# NARRABRI MINE

# EXTRACTION PLAN

## COAL RESOURCE RECOVERY PLAN

PANELS 201 - 202

## Prepared by:

| Title | Name | Signature | Date |
|---|---|---|---|
| Senior Environmental Manager | S. van der Meulen<br>Onward Consulting |  | 30 March 2022 |
| Director | Mark Vile<br>Onward Consulting |  | 30 March 2022 |




Onward document number:
NCO-004B-0 PLN

## Document review history

In accordance with Project Approval Schedule 6 Condition 3, this document has been reviewed as follows:

| Review Date | Reason for review | Reviewed by | Revision required (Y/N) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |

# Acronyms and abbreviations

| Acronym | Description |
|---|---|
| º | degrees |
| AHD | Australian Height Datum |
| AR | Annual Review |
| CHPP | Coal Handling and Preparation Plant |
| CRRP | Coal Resource Recovery Plan (this document) |
| DGS | Ditton Geotechnical Services |
| DPE | The former NSW Department of Planning and Environment |
| DPE Water | The Water group within DPE |
| EA | Environmental Assessment |
| EPA | The NSW Environment Protection Authority |
| EP&A Act | *Environmental Planning and Assessment Act 1979* (NSW) |
| EP&A Regulation | Environmental Planning and Assessment Regulation 2000 |
| EPBC Act | *Environment Protection and Biodiversity Conservation Act 1999* (Cth) |
| ha | hectare |
| HSE | health, safety and environment |
| km | kilometre |
| m | metre |
| ML | mining lease |
| mm | millimetre |
| mm/m | millimetre per metre |
| Mt | million tonnes |
| Mtpa | million tonnes per annum |
| NCOPL | Narrabri Coal Operations Pty Ltd |
| NSC | Narrabri Shire Council |
| NSW | New South Wales |
| ROM | run of mine |
| UCS | unconfined compressive strength |
| WHC | Whitehaven Coal |

# Table of contents

# Tables



# Figures

# 1. Introduction

## 1.1 Background

The Narrabri Mine is an existing underground coal mining operation situated in the Gunnedah Coalfield. It is located approximately 25 kilometres (**km**) south-east of Narrabri and approximately 60 km north-west of Gunnedah, within the Narrabri Shire Council (**NSC**) Local Government Area in New South Wales (**NSW**). The Narrabri Mine includes an underground coal mine, a coal handling and preparation plant (**CHPP**) and associated rail siding and surface infrastructure.

The Narrabri Mine is operated by Narrabri Coal Operations Pty Ltd (**NCOPL**), on behalf of the Narrabri Mine Joint Venture, which consists of two Whitehaven Coal Limited (**WHC**) wholly owned subsidiaries, and other joint-venture partners[1]. The underground mine is covered by Mining Lease (**ML**) 1609 which covers an area of 5,298 hectares (**ha**) for the predominant purpose of mining for coal from the Hoskissons Coal Seam.

Stage 1 of the Narrabri Mine was approved in November 2007 under Part 3A of the *Environmental Planning and Assessment Act 1979* (**EP&A Act**). Construction of the mine and supporting infrastructure commenced in 2008, with production using a continuous miner following in 2010. Following the approval of the Stage 2 Environmental Assessment (R.W Corkery & Co., 2009) (the **EA**) and the issue of Project Approval 08_0144 for Stage 2 (**Project Approval**) in July 2010 and EPBC approval (2009/5003) in January 2011, the Narrabri Mine was converted to an 8 million tonnes (**Mt**) per annum (**Mtpa**) run of mine (**ROM**) longwall mining operation, which commenced in 2012.

The Project Approval has subsequently been modified on a number of occasions. The environmental assessment for Modification 5 (Resource Strategies, 2015) (**MOD 5**), approved in December 2015, changed the mine geometry by reducing the number of longwall (**LW**) panels from 26 to 20, increased some LW panel widths and increased the production to 11 Mtpa of ROM coal until July 2031.

Modification 7, the most recent modification of the Project Approval, was approved on 23 November 2021. The environmental assessment for Modification 7 (Resource Strategies, 2021) (**MOD 7**) describes the change in mining method within the extent of the previously approved LW 201 and LW 202 and allows for up to 0.7 Mtpa via bord and pillar extraction at pillar reduction panels CF 201 to CF 205[2]. The bord and pillar mining will occur concurrently with longwall operations, and is scheduled to commence in 2022 for a period of approximately five years. The maximum ROM coal production rate of the concurrent operation remains within the approved limit of 11 Mtpa.

The Extraction Plan provides further details of the Narrabri Mine operations to date; a consideration of the applicable statutory requirements and the modifications to the Project Approval; and information relevant to the extraction of coal from pillar reduction panels CF 201 to CF 205 (hereafter referred to as **Panels 201 to 202**). The surface area predicted to be affected by the proposed secondary extraction of Panels 201 to 202 has been defined as the **Extraction Plan Area**.

The underground mining layout for Panels 201 to 202 is presented in Figure 1.1 and is further described in section 3.3.

[1] For full details on the joint venture ownership, please refer to the introduction of the Extraction Plan.

[2] The pillar reduction panel naming 'CF' is an acronym for 'cut and flit'.


Source: Geoscience Australia (2011); NSW Spatial Services (2019)

LEGEND

— — Underground Mine Footprint

—E— Electricity Transmission Line (Constructed)

ONWARD CONSULTING

NARRABRI COAL MINE

**Figure 1.1 : Underground Mining Layout for Panels 201 and 202**

## 1.2 Purpose and scope

As required by Project Approval Schedule 6 Condition 2, this Coal Resource Recovery Plan (**CRRP**) for Panels 201 to 202 has been prepared in accordance with the former NSW Department of Planning and Environment (**DPE**) *Draft Guidelines for the Preparation of Extraction Plans* (unpublished) (**Extraction Plan Guidelines**). It complies with Schedule 3 Condition 4(g) of the Project Approval, which states that, as part of the Extraction Plan, a CRRP is to be prepared to the satisfaction of the NSW Resources Regulator that demonstrates the effective recovery of the available coal resource through underground mining activities.

In order to comply with the relevant statutory requirements outlined in the Project Approval, this CRRP provides a description of the:

- coal resource available;
- proposed mining method, schedule and mine plan;
- resource recovery and effects on future mining; and
- justification for the proposed mine plan.

Attachment 2 to the Extraction Plan in the form of Plan 1 to 8 provides supporting information regarding details of coal resource, geological data, existing and proposed workings, potentially impacted surface features and subsidence monitoring.

## 1.3 Objectives

The objective of this CRRP is to detail the efficient and effective extraction of coal from pillar reduction panels CF 201 to CF 205 (hereafter referred to as Panels 201-202).

## 1.4 Statutory requirements

This CRRP has been prepared in accordance with the applicable conditions and requirements of the Project Approval, EPBC 2009/5003, ML 1609 and all relevant legislation and guidelines as set out in the following sections. A full consideration of the applicable compliance requirements is provided in section 2 of the Extraction Plan.

### 1.4.1 Project Approval

There are no specific Project Approval conditions related to the CRRP. There are also no specific commitments in the Statement of Commitments (Appendix 3 of the Project Approval) related to the CRRP.

### 1.4.2 EPBC approval

The Narrabri Mine is subject to EPBC 2009/5003 issued under the EPBC Act. There are no specific EPBC conditions related to this CRRP.

### 1.4.3 Mining lease

The original ML 1609 issued in 2008 has been amended to include a reference to Extraction Plans, removing the requirements for a Subsidence Management Plan. Table 1.1 lists the relevant conditions from the ML related to resource recovery, and where these are addressed in this CRRP.

**Table 1.1 - Relevant ML 1609 condition**

| Mining Lease 1609 condition | | CRRP reference |
|---|---|---|
| **Condition** | **Summary of the requirement** | |
| 25 | **Resource Recovery**<br>NCOPL shall recover the minerals which the ML entitles NCOPL to mine and which are economically recoverable from the ML area or which for environmental reasons are necessary to be recovered | Section 3.7 |

### 1.4.4 Extraction Plan Guidelines

As stated in the Extraction Plan Guidelines, any required CRRP should also be included as an attachment to the Extraction Plan. Further details regarding how the requirements of the Extraction Plan Guidelines are addressed are provided in section 1.8 of the Extraction Plan.

## 1.5 Risk assessment

A subsidence risk assessment has been undertaken to identify the risks associated with subsidence at the Narrabri Mine. It builds on previous risk assessments completed for LW 101 to LW 110 and is presented as Appendix K to the Extraction Plan.

The updated risk assessment for Panels 201 to 202 has not identified any high-risk items and as a result, risks associated with subsidence within the Extraction Plan Area for the Narrabri Mine have been assessed as low to moderate.

## 1.6 Consultation and approval

The development of this CRRP does not require any specific individual consultation during preparation.

The overall consultation and approval process required for the Extraction Plan by the Project Approval is detailed in section 1.9 of the Extraction Plan.

## 1.7 Access to information

In accordance with Schedule 6 Condition 10 of the Project Approval, the approved Extraction Plan and all appendices, including this CRRP, are publicly available on the WHC website. All information will be kept up to date.

Note that any printed copies of this CRRP are uncontrolled.

# 2. Geological and geotechnical setting

## 2.1 Regional geology

As described in the EA, the Narrabri Mine is located within the Permo-Triassic Gunnedah Basin, which forms the central part of the north-south elongate Sydney-Gunnedah-Bowen Basin system. The Narrabri Mine is located in the near the north-western boundary of the Gunnedah Basin and the eastern margin of the Surat Basin, a sub-basin of the larger Great Artesian Basin. Hence, the rocks and sediments beneath and surrounding the mine can be grouped into:

- undifferentiated Quaternary sediments;
- Jurassic Surat Basin sequence; and
- the Gunnedah Basin sequence.

The Boggabri Ridge, comprising Early Permian volcanic rocks, forms the basement of the Gunnedah Basin and divides the basin into two parts, the Maules Creek sub-basin to the east, and the Mullaley sub-basin to the west.

The Narrabri Mine is located within the Mullaley sub-basin which contains Permian and Triassic sedimentary and volcanic rocks. The rocks strike approximately north-south and dip to the west at an angle of less than 10 degrees (°). In the area of ML 1609, adjacent to the Boggabri Ridge, there is a local angular unconformity between the Late Permian Black Jack Group and the overlying Triassic Digby Formation.

The western part of ML 1609 is overlain by Jurassic sedimentary and volcanic rocks along the eastern margin of the Oxley Embayment, a part of the Surat Basin.

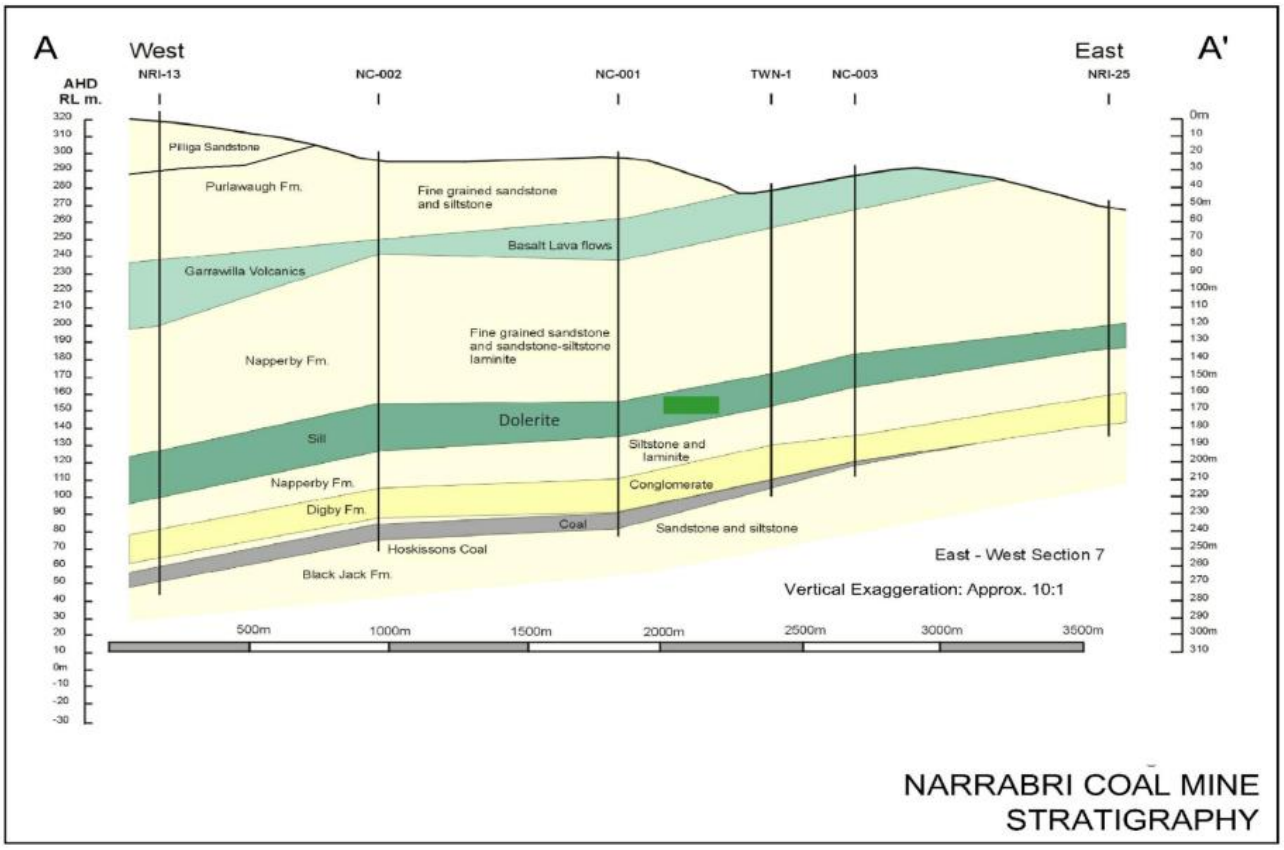
## 2.2 Local geology and stratigraphy

As described in the EA, the rocks throughout ML 1609 strike north-south and dip gently to the west. Minor variations to the north-south strike may be the result of variable thickness and compaction of the sedimentary units being draped over the faulted and uneven surface on the underlying Boggabri Volcanics. To the east of ML 1609, the Boggabri Volcanics have been uplifted and faulted along a north-south trending anticline structure, the Boggabri Ridge. The proximity of ML 1609 to the Boggabri Ridge is a major control on the outcrop and structure of the local geology.

The stratigraphic sequence at the Narrabri Mine is illustrated in a representative east-west cross section in Figure 2.1. Each unit in the sequence depicted is further described below.

**Quaternary Sediments**

Undifferentiated Quaternary alluvial gravel, sand silt and clay overly the Jurassic and Triassic rocks. Whilst not apparent in the cross-section depicted in Figure 2.1, these sediments are present in the east and northeast of the Narrabri Mine associated with the Namoi River, located to the east of the Narrabri Mine.




Source: DGS, 2021. Figure 4A.

**Figure 2.1 - Typical section of lithology (east - west) across the Extraction Plan Area**

## Surat Basin (Great Artesian Basin) Sequence (Jurassic)

The Pilliga Sandstone crops out along the western margin of ML 1609. It is up to 60 m thick (DME Narrabri DDH-30) and consists of medium bedded, cross-bedded, well sorted, and fine to coarse grained quartz sandstone. The Purlawaugh Formation is up to 140 m thick and crops out over the western half of ML 1609. It consists of thinly bedded, generally fine grained, silty lithic sandstone, siltstone and minor claystone. Thin stony coal seams are present in the lower part of the unit.

The Garrawilla Volcanics unconformably overlie the Triassic Napperby Formation or the Deriah Formation where it is present. The volcanics consist mainly of alkali basalt flows with very minor intervening mudstone and clastic rocks. The Garrawilla Volcanics are up to 40 m thick.

## Gunnedah Basin Sequence (Permian to Triassic)

The Napperby Formation is up to 140 m thick. It consists of a coarsening-up sequence of siltstone, sandstone/siltstone laminite, and fine to medium grained quartz-lithic sandstone. An intrusive dolerite sill is present in the lower part of the Napperby Formation in ML 1609. It varies in thickness from 0 to 30 m but is typically 15 to 20 m thick. It occurs approximately 30 to 35 m above the base of the Napperby Formation. It is dark green alkali basalt and is almost certainly related to the Garrawilla Volcanics. The basalt typically has strongly developed sub-vertical fractures infilled with secondary chlorite and zeolite minerals. The fractures do not continue into the enclosing rocks and may be related to cooling shrinkage.

The Digby Formation is divided into two units, the lower Digby Conglomerate and the overlying Ulinda Sandstone. The Ulinda Sandstone is either not present in ML 1609 or the boundary between these units is not clear with interbedded conglomerate and sandstone common in the top of the conglomerate. Consequently, the whole unit is referred to as the Digby Conglomerate in this area.

The Digby Conglomerate unconformably overlies the coal-bearing Black Jack Group. The unit consists mainly of thickly bedded, polymictic, lithic, pebble conglomerate with clasts of volcanic, meta-sediment and jasper in a lithic rich matrix. Minor finely to medium bedded, lithic sandstone beds are present towards the top of the unit. The Digby Formation is typically 15 to 20 m thick in ML 1609. The boundary with the underlying Black Jack Group is an angular unconformity. In the east of ML 1609, it cuts the Hoskissons Seam at a depth of approximately 130 to 160 m below the land surface. In the west, over a distance of approximately 5 km, there is up to 20 m of the Black Jack Group remaining above the Hoskissons Seam.

The Black Jack Group consists of lithic sandstone, siltstone, claystone and coal with minor tuff. It is up to 70 m thick in the western part of the ML 1609 but is less than 40 m thick in the east due to the low angle unconformity with the overlying Digby Formation. The Hoskissons Seam and the Melville Seam are present within ML 1609. Thickness and quality characteristics are such that only the Hoskissons Seam is currently considered to contain coal resources with mining potential.

Throughout ML 1609, the Black Jack Formation includes the following strata:

- Arkarula Formation - quartzose sandstone and siltstone. Typically, the upper 10 m of the Black Jack Formation;
- Brigalow Formation - coarse sandstone and conglomerate interbedded with the coal seam and grades laterally into the Arkarula Formation, thickening to the west across the Narrabri Mine from 2 to 19 m; and
- Pamboola Formation - lithic sandstone, siltstone, claystone and coal. Continuous over the Narrabri Mine below the Arkarula Formation and Brigalow Formation with a thickness of between 55 and 75 m.

### 2.2.1 Geological structure and geotechnical attributes

As noted previously, the major structural elements of the local geology are influenced by the proximity of the Boggabri Ridge. Regional aeromagnetic data indicates a strong north-west structure trend with northwest trending fault blocks in the basement. Exploration has identified one major fault in the northern area of the ML and two fault zones in the southern area of the ML. Each of these structures is oriented in a NW-SE direction and the northern structure decreases in magnitude towards the west. The geotechnical attributes of the various overlying units, the seam and seam floor are discussed in Table 2.1.

### Table 2.1 - Roof and floor strata features by geological unit

| Unit | Description | Comments |
|---|---|---|
| Napperby Formation | Comprises mudstones, siltstones, sandstones and sandstone/siltstone laminites. Some units very weak, particularly along bedding planes and laminae. | This unit is not significant operationally. However, the drifts and ventilation shaft pass through the formation for the majority of their length. Excavation was relatively easy, however some sections required high density support and in these areas the depth of cut before supporting was restricted.<br>This unit is expected to behave favourably in relation to longwall mining. |
| Dolerite sill | Basalt sill 40 to 60 m above the coal seam which is very strong. | Operational impact is expected to be slight due to the amount of interburden together with its fractured nature. |
| Digby Formation | Weakly cemented conglomerate with high matrix to pebble ratio. Strength tests indicate moderate strength. | Operational impact is not expected to be as severe as other NSW conglomerates but the unit would behave massively, possibly more like a massive sandstone. Consequently, difficulty in achieving first cave and periodic weighting is anticipated. Stress tests indicate it is highly stressed relative to strength which should help the unit to cave following mining. |
| Benelabri Formation | These sandstone, sandstone/siltstone layers are not always present. They increase in thickness towards the west, separating the coal from the conglomerate. Moderate strength. | As significant thickness of roof coal is to be carried, these layers are not of great importance in terms of roof behaviour. However, by increasing the separation between the working section and the base of the conglomerate at the face start positions in the west, they would positively influence the potential for windblasts. |
| Roof coal | Generally, greater than 1m of clean coal in immediate roof. | The roof coal is expected to form a good roof on development with low stress as a result of shielding by the overlying conglomerate, such that roof support densities on development would be towards the lower end of those commonly found in other coal regions. Higher levels of secondary support may be required on retreat as a result of the altered stress field. |
| Working section | Not heavily cleated. Extent of jointing not known. | Refer to section 3.5 and the Mine Subsidence Assessment Report provided as Appendix B of the Extraction Plan for assessments of stability of underground workings. |
| Arkarula / Brigalow Formation | Tests indicate moderate strength floor with no slaking tendency. | Floor problems are not anticipated. |

# 3. Mining system and resource recovery

## 3.1 Coal resource

The coal resource at the Narrabri Mine consists of the Hoskissons Seam, which strikes generally north-south and dips gently to the west and ranges from 4.5 to 9.5 m thickness across the Extraction Plan Area. In the eastern half of ML 1609, the seam is cut off at a depth of approximately 160 m by a low angle unconformity between the coal seam and the overlying Digby Formation. The lower portion of the seam contains low-ash coal suitable for thermal applications, whilst the upper section contains high-ash stony coal and tuffaceous claystone bands that will remain in the roof where the seam thickness exceeds 4.3 m (the target mining height).

## 3.2 Mining method

Longwall mining is more cost effective for longer panels and therefore continues to be the preferred mining method. However, given the shorter length of LW 201 and LW 202 and the geological conditions identified in the area, NCOPL has identified the opportunity to cost-effectively mine coal within Panel 201 and 202 via bord and pillar methods concurrently with ongoing longwall mining elsewhere. This has the economic advantage of extracting better quality ROM coal within Panel 201 and 202 earlier in the mine schedule, which results in an improved forecast economic return.

Coal is transferred via a conveyor system to the Pit Bottom Area for transfer to the surface via the drift conveyor.

## 3.3 Mine design, geometry and depth of cover

Using the information gathered during exploration activities, the mine plan has been designed to maximise resource recovery in those areas which appear to be free of major structural disturbance and which would support a high-production operation of bord and pillar mining. The proposed layout of Panels 201-202 is shown in Figure 1.1, and in Plan 1 provided as part of Attachment 2 to the Extraction Plan. The five pillar reduction panels will be extracted from north to south and from east to west.

The pillar reduction panels will have cover depths ranging from 177 to 212 m and widths ranging from 154 to 280 m. The completed panels will have ‘critical’ to ‘supercritical’[3] width to height (**W/H**) ratios of 0.80 to 1.39. The panel lengths will range from 155 to 348 m.

The production panels will be developed on a grid of 30.5 m square pillars (solid) in the upper 3.2-3.5 m of the lower Hoskissons Seam and second workings will ‘pocket’ every second row of pillars and increase the extraction ratio from 31 % to 66 %. The floor would then be brushed to 1.1 m depth on retreat to give a total roadway height of 4.3 m.

The north-south orientated, intra-panel (gate road) pillars will separate the production panels and include two outside rows (29.5 to 38.5 m wide x 35.1 m to 39.8 m long) and two inside rows (25 m wide x 29 m to 59 m long). Some of the two inside row pillars may also be extracted on retreat, depending on conditions, to leave residual pillar widths of 13 m.

[3] Refer to the Mine Subsidence Assessment in Appendix B to the Extraction Plan for full details regarding the definitions for critical and supercritical subsidence behaviour.

The inter-panel (barrier) pillars between the CF panels will be orientated east-west and 34 to 64 m wide after second workings. The barrier pillars will have stub headings extracted on a centre spacing of 37 m, with at least one lift left and right on advance.

A summary of the pillar reduction panel geometry is provided in Table 3.1.

**Table 3.1 - Proposed pillar reduction panel dimensions**

| Panel / sub-panel | Mean cover depth [H] (m) | Panel width [W] (m) | W/H ratio | E-W barrier pillar (m) | N-S gateroad pillar (m) |
|---|---|---|---|---|---|
| **Proposed pillar reduction mining geometry (66% extraction ratio)** | | | | | |
| CF 201-A | 185 | 272 | 1.47 | 56 x 348.5 | 34.3 x 39.8 |
| CF 201-B | 210 | 273 | 1.30 | 50 x 348 | 38.5 x 39.2 |
| CF 202-C | 182 | 235 | 1.29 | 64 x 339 | 31.8 x 35.1 |
| CF 202-D | 199 | 199 | 1.00 | 64 x 339 | 30.6 x 38.2 |
| CF 203-E | 186 | 199 | 1.07 | 41 x 339 | 30.7 x 35.2 |
| CF 203-F | 194 | 236 | 1.22 | 41 x 339 | 30.4 x 38.3 |
| CF 204-G | 194 | 236 | 1.22 | 34 x 339 | 29.7 x 35.1 |
| CF 204-H | 194 | 199 | 1.03 | 34 x 339 | 30.6 x 37.9 |
| CF 205-I | 188 | 188 | 1.00 | 28 x 54 | 32.6 x 35.3 |
| CF 205-J | 191 | 287 | 1.50 | 19 x 223 | 29.5 x 38.2 |

## 3.4 Schedule

NCOPL's underground mining operations and associated surface support activities will be conducted seven days a week, 24 hours a day on a rotating shift basis. Surface operations not required specifically for underground mining (e.g. administration) operate during standard business hours. The headings of the mains are developed by the continuous miners at a potential rate of approximately 120 m per week, with the gate road headings developed at a rate of approximately 240-280 m per week.

Extraction via the bord and pillar method will occur concurrently with the existing longwall operations and is scheduled to commence in 2022. Bord and pillar mining will occur over approximately five years at a rate of 0.7 Mtpa OM coal.

Anticipated and actual start and completion dates are summarised in Table 3.2, dependent on relevant mining constraints and status of subordinate approvals. The maximum annual mining rate will not exceed 11 Mt.

**Table 3.2 - Proposed mining schedule (secondary extraction)**

| Panel | Estimated starting date | Duration | Estimated completion date |
|---|---|---|---|
| CF 201 | March 2022 | 12 months | Mar 2023 |
| CF 202 | Mar 2023 | 11 months | Jan 2024 |
| CF 203 | Jan 2024 | 8 months | Aug 2024 |
| CF 204 | Aug 2024 | 10 months | May 2025 |
| CF 205 | Jun 2025 | 11 months | Apr 2026 |

## 3.5 Stability of underground workings

The maximum subsidence above the proposed pillar reduction panels would depend on the stability of the remnant pillars after mining is completed. The stability of the pillars has been assessed based on consideration of the following key factors usually associated with the behaviour of pillar-roof-floor strata systems:

- panel geometry (i.e. width, cover depth and mining height) and mining method;
- pillar stress and strength;
- pillar factor of safety;
- pillar width/height ratio (w/h); and
- bearing capacity of immediate roof and floor strata.

The probability of instability for the pillars within bord and pillar panels have been assessed and the magnitude of the stress acting on the pillars is dependent on the cover depth, direction of loading and width of the second workings area or goaf. The pillar width/height ratio is also a very important factor that indicates the post-yield behaviour of the pillars when they are overloaded. Pillars with w/h ratios <3 are considered most likely to 'strain-soften' and result in rapid failure and pillar runs, whereas w/h ratios >5 are more likely to fail slowly or squeeze, yield and then 'strain-harden'. These w/h ratio ranges, however, should be used as a guide only, as all pillar sizes are susceptible to 'weak' interface contacts or mid-angled structure that allow loss of confinement under load, and therefore, have the potential to modify strength and post-yield performance.

As the mine progresses updated reports will be commissioned to meet the mining geological conditions.

## 3.6 Future mining

The bord and pillar mining of Panels 201 and 202 will occur concurrently with the existing longwall operations and is scheduled to commence around March 2022. Following the completion of LW 109 and LW 110, extraction will progress to LW 203 to LW 209, followed by LW 111 and LW 108a. It is intended that longwalls will be extracted sequentially along the northern side of the main headings working inbye then along the southern side of the main headings working outbye.

Subsequent Extraction Plans will be prepared for individual or groups of longwall panels based on the mine forecasting information that will be prepared as operations progress.

## 3.7 Resource recovery

The mining layout has been optimised to achieve maximum resource recovery within the ML 1609 boundary, based on the geological constraints discovered to date, surface constraints (including heritage items) and the proposed bord and pillar extraction method. The expected resource recovery from Panels 201-202 is shown in Table 3.3.

**Table 3.3 - Reserves and resource recovery**

| Panel | *In-situ* reserve (incl. roof coal) (Mt) | Recovered coal (Mt) | Recovery (%) |
|---|---|---|---|
| CF 201-A | 1,343,346 | 330,001 | 25 |
| CF 201-B | 1,873,645 | 371,179 | 20 |
| CF 202-C | 939,087 | 279,275 | 30 |
| CF 202-D | 1,066,031 | 228,318 | 21 |
| CF 203-E | 666,720 | 223,718 | 34 |
| CF 203-F | 1,131,313 | 257,340 | 23 |
| CF 204-G | 774,986 | 278,012 | 36 |
| CF 204-H | 816,993 | 231,170 | 28 |
| CF 205-I | 516,460 | 189,781 | 37 |
| CF 205-J | 1,008,442 | 369,140 | 37 |

As a result of proposed mining, there will be some subsidence impacts on the overlying strata. However, the overlying strata contain no currently identified viable coal seams within the geographical and depositional constraints of the deposit. Within the Hoskissons Seam, the top 4 m of the seam generally contain bedded tuffaceous bands that significantly reduce the quality of this upper resource. The proposed mining layout provides for the best resource recovery for CF 201-205 utilising proven conventional mining techniques, however it is noted that the operation will not recover the lower quality roof coal within the Hoskissons Seam.

## 3.8 Justification

The Mine Plan (refer to Plan 1 in Attachment 1 to the Extraction Plan) has been developed based on extensive drilling, groundwater modelling, environmental investigation and assessment and consultation with relevant authorities, as described in the EA, MOD 5 and MOD 7. Panel boundaries are primarily constrained by the geology and characteristics of the Hoskissons Seam, and the mine plan has been developed to maximise resource recovery and allow for a high production mning operation.

The Subsidence Monitoring Program provided as Appendix C to the Extraction Plan summarises the overall monitoring of mining impacts on the natural and built environments, with management actions detailed in the relevant environmental management plan(s) or the Built Features Management Plan. This is further detailed on Plan 2 in Attachment 1 to the Extraction Plan. Further detailed information regarding the Narrabri Mine operation is provided in the EA, MOD 5 and MOD 7. The proposed monitoring and management of subsidence impacts associated with secondary extraction, in order to minimise impacts to surface features at the Narrabri Mine is documented in the Extraction Plan and associated sub-plans.

# 4. Evaluation and review

As required by Schedule 6 Condition 3 of the Project Approval, within three months of any of the following:

- completion of an independent environmental audit (as required by Schedule 6 Condition 7);
- submission of an Incident Report (as required by Schedule 6 Condition 4);
- submission of an Annual Review (as required by Schedule 6 Condition 6); and
- any modification to the conditions of the Project Approval (unless the conditions require otherwise),

NCOPL will the review, and if necessary, revise this CRRP. This is to ensure that the strategies, plans and programs are updated on a regular basis, and incorporate any recommended measures to improve the environmental performance of the Narrabri Mine operations. The review history table in the front of this Plan provides the details of each review.

Condition 3 of Schedule 6 further states that if the review determines that this CRRP requires revision, then this will be completed to the satisfaction of the Secretary.

# 5. References

Department of Planning and Environment (unpublished). *Guidelines for the Preparation of Extraction Plans*.

Ditton Geotechnical Services (2017) *Mine Subsidence Assessment for the Proposed LW107 to LW110 Extraction Plan at the Narrabri Mine*. Prepared for Narrabri Coal Operations Pty Ltd.

Ditton Geotechnical Services (2021) *Mine Subsidence Assessment for Pillar Reduction Panels CF201-CF205 (A-J) and Longwalls LW203 to LW205 at the Narrabri Underground Mine*. Prepared for Narrabri Coal Operations Pty Ltd. DGS Report No. NAR-004/8. Prepared for Narrabri Coal Operations Pty Ltd.

Resource Strategies (2015) *Narrabri Mine Modification 5 - Environmental Assessment*. Prepared for Narrabri Coal Operations Pty Ltd.

Resource Strategies (2021) *Narrabri Mine Modification 7 - Environmental Assessment.* Prepared for Narrabri Coal Operations Pty Ltd.

RW Corkery & Co. Pty Ltd (November 2009) *Environmental Assessment for the Narrabri Coal Mine Stage 2 Longwall Project*, Project Application No:MP08_0144. Prepared for Narrabri Coal Operations Pty Ltd.

# 6. Glossary

| Term | Definition[4] |
|---|---|
| Angle of draw | The angle between the vertical and the line joining the edge of the mining void with the limit of vertical subsidence, usually taken as 20 mm. |
| Anomalous subsidence | Normally refers to unexpected subsidence effects and is usually caused by latent geological conditions (joints, faults, dykes) |
| Chain pillar | The pillar(s) of coal left between adjacent longwall panels. This forms a barrier that allows the goaf to be sealed off and facilitates tailgate roof stability. |
| Compressive strain | A decrease in the distance between two points on the surface. This can cause shear cracking or steps at the surface if > 3 millimetres per metre (mm/m). |
| Council | Narrabri Shire Council |
| Cover depth | The depth of coal seam from the ground surface (metres). |
| Department | The NSW Department of Planning and Environment (DPE) |
| Environmental consequences | The environmental consequences of subsidence impacts including: damage to built features; loss of surface flows to the subsurface; loss of standing pools; adverse water quality impacts; development of iron bacterial mats; cliff falls; rock falls; damage to Aboriginal heritage sites; impacts to aquatic ecology; ponding. |
| Extraction Plan Area | The area predicted to be affected by the proposed secondary extraction of the approved pillar reduction panels CF 201-205 |
| First workings | Development headings created by a continuous mining machine - designed to remain stable during development and longwall extraction. Provide ventilation and services, access for staff and materials, and allow for transportation of raw coal out of the mine (i.e. also referred to as mains headings, gate roads, maingate, tailgate). |
| Goaf | The mined-out area into which the immediate roof strata breaks. |
| Groundwater | Water contained in the interconnected pore spaces and voids of the saturated zone of sediments and rocks. |
| Incident | An occurrence or set of circumstances that causes or threatens to cause material harm and which may or may not be or cause a non-compliance |
| Minimise | Implement all reasonable and feasible mitigation measures to reduce the impacts of the Narrabri Mine |
| MOD 5 | Reduced the number of longwall panels from 26 to 20; increased the longwall panel widths for LW 107 to LW 120 from approximately 295 m to approximately 400 m; extended the western footprint approximately 60 m; and increased the maximum ROM coal processing rate from 8 Mtpa to 11 Mtpa. |
| MOD 7 | Describes the change in mining method within the extent of the previously approved LW 201 and LW 202 and allows for up to 0.7 Mtpa via bord and pillar extraction at pillar reduction panels CF 201 to CF 205 |
| Panels 201 to 202 | Pillar reduction panels CF 201 to CF 205 |
| Planning Secretary | Planning Secretary under the EP&A Act, or nominee |
| Project Approval | Development consent (DA_08_0144) issued on 26th July 2010 under Section |

[4] The majority of the definitions are as provided in Project Approval 08_0144.

| Term | Definition[4] |
|---|---|
| | 75J of the *Environmental Planning and Assessment Act 1979* by the Department of Planning & Infrastructure (as modified). |
| Rehabilitation | The restoration of land disturbed by the development to ensure it is safe, stable and non-polluting over the short, medium and long term |
| Second workings | Extraction of coal from longwall panels, mini-wall panels, or pillar extraction. |
| Subsidence | The totality of subsidence effects, subsidence impacts and environmental consequences of subsidence impacts. |
| Subsidence effects | Deformation of the ground mass due to mining, including all mining-induced ground movements, including both vertical and horizontal displacement, tilt, strain and curvature. |
| Subsidence impacts | Physical changes to the ground and its surface caused by subsidence effects, including tensile and shear cracking of the rock mass, localised buckling of strata caused by valley closure and upsidence and surface depressions or troughs. |
| Tailgate | Refers to the tunnels or roadways down the side of a longwall block which provides a ventilation pathway for bad or dusty air away from the longwall face. It is usually located on the side of the longwall panel adjacent to extracted panels or goaf. |
| Tensile strain | An increase in the distance between two points on the surface. This is likely to cause cracking at the surface if it exceeds 2 mm/m. Tensile strains are usually associated with convex (hogging) curvatures near the sides (or ends) of the panels. |
| Tilt | The rate of change of subsidence between two points (A and B), measured at set distances apart (usually 10 m). Tilt is plotted at the mid-point between the points and is a measure of the amount of differential subsidence |
| Unacceptable risk | The level of risk at which mitigation actions are deemed to be warranted. |
| Upsidence | Relative vertical upward movements of the ground surface associated with subsidence. |
| Vertical subsidence | Vertical downward movements of the ground surface caused by underground coal mining. |
| Watercourse | A river, creek or other stream, including a stream in the form of an anabranch or tributary, in which water flows permanently or intermittently, regardless of the frequency of flow events: In a natural channel, whether artificially modified or not, or in an artificial channel that has changed the course of the stream. It also includes weirs, lakes and dams |