Longwalls 205 to 208

Coal Resource Recovery Plan

October 2020

DOCUMENT CONTROL

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1 INTRODUCTION

This Coal Resource Recovery Plan (CRRP) has been prepared as part of the Ashton Coal Extraction Plan for Longwalls 205 to 208.

1.1 SCOPE & OBJECTIVE

The CRRP has been prepared to demonstrate the effective recovery of the available resource in Longwalls 205 to 208 within the Upper Lower Liddell (ULLD) Seam at the Ashton Underground Coal Mine using conventional longwall mining techniques (**Figure 1**).

This CRRP has been prepared in accordance with Condition 32(g), Schedule 3 of DA 309-11-2001-i (MOD 5) as a component of the Ashton Coal Mine Longwalls 205 to 208 Extraction Plan.

This report provides a description of the:

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

Graphical Plans (included with the main Extraction Plan) provide supporting information and provide details of the coal resource, existing and proposed workings, and impacted surface features. The plans have been prepared in accordance with the *Guidelines for the Preparation of Extraction Plans (Draft V5)* (Extraction Plan Guidelines) provided to Ashton Coal Operations Pty Ltd (ACOL) by the Department of Planning and Environment (now Department of Planning, Industry and Environment [DPIE]) in 2016.

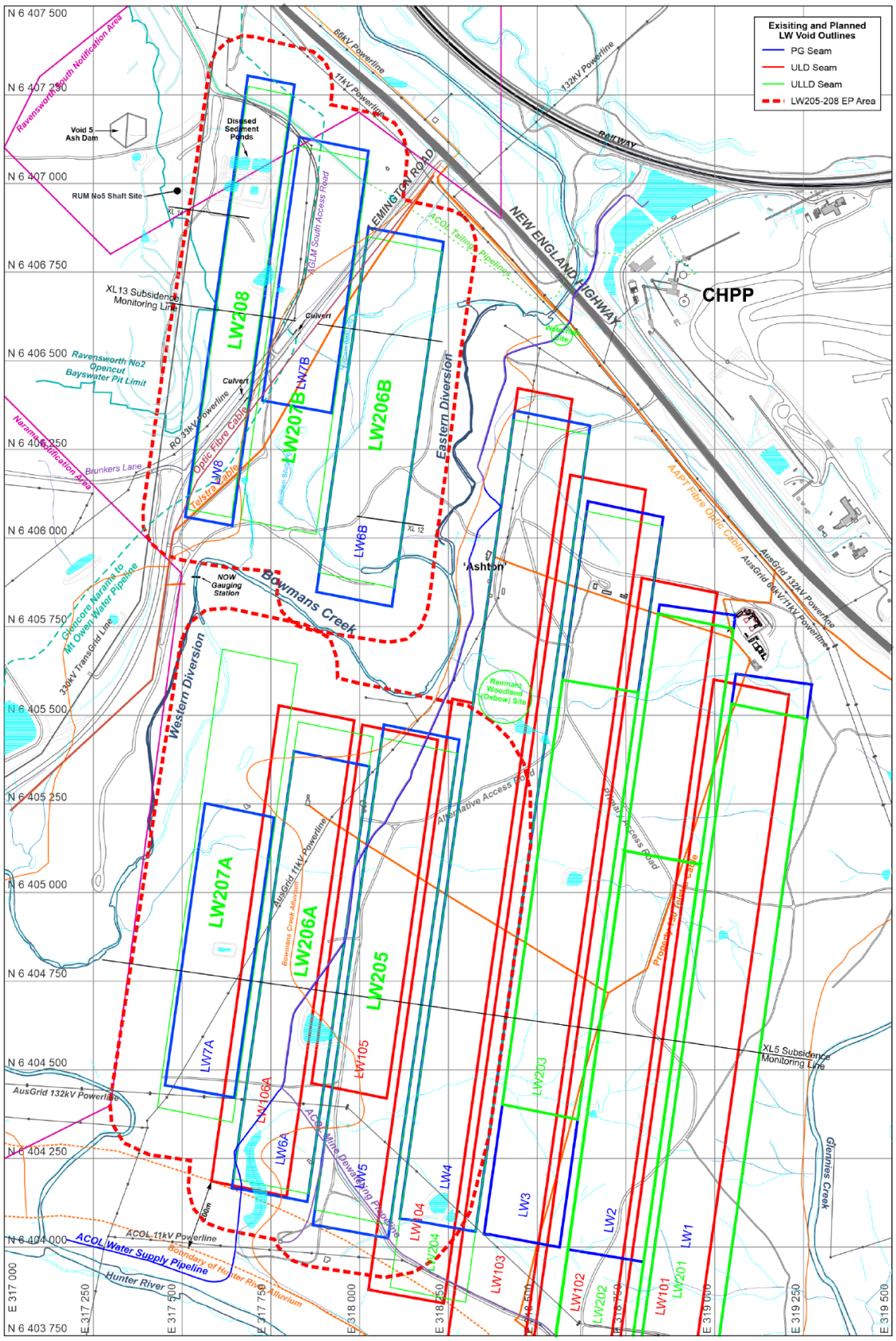


Figure 1 – Longwalls 205 - 208

2 RESOURCE DESCRIPTION

2.1 SITE CONDITIONS

The Ashton Underground Coal Mine is located in the Hunter Coalfield, within the Northern Sydney Basin. The coal seams and surrounding strata form the very basal part of the Burnamwood Formation of the Jerrys Plains Subgroup (which only occurs in the far south-west of the underground mining area), and the underlying, thinner Bulga Formation and much thicker Foybrook Formation of the underlying Vane Subgroup. The stratigraphy of the Ashton Underground Coal Mine is dominated by the seams and strata of the Foybrook Formation. The above formations are stratigraphic units of the Late Permian Singleton Supergroup. The Foybrook Formation is the basal coal bearing sequence of the Wittingham Coal Measures and the Singleton Supergroup.

The current study area is located on the western limb of the Camberwell Anticline (see **Figure 2**) which is the principal structural feature of the Development Consent area. The axis of this structure trends along the eastern boundary of EL4918 which coincides with a sub crop of the coal seams of principal interest. These sub crops define the westerly dipping limb of the Camberwell Anticline. The stratum consists of a mix of sandstone, shale, and interbedded to finely laminated sandstone/shale with a number of coal seam splits between.

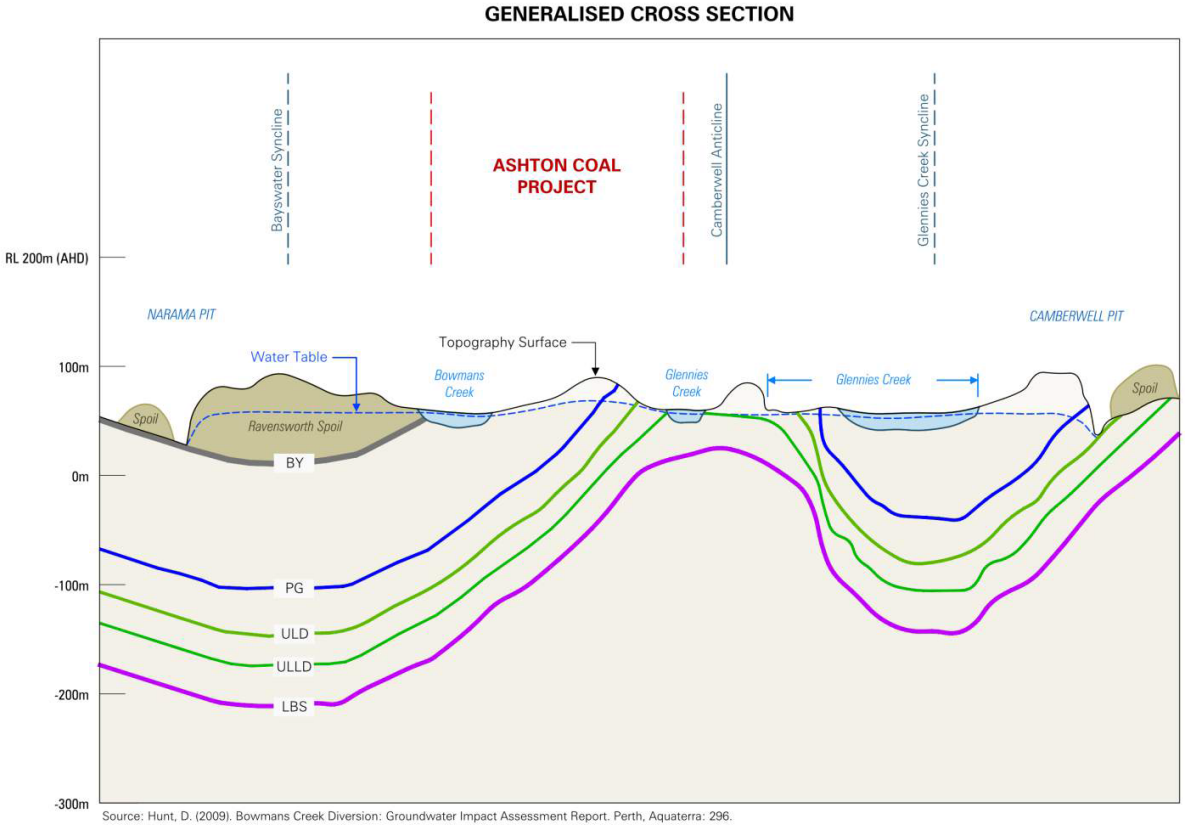


Figure 2 – Generalised Cross Section

ACOL is proposing to extract Longwalls 205 to 208 within the ULLD Seam using conventional longwall mining methods. The Extraction Plan area is bounded by the mining lease to the east and south, interburden thickness to the south for Longwall 205 and the 200 Main Headings to the north.

The Ashton Coal Project (ACP) primarily produces a semi-soft coking coal at 9.5% ash for the export market. The coal seams of the Foybrook Formation at the Ashton Underground Coal Mine are bituminous, high-volatile, low sulphur, vitrinite-rich and low in other elements such as chlorine and phosphorous. The ash content of run of mine (ROM) coal at the Ashton Underground Coal Mine is variable due to a variable seam cross-dip, seam thickness, splitting and convergence and stone bands. ROM coal ash at the Ashton Underground Coal Mine ranges from 30.7% to 57.3% with an average of 42.9% (ROM moisture 8.65%), (Kaltschmidt T., Life of Mine 2016 XPAC model). Raw coal is processed in the Ashton Coal Handling and Preparation Plant (CHPP) and a low ash product (9.5% average) with strong coking CSN (swell) properties is recovered. This places the coal resources at the Ashton Underground Coal Mine at the upper end of the coal rank profile for the Hunter Valley.

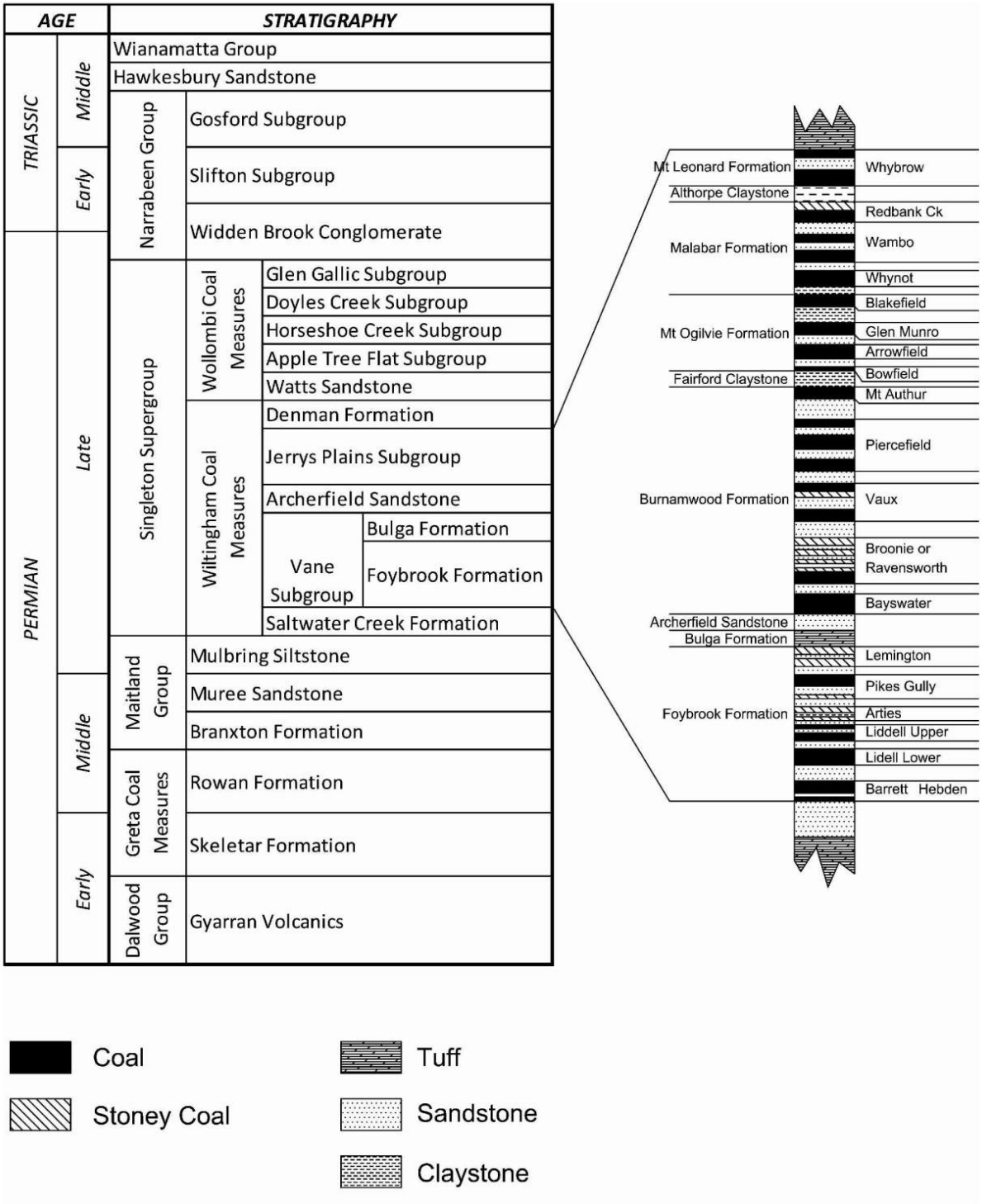
The ULLD Seam varies from 3.41 m in surface borehole YAC-011 in the TG201 4ct-5ct chain pillar where the ULLD1-2 plies split is 0.51 m of mudstone and siltstone 25-36 MPa strength and the normal split ULLD2-3 plies of 0.25 m of mudstone 24 MPa strength and 1.19 m in ULD-ULLD interseam borehole ISLL04 which has a very high strength sandstone roof and high strength sandstone and siltstone floor. Away from these areas, the ULLD Seam varies in thickness from 1.70 m-2.8 m but is generally 2.0 m-2.6 m thick with some variations.

2.2 OVERBURDEN STRATIGRAPHY

The stratum within the Foybrook Formation is deltaic in origin and comprises, in order of predominance: fine to coarse grained sandstone, siltstone, conglomerate, mudstone, shale and coal. The top of this formation corresponds with the base of the overlying Bulga Formation which is in turn overlain by the Archerfield Sandstone and Jerrys Plains Subgroup respectively. The Bulga Formation and Archerfield Sandstone are marine sandstones or laminates.

The Jerrys Plains Subgroup includes the basal Bayswater Seam which has been mined by open cut methods in the adjacent Ravensworth Mine. A remnant portion of the Bayswater Seam exists in the far south-western part of the (ACP). The Bayswater Seam does not form part of the target seams of the ACP. Conglomerates outcrop at several locations along the natural channel of Bowmans Creek (i.e. near the New England Highway Bridge and the NSW Department of Planning Industry and Environment – Water [DPIE Water]) stream gauging station) and in the prominent north-south trending ridge in the eastern part of the surface area of the underground mining area.

A typical stratigraphic section of the Hunter Coalfield is shown in **Figure 3**.



Ref : Ashton Coal A-9410 (10/02/2010)

Figure 3 – Stratigraphy of the Hunter Coalfields

2.3 ULLD SEAM CONDITIONS

The Upper Lower Liddell Seam is composed of the ULLD1, ULLD2 and ULLD3 plies. The top part of ULLD Seam splits to variable thickness between plies ULLD1 and ULLD2 in the east of ML1533. The seam split trends south-west across LW201, LW202, LW203A, LW204 and LW205, where it turns west across the outbye half of LW206A and then trends west-north west across the outbye half of LW207A and the far inbye parts of LW207B and LW208. The Upper Lower Liddell Seam subcrops near the eastern boundary of EL4918 (East). Working Section seam thickness in the Underground Resource domain ML1533 (southeast of the highway) averages 2.2m, with average raw ash of 33% (adb) and specific energy 22 MJ/kg (adb). In July 2015 underground mining commenced in ML1533 in this seam, following a drift being driven from overlying workings. The first longwall mining of this seam commenced in July 2017 in LW201. The three plies of the Upper Lower Liddell Seam (ULLD1-ULLD3) are shown in **Figure 4.**

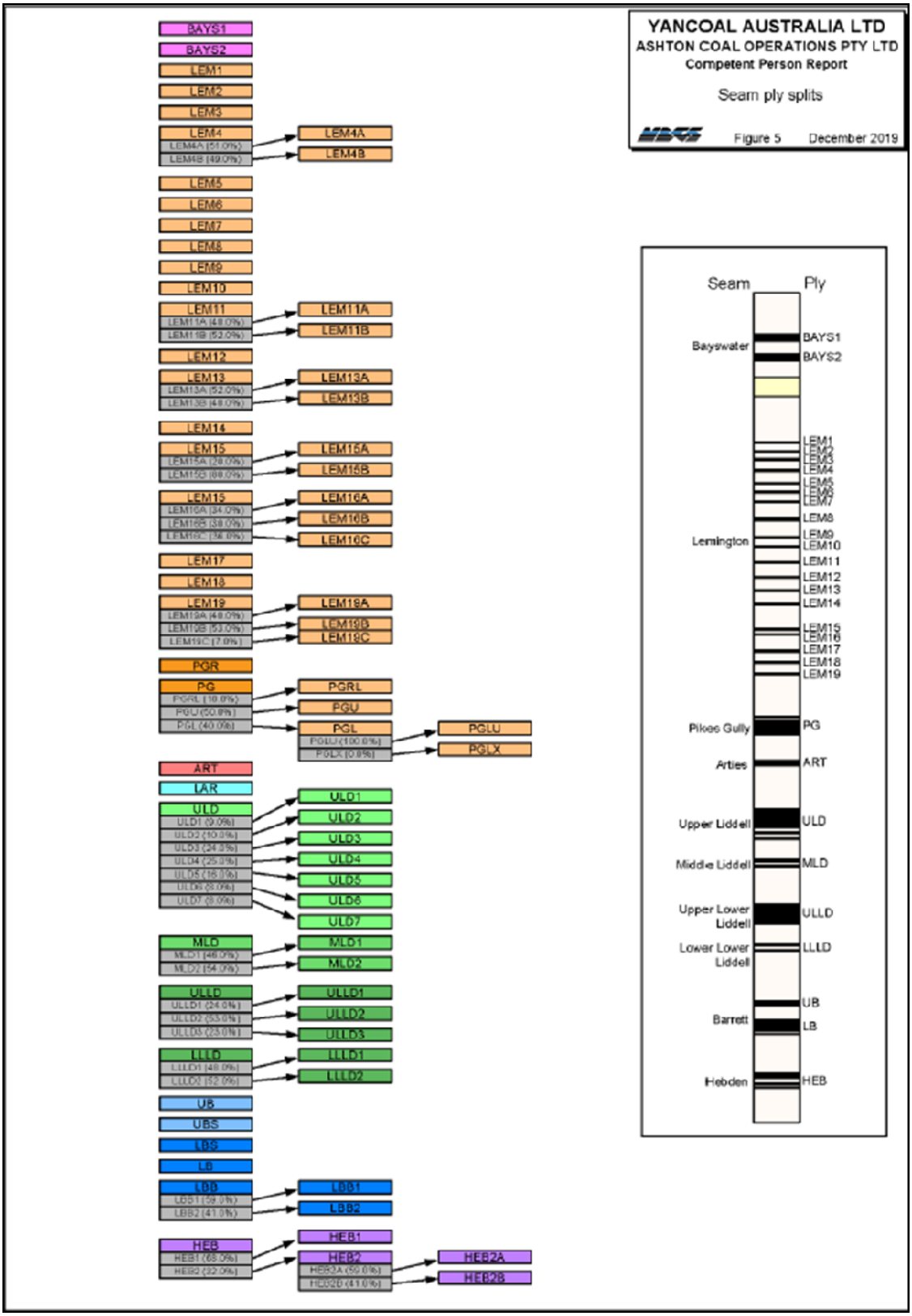


Figure 4 – Stratigraphy of the Hunter Coalfields

2.4 GEOLOGICAL STRUCTURES

Regional structures in the vicinity of Ashton include the Camberwell Anticline which extends approximately northward from the north-east of Ashton through the Glendell tenements, adjoining to the north, as well as the Bayswater Syncline further west beyond the Ashton boundary running approximately north-south through Ravensworth Underground Mine. Camberwell Anticline is asymmetric with a moderately dipping (9° to 18° degrees) eastern limb which is situated in ML1529, and a gently dipping (6° to 9°) western limb which is situated in the remainder of the area. Difficult mine conditions have been experienced locally in underground mine operations where conglomerate channel deposits occur in the Upper Liddell Seam roof accompanied by local loss of the upper coal plies in areas of very hard sandstone and conglomeratic roof. Similar mining conditions have been encountered in the adjoining Ravensworth Underground Mine associated with palaeochannels extending down from the overlying strata. Routine underground mapping and high frequency RIM surveys are carried out to predict where conglomerate roof associated with channel development is expected ahead of current development and longwall extraction.

Zones of small scale normal and reverse faulting in the south of ML1533 were encountered in past underground mining of Pikes Gully Seam and Upper Liddell Seam. These faults have persisted at depth and have been located in longwall development roadways in Upper Lower Liddell Seam.

2.4.1 Local Faulting

Past development and longwall operations have exposed generally north-south trending faults with throws of <1m which do not cause major mining issues. The majority of faults are normal and indicative predictions on the location and nature of faults can be made with projections at depth from earlier and ongoing underground mine operations. Faults located in the original proposed installation roadway for LW105 dipping at 75° with throws of 1.3m and 0.9m and a number of close spaced faults along the adjoining maingate and tailgates driveages, necessitated the shortening of LW105, resulting in sterilisation of some resources at the outbye end of the panel. A known graben structure, previously mined through in Pikes Gullly Seam and Upper Liddell Seam was, as expected, intersected in the installation roadway of LW203 in the Upper Lower Liddell Seam. This graben is bounded by normal faults of 1.3m down throw in the west and 2m down throw in the east. Within the graben a large number of normal faults with throws of up to about 1m occur.

2.4.2 Igneous Intrusions

The geological setting at Ashton is relatively simple and dykes intersected in earlier Pikes Gully Seam and Upper Liddell Seam mining are projected down to the Upper Lower Liddell Seam to predict expected intersection in gate road development. A north-south trending teschenite dyke affects the Upper Liddell Seam in the eastern portion of ML1533 and was mined in LW102. RIM surveys have been routinely used in advance of mining to allow extraction of hard dykes prior to longwall extraction when detected. No igneous intrusions are expected in the LW205 – 208 domain.

2.5 STABILITY OF UNDERGROUND WORKINGS

The proposed pillars in the application area are designed to provide stable underground workings for the period of development and subsequent extraction. As such, pillars are designed with an appropriate Factor of Safety and width to height ratio for their purpose.

Detail on predicted subsidence impacts, the associated method of prediction and relevant subsidence parameters can be found in the Extraction Plan main report.

Accompanying the designed mining layout is a monitoring program whose objective is to monitor roadways, pillars and panel performance, to ensure the adequacy of the design. The monitoring program comprises a combination of tell-tales, gel extensometers, borescopes, and visual inspections. Monitoring is conducted during both development and secondary extraction.

In accordance with Condition 31, Schedule 3 of DA309-11-2001-i, correspondence was provided to the Division of Resources and Geoscience (now NSW Resources Regulator) in March 2019 and in March 2020 outlining the design specifications of the first workings for Longwalls 205-208 including the main headings, TG and MG panels.

The NSW Resources Regulator provided a response in July 2020 stating that it was satisfied the workings would remain long term stable and non-subsidising.

3 MINING SYSTEMS AND RESOURCE RECOVERY

3.1 MINING GEOMETRY

The layouts of longwalls 205 to 208 within the ULLD Seam are shown in **Figure 1**. A summary of the dimensions of these panels is provided in **Table 1**. The longwalls will be extracted in the order of Longwall 205, 206, 207 and then 208.

Table 1. Geometry of Longwalls 205 to 208

Panel	Overall Void Length Including Installation Heading (m)	Overall Void Width Including First Workings (m)	Overall Tailgate Chain Pillar Width (m)
Longwall 205	1,343	215.4	25.0
Longwall 206A	1,309	215.4	25.0
Longwall 206B	957	215.4	25.0
Longwall 207A	1,304	215.4	25.0
Longwall 207B	1,065	215.4	25.0
Longwall 208	1,203	124.0	26.6

3.2 DEPTH OF COVER

Overburden ranges from a minimum of 175 m above the northeast corner of Longwall 206B to a maximum 260 m over the southwest corner of Longwall 207A. The depth is approximately 215 m at the southeast corner of Longwall 205 and approximately 220 m at the northwest corner of Longwall 208.

The thickness of the ULLD seam varies from 1.6 m to 3.0 m over the area of Longwalls 205-208 but is mostly within the range 2.0 to 2.8 m. The mining height is assumed to be in the range 2.2 m to 2.8 m.

The estimated incremental and cumulative subsidence profiles for Longwalls 205-208 are shown in **Figure 4**.

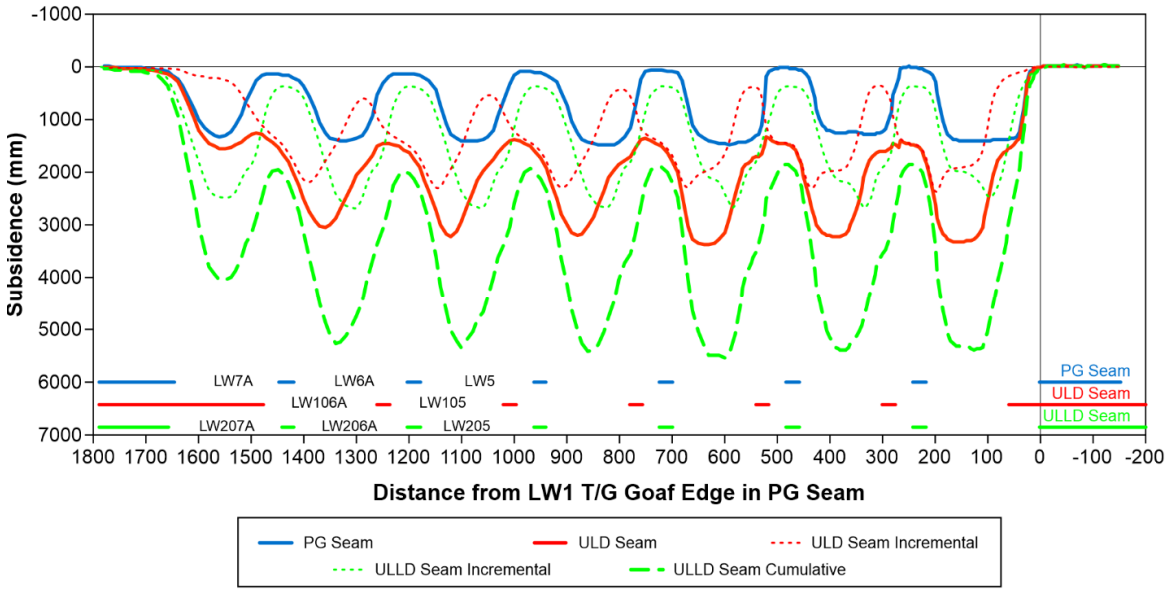


Figure 4 **Estimated incremental and cumulative subsidence profiles for Longwalls 205-208**

3.3 MINING METHOD

ACOL will use the conventional longwall mining method in the ULLD Seam for Longwalls 205 to 208.

The thickness of the ULLD Seam varies from 1.6 m to 3 m over the area of Longwalls 205-208 but is mostly within the range of 2 – 2.8 m. It is anticipated that an average longwall mining height of 2.5 metres will be achieved using conventional longwall mining techniques with variations of about ± 0.3 metres to accommodate the practical operational requirements of the mining equipment.

Extraction will take place generally in a south to north direction towards the Mains Headings.

Long term mains development pillars are designed to be long term stable and non-subsiding, thus rendering the roads serviceable for the life of the mine.

Development roads will nominally be driven at a width of up to 5.4 metres using single pass continuous miners.

3.4 SCHEDULE

The mining schedule for the Extraction Plan Area is shown in **Table 3**. Extraction will progress in a direction towards the Mains Headings in each Panel commencing with LW205. Development rates are budgeted from 8 to 10 metres per continuous miner shift dependent on geological conditions and support regime. Longwall extraction will typically produce in the order of 3,000 to 4,000 tonnes per shift.

Normally operations are carried out 24 hours per day seven days per week. Generally maintenance operations (e.g. stonedusting, continuous miner, longwall and roadway maintenance etc.) are undertaken on Wednesdays.

The anticipated start and completion dates are summarised in **Table 2**.

Table 2. Panel Extraction Rate and Sequence

Panel	Start Date	End Date	Estimated Duration (Days)
Longwall 205	March 2021	October 2021	160
Longwall 206A	November 2021	April 2022	150
Longwall 206B	May 2022	August 2022	92
Longwall 207A	September 2022	January 2023	124
Longwall 207B	February 2023	May 2023	95
Longwall 208	June 2023	October 2023	116

3.5 FUTURE MINING

The ACP is approved as a multi-seam longwall operation. Following mining in the ULLD seam, mining will progressively access the reserves within the Lower Barrett (LB) Seam as approved under the Development Consent.

3.6 RESOURCE RECOVERY

The method of extraction selected allows for maximum resource recovery whilst providing safety for the workforce. There are no significant environmental impacts that preclude longwall extraction within the Extraction Plan area.

In the initial planning of the area an option study was conducted whereby a number of alternative mine plans were considered having regard to the lease boundaries, exploration geological data and initial environmental assessment details. The plan and layout have been continually reassessed and reviewed as additional exploration, geological, and environmental data have become available.

The resultant mine plan provides for optimum resource recovery within the bounds created by geological and previous mining constraints. It is considered to be a layout which will result in subsidence being completed in accordance with DA 309-11-2001-i conditions.

The interburden thickness ranges over the planned layout area of Longwalls 205-208 from approximately 20 m to 40 m but is more typically in the range 25 – 35m. A minimum interburden of 15m is required to ensure geotechnical integrity.

The estimated recovery of the resource for the Extraction Plan Area is provided in **Table 3**. Particulars relating to each longwall panel are provided in **Table 4**.

Table 3. Extraction Plan Area Estimated Resource Recovery

Total tonnes of coal (Resource within Extraction Plan area)	8.4 Mt
Total tonnes extracted through development	0.64 Mt
Tonnes extracted by longwall	5.78 Mt
Percentage recovery	77%

Table 4. Estimated Individual Panel Tonnages

Panel	Panel Length (m)	Panel Width (void m)	Average Extraction Height (m)	Panel Extraction Tonnes (t)
Longwall 205	1,343	215.4	2.5	1,241,742
Longwall 206A	1,309	215.4	2.5	1,205,240
Longwall 206B	957	215.4	2.5	796,032
Longwall 207A	1,304	215.4	2.5	1,098,252
Longwall 207B	1,065	215.4	2.5	855,840
Longwall 208	1,203	124.0	2.5	585,899

3.7 JUSTIFICATION

The longwall layout, as indicated on **Figure 1**, has been developed based on extensive drilling, groundwater modelling, subsidence assessments, environmental investigation and assessment and consultation with relevant authorities.

The vertical alignment of Longwalls 205 – 208 is horizontally offset from the immediately overlying Upper Liddell (ULD) Seam mine workings and directly beneath the overlying Pikes Gully (PG) Seam mine workings. The layout and method also provide an extraction layout which maximises the efficient use and management of resources through maximising resource utilisation and using well established surface facilities. There are no significant environmental impacts that preclude longwall mining within the Extraction Plan area.

The subsidence monitoring program contained within 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 Built Features Management Plan.

4 REFERENCES

Strata Control Technology (2020) S*ubsidence Assessment for the Extraction Plan for Longwalls 205 – 208 in the Upper Lower Liddell Seam*, Report Number ASH4927.