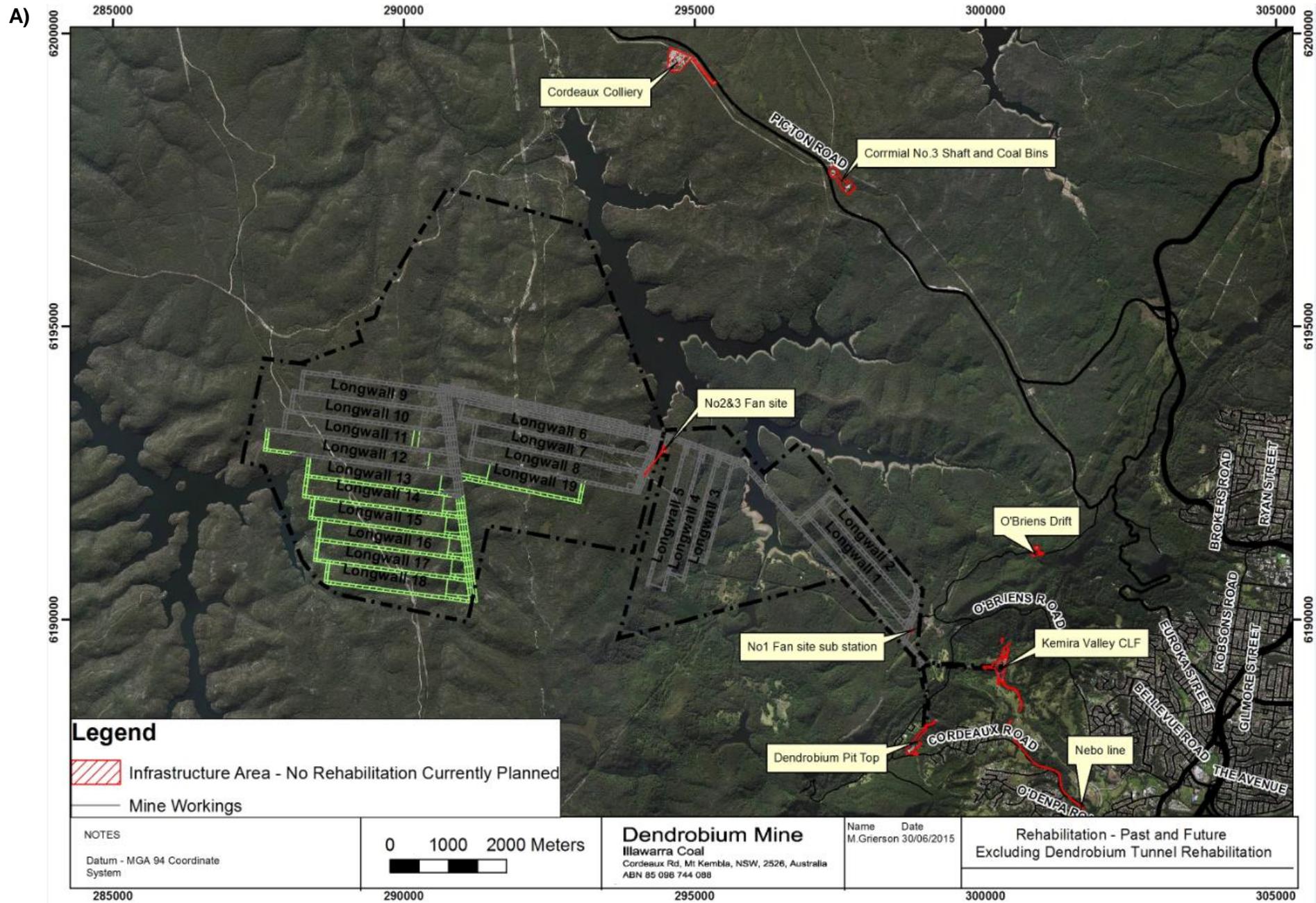


PLAN 9 – NOISE MONITORING LOCATIONS



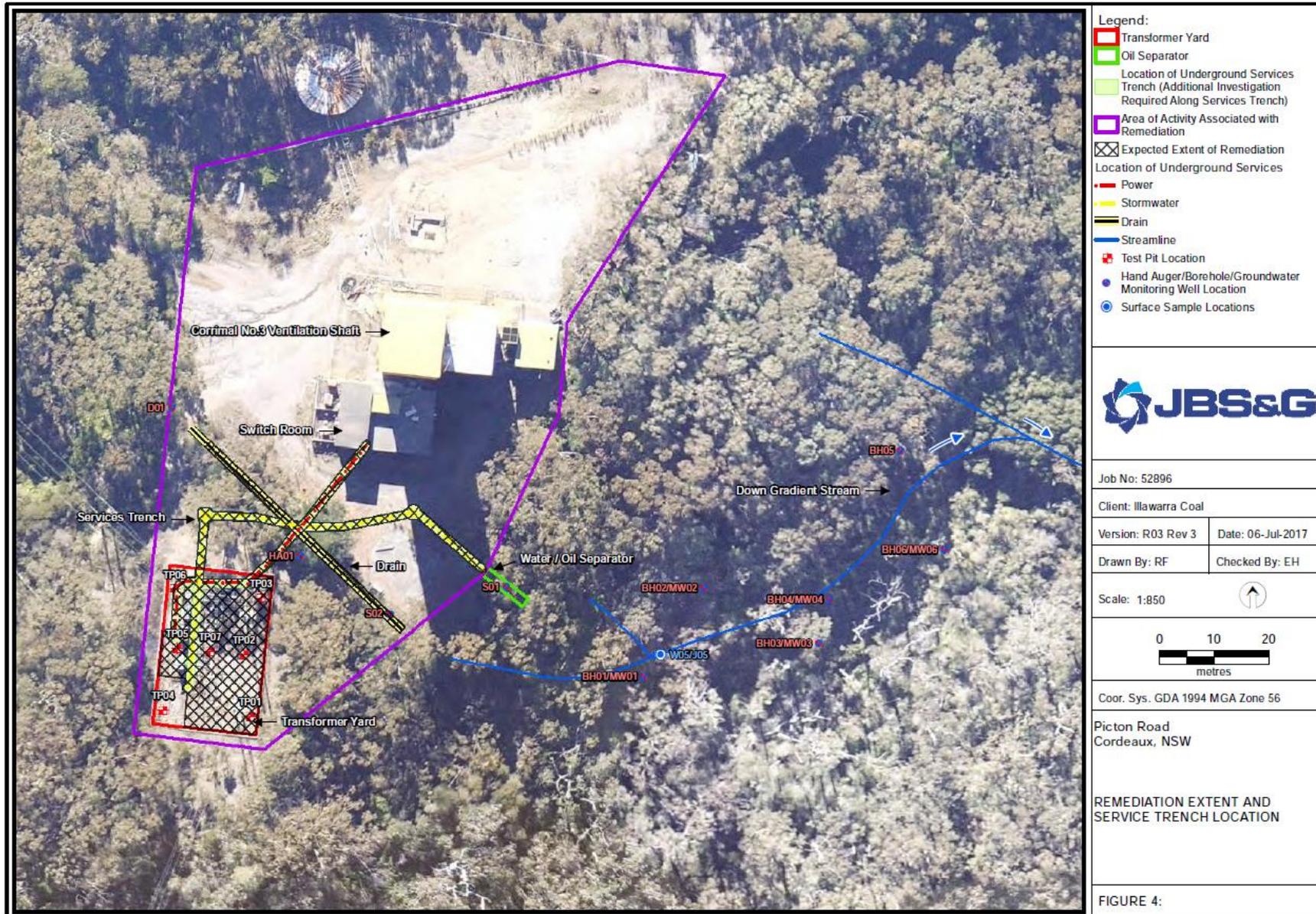
PLAN 10 – REHABILITATION AREAS

Planned Rehabilitation – All other Areas



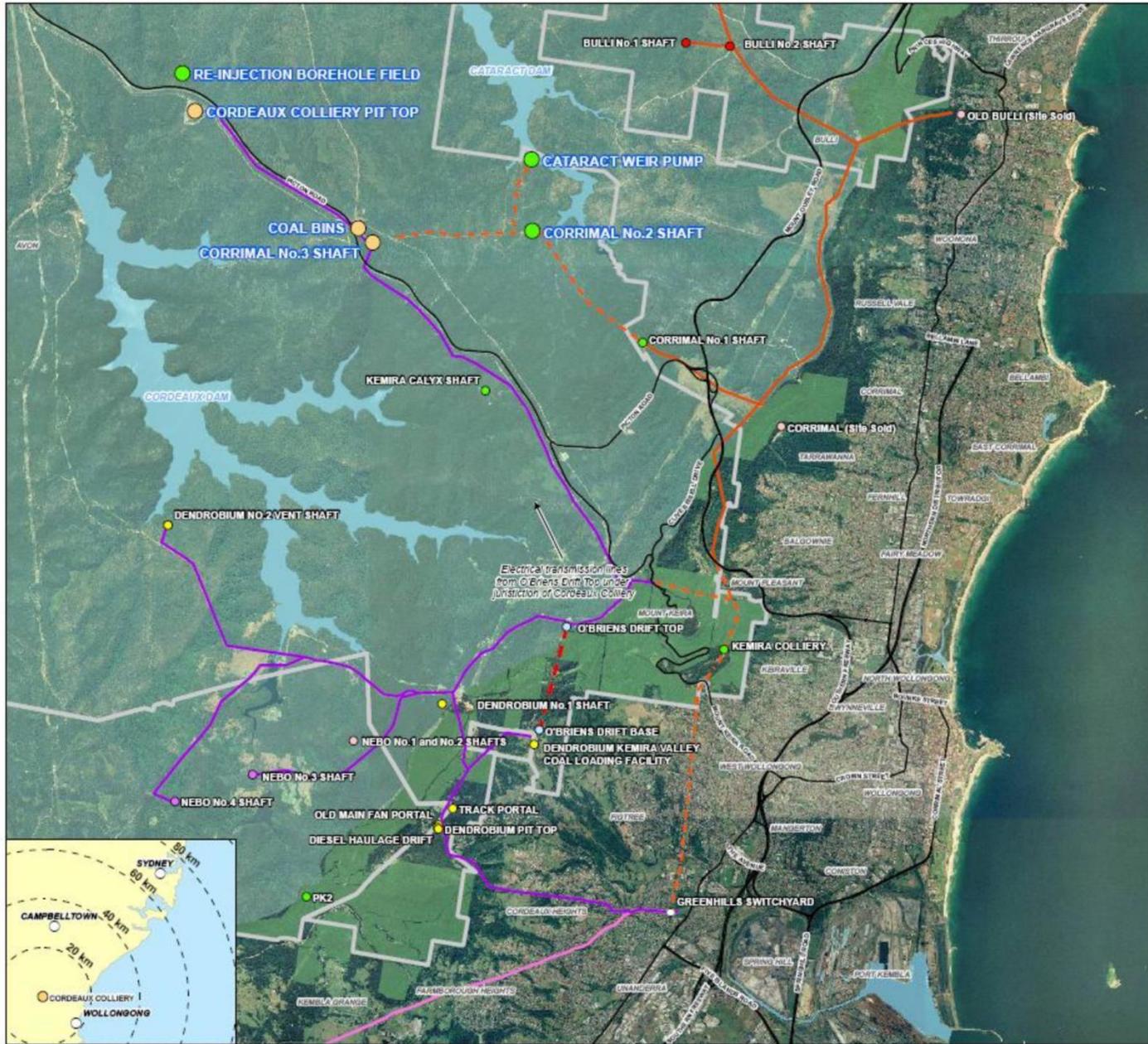
PLANS CONTINUED

B) Cordeux Colliery – Corrimal No. 3 Shaft Remediation



File Name: 52896_04
 Reference: <http://maps.au.namap.com> - IMAGERY 20120117

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 (Dendrobiium)
 - 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



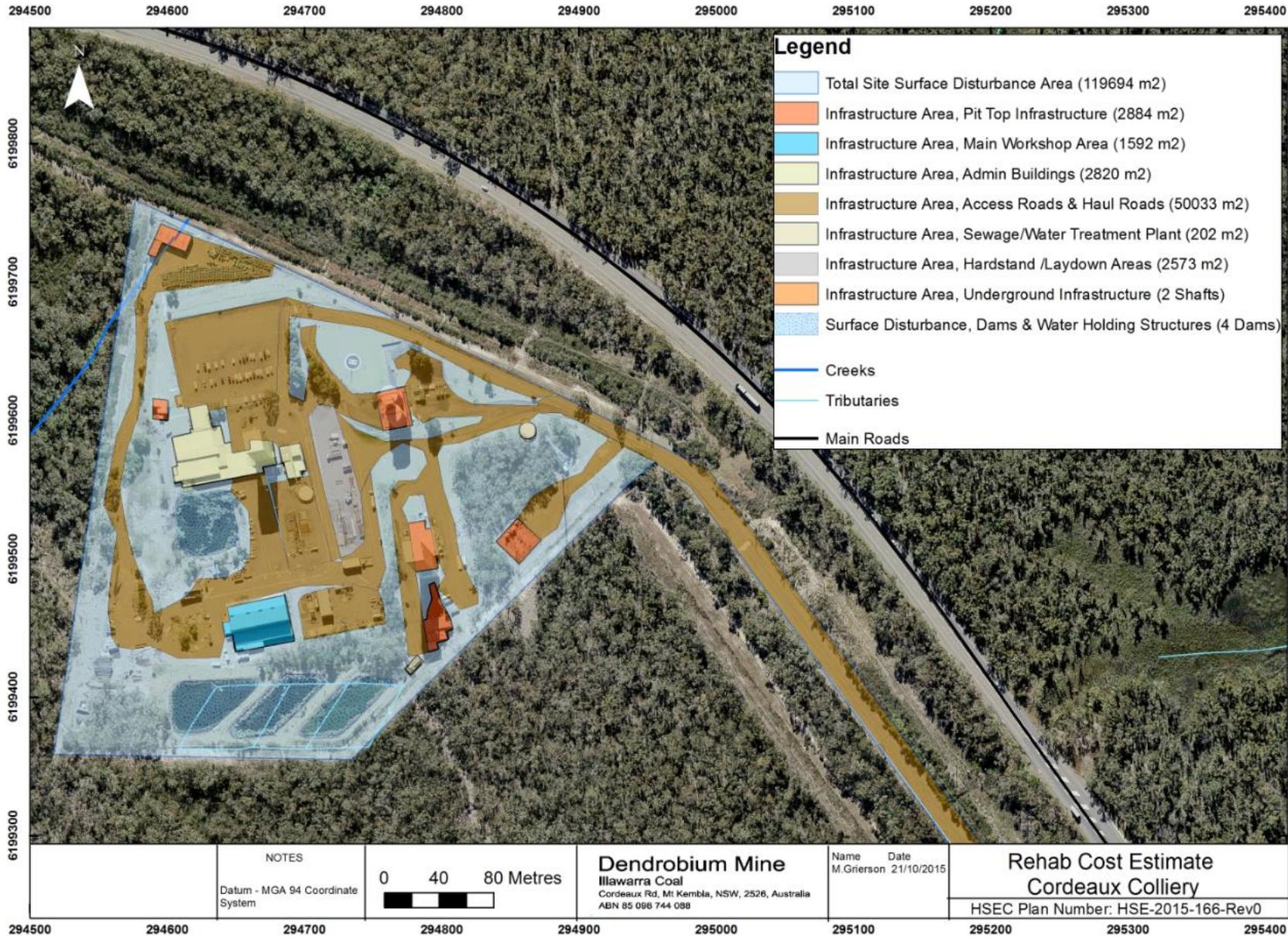
FIGURE 2.1

Scale 1:60,000 (at A3)

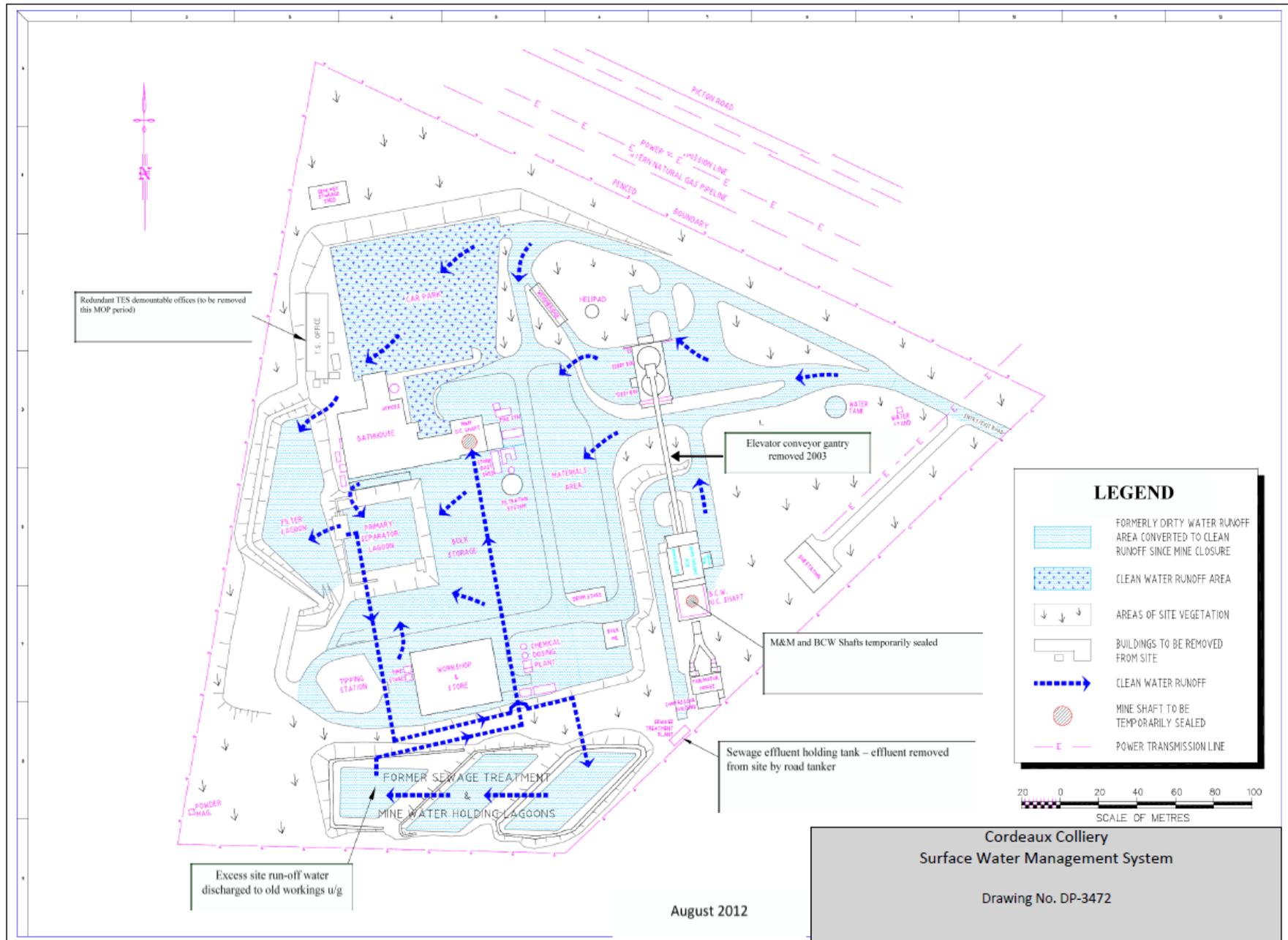


Map Produced by Cardno Forbes Rigby Pty Ltd
 Date: 04 December 2009
 Coordinate System: Zone 58 MGA/GDA94
 GIS MAP REF: 110225-01_1801_LocalityPlan_Cordeaux.mxd 04

PLAN 12 – CORDEAUX COLLIERY PIT TOP INFRASTRUCTURE

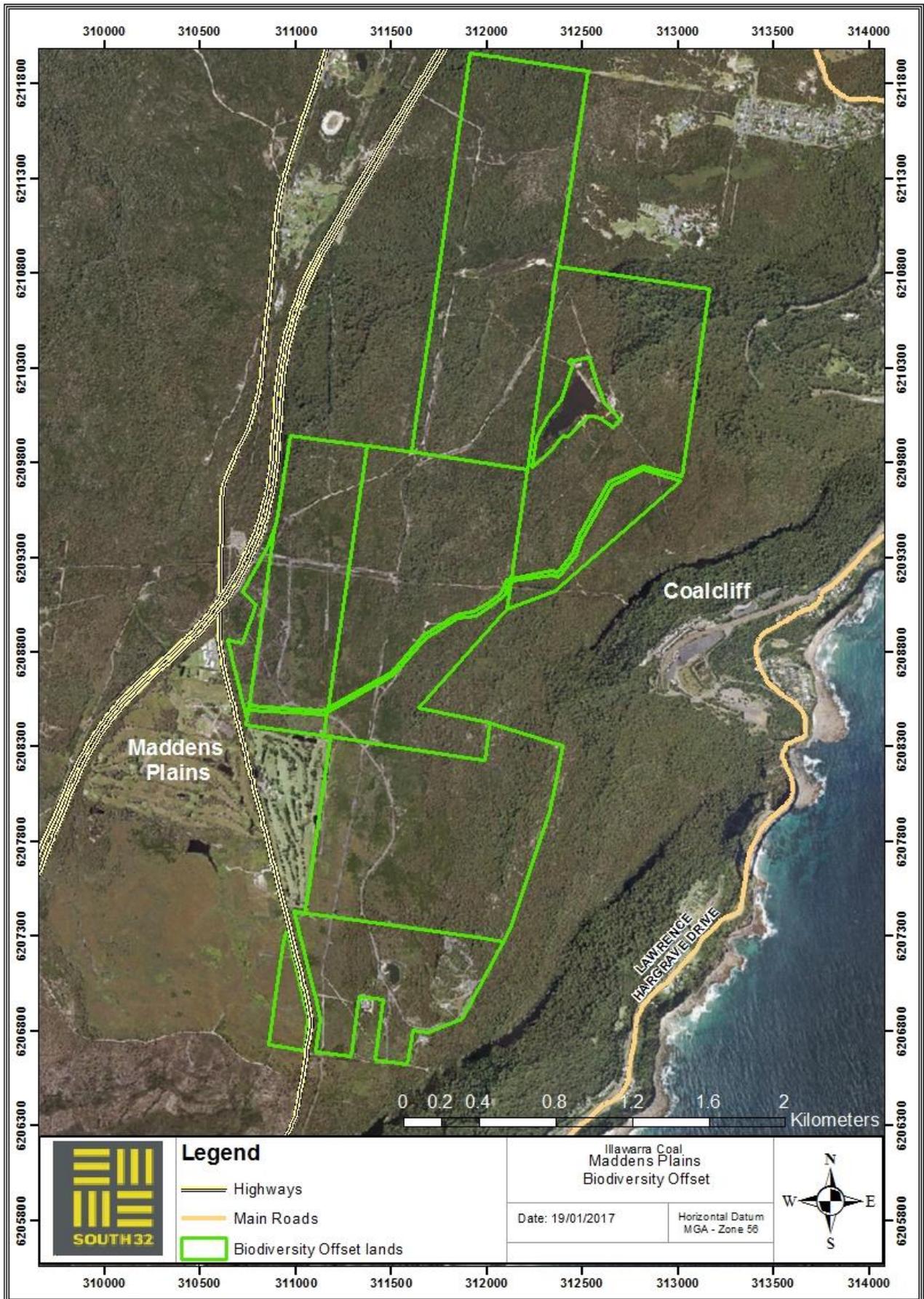


PLAN 13 – CORDEAUX COLLIERY PIT TOP SURFACE WATER MANAGEMENT



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

APPENDICES CONTINUED

**APPENDIX G : DENDROBIUM MINE CORDEAUX COLLIERY COMPLIANCE AUDIT
PROGRAM – CATCHMENT SPECIAL AREAS**

APPENDICES CONTINUED

APPENDIX H: DENDROBIUM MINE TRIENNIAL INDEPENDANT AUDIT REPORT FY18