



**NSW
Resources
Regulator**

FWP0001016

DENDROBIUM COLLIERY FORWARD PROGRAM

Friday 1 July 2022 to Monday 30 June 2025



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Summary

DETAIL

Mine	Dendrobium Colliery
Reference	FWP0001016
Forward program commencement date	Friday 1 July 2022
Forward program end date	Monday 30 June 2025
Forward program revision (if applicable)	
Contact	David Gregory
Mining leases	ML 1566 (1992), ML 1510 (1992), CCL 768 (1973)
Project location	Illawarra Coal Holdings Pty Ltd
Date of submission	Friday 29 July 2022

Important

The department may make the information in your program and any supporting information available for inspection by members of the public, including by publication on its website or by displaying the information at any of its offices. If you consider any part of your program to be confidential, please communicate this to the department via the message function on this submission within the NSW Resources Regulator Portal.

Three-year forecast – surface disturbance activities

Project description

The Dendrobium Operations are managed in accordance with Development Consent 60- 03-2001, as modified (the Consent). Dendrobium Operations incorporate legacy sites and the Cordeaux Pit Top which are covered by CCL 768 and Development Consent D74/134 (Cordeaux). Dendrobium Mine is owned and operated by Dendrobium Coal Pty Ltd, a subsidiary company of Illawarra Coal Holdings Pty Ltd (ICHPL), a wholly owned subsidiary of South32 Limited. The mining operations are located immediately adjacent to Mt Kembla, approximately 8 km west of Wollongong, NSW, on the Woronora Plateau. Under the Consent, Dendrobium Mine is approved to produce up to 5.2 million tonnes (t) per annum until 31 December 2030. Dendrobium Mine primarily extracts hard coking coal from the Wongawilli Seam of the Southern Coalfield. Five major mining areas make up the approved mine plan for Dendrobium (Areas 1, 2, 3A, 3B and 3C). Cordeaux is under “care and maintenance” and has maintained this status.

Description of surface disturbance activities

Exploration activities

Exploration activities over the next three years may include:

- Drilling of nominally ten boreholes to target identified features and to explore in Dendrobium Area 3c.
- Drilling to target igneous sill boundaries in Dendrobium Area 5 as a result of the Independent Peer Review.
- Drilling to target structural features to enable mining in existing domains for Longwalls 19a and 21a.

Construction activities

The following activities are associated with MOD9 of the Dendrobium Development Consent DA 60-03-2001):

- Construction of new gas management infrastructure and ancillary infrastructure to facilitate management of post-drainage and pre-drainage gas from Area 3C at the site of the existing Dendrobium No. 2 and 3 Shafts.
- Gas extraction from the underground mine via a borehole and vacuum pump, with associated infrastructure including a cooling water system incorporating cooling towers.

- Gas treatment using an enclosed flare on the surface. Under conditions not suitable for flaring, gasses would alternatively be vented via a stack approximately 25 metres (m) high.
- Ancillary infrastructure, such as fencing, pumps, CO2 tanks, condensate tanks and surface pipes.
- Additional water management infrastructure (e.g. sediment controls).
- Process/fire water system, including bores to pump water from and return water to the underground mine workings and pipes/tanks to convey and store this water.
- Installation and use of a transportable substation for electricity requirements.
- Minor upgrades of existing electricity transmission infrastructure within Mining Lease (ML) 1566.
- Temporary bracing of the 2-span Bailey Bridge (Sandy Creek Crossing).

Construction activities associated with an application for the Dendrobium Mine Extension Project may occur in the next three years subject to approval.

Mining schedule

Mining development method and sequencing and general mine features.

The Dendrobium Mine currently extracts from the Wongawilli Seam within Consolidated Coal Lease (CCL) 768. Coal is extracted using conventional longwall underground mining methods. Underground main roads are also developed to access and support the underground operations. ROM coal is transported from the underground operations to the Kemira Valley Coal Loading Facility via an underground conveyor network, reaching the surface via the Kemira Valley Tunnel. ROM coal is temporarily stockpiled at the Kemira Valley Coal Loading Facility before being loaded onto trains for transport to the Dendrobium Coal Preparation Plant.

Three mining areas make up the approved mine plan for Dendrobium and are named Areas 1, 2 and 3 (including 3A, 3B and 3C). Mining is currently occurring within Area 3A.

Areas identified for emplacements, the sequencing of emplacements, construction, and management.

The coal wash from the Dendrobium Coal Preparation Plant will continue to be emplaced as landfill at the West Cliff Coal Wash Emplacement Area (CWEA) (Stage 3 CWEA) if alternative beneficial uses cannot be found i.e. coal wash to customers for engineering purposes (e.g. civil construction fill) or for other circular economy opportunities (e.g. beneficial uses).

Processing infrastructure activities and the location of tailings facilities and schedule for emplacement

ROM coal is transported from underground workings to the Kemira Valley Coal Loading Facility via an underground conveyor network. Sizing and stockpiling of coal take place at the Kemira Valley Coal Loading Facility prior to transport to the Dendrobium Coal Preparation Plant via the Kemira Valley Rail Line, in accordance with the approved hours of operation. The coal wash from the Dendrobium Coal Preparation Plant will continue to be emplaced as landfill at the West Cliff Coal Wash Emplacement Area (CWEA) if alternative uses cannot be found i.e. coal wash to customers for engineering purposes (e.g. civil construction fill) or for other circular economy opportunities (e.g. beneficial uses).

Waste disposal and materials handling operations.

Waste will be managed in accordance with the Dendrobium Waste Management Plan. Presently there are comprehensive waste segregation processes in place (on- and off-site) which significantly reduces the amount of general waste going to landfill. Waste generated by the project is collected and segregated into appropriate waste types to enable the proper facilitation of waste classification, storage, transport, disposal and tracking. Waste sorting is limited on site with most of the general and recyclable waste being sorted off site at an approved waste management facility. Transportation of up to approximately 1 Mtpa of coal wash may be required by road from the Dendrobium CPP to the West Cliff Stage 3 Coal Wash Emplacement Area where alternative uses cannot be found. Emplacement of coal wash is managed in accordance with the approved Coal Wash Emplacement Area Management Plan (CWEAMP).

Key production milestones

MATERIAL	UNIT	YEAR 1	YEAR 2	YEAR 3
Stripped topsoil (if applicable)	(m ³)	67	0	0
Rock/overburden	(m ³)	0	0	0
Ore	(Mt)	4.7	2.5	2.5
Reject material¹	(Mt)	1	0.5	0.5
Product	(Mt)	3.6	2	2

¹ This includes coarse rejects, tailings and any other wastes resulting from beneficiation.

Three-year rehabilitation forecast

Rehabilitation planning schedule

Rehabilitation planning schedule

Most facilities are required for the operational life of Dendrobium Mine. IMC is currently progressing investigations and studies to inform the rehabilitation works required for a number of Dendrobium and Cordeaux's redundant assets. Refer Forward Work Program and Schedule in the Dendrobium and Cordeaux RMP (Table 19, Page 49) - URL <https://www.south32.net/docs/default-source/illawarra-coal/dendrobium/mining-operations-plans/dendrobium-rehabilitation-management-plan.pdf>. Executing the rehabilitation work remains subject to the outcomes of these investigation and studies, as well as external and internal approval processes.

Investigations and engineering are underway, looking at redundant infrastructure associated with O'Briens Drift, however the rehabilitation works are not expected to take place within the next three years.

Investigations are underway for some of Dendrobium's redundant Powerlines - It is expected to take at least three years to complete investigations and progress into approvals phase.

Rehabilitation works are expected to take place at the redundant Dendrobium O'Briens Gap Pumphouse within the next twelve months.

The WC21 rehabilitation trial is planned to commence over the coming months. Refer Rehabilitation Research and Trials section.

Stakeholder consultation

Refer Table 18, Page 46 of the Dendrobium and Cordeaux RMP - URL: <https://www.south32.net/docs/default-source/illawarra-coal/dendrobium/mining-operations-plans/dendrobium-rehabilitation-management-plan.pdf>. The stakeholder consultation proposed over the next three years includes:

1. Consult with key agencies on the RMP Rehab Objectives and Completion Criteria (already underway); and
2. Discuss potential future land use options (for example mountain bike trails) for legacy sites and land surrounding Dendrobium (proposed).

Rehabilitation studies, risk assessments and/or design work

As mentioned previously, IMC is currently progressing investigations and studies to inform the rehabilitation works required for a number of Dendrobium's redundant assets. Refer Forward Work Program and Schedule in the Dendrobium and Cordeaux RMP (Table 19, Page 49) - URL <https://www.south32.net/docs/default-source/illawarra-coal/dendrobium/mining-operations-plans/dendrobium-rehabilitation-management-plan.pdf>. Executing the rehabilitation work remains subject to the outcomes of these investigation and studies, as well as external and internal approval processes.

Rehabilitation research and trials

RRT NUMBER	PROJECT/TRIAL NAME	OBJECTIVE OF TRIAL/PROJECT	METHODOLOGY	EXPECTED DATE OF COMPLETION	STATUS
RRT0001002	Investigations to Support Rehabilitation in WC21 and Donalds Castle Creek	The principal objective of the trial is to hold water in the two targeted pools following remediation activities.	Hand grouting, shallow pattern grouting and directional/angled grout curtain. Cofferdams and diversion piping will be used to divert any surface flow during works if required. It is likely that water will need to be pumped into the sites in order to assess the water holding potential of the pools following remediation. Overlying sediment will be managed during the drilling and grouting process.	31 Jul 2025	Ongoing

Rehabilitation maintenance and corrective actions

WC21 and Donalds Castle Creek Rehabilitation Trial: A monitoring program will remain in place during and after the implementation of the rehabilitation measures. The monitoring locations will be reviewed during the rehabilitation as required and can be modified (with agreement) accordingly. Analyses of monitoring data (principally pool water level recession curves) from pre-mining, control, impact and mitigation sites is used to determine the success of the rehabilitation. Observations undertaken as part of the monitoring program will provide contextual information to the above assessment approach. Monitoring data and observations are documented and reported. Objective performance criteria will be developed following the rehabilitation works and monitoring at the WC21 trial remediation sites.

Rehabilitation schedule

Refer Forward Work Program and Schedule in the Dendrobium and Cordeaux RMP (Table 19, Page 49) - URL <https://www.south32.net/docs/default-source/illawarra-coal/dendrobium/mining-operations-plans/dendrobium-rehabilitation-management-plan.pdf>.

Subsidence remediation for underground operations

Subsidence effects include surface and subsurface cracking, buckling, dilation and tilting. These effects have occurred in WC21 (Wongawilli Creek) and Donald's Castle Creek (DCC), resulting in changes to the hydrology of the streams. IMC is currently undertaking investigations to support the rehabilitation of WC21 and DCC. The investigations and remediation trials are detailed within the WC21 and DCC Remediation Plan (IMC, 2021); URL: <https://www.south32.net/docs/default-source/illawarra-coal/dendrobium/dendrobium-environmental-management-plans---surface-facilities/wc21-and-donalds-castle-creek-rehabilitation-plan.pdf> and summarised in the Dendrobium and Cordeaux RMP.

Monitoring and remediation of subsidence impacts from current longwalls will be undertaken in accordance with the relevant subsidence management plan.

Progressive mining and rehabilitation statistics

Three-yearly forecast cumulative disturbance and rehabilitation progression

FORECAST	UNIT	YEAR 1	YEAR 2	YEAR 3
A Total surface disturbance footprint	(ha)	349.64	349.64	349.64
B Total active disturbance	(ha)	308.33	308.33	308.33
C Land prepared for rehabilitation	(ha)	0.83	0.83	0.84
D Ecosystem and land use establishment	(ha)	3.23	3.35	3.47

Rehabilitation key performance indicators (KPIs)

FORECAST	UNIT	YEAR 1	YEAR 2	YEAR 3
O Total new active disturbance area	(ha)	0.13		
P Area proposed for active rehabilitation	(ha)	0.12	0.12	0.12
Q Annual rehabilitation to disturbance ratio		0.92		

Attachment 1 – Reporting Definitions

REPORTING CATEGORY	DEFINITION
<p>A Total disturbance footprint – surface disturbance</p>	<p>All areas within a mining lease that either have at some point in time or continue to pose a rehabilitation liability due to surface disturbance activities.</p> <p>The total disturbance footprint is the sum of the total active disturbance, decommissioning, landform establishment, growth medium development, ecosystem and land use establishment, ecosystem and land use development and rehabilitation completion (see definitions below).</p> <p>Underground mining operations should not include the footprint of underground mining areas/subsidence management areas in the total disturbance footprint.</p>
<p>B Total active disturbance</p>	<p>Includes on-lease exploration areas, stripped areas ahead of mining, infrastructure areas, water management infrastructure, sewage treatment facilities, topsoil stockpile areas, access tracks and haul roads, active mining areas, waste rock emplacements (active/unshaped/in or out-of-pit), tailings dams (active/unshaped/uncapped) and temporary stabilised areas (e.g. areas sown with temporary cover crops for dust mitigation and temporary rehabilitation).</p>
<p>C Rehabilitation – land preparation</p>	<p>Includes the sum of all disturbed land within a mining lease that have commenced any, or all, of the following phases of rehabilitation – decommissioning, landform establishment and growth medium development.</p> <p>Refer to the glossary of terms in this document for the definition of these phases of rehabilitation.</p>
<p>D Ecosystem and land use establishment</p>	<p>Includes the area which has been seeded/planted with the target vegetation species for the intended final land use. However, vegetation has not matured to a stage where it can be demonstrated that it will be sustainable for the long term and or require only a maintenance regime consistent with target reference/analogue sites.</p> <p>Typically, rehabilitation areas would be in this phase for at least two years (and usually more) before rehabilitation can be classified as being in the ecosystem and land use development phase. This phase does not apply to infrastructure areas that are being retained as part of final land use for the site.</p>

REPORTING CATEGORY	DEFINITION
O	The area of any new active disturbance that will be created during the next three years, as defined under definition A1 (definition A1 Table 5).
P	The sum of any new rehabilitation to be commenced in the next three years. These areas may be in the phases “Rehabilitation - Land Preparation” or the “Ecosystem & Land Use Establishment” (definitions C & D in Table 5).
Q	The rehabilitation to disturbance ratio (S / R) indicates how many hectares of new rehabilitation are undertaken for each hectare of land disturbed during the three years. A ratio of 1/1 indicates that the area of new rehabilitation and disturbance in that period are the same.

Attachment 2 – Definitions

WORD	DEFINITION
Active	In the context of rehabilitation, land associated with mining domains is considered ‘active’ for the period following disturbance until the commencement of rehabilitation.
Active mining phase of rehabilitation	In the context of rehabilitation, the active mining phase of rehabilitation constitutes the rehabilitation activities undertaken during mining operations such as salvaging and managing soil resources, salvaging habitat resources, and native seed collection. This phase also includes management actions taken during operations to manage risks to rehabilitation and enhance rehabilitation outcomes such as selective handling of waste rock and management of tailings emplacements.
Analogue site	In the context of rehabilitation, an analogue site is a ‘reference site’ that represents an example of the defining characteristics (such as vegetation composition and structure or agricultural productivity) of the final land use. Characteristics of analogue sites can be assessed to develop the rehabilitation objectives and completion criteria for final land use domains.
Annual rehabilitation report and forward program	As described in the Mining Regulation 2016.
Annual reporting period	As defined in the Mining Regulation 2016.
Closure	A whole-of-mine-life process, which typically culminates in the relinquishment of the mining lease. It includes decommissioning and rehabilitation to achieve the approved final land use(s).
Decommissioning	The process of removing mining infrastructure and removing contaminants and hazardous materials.
Decommissioning Phase of Rehabilitation	Activities associated with the removal of mining infrastructure and removal and/or remediation of contaminants and hazardous materials. In the context of the rehabilitation management plan this phase of rehabilitation may also include studies and assessments associated with decommissioning and demolition of infrastructure or works carried out to make safe or ‘fit for purpose’ built infrastructure to be retained for future use(s) following lease relinquishment.

WORD	DEFINITION
Department	The Department of Regional NSW.
Disturbance	See Surface Disturbance.
Disturbance area	<p>An area that has been disturbed and that requires rehabilitation.</p> <p>This may include areas such as on-licence exploration areas, stripped areas ahead of mining, infrastructure areas, water management infrastructure, sewage treatment facilities, topsoil stockpile areas, access tracks and haul roads, active mining areas, waste emplacements (active/unshaped/in or out-of-pit), tailings dams (active/unshaped/uncapped), and areas requiring rehabilitation that are temporarily stabilised (i.e. managed to minimise dust generation and/or erosion).</p>
Domain	<p>An area (or areas) of the land that has been disturbed by mining and has a specific operational use (mining domain) or specific final land use (final land use domain). Land within a domain typically has similar geochemical and/or geophysical characteristics and therefore requires specific rehabilitation activities to achieve the associated final land use.</p>
Ecosystem and Land Use Development	<p>This phase of rehabilitation consists of the activities to manage maturing rehabilitation areas on a trajectory to achieving the approved rehabilitation objectives and completion criteria.</p> <p>For vegetated land uses this phase may include processes to develop characteristics of functional self-sustaining ecosystems, such as nutrient recycling, vegetation flowering and reproduction, and increasing habitat complexity, and development of a productive, self-sustaining soil profile.</p> <p>This phase of rehabilitation may include specific vegetation management strategies and maintenance such as tree thinning, supplementary plantings and weed management.</p>
Ecosystem and Land Use Establishment	<p>This phase of rehabilitation consists of the processes to establish the approved final land use following construction of the final landform.</p> <p>For vegetated land uses this rehabilitation phase includes establishing the desired vegetation community and implementing land management activities such as weed control. This phase of rehabilitation may also include habitat augmentation such as installation of nest boxes.</p>
Exploration	Has the same meaning as that term under the State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007.

WORD	DEFINITION
Final landform and rehabilitation plan	As defined in the Mining Regulation 2016.
Final land use	As defined in the Mining Regulation 2016.
Form and way	Means the form and way approved by the Secretary. Approved form and way documents are available on the Department’s website.
Growth Medium Development	<p>This phase of rehabilitation consists of activities required to establish the physical, chemical and biological components of the substrate required to establish the desired vegetation community (including short lived pioneer species).</p> <p>This phase may include spreading the prepared landform with topsoil and/or subsoil and/or soil substitutes, applying soil ameliorants to enhance the physical, chemical and biological characteristics of the growth media, and actions to minimise loss of growth media due to erosion.</p>
Habitat	Has the same meaning as that term under the <i>Biodiversity Conservation Act 2016</i> and the <i>Fisheries Management Act 1994</i> (as relevant).
Indicator	An attribute of the biophysical environment (e.g. pH, topsoil depth, biomass) that can be used to approximate the progression of a biophysical process. It can be measured and audited to demonstrate (and track) the progress of an aspect of rehabilitation towards a desired completion criterion (i.e. defined end point). It may be aligned to an established protocol and used to evaluate changes in a system.
Land	As defined in the <i>Mining Act 1992</i> .
Landform Establishment	<p>This phase of rehabilitation consists of the processes and activities required to construct the final landform.</p> <p>In addition to profiling the surface of rehabilitation areas to the approved final landform profile this phase may include works to construct surface water drainage features, encapsulate problematic materials such as tailings, and prepare a substrate with the desired physical and chemical characteristics (e.g. rock raking or ameliorating sodic materials).</p>
Large mine	As defined in the Mining Regulation 2016.
Lease holder	The holder of a mining lease.

WORD	DEFINITION
Life of mine	The timeframe of how long a mine is approved to mine, from commencement to closure.
Mine rehabilitation portal	<p>Means the NSW Resources Regulator’s online portal that lease holders must use (via a registered account) to:</p> <ul style="list-style-type: none"> ■ upload rehabilitation geographical information system (GIS) spatial data ■ develop rehabilitation GIS spatial data (using online tracing functions) ■ generate rehabilitation plans and rehabilitation statistics using the map viewer and Rehabilitation Key Performance Indicator functionalities. <p>Data submitted to the mine rehabilitation portal is collated in a centralised geodatabase for use by the NSW Resources Regulator to regulate rehabilitation performance of lease holders.</p>
Mining area	As defined in the <i>Mining Act 1992</i> .
Mining domain	A land management unit with a discrete operational function (e.g. overburden emplacement), and therefore similar geophysical characteristics, that will require specific rehabilitation treatments to achieve the final land use(s).
Mining land	As defined in the <i>Mining Act 1992</i> .
Native vegetation	Has the same meaning as that term under section 60B of the <i>Local Land Services Act 2013</i> .
Overburden	Material overlying coal or a mineral deposit.
Performance indicator	An attribute of the biophysical environment (for example pH, slope, topsoil depth, biomass) that can be used to demonstrate achievement of a rehabilitation objective. It can be measured and audited to demonstrate (and track) the progress of an aspect of rehabilitation towards a desired completion criterion, that is, a defined end point. It may be aligned to an established protocol and used to evaluate changes in a system.

WORD	DEFINITION
Phases of rehabilitation	<p>The stages and sequences of actions required to rehabilitate disturbed land to achieve the final land use. The phases of rehabilitation are:</p> <ul style="list-style-type: none"> ■ active mining ■ decommissioning ■ landform Establishment ■ growth medium development ■ ecosystem and land use establishment ■ ecosystem and land use development.
Progressive rehabilitation	<p>The progress of rehabilitation towards achieving the approved rehabilitation completion criteria. This may be described in terms of domains, phases, performance indicators and rehabilitation completion criteria.</p>
Rehabilitation Completion	<p>The final phase of rehabilitation when a rehabilitation area has achieved the approved rehabilitation objectives and rehabilitation completion criteria for the final land use. Rehabilitation areas may be classified as complete when the NSW Resources Regulator has determined in writing that the relevant rehabilitation obligations have been fulfilled following submission of <i>Form ESF2 Rehabilitation completion and/or review of rehabilitation cost estimate</i> application by the lease holder.</p>
Rehabilitation Completion criteria	<p>As defined in the Mining Regulation 2016.</p>
Rehabilitation cost estimate	<p>As defined in the Mining Regulation 2016.</p>
Rehabilitation management plan	<p>As defined in the Mining Regulation 2016.</p>
Rehabilitation objectives	<p>As defined in the Mining Regulation 2016.</p>
Rehabilitation risk assessment	<p>As defined in the Mining Regulation 2016.</p>
Rehabilitation schedule	<p>The defined timeframes for progressive rehabilitation set out in the forward program.</p>

WORD	DEFINITION
Relevant stakeholders	Means any persons or bodies who may be affected by the mining operations, including rehabilitation, carried out on the lease land, and includes: <ul style="list-style-type: none"> ■ the relevant development consent authority ■ the local council ■ the relevant landholder(s) ■ community consultative committee (if required under the development consent) or equivalent consultative group ■ affected land holder(s) ■ government agencies relevant to the final land use ■ affected infrastructure authorities (electricity, telecommunications, water, pipeline, road, rail authorities) ■ local Aboriginal communities, and ■ any other person or body determined by the Minister to be a relevant stakeholder in relation to a mining lease.
Risk	The effect of uncertainty on objectives. It is measured in terms of consequences and likelihood (AS/NZS ISO 31000:2009).
Secretary	The Secretary of the Department.
Security deposit	An amount that a mining lease holder is required to provide and maintain under a mining lease condition, to secure funding for the fulfilment of obligations under the lease (including obligations that may arise in the future).
Surface disturbance	Includes activities that disturb the surface of the mining area, including mining operations, ancillary mining activities and exploration.
Tailings	A combination of the fine-grained solid material remaining after the recoverable metals and minerals have been extracted from the mined ore, and any process water ² .
Waste	Has the same meaning as that term under the <i>Protection of the Environment Operations Act 1997</i> .

² Commonwealth of Australia (DITR), 2007. *Tailings Management*.

Attachment 3 – Plans

DENCDX_2022_Plan2A.zip

DENCDX_2022_Domain 10_FC_Plan2B-C.pdf

DENCDX_2022_Domain 10_FC_Plan2C-C.pdf

Forward Program (LARGE MINE) v2.1