Longwalls 205 - 208 Extraction Plan Subsidence Risk Assessment

Yancoal - Ashton Coal Mine

5th May 2020

EXECUTIVE SUMMARY

A risk assessment of the Ashton Coal Mine's subsidence risks associated with extraction of longwalls 205 - 208 was conducted on 5th May 2020. The risk assessment was facilitated by Kylie Hannigan (STAC Consulting) and consisted of Ashton management and workforce representatives and external content / technical experts (Refer Section 3 – Risk Assessment Participants).

The Risk Assessment:

- Reviewed applicable risk assessment considerations via presentation from Ken Mills: Subsidence Risk Assessment for Longwalls 205 – 208 EP Presentation (Refer Appendix 3);
- Considered Areas / Features and potential subsidence risks for these features at the Ashton Coal Mine;
- Utilised the previous risk assessment undertaken for longwalls 201 - 204 as the framework for this risk assessment;
- Determined the potential event/consequence associated with the risk source; determined the existing risk controls; categorised the risk control in accordance with the hierarchy of control (refer Section 2.4 Methodology); determined loss type; assessed level of risk (using Yancoal Risk Matrix); identified any additional risk control measures; and assessed for level of residual risk;
- Utilised the Ashton Risk Assessment Methodology including the Yancoal Risk Matrix (Refer Section 2.4 Risk Methodology); and
- Provides the underpinning risk assessment for the extraction plan for longwalls 205 - 208 at the Ashton Coal Mine.

Overall risk rankings for the risk sources assessed were (Figure 1):

- Extreme – 0;
- High – 7;
- Moderate – 9; and
- Low – 18.

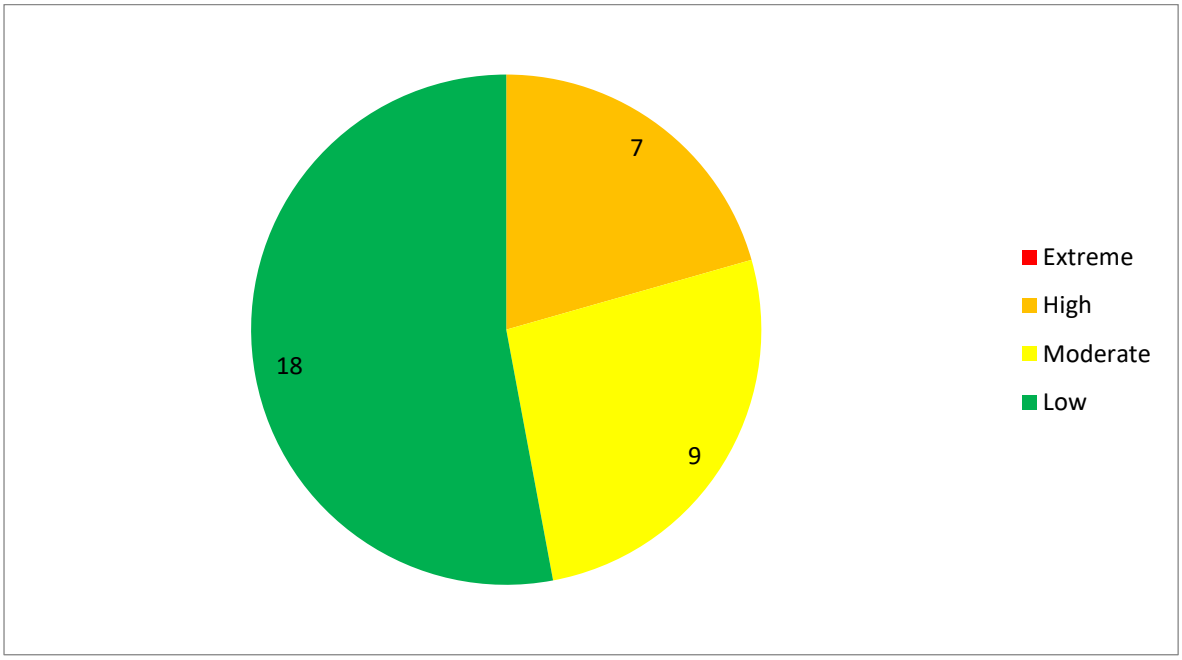

Figure 1: Risk Sources by Risk Level

Loss types were assessed considering the most significant consequence for the identified risk source and for the risk sources assessed, loss type distribution was (Figure 2):

- P (Harm to People) – 4;
- E (Environmental Impact) – 12;
- O (Asset Damage and Other Consequential Losses – 14; and
- R (Impact on Reputation) – 5.

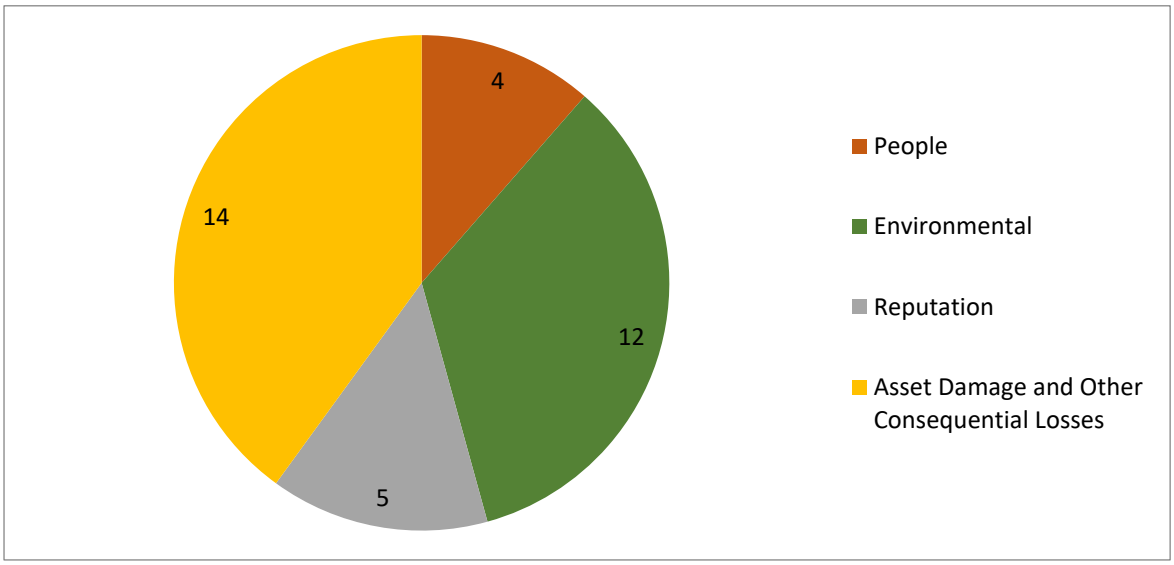

Figure 2: Risk Sources by Loss Type

Of the risk sources assessed, the maximum reasonable consequences for the potential event consequences (with existing controls implemented) were assessed as (Figure 3):

- 5 Catastrophic – 0;
- 4 Major – 5;
- 3 Moderate – 6;
- 2 Minor – 13; and
- 1 Insignificant – 10.

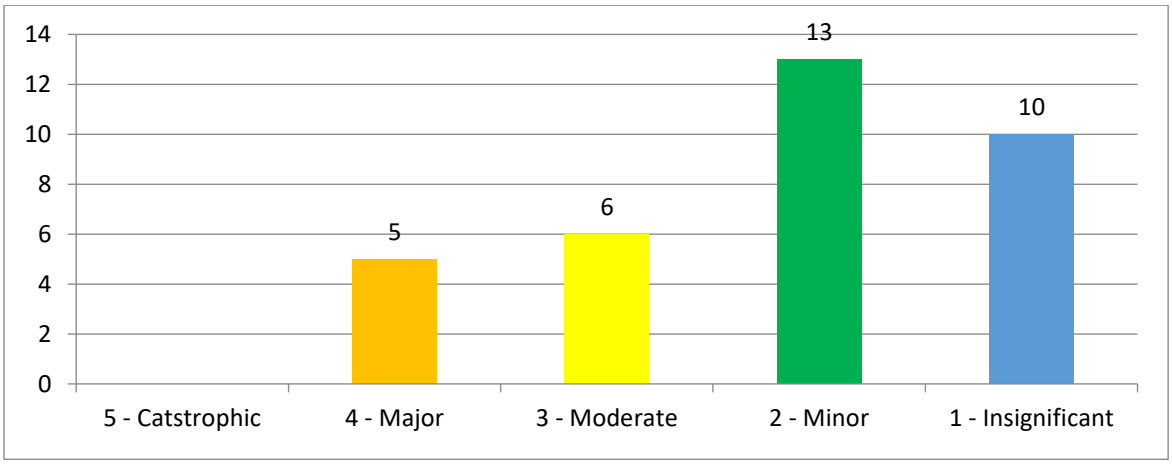

Figure 3: Risk Sources by Effect/Consequence Risk Score

The potential risk sources categorised as major were identified as:

#	Area / Feature (Risk Source)	Potential Event / Consequences	Loss Type	Consequence, Likelihood, Risk Level and Category			
2.02	Roads (Lemington Road and two associated culverts)	Cracking and change of grade on Lemington Road due to subsidence - predicted 2 to 2.5m of subsidence (refer to Appendix 3) resulting in roadway damage and potential for personal injury to road users or the roadway becoming not trafficable.	(P) Harm to People	4	D	14	(H)
2.06	Impacts to mine water supply lines, tailings line, mine dewatering lines, gas pipelines and tube bundle pipe lines (ACOL owned) and Narama to Mt Owen Water Supply (Glencore owned)	Discharge of Ashton Coal Operations Limited (ACOL) mine water to Bowmans Creek from damage to pipeline due to subsidence.	(E) Environmental Impact	4	C	18	(H)
		Damage to tailings line due to subsidence resulting in discharge of tailings from pipeline to Bowmans Creek.	(E) Environmental Impact	4	D	14	(H)
		Damage to Mt Owen Water Supply line due to subsidence resulting in discharge of mine water to Bowmans Creek.	(E) Environmental Impact	4	C	18	(H)
5.08	Ashton Dewatering Bores	Damage and interruption to dewatering bores.	(O) Asset Damage and Other	4	D	14	(H)

The distribution of consequences against the likelihood scale following implementation of additional actions at the Ashton Coal Mine is graphically represented in Figure 4:

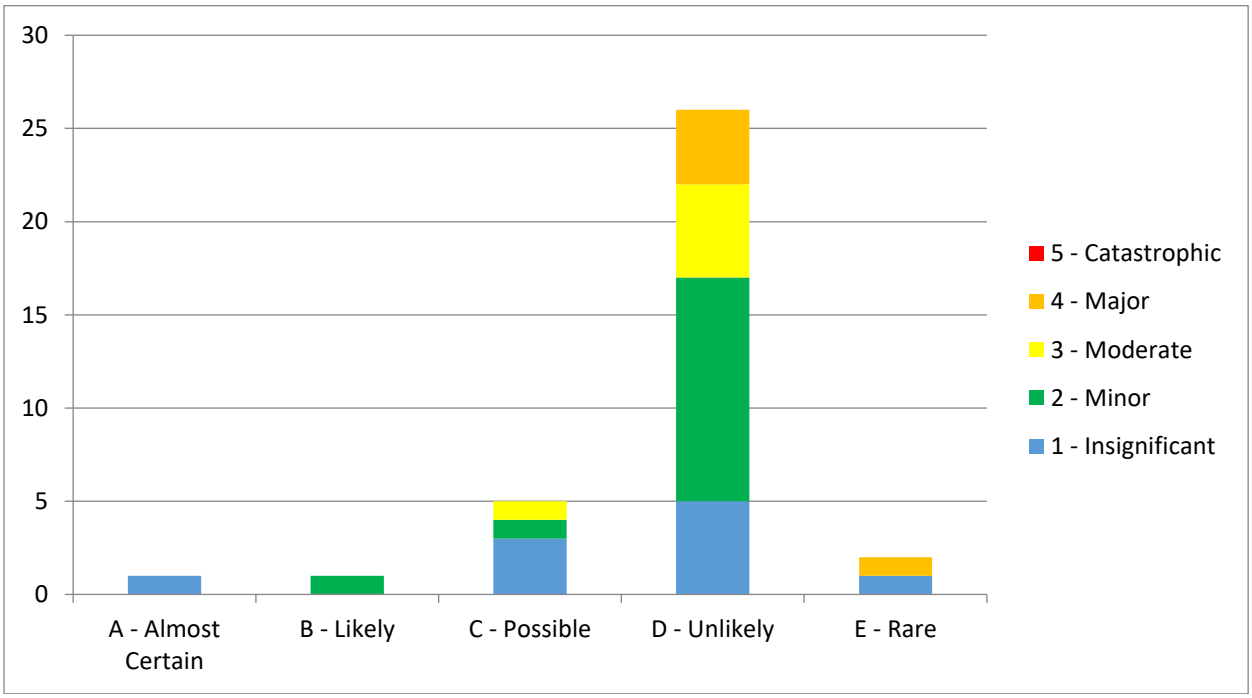

Figure 4: Risk Sources by Likelihood and Effect/Consequence Risk Scores

Therefore, following implementation of additional controls / actions, the major risks identified (based on the Yancoal Risk Matrix) are either Unlikely (i.e. could happen in 50 years) or Rare (has never been known to occur in the Australian Mining Industry or is highly unlikely that it could ever occur).

As a result of the risk assessment review, 31 further controls / actions have been identified (Refer to Section 5 Risk Control Action/Implementation Plan).

With the existing controls and further controls / actions to be implemented, the risk assessment team considered the risks relating to extraction of Longwalls 205 – 208 at the Ashton Coal Mine to be as low as reasonably practicable.

Kylie Hannigan (BOHS, MAusIMM)
Risk Assessment Facilitator / RA Report Author
Bachelor of Occupational Health & Safety (BOHS)
MINE7033 Minerals Industry Risk Management – Establish and Maintain Risk Management Systems (G3)
Lead Auditor – OH&S (RABQSA Certification No. 113053)

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1. OPERATIONAL OVERVIEW

The Ashton Coal Project (ACP) is located in the Upper Hunter Valley of New South Wales, approximately 14 kilometres (km) north-west of Singleton. Ashton Coal Operations Ltd (ACOL) are the site operators and are a wholly owned subsidiary of Yancoal Australia Limited (Yancoal).

The key elements of the ACP include:

- An open cut pit (NEOC) that has now been completed, with the final void remaining for the storage of coarse and fine reject;
- A four-seam descending underground mine with approval to extract up to 5.45 Million Tonne Per Annum (Mtpa) of Run of Mine (ROM) coal;
- Surface mine infrastructure associated with the underground Mine, including gas drainage bores, ventilation fans and mine dewatering infrastructure;
- Coal handling and preparation facilities (CHPP) including rail siding and rail loading bin;
- Reject and tailings emplacement; and
- Administration, bathhouse and workshop buildings.

The underground mine workings are located to the south of the New England Highway. Access is from the northern side of the New England Highway via portals in the southern highwall of the Arties Pit (a component of the previously completed NEOC). The main headings are generally aligned beneath and adjacent the New England Highway corridor, thereby minimising the impact of subsidence whilst maximising the recoverable area to the south. The underground mine is a multi-seam operation mining the Pikes Gully (complete), Upper Liddell (complete), Upper Lower Liddell (currently mining Longwalls 201-204) and the Lower Barrett (future) seams of the Foybrook formation. Coal is mined via longwall extraction methods. The underground operates 24 hours per day, 7 days per week.

Coal is transported via conveyor to a CHPP where it is stockpiled, processed as required, stockpiled again and then transported offsite via rail.

ACOL is committed to using risk assessment techniques to identify, analyse and assess the risks of principal hazards at its operations, as per the Ashton Risk Management Procedure. As such, ACOL requested that STAC Consulting facilitate a risk assessment as part of the Extraction Plan process for the next series of longwalls in the Upper Lower Liddell Seam (Longwalls 205-208).

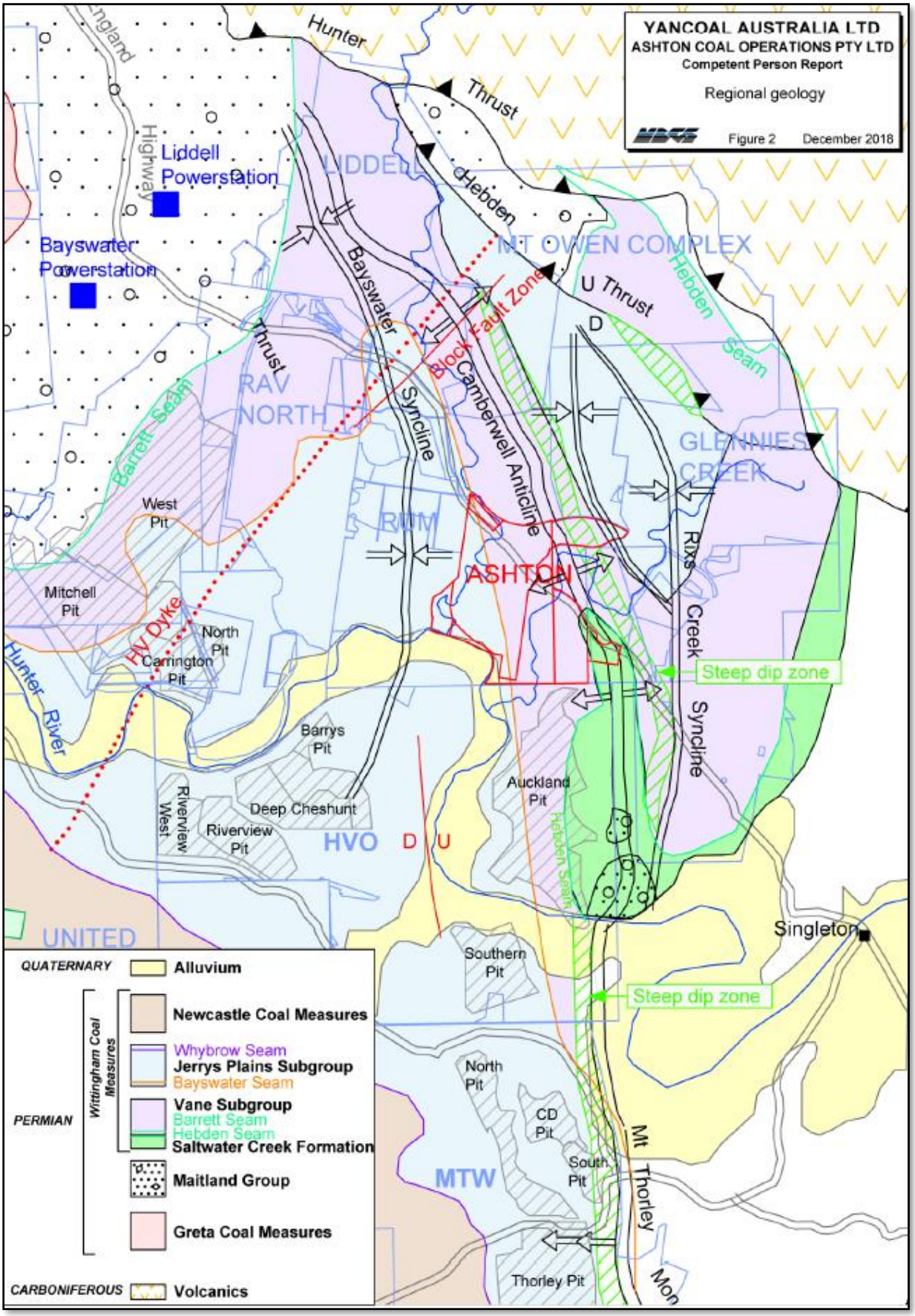
The risk assessment was undertaken with the expectation of compliance with the NSW Work Health and Safety (Mines and Petroleum Sites) Act 2013 and Work Health and Safety (Mines and Petroleum Sites) Regulations 2014 as subordinate instruments to the NSW Work Health and Safety Act (2011) and NSW Work Health and Safety Regulations (2017).

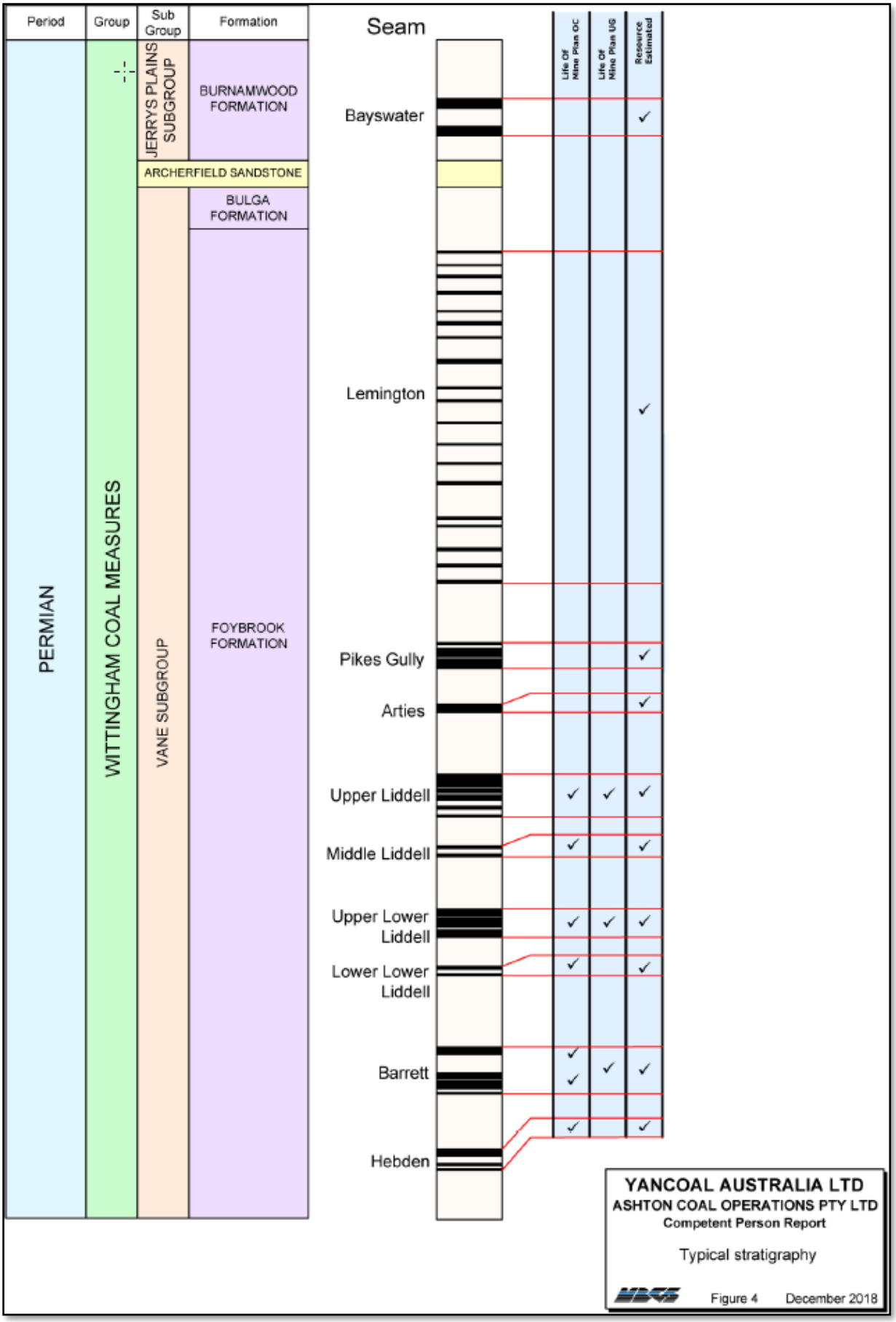
This risk assessment applies to subsidence at Ashton Coal Mine in the surface parts of the operation addressing the current relevant Acts and Regulations.

2. RISK ASSESSMENT CONTEXT

Coal Seams and Surrounding Strata

Coal seams recognised in the Ashton area (in descending stratigraphic order) include the Bayswater, Lemington, Pikes Gully, Arties, Upper Liddell (ULD), Middle Liddell, Upper Lower Liddell (ULLD), Lower Lower Liddell, Upper Barrett and Lower Barrett seams. The dominant regional structure within the Ashton area is the north-south trending Camberwell Anticline, the underground mine is located on the western flank of the anticline and is not impacted by the structure other than the seam dip. See Figures below:


YANCOAL AUSTRALIA LTD
ASHTON COAL OPERATIONS PTY LTD
Competent Person Report
Regional geology
Figure 2 December 2018
Hunter
Thrust
Hebden
Liddell Powerstation
Bayswater Powerstation
Highway
LIDDELL
MT OWEN COMPLEX
Bayswater
Thrust
Block Fault Zone
U Thrust
D
Hebden Seam
Barrett Seam
RAV NORTH
Syncline
Camberwell Anticline
GLENNIES CREEK
West Pit
RUM
ASHTON
Rixs Creek
Mitchell Pit
HV Dyke
North Pit
Carrington Pit
Steep dip zone
Hunter River
Barrys Pit
Auckland Pit
Riverview West
Deep Cheshunt
Riverview Pit
HVO
D
U
Syncline
UNITED
Singleton
Southern Pit
Steep dip zone
North Pit
CD Pit
South Pit
MTW
Mt Thorley
Thorley Pit
QUATERNARY
Alluvium
PERMIAN
Wittingham Coal Measures
Newcastle Coal Measures
Whybrow Seam
Jerrys Plains Subgroup
Bayswater Seam
Vane Subgroup
Barrett Seam
Hebden Seam
Saltwater Creek Formation
Maitland Group
Greta Coal Measures
CARBONIFEROUS
Volcanics


Period
Group
Sub Group
Formation
Seam
Life Of Mine Plan OC
Life Of Mine Plan UG
Resource Estimated
PERMIAN
WITTINGHAM COAL MEASURES
JERRYS PLAINS SUBGROUP
BURNAMWOOD FORMATION
ARCHERFIELD SANDSTONE
BULGA FORMATION
VANE SUBGROUP
FOYBROOK FORMATION
Bayswater
Lemington
Pikes Gully
Arties
Upper Liddell
Middle Liddell
Upper Lower Liddell
Lower Lower Liddell
Barrett
Hebden
YANCOAL AUSTRALIA LTD
ASHTON COAL OPERATIONS PTY LTD
Competent Person Report
Typical stratigraphy
Figure 4
December 2018

The Pikes Gully Seam is located within the upper part of the Vane Sub-group of the Wittingham Coal Measures. The seam has an average thickness of 2.20 metres and is overlain by the Lemington seam 15 metres above and underlain by the Arties seam 9 metres below. Extraction in the Pikes Gully Seam as a component of the ACP was completed in late 2013.

The Pikes Gully seam is typical of the seams in the area, consisting of generally bright banded coal with relatively common thin mudstone and claystone partings. The seam is overlaid by a thin rider band of coal with mudstone interburden thickness of up to 400mm. The rider seam is generally within the mining section except where it splits away at the southern and north-western ends of the longwall panels. The seam is classed as a sub bituminous coking coal with an average UCS of approximately 10 MPa.

The dominant joint direction is 170° with a vague sub-set at 50° the jointing tends to be vertical to sub-vertical. Cleating within the coal follows similar directions. Minimal infill occurs on either the cleats or the joints. The seams dip to the west at approximately 6° with little evidence of structural disturbance. Minimal igneous activity is known in the area and is consistent with surrounding properties. However, a small north-south trending doleritic dyke is located predominately in the second longwall panel of all seams. Inseam drilling has been conducted to confirm its thickness and hardness within the ULLD seam. This dyke is associated with small-scale normal faulting in the area.

The ULD Seam is located below the Pikes Gully and Arties Seams. The thickness across the underground mining area is generally around 2.10 to 2.25 metres with some splitting across the lease. The ULD seam also thickens to the north west of the lease. The roof and floor tend to be predominantly sandstone and siltstone, though softer and finer-grained in areas of split development. Interburden thickness between the ULD Seam and the underlying ULLD Seam averages approximately 30m.

The ULLD Seam is located below the ULD Seam and Middle Liddell Seams. The thickness across the underground mining area is between 1.80 and 3.10 metres with some splitting across the lease. The roof and floor tend to be predominantly sandstone and siltstone, though softer and finer-grained in areas of split development. The first longwall mining of this seam commenced in July 2017 in LW201.

Mine Layout and Mining Methods

The Ashton Coal Mine is approved as a multi seam operation to extract coal from the following seams in descending order:

1. Pikes Gully Seam (PG).
2. Upper Liddell Seam (ULD).
3. Upper Lower Liddell Seam (ULLD).
4. Lower Barret Seam (LB).

A series of eight longwall panels have been mined in the uppermost PG Seam and longwall mining in this seam is now complete. To date, six of the planned seven longwall panels in the second seam (ULD Seam) have been extracted. The northern part of the sixth longwall (106B) and two parts of the seventh longwall (107A and 107B) will not be mined. The third longwall (203) panel in the third seam (ULLD Seam) is currently being mined.

In the offset geometry, the panels in the first seam (PG) and third seam (ULLD) are superimposed as shown below. The second seam (ULD) and fourth seam (LB) are also superimposed but both sets of panels are offset 60m to the west relative to the PG and ULLD Seam panels.

Extraction is being undertaken by longwall mining methods.

Mine Access

The underground mine is accessed via three inseam portals within the Pikes Gully Seam horizon from a highwall of a box cut in the Arties pit. The three portal entries comprise of men and materials transport entry, a conveyor belt entry and an air intake. The main ventilation fan is positioned at a separate compound which comprises of dual fans positioned over a single 5.5m upcast shaft.

The ULD seam is accessed via two inter-seam drifts from the Pikes Gully Seam pit bottom to the ULD seam. The drifts comprise a men and materials drift and conveyor drift with linking cut-throughs. ULD seam ventilation is via two drifts, one down cast shaft and one upcast shaft between the Pikes Gully seam and the ULD Seam.

The ULLD seam is accessed via two inter-seam drifts from the ULD seam pit bottom to the ULLD seam. The drifts comprise a men and materials drift and conveyor drift with linking cut-throughs. Ventilation to the ULLD seam is via these two drifts and a downcast shaft between the ULD seam and the ULLD seam with the return via an inter-seam shaft to the main ULD seam return.

Development Roadways
Main heading panels comprise between 3 to 5 roadways. Gateroad panels comprise 2 roadways for all seams. A backroad is maintained to the backroad fan inbye of all longwall panels.

Development roadways are nominally 2.6 – 2.8m high by 5.4m wide with local height variations to 4.5m allowed for mine infrastructure installations (e.g. belt transfers).

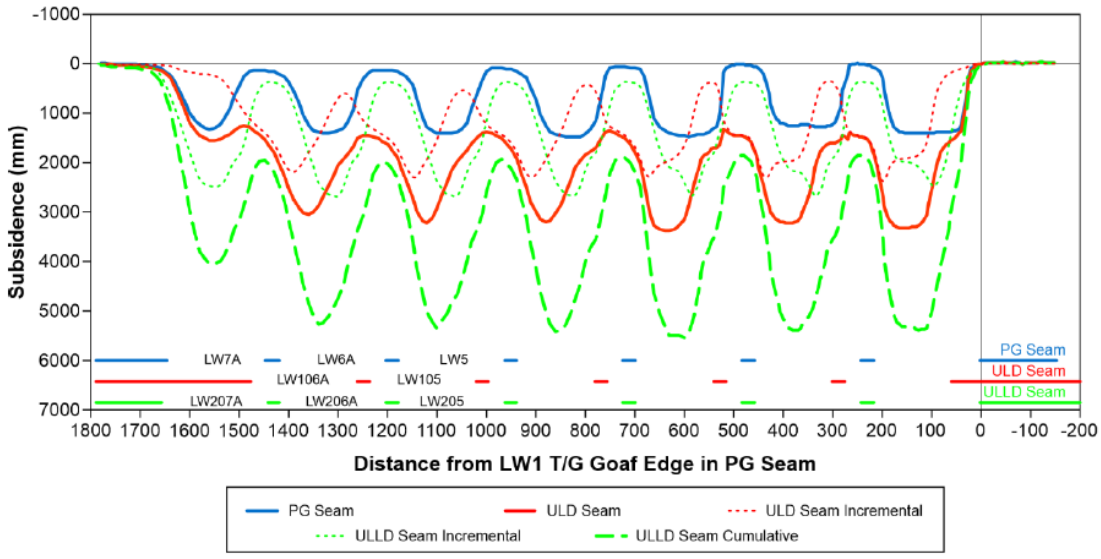
Longwall Mining
Longwall blocks are up to 210 metres wide with a mining height of between 2.4 to 2.8m.

Surface infrastructure and mine scheduled longwall extraction for the next three years is shown in Appendix 4.

Subsidence
Subsidence effects are defined as the differential ground movement measured between pre-mining and post-mining after it settles above an underground mining area. Subsidence effects are typically measured in parameters such as total vertical subsidence, tilt, strain and horizontal displacement. Depending on many parameters such as the underground mining layout, the depth of cover, the material properties of the overlying strata and the natural and man-made condition of the surface and sub-surface environment, subsidence effects may or may not result in a subsidence impact.

A comprehensive subsidence monitoring program involving high confidence three-dimensional (3D) survey measurements has been in place since the start of longwall mining at the ACP in 2007.

The forecast of total cumulative vertical subsidence of 5.8m after the mining of three seams is shown below. Mining in the ULLD seam is due to be completed at the end of 2023. Mining of the fourth seam (LB) will result in a total cumulative vertical subsidence of approx. 8.5m.



Also refer to Appendix 3: Subsidence Considerations for Longwalls 205 – 208.

2.1 Goal/Objectives

The goal and objectives of this risk assessment review were to:

- Identify, analyze, and assess potential risks associated with subsidence from the extraction of Longwalls 205-208 at the Ashton Coal Mine;
- Identify existing risk controls; and
- Identify any additional risk controls / actions required to reduce the risk to "As Low as Reasonably Practicable" (ALARP).

The risk assessment review considered requirements to enable compliance with:

- NSW Environmental Planning and Assessment Act 1979;
- NSW Mining Act 1992;
- NSW Work Health and Safety (Mines and Petroleum Sites) Act 2013;
- NSW Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 - specifically Clause 67 Subsidence and Schedule 1 (3C) Subsidence; and
- NSW Water Management Act 2000.

The effective implementation of the controls outlined in this risk assessment are intended to reduce the potential impacts to health, safety, environment, assets, and reputation from subsidence at the mine.

Following the risk assessment, the Extraction Plan for Longwalls 205 - 208 will be updated and finalised.

2.2 Scope

The scope of the risk assessment was to conduct an assessment of potential subsidence risks for Longwalls 205 to 208 at the ACP to determine if the risks from subsidence have been reduced to as low as reasonably practicable.

The scope of the risk assessment review was to:

- Review applicable risk assessment considerations via presentation from content / technical expert on subsidence Dr Ken Mills: Subsidence Risk Assessment for Longwalls 205 – 208 EP Presentation (Refer Appendix 3);
- Consider Areas / Features and potential subsidence risks for these features at the Ashton Coal Mine;
- Utilise the previous risk assessment undertaken for longwalls 201 - 204 as the framework for this risk assessment;
- Determine the potential event/consequence associated with the risk source; determine the existing risk controls; categorise the risk control in accordance with the hierarchy of control (refer Section 2.4 Methodology); determine loss type; assess level of risk (using Yancoal Risk Matrix); identify any additional risk control measures or actions required; and assess for level of residual risk;
- Utilise the Ashton Risk Assessment Methodology including the Yancoal Risk Matrix (Refer Section 2.4 Risk Methodology); and
- Provide the underpinning risk assessment for the extraction plan for Longwalls 205 - 208 at the Ashton Coal Mine.

2.3 Stakeholders

Internal and external stakeholders considered during the performance of this risk assessment included:

- Ashton Coal Mine Employees;
- Ashton Coal Mine Contractors;
- Ashton Coal Mine Visitors;
- Neighbours (particularly those accessing Dairy Lane and neighbouring mines and landowners);
- Yancoal Corporate;
- Government Regulators;
- Site and Industry Safety and Health Representatives (i.e. Check Inspectors); and
- Local Community (including those travelling on New England Highway and Lemington Road).

2.4 Risk Methodology

The WRAC risk assessment methodology was used. The risk assessment followed the principles outlined in AS/NZS ISO 31000:2018 and MDG1010 – Minerals Industry Risk Management Handbook and complied with the Ashton Risk Management Procedure.

The Yancoal Risk Matrix (refer to Appendix 1) was used to assess risk.

The following hierarchy of control is used to determine and categorise risk controls (from most effective to least effective):

- Elimination;
- Substitution;
- Isolation;
- Engineering;
- Administrative;
- PPE; and
- Mitigants.

2.5 Unquantifiable Hazards

Nil unquantifiable hazards were identified.

2.6 Reference Material

Reference material that was consulted to assist in the identification of risk sources and controls applicable to the Ashton Coal Mine included:

- Presentation from content / technical expert (Dr Ken Mills) on subsidence: Subsidence Risk Assessment for Longwalls 205 – 208 EP Presentation (Refer Appendix 3);
- Plan of ULLD Longwalls 205 – 208 Extraction (Refer Appendix 4);
- NSW Work Health and Safety (Mines and Petroleum Sites) Act 2013;
- NSW Work Health and Safety (Mines and Petroleum Sites) Regulation 2014;
- NSW Work Health and Safety Act 2011;
- NSW Work Health and Safety Regulations 2017 - specifically Clause 67 Subsidence and Schedule 1 (3C) Subsidence;
- Managing Risks of Subsidence Guide (NSW Regulator, February 2017);
- EDG17 Applications for Subsidence Management Approvals;
- Environmental Planning and Assessment Act 1979;
- Mining Act 1992;
- NSW Water Management Act 2000;
- Engineering Report: Ashton Coal 132Kv Transmission Line Assessment – ULLDLW201 – LW204 (Project No. 00013329, 15 November 2016);
- Ashton Coal Mine Longwalls 201 to 204 Extraction Plan (November 2016);
- Ashton Coal Operation Subsidence Principal Hazard Management Plan (Doc ID: ACO-SITE-9134, Revision No. 2, Next Review: 19.12.2020); and
- Ashton Coal Project – Subsidence Effects Monitoring Program – Upper Liddell Seam Longwalls 105 – 107, July 2015.

2.7 Assumptions

Assumptions made during the performance of this risk assessment included:

- Rate and method of longwall operations will be as per previous longwalls at the Ashton Coal Mine;
- The layout, schedule and sequence of mining operations will be as per Appendix 4;
- Ranking is undertaken using the Yancoal Risk Matrix (Refer Appendix 1);
- ACOL has a current approved Extraction Plan (with underpinning Extraction Plan Risk Assessment) for Longwalls 201 – 204;
- ACOL has a current Subsidence Monitoring Program and associated TARP for Subsidence Monitoring; and

- Heritage / Artefacts - area is inspected and cleared prior to Subsidence (as per Aboriginal Heritage Management Plan).

Effectiveness of the risk treatment measures outlined in this risk assessment will be assessed through:

- Results of Subsidence Monitoring Program;
- Risk Assessment Action Completion;
- Incident Reporting and Investigation Analysis (subsidence related); and
- Community Complaints (subsidence related).

Consequence was assessed as the maximum reasonable outcome of the identified potential event if the event was realised (i.e. controls failed resulting in potential event) and likelihood was based on most likely outcome given the Australian mining industry history if the risk controls were implemented and effective.

2.8 Exclusions

Nil specific exclusions.

The risk assessment did not consider the impacts from:

- Natural disasters (cyclones, tsunami, earthquake); and
- Wilful damage (e.g. sabotage).

2.9 Terminology

Abbreviations used throughout the risk assessment include:

- ALARP – As Low As Reasonably Practicable.
- LTA – Less Than Adequate.
- TARP – Trigger Action Response Plan.
- RA – Risk Assessment.
- LW – Longwall.
- EIS – Environmental Impact Statement.
- PG – Pikes Gully.
- ULD – Upper Liddell.
- ULLD – Upper Lower Liddell.
- LB – Lower Barret.
- EP – Extraction Plan.
- ACHMP – Archaeological and Cultural Heritage Management Plan.
- AHIP – Aboriginal Heritage Impact Permit.
- GDE – Groundwater Dependent Ecosystems.
- GDP – Ground Disturbance Permit.
- PHMP – Principal Hazard Management Plan.
- CHPP – Coal Handling and Preparation Plant.
- CCC – Community Consultative Committee.

2.10 Review Period

This risk assessment is not required to be reviewed as it is specific to the Longwalls 205 – 208 Extraction Plan only. Future Extraction Plans will require a new risk assessment to be undertaken.

2.11 Controls Adopted / Rejected

All controls discussed during the conduct of the risk assessment are to be adopted (existing controls) or investigated / implemented (additional controls).

If an additional control is rejected, the reason for rejection will be recorded against the action for the additional control in Intelex.

3. RISK ASSESSMENT PARTICIPANTS

No.	Date	Name Full name of person	Role In Business In RA i.e.: Facilitator, Scribe, Content / Technical Expert, Participant	Experience Record: Industry skills and experience generally (including number of years);	Relevance to this assessment Record: Any formal/technical qualifications; Formal risk assessment qualifications NB: experience must demonstrate relevance to the topic being risk assessed	Consensus (Y/N) If no, non-consensus matter must be recorded in applicable section	Signature
1	5/05/2020	Kylie Hannigan (STAC Consulting)	Facilitator / Scribe	24 years mining experience (both underground and open cut) 21 years health, safety, training and HR experience (including management roles) **Mining Clients:** Yancoal, Glencore/Xstrata, Rio Tinto, BHPBilliton/BMA, AngloAmerican, Peabody, Idemitsu, Various Contractors **Previously worked at:** Ulan Underground, Crinum/Crinum East Underground, Kestrel Underground, Blair Athol Open Cut	Consultant 20+ years Risk Assessment Facilitation Bachelor of Occupational Health and Safety (BOHS) MINE7033 (G3) Risk Management (University of Queensland) Lead Auditor (RABQSA Cert. No. 113053) Australian Institute of Mining and Metallurgy (AusIMM) - Member AIHS (formerly SIA) - Member Australian Institute of Management - Member	Yes	Refer to Appendix 2

No.	Date	Name Full name of person	Role In Business In RA i.e.: Facilitator, Scribe, Content / Technical Expert, Participant	Experience Record: Industry skills and experience generally (including number of years);	Relevance to this assessment Record: Any formal/technical qualifications; Formal risk assessment qualifications NB: experience must demonstrate relevance to the topic being risk assessed	Consensus (Y/N) If no, non-consensus matter must be recorded in applicable section	Signature
2	5/05/2020	Tony Sutherland	Participant	35 years mining experience (both underground - 33 years and open cut) 3 years at Ashton Previously at Austar, Donaldson Open Cut, Abel, Tasman, North Wambo, Wollemi, United, Dartbrook, Moonee, Hunter Valley No. 1 Open Cut, Chain Valley, Liddell, West Wallsend, Newvale No. 2	**Technical Services Manager** Bachelor of Engineering Degree (Mining) Masters Business & Technology Practising Certificate - Mining Engineering Manager - Underground and Open Cut, Open Cut Examiner, Ventilation Officer and Undermanager Mine Manager's Certificate of Competency (Underground & Open Cut) Mines Rescue trained (20 years) Ventilation Officer (previously at Chain Valley, Dartbrook) G2 Risk Management Qualifications Lead Auditor Qualifications (SAI Global Certification No. C257507) Australian Institute of Mining and Metallurgy (AusIMM) - Member CPD Member - Mine Manager's Association of Australia	Yes	Refer to Appendix 2
3	5/05/2020	Phil Brown	Participant	22 years experience (environmental - mining), 4 years - Pasminco 3 years at Ashton Previously at Abel, Donaldson, Tasman, Ellalong, Gretley	**Environment and Community Relations Superintendent** Health Inspection Certificate Bachelor of Applied Science (Environmental Health) Masters in Environmental Studies	Yes	Refer to Appendix 2

No.	Date	Name Full name of person	Role In Business In RA i.e.: Facilitator, Scribe, Content / Technical Expert, Participant	Experience Record: Industry skills and experience generally (including number of years);	Relevance to this assessment Record: Any formal/technical qualifications; Formal risk assessment qualifications NB: experience must demonstrate relevance to the topic being risk assessed	Consensus (Y/N) If no, non-consensus matter must be recorded in applicable section	Signature
4	5/05/2020	Jeff Peck	Participant	38 years mining experience (UG) 12 years at Ashton 40 years - surveying 30 years - registered mine surveyor Previously at Glennies Creek and Lake Macquarie Mines	**Mining Surveyor** Diploma in Mine Surveying Associate Diploma in Civil Engineering Participation in Risk Assessments	Yes	Refer to Appendix 2
5	5/05/2020	David Cooke	Participant	17 years mining experience (UG) 11 years at Ashton Previously at Dartbrook, Wambo, Blakefield, Ravensworth	**Operator / Site Safety and Health Representative - UG**	Yes	Refer to Appendix 2
6	5/05/2020	Lachlan Crawford	Participant	21 years mining experience (consulting, research and site) 25 years environmental experience 3 years at Ashton (Contracting) Previously at UQ (Research), BMA - Saraji, various sites consulting, Bloomfield Colliery, E&C Manager (Wambo)	**Environment and Community Coordinator** Bachelor of Applied Science Masters of Mineral Resources	Yes	Refer to Appendix 2

No.	Date	Name Full name of person	Role In Business In RA i.e.: Facilitator, Scribe, Content / Technical Expert, Participant	Experience Record: Industry skills and experience generally (including number of years);	Relevance to this assessment Record: Any formal/technical qualifications; Formal risk assessment qualifications NB: experience must demonstrate relevance to the topic being risk assessed	Consensus (Y/N) If no, non-consensus matter must be recorded in applicable section	Signature
7	5/05/2020	Josh Peters	Participant - Resource Strategies (to 10:30am)	18 years mining industry (environmental consultant - focus on Approvals and EIS) - open cut and underground Underground sites (NSW and QLD) - Metropolitan, Wambo, Tasman, Abel, Westcliff, Dendrobium, Appin	**Project Manager** Bachelor of Environmental Science	Yes	Refer to Appendix 2
8	5/05/2020	Matthew Copeland	Participant - Resource Strategies	5 years mining industry (environmental consultant - focus on Approvals and EIS) - open cut and underground Underground sites (NSW and QLD) - Metropolitan, Wambo, Tasman	**Project Manager** Bachelor of Civil and Geotechnical Engineering	Yes	Refer to Appendix 2
9	5/05/2020	Dr K.W. (Ken) Mills	Content / Technical Expert - SCT	40 years experience as a geotechnical engineer working in field of rock mechanics primarily associated with underground coal mines.	**Principal Geotechnical Engineer / Director - SCT Operations Pty Ltd** PhD - Rock Mechanics Bachelor of Civil Engineering	Yes	Refer to Appendix 2
10	5/05/2020	Andrew Durick	Participant - AGE Water Consultant	24 years experience (modelling groundwater) Qld State Government and AGE Various sites in Bowen Basin and Hunter Valley	**Director / Principal Modeller - AGE** Bachelor of Engineering and Environmental Engineering Master of Applied Science (Mathematics)	Yes	Refer to Appendix 2

4. RISK ASSESSMENT WORKSHEET (WRAC)

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
1. Natural Features																			
A	**Catchment Areas and Declared Special Areas**	**1.01**	**Small Woodland Area - Oxbow Archaeological Site (over LW204 block) however outside of the area being assessed**																
B	**Rivers and Creeks (Bowmans Creek, Glennies Creek and Hunter River)**	**1.02**	**Surface water quantity changes to Bowmans Creek, Glennies Creek and Hunter River due to mine subsidence** **Note: LW Panels 5, 6 and 7 >200m from edge of panel to Hunter River Alluvium** **Note: Water quality impact on Bowmans Creek salinity levels assessed and negligible (decrease in salinity and increase in quality)**	Loss of catchment area for Bowmans Creek (minor) - reduced flow to Bowmans Creek, Hunter River and Glennies Creek	Approved Bowmans creek diversion and mine designed to stand off and minimise effects on the creeks and rivers	Effective	Environment and Community Superintendent	**Engineering**	**(E) Environmental Impact**	**2**	**D**	**5**	**(L)**	Review and update Site Water Management Plan to consider LW205 - LW208	**2**	**D**	**5**	**(L)**	Phil Brown
					Mine design includes a 40 metre minimum offset (based on overlying goaf edges) from high bank - Bowmans Creek	Effective	Environment and Community Superintendent	**Engineering**						Review and update Flora and Fauna Management Plan to consider LW205 - LW208					Phil Brown
					LW Panels 5, 6 and 7 >200m from edge of panel to Hunter River Alluvium	Effective	Mining Surveyor	**Engineering**											
					Surface and Groundwater Impact Assessment for LW205 - LW208 Impacts (AGE, April 2020) - controls and recommendations included in the LW205 - LW208 Extraction Plan	Effective	Environment and Community Superintendent	**Administrative**											
					Bowmans Creek EA (2009) - assessed Surface and Groundwater Impacts	Effective	Environment and Community Superintendent	**Administrative**											

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
					Ashton Coal Project EIS (2001) - assessed Surface and Groundwater Impacts	Effective	Environment and Community Superintendent	**Administrative**											
					Site Water Management Plan (2018)	Effective	Environment and Community Superintendent	**Administrative**											
					Flora and Fauna Management Plan (2017)	Effective	Environment and Community Superintendent	**Administrative**											
					Previous seams extracted (PG, ULD and ULLD seams) and design information available	Effective	Mining Surveyor	**Administrative**											
					Water Access Licence (WAL) to cover reduction of base flow from Bowmans Creek	Effective	Environment and Community Superintendent	**Administrative**											
					Flow monitoring capability on Bowmans Creek (Ashton, Government Gauging Station and Manual)	Effective	Environment and Community Superintendent	**Administrative**											
			Landform Changes	Water losses from the surface - potential water inflow into mine through cracking in breach of annual licence allocation	CITECT Monitoring of Dewatering Borehole (Borehole Pumps 5 & 6) - alarm settings based on water outflow triggers	Effective	Engineering Manager	**Engineering**	**(E) Environmental Impact**	**3**	**C**	**13**	**(H)**	Review and update Surface and Groundwater Impact Modelling and Assessment to consider increased water inflow (potentially double) from landform changes (Northern Area when mining LW206) and healing of cracking.	**3**	**D**	**9**	**(M)**	Phil Brown

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
														Refer to previous inflow issues that occurred in LW6B.					
				Rainfall event and surface cracking - potential water inflow into mine Note: Not an Inrush Potential	Surface and Groundwater Impact Assessment for LW205 - LW208 Impacts (AGE, April 2020) - controls and recommendations included in the LW205 - LW208 Extraction Plan	Effective	Environment and Community Superintendent	**Administrative**	**(O) Asset Damage and Other**	**3**	**A**	**20**	**(H)**	Installation of Borehole Pump 7 (by end 2020) - consideration of flow-rate to consider modelled water inflows if surface to seam cracking (LW206B and LW207B) and significant rainfall event coincide.	**3**	**C**	**13**	**(H)**	Tony Sutherland
					Bowmans Creek EA (2009) - assessed Surface and Groundwater Impacts	Effective	Environment and Community Superintendent	**Administrative**						Review water storage / management / pumping capability underground especially when mining LW206B and LW207B if there is a scenario of surface cracking connection to ULLD seam coinciding with a significant rainfall event.					Tony Sutherland
					Ashton Coal Project EIS (2001) - assessed Surface and Groundwater Impacts	Effective	Environment and Community Superintendent	**Administrative**											
					Water Access Licences (WALs)	Effective	Environment and Community Superintendent	**Administrative**											
					Monthly Water Balance checks	Effective	Environment and	**Administrative**											

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
					by Environmental Team (considers rainfall, inflow and dewatering borehole data)		Community Superintendent												
					Site Water Management Plan includes TARP (24L/second or greater - investigate)	Effective	Environment and Community Superintendent	**Administrative**											
C	**Aquifers, known groundwater resources**	**1.03**	**Alluvial ground water level and quality changes greater than predicted**	Alluvial ground water level and quality changes greater than predicted.	Surface and Groundwater Impact Assessment for LW205 - LW208 Impacts (AGE, April 2020) - controls and recommendations included in the LW205 - LW208 Extraction Plan	Effective	Environment and Community Superintendent	**Administrative**	**(E) Environmental Impact**	**3**	**D**	**9**	**(M)**	Review and update the Water Management Plan to consider LW205 - LW208.	**3**	**D**	**9**	**(M)**	Phil Brown
					Site Water Management Plan (2018)	Effective	Environment and Community Superintendent	**Administrative**											
					Groundwater Model - reviewed as part of condition of approval and assumptions updated (including observations)	Effective	Environment and Community Superintendent	**Administrative**											
					WAL - 29566 (Bowmans Creek Alluvial Access Licence) - 358ML/year	Effective	Environment and Community Superintendent	**Administrative**											
			Hard Rock ground water quantity and quality changes greater than predicted (including the combined effect).	Hard Rock ground water level and quality changes greater than predicted (including the combined effect).	Surface and Groundwater Impact Assessment for LW205 - LW208 Impacts (AGE, April 2020) - controls and recommendations included in the	Effective	Environment and Community Superintendent	**Administrative**	**(E) Environmental Impact**	**2**	**D**	**5**	**(L)**	Review and update Water Management Plan to consider LW205 - LW208.	**2**	**D**	**5**	**(L)**	Phil Brown

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
					LW205 - LW208 Extraction Plan														
					Site Water Management Plan (2018)	Effective	Environment and Community Superintendent	**Administrative**											
					Groundwater Model - reviewed as part of condition of approval and assumptions updated (including observations)	Effective	Environment and Community Superintendent	**Administrative**											
					WALs 41501, 41552 and 41553 (Sydney Basin – North Coast Groundwater Source) – totalling 692ML/year	Effective	Environment and Community Superintendent	**Administrative**											
D	**Springs**	**1.04**	**N/A to LW205 - LW208 Extraction Area**																
E	**Sea / Lake**	**1.05**	**N/A to LW205 - LW208 Extraction Area**																
F	**Shorelines**	**1.06**	**N/A to LW205 - LW208 Extraction Area**																
G	**Natural Dams**	**1.07**	**N/A to LW205 - LW208 Extraction Area**																
H	**Cliffs / Pagodas**	**1.08**	**N/A to LW205 - LW208 Extraction Area**																
I	**Steep Slopes**	**1.09**	**N/A to LW205 - LW208 Extraction Area**																
J	**Escarpments**	**1.10**	**N/A to LW205 - LW208 Extraction Area**																
K	**Land Prone to Flooding or Inundation**	**1.11**	**Land Changes - Land Prone to Flooding or Inundation (including ponding)**	Landform no longer free draining due to mine subsidence - non-compliance with commitments (including	Remedial actions to maintain a free draining landform from outcomes of subsidence monitoring and inspections	Effective	Environment and Community Superintendent	**Engineering**	**(E) Environmental Impact**	**3**	**D**	**9**	**(M)**	As Low as Reasonably Practicable	**3**	**D**	**9**	**(M)**	

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
				reducing agricultural value - final landform)	Bowmans Creek EA (2009) includes commitments to maintain a free draining landform on Western Blocks	Effective	Environment and Community Superintendent	**Administrative**											
					Existing Site Water Management Plan and Mining Operations Plan include controls for maintaining free draining landscape (e.g. cutting in or backfilling)	Effective	Environment and Community Superintendent	**Administrative**											
					Studies have been conducted to determine potential landform changes by External Specialist (refer to Subsidence Assessment Report)	Effective	Environment and Community Superintendent	**Administrative**											
					Subsidence Monitoring Program	Effective	Mining Surveyor	**Administrative**											
					Monthly Environmental Inspection (Intelex Driven)	Effective	Environment and Community Superintendent	**Administrative**											
L	**Swamps, Wetlands, Water-Related Ecosystems**	**1.12**	**Impacts to groundwater dependent ecosystems:** **- Hunter River** **- Bowmans Creek** **- Glennies Creek**	Surface water quality/quantity changes due to subsidence impacts to GDEs	Mapped GDEs - State Government mapping does not include River Red Gums		Context	**Administrative**	**(E) Environmental Impact**	**2**	**D**	**5**	**(L)**	Confirm existence / non-existence of GDEs in LW205 - LW208 Extraction area	**2**	**D**	**5**	**(L)**	Phil Brown
					Site Water Management Plan (2018) including Groundwater Monitoring Program	Effective	Environment and Community Superintendent	**Administrative**											
					Flora and Fauna Management Plan (2017)	Effective	Environment and	**Administrative**											

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							Community Superintendent												
					Mapped GDEs are located outside the angle of draw	Effective	Environment and Community Superintendent	**Administrative**											
M	**Threatened and protected species**	**1.13**	**Impacts to threatened or protected species:** **- Woodland Birds** **- Micro-bats** **- River Red-gums**	Subsidence results in impact on threatened or protected species either through subsidence or need to repair (i.e. repair works for subsidence)	River Red Gums are remote from the Extraction Plan area		Context	**Isolation**	**(E) Environmental Impact**	**1**	**C**	**4**	**(L)**	Implement Nest Box Program in re-established vegetation along Bowmans Creek Diversions (part of annual Flora and Fauna Monitoring)	**1**	**C**	**4**	**(L)**	Phil Brown
					Flora and Fauna Management Plan (2017) - includes Annual Flora and Fauna Monitoring within Bowmans Creek Riparian Corridor	Effective	Environment and Community Superintendent	**Administrative**											
					Monthly Environmental Inspection (Intelex Driven) - includes River Red Gums	Effective	Environment and Community Superintendent	**Administrative**											
					Ground Disturbance Permits - for subsidence repairs	Effective	Environment and Community Superintendent	**Administrative**											
					Subsidence Monitoring Program - inspections include recording of nest trees	Effective	Mining Surveyor	**Administrative**											
					Subsidence Monitoring Inspection Sheet - includes check for nest trees	Effective	Mining Surveyor	**Administrative**											

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
					Nest Box Program	In Progress	Environment and Community Superintendent	**Administrative**											
N	**National Parks**	**1.14**	**N/A to LW205 - LW208 Extraction Area**																
O	**State Recreation Areas**	**1.15**	**N/A to LW205 - LW208 Extraction Area**																
P	**State Forests**	**1.16**	**N/A to LW205 - LW208 Extraction Area**																
Q	**Natural Vegetation**	**1.17**	**Riparian Vegetation along Excised Section of Bowmans Creek**	Loss of habitat and connectivity of tree corridor	Flora and Fauna Management Plan (2017) - includes Annual Flora and Fauna Monitoring within Bowmans Creek Riparian Corridor	Effective	Environment and Community Superintendent	**Administrative**	**(E) Environmental Impact**	**2**	**D**	**5**	**(L)**	Implement Nest Box Program in re-established vegetation along Bowmans Creek Diversions (part of annual Flora and Fauna Monitoring)	**2**	**D**	**5**	**(L)**	Phil Brown
					Monthly Environmental Inspection (Intelex Driven)	Effective	Environment and Community Superintendent	**Administrative**											
					Nest Box Program	In Progress	Environment and Community Superintendent	**Administrative**											
					Revegetation along Bowmans Creek Diversions	Effective	Environment and Community Superintendent	**Administrative**											
R	**Areas of significant geological interest**	**1.18**	**N/A to LW205 - LW208 Extraction Area**																
S	**Any other feature considered significant**	**1.19**	**N/A to LW205 - LW208 Extraction Area**																
2. Public Utilities																			
A	**Railways**	**2.01**	**N/A to LW205 - LW208 Extraction Area**																

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B	**Roads (All Types)**	**2.02**	**Roads (New England Highway)**	Subsidence impacts roads resulting in personal injury to persons travelling on road	Mine Plan – angle of draw touches the highway road reserve but no impact to highway	Effective	Technical Services Manager	**Engineering**	**(P) Harm to People**	**1**	**E**	**1**	**(L)**	Extraction Plan - Built Features Management Plan Appendix to include: - New England Highway	**1**	**E**	**1**	**(L)**	Phil Brown
					Geotechnical assessment for pillar stability and potential for potholes (First Workings Pillar Stability Review, Mine Advice, 2019) indicated long term stable and non-subsiding	Effective	Technical Services Manager	**Engineering**											
					Built Features Management Plan - Appended to Extraction Plan (includes all Major Infrastructure impacted by subsidence in the Extraction Plan Area)	Effective	Environment and Community Superintendent	**Administrative**											
					RMS Pothole Management Plan (for New England Highway) Note: potholes unlikely to be a concern for LW205 - LW208 as at depths >50m	Effective	Technical Services Manager	**Administrative**											
					Subsidence Monitoring Program	Effective	Mining Surveyor	**Administrative**											
					Existing survey monitoring shows no impact to New England Highway.	Effective	Context												
			Roads (Dairy Lane) - N/A to LW205 - LW208																

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
			Roads (Lemington Road and two associated culverts)	Cracking and change of grade on Lemington Road due to subsidence - predicted 2 to 2.5m of Subsidence (refer to Appendix 3) resulting in roadway damage and potential for personal injury to road users or the roadway becoming not trafficable	Asset Management Plan Appended to Built Features Management Plan Appended to Extraction Plan (includes all Major Infrastructure impacted by subsidence in the Extraction Plan Area)	Effective	Environment and Community Superintendent	**Administrative**	**(P) Harm to People**	**4**	**D**	**14**	**(H)**	Extraction Plan - Built Features Management - Asset Management Plan Appendix to include: - Singleton Council (Lemington Road) considering monitoring 24/7 when impacted, remediation / repair plans including regular regrading, traffic control, communication with road users - Rav, HVO, etc., roadway signage, culverts.	**4**	**E**	**10**	**(M)**	Phil Brown
					Subsidence Monitoring Program	Effective	Mining Surveyor	**Administrative**						Review and update Subsidence Monitoring Program to incorporate Lemington Road for LW205 - LW208 Extraction					Jeff Peck
					Agreement (December 2013) - Ravensworth, ACOL and Singleton Shire Council. ACOL monitor and maintain and obtain payment from Ravensworth for maintenance of roadway	Effective	Environment and Community Superintendent	**Administrative**						Consider roadway design post-subsidence including culvert positioning and depth (consider drainage from Western to Eastern side).					Jeff Peck

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			Southern AGLM Access Road - Part Sealed at Entrance then Dirt Road	Cracking and change of grade on Southern AGLM Access Road due to subsidence - predicted 2 to 2.5m of Subsidence (refer to Appendix 3) resulting in roadway damage and potential for personal injury to road users or the roadway becoming not trafficable - restricting access to area	Asset Management Plan Appended to Built Features Management Plan Appended to Extraction Plan (includes all Major Infrastructure impacted by subsidence in the Extraction Plan Area)	Effective	Environment and Community Superintendent	**Administrative**	**(P) Harm to People**	**2**	**D**	**5**	**(L)**	Extraction Plan - Built Features Management - Asset Management Plan Appendix to include: - Southern AGLM Access Road considering monitoring when impacted, remediation / repair plans including regular regrading, communication with road users - AGLM, etc., roadway signage, culverts.	**2**	**D**	**5**	**(L)**	Phil Brown
					Subsidence Monitoring Program	Effective	Mining Surveyor	**Administrative**	**(O) Asset Damage and Other**					Review and update Subsidence Monitoring Program to incorporate Southern AGL Access Road (including fences and gates)	**2**	**B**	**12**	**(M)**	Jeff Peck
														Determine who accesses Southern AGLM Access Road (e.g. commercial composting facility, AGLM, ACOL, etc.) and consider in the Southern AGLM Access Road Asset Management					Phil Brown

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
														Plan. Consider alternative access.					
C	**Bridges**	**2.03**	**Bridges (New England Highway) N/A to LW205 - LW208**																
D	**Tunnels**	**2.04**	**N/A to LW205 - LW208 Extraction Area**																
E	**Culverts**	**2.05**	**Refer to Roadways (Line Item 2.02)**																
F	**Water / Gas / Sewerage Pipelines**	**2.06**	**Impacts to mine water supply lines, tailings line, mine dewatering lines, gas pipelines and tube bundle pipe lines (ACOL owned) and Narama to Mt Owen Water Supply (Glencore owned)**	Discharge of ACOL mine water to Bowmans Creek from damage to pipeline due to subsidence	Poly welded plastic pipe	Effective	Environment and Community Superintendent	**Substitution**	**(E) Environmental Impact**	**4**	**C**	**18**	**(H)**	Review and update Subsidence Monitoring Program to incorporate mine water supply lines, tailings line, mine dewatering lines and gas pipelines (ACOL owned) and Narama to Mt Owen Water Supply (Glencore owned) for LW205 - LW208 Extraction	**4**	**D**	**14**	**(H)**	Jeff Peck
				Damage to tailings line due to subsidence resulting in discharge of tailings from pipeline to Bowmans Creek	Leak detection monitoring - tailings water, return water (through CITECT to CHPP Control Room)	Effective	Environment and Community Superintendent	**Engineering**	**(E) Environmental Impact**	**4**	**D**	**14**	**(H)**	Survey the Narama to Mt Owen Water Supply Pipeline to confirm location (As Built obtained from Glencore however not accurate)	**4**	**D**	**14**	**(H)**	Jeff Peck

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
				Damage to Mt Owen Water Supply line due to subsidence resulting in impact to neighbour (Glencore)	Gas pipeline monitoring (through CITECT to UG Control Room)	Effective	Technical Services Manager	**Engineering**	**(R) Impact on Reputation**	**2**	**C**	**8**	**(M)**	Review design of tube bundle pipelines and gas pipelines / depth of pipelines for future pipeline installations to factor in subsidence impacts (e.g. try to keep shallow if possible)	**2**	**D**	**5**	**(L)**	Todd Shumack
				Damage to Mt Owen Water Supply line due to subsidence resulting in discharge of mine water to Bowmans Creek	Pressure testing of pipelines prior to commissioning	Effective	Environment and Community Superintendent	**Engineering**	**(E) Environmental Impact**	**4**	**C**	**18**	**(H)**	Verify detection / monitoring on Narama to Mt Owen Water Supply with Glencore to determine if damage to the pipeline is able to be detected (and notification to ACOL of damage for repair).	**4**	**D**	**14**	**(H)**	Phil Brown
				Damage to gas lines due to subsidence results in uncontrolled discharge of gas into environment and stoppage to operation	Shiftly Inspection of Tailings Line (by CHPP Supervisor)	Effective	CHPP Superintendent	**Administrative**	**(O) Asset Damage and Other**	**2**	**C**	**8**	**(M)**		**2**	**D**	**5**	**(L)**	
					Subsidence Monitoring Program - visual inspections	Effective	Mining Surveyor	**Administrative**											
G	**Liquid Fuel Pipelines**	**2.07**	**N/A to LW205 - LW208 Extraction Area**																

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
H	**Electricity Transmission Lines (Overhead / Underground) and Associated Infrastructure**	**2.08**	**Impacts on Electricity Transmission Lines:** **- Southern 132kV - Ausgrid** **- 11kV line - Ausgrid** **- 330kV line - Transgrid** **- 11kv line - Ausgrid (New England Highway)** **- 11kV line – ACOL** **- 33kv line - Rav Ops**	Damage to electricity transmission lines due to subsidence that interrupts supply and requires repairs / causes safety issues	Single-pole structures (excluding Transgrid 330kV line)	Effective	Technical Services Manager	**Engineering**	**(O) Asset Damage and Other**	**2**	**D**	**5**	**(L)**	Review and update Built Features Management Plans for: - Ausgrid - Transgrid - Rav Ops	**2**	**D**	**5**	**(L)**	Phil Brown
				Flooding or inundation of electricity transmission lines restricting access if requiring repair (Southern Block - 11kV Ausgrid Line)	Transgrid 330kV line is remote and designed to accommodate subsidence (no movement expected but planned to be checked)	Effective	Technical Services Manager	**Engineering**	**(O) Asset Damage and Other**	**3**	**D**	**9**	**(M)**	Complete subsidence impact assessment of Rav Ops 33kV line and determine ongoing management process with Rav Ops (longwall by longwall basis).	**3**	**D**	**9**	**(M)**	Phil Brown
					New England Highway 11kV Ausgrid line is remote - no impact	Effective	Technical Services Manager	**Engineering**						Upgrade of Southern 132kV Ausgrid Line - pole replacement and footings as per Lindsay Dynan (2016) structural assessment					Tony Sutherland
					Built Features Management Plan - includes Electricity Transmission Plans - one Plan for each Owner (includes inspections, monitoring and TARP)	Effective	Environment and Community Superintendent	**Administrative**						Complete subsidence predictions and advice for management for 11kV Ausgrid lines across LW205 - LW208 block.					Tony Sutherland
					Development Consent includes a commitment to maintain safe, serviceable, and repairable - including	Effective	Environment and Community Superintendent	**Administrative**						Rav Ops 33kV Line Pole requires relocation following mining to remove from ponding area.					Tony Sutherland

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					electricity transmission lines														
					Subsidence predictions completed for transmission lines	Effective	Environment and Community Superintendent	**Administrative**											
					Existing Structural Adequacy Assessment Report on AusGrid 132kV Line	Effective	Technical Services Manager	**Administrative**											
I	**Telecommunication Lines (Overhead / Underground) and Associated Infrastructure**	**2.09**	**Impacts on Telecommunication Lines:** **- Telstra Local Network (Copper Cable) services the Office of Water Gauging Station and beyond** **- Rav Ops Fibre Optic Cable (alongside Lemington Road)**	Damage to telecommunication lines due to subsidence that interrupts supply and requires repairs / causes safety issues	Built Features Management Plan (including Telstra Asset Management Plan and Rav Ops Asset Management Plan)	Effective	Environment and Community Superintendent	**Administrative**	**(O) Asset Damage and Other**	**2**	**C**	**8**	**(M)**	Survey the Rav Ops Fibre Optic Cable to confirm location (Dial before Dig, etc.) and determine with Rav Ops what this cable is used for / what the potential impacts are if damaged.	**2**	**D**	**5**	**(L)**	Jeff Peck
														Review and update Built Features Management Plans (including contingency if damaged) for: - Telstra - Rav Ops Options: Telstra Cable replaced by mobile, fibre optic placed on surface if able. If fibre optic has to be replaced consider placement along 330kV powerline corridor.					Phil Brown

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J	**Water Treatment Tanks, Water and Sewage Treatment Works**	**2.10**	**N/A to LW205 - LW208 Extraction Area**																
K	**Dams, Reservoirs and Associated Works**	**2.11**	**Impact on Void 5 Ash Dam**	No impact due to remote location and construction type that is not susceptible to small movements	Advising DSC of Face Position of First Workings	Effective	Mining Surveyor	**Administrative**	**(R) Impact on Reputation**	**2**	**D**	**5**	**(L)**	Advise DSC prior to mining within the Notification Zone for LW205-LW208 extraction.	**2**	**D**	**5**	**(L)**	Jeff Peck
			Impact on Sediment Dams **Note: Dams are not being used as Sediment Dams but do hold water**	Damage due to cracking from subsidence	Subsidence Monitoring Program - visual inspections (and remediation as required)	Effective	Mining Surveyor	**Administrative**	**(O) Asset Damage and Other**	**1**	**C**	**4**	**(L)**		**1**	**C**	**4**	**(L)**	
L	**Air Strips**	**2.12**	**N/A to LW205 - LW208 Extraction Area**																
M	**Any Other Infrastructure Items**	**2.13**	**Impact on Ravensworth Underground #5 Ventilation Shaft**		Note: Outside of area where subsidence is expected to have an affect however monitoring is recommended.				**(O) Asset Damage and Other**	**1**	**D**	**2**	**(L)**	Review and update Subsidence Monitoring Program to include the Ravensworth UG #5 Ventilation Shaft	**1**	**D**	**2**	**(L)**	Jeff Peck
3. Public Amenities																			
A	**Hospitals**	**3.01**	**N/A to LW205 - LW208 Extraction Area**																
B	**Places of Worship**	**3.02**	**N/A to LW205 - LW208 Extraction Area**																
C	**Schools**	**3.03**	**N/A to LW205 - LW208 Extraction Area**																
D	**Shopping Centres**	**3.04**	**N/A to LW205 - LW208 Extraction Area**																
E	**Community Centres**	**3.05**	**N/A to LW205 - LW208 Extraction Area**																
F	**Office Buildings**	**3.06**	**N/A to LW205 - LW208 Extraction Area**																

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
G	**Swimming Pools**	**3.07**	**N/A to LW205 - LW208 Extraction Area**																
H	**Bowling Greens**	**3.08**	**N/A to LW205 - LW208 Extraction Area**																
I	**Sports Ovals and Cricket Grounds**	**3.09**	**N/A to LW205 - LW208 Extraction Area**																
J	**Race Courses**	**3.10**	**N/A to LW205 - LW208 Extraction Area**																
K	**Golf Courses**	**3.11**	**N/A to LW205 - LW208 Extraction Area**																
L	**Tennis Courts**	**3.12**	**N/A to LW205 - LW208 Extraction Area**																
M	**Any other Public Amenities considered Significant**	**3.13**	**N/A to LW205 - LW208 Extraction Area**																
4. Farm Land and Facilities																			
A	**Agricultural Utilisation or Agricultural Suitability of Farm Land**	**4.01**	**Changes to the agricultural Utilisation or Agricultural Suitability of Farm Land**	Injury to cattle on farming land	Existing use is general grazing	Effective	Environment and Community Superintendent	**Administrative**	**(R) Impact on Reputation**	**2**	**D**	**5**	**(L)**	Confirm agistment licence for property states that it is an active mine site and determine management plan for cattle / subsidence repairs.	**2**	**D**	**5**	**(L)**	Phil Brown
					Farmland Monitoring Program (vegetation monitoring over grass lands)	Effective	Environment and Community Superintendent	**Administrative**											
					Mining Operations Plan includes farm land	Effective	Environment and Community Superintendent	**Administrative**											
					Agistment Licence for Property (states it is an active mine site)	Effective	Environment and Community Superintendent	**Administrative**											

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
B	**Farm Buildings and Sheds**	**4.02**	**ACOL-Owned Farm Buildings / Sheds: - Yellow House**	Subsidence impacts resulting in house no longer able to be used as storage	Owned by ACOL, unoccupied and not used for farming purposes (currently stores drill core). No significance.	Effective	Environment and Community Superintendent	**Administrative**	**(O) Asset Damage and Other**	**1**	**A**	**11**	**(M)**	Consider relocation of cores from Yellow house prior to impact from mine subsidence.	**1**	**A**	**11**	**(M)**	Graham Noon
					No intent to maintain the house in safe, serviceable, and repairable condition - will be barricaded following any damage	Effective	Environment and Community Superintendent	**Administrative**											
C	**Gas or Fuel Storage**	**4.03**	**N/A to LW205 - LW208 Extraction Area**																
D	**Poultry Sheds**	**4.04**	**N/A to LW205 - LW208 Extraction Area**																
E	**Glass Houses**	**4.05**	**N/A to LW205 - LW208 Extraction Area**																
F	**Hydroponic Systems**	**4.06**	**N/A to LW205 - LW208 Extraction Area**																
G	**Irrigation Systems**	**4.07**	**N/A to LW205 - LW208 Extraction Area**																
H	**Fences, Gates and Cattle Grids**	**4.08**	**ACOL Fences, Gates and Cattle Grids and Southern AGL Access Road**	Damage due to mine subsidence requiring repairs	Built Features Management Plan and Asset Management Plans	Effective	Environment and Community Superintendent	**Administrative**	**(O) Asset Damage and Other**	**1**	**D**	**2**	**(L)**	Agistment Licence to include repair requirements for fences, gates and cattle grids.	**1**	**D**	**2**	**(L)**	Phil Brown
					Monthly Environmental Inspection - conservation areas and cattle exclusion zones (Intelex Driven)	Effective	Environment and Community Superintendent	**Administrative**						Review and update Subsidence Monitoring Program to incorporate Southern AGL Access Road (including fences and gates)					Jeff Peck

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
					Fencing would need to be fixed as the land is subsided	Effective	Environment and Community Superintendent	**Administrative**											
					Agistment Licence for Property (states it is an active mine site)	Effective	Environment and Community Superintendent	**Administrative**											
I	**Farm Dams**	**4.09**	**ACOL Farm Dams**	Damage due to mine subsidence requiring repairs or reduced storage capacity of dams	Subsidence Monitoring Program - visual inspections	Effective	Mining Surveyor	**Administrative**	**(O) Asset Damage and Other**	**1**	**C**	**4**	**(L)**	As Low as Reasonably Practicable	**1**	**C**	**4**	**(L)**	
J	**Wells and Bores**	**4.10**	**Private Bores in Locality**	Loss of water / bore water quality	Site Water Management Plan	Effective	Environment and Community Superintendent	**Administrative**	**(O) Asset Damage and Other**	**1**	**D**	**2**	**(L)**	As Low as Reasonably Practicable	**1**	**D**	**2**	**(L)**	
					Groundwater Model - reviewed as part of condition of approval and assumptions updated (including observations)	Effective	Environment and Community Superintendent	**Administrative**											
					No privately owned bores in the area of the LW205 - LW208 predicted to be impacted	Effective	Context												
			Note: Mining Surveyor confirmed that no wells remained following Subsidence RA on 12/02/20																
K	**Any other Feature considered Significant**	**4.11**	**N/A to LW205 - LW208 Extraction Area**		-														
5. Industrial, Commercial and Business Establishments																			
A	**Factories**	**5.01**	**N/A to LW205 - LW208 Extraction Area**																

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
B	**Workshops**	**5.02**	**N/A to LW205 - LW208 Extraction Area**																
C	**Business or Commercial Establishments**	**5.03**	**N/A to LW205 - LW208 Extraction Area**																
D	**Gas or Fuel Storages or Associated Plants**	**5.04**	**N/A to LW205 - LW208 Extraction Area**																
E	**Waste Storages or Associated Plants**	**5.05**	**N/A to LW205 - LW208 Extraction Area**																
F	**Buildings, Equipment or Operations that are sensitive to Surface Movements**	**5.06**	**N/A to LW205 - LW208 Extraction Area**																
G	**Surface Mining (Open Cut) Voids or Rehabilitated Areas**	**5.07**	**Ravensworth #2 Bayswater Pit**	Mining in vicinity may see inflows into underground workings if water storage in Bayswater pit	Bayswater dips to the West	Effective	Context		**(O) Asset Damage and Other**	**2**	**C**	**8**	**(M)**	Consider installation of piezometer in Bayswater Pit if concerned regarding potential source of water inflow into underground.	**2**	**C**	**8**	**(M)**	Phil Brown
H	**Mine Infrastructure including Tailings**	**5.08**	**ACOL Dewatering Bores**	Damage and interruption to dewatering bores	Bore angle of draw outside of predicted subsidence impact - tolerable	Effective	Technical Services Manager	**Engineering**	**(O) Asset Damage and Other**	**4**	**D**	**14**	**(H)**	Review location of Borehole 7 - based on predicted subsidence impact zone (shearing of borehole) or borehole pumps.	**4**	**D**	**14**	**(H)**	Tony Sutherland
6. Areas of Archaeological or Heritage Significance																			
A	**Areas of Archaeological and/or Heritage Significance**	**6.01**	**Impact outside of the AHIP approved activities due to mine subsidence.** **Note: Bowmans Creek Water Hole site is outside of**	Environmental prosecution	Archaeological and Cultural Heritage Management Plan (ACHMP)	Effective	Environment and Community Superintendent	**Administrative**	**(E) Environmental Impact**	**3**	**D**	**9**	**(M)**	As Low as Reasonably Practicable	**3**	**D**	**9**	**(M)**	
					ACHMP includes development consent (as	Effective	Environment and	**Administrative**											

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
			predicted subsidence impact area		modified for Bowmans Creek) includes controls for managing items in areas of cultural significance		Community Superintendent												
					Approved AHIP for arch clearance ahead of mining longwall panels	Effective	Environment and Community Superintendent	**Administrative**											
					Ground Disturbance Permits - for subsidence repairs	Effective	Environment and Community Superintendent	**Administrative**											
7. Items of Architectural Significance																			
A	**Items of Architectural Significance**	**7.01**	**N/A to LW205 - LW208 Extraction Area**																
8. Survey Control Marks																			
A	**Permanent Survey Control Marks**	**8.01**	**Impact on State Survey Marks on Lemington Road**	Notification not provided to NSW Spatial Services	Nil				**(R) Impact on Reputation**	**1**	**C**	**4**	**(L)**	Notification to NSW Spatial Services regarding impact on state survey marks	**1**	**D**	**2**	**(L)**	Jeff Peck
9. Residential Establishments																			
A	**Houses**	**9.01**	**Yellow House - Refer to Section 4.02**																
B	**Flats or Units**	**9.02**	**N/A to LW205 - LW208 Extraction Area**																
C	**Caravan Parks**	**9.03**	**N/A to LW205 - LW208 Extraction Area**																
D	**Retirement or Aged Care Villages**	**9.04**	**N/A to LW205 - LW208 Extraction Area**																

#	Area / Feature	#	Risk Source	Potential Event /Consequences	Existing Control	Control Status	Control Owner	HOC &/ or Mitigant	Loss Type	Consequence	Likelihood	Existing Risk	Risk Level	Additional Control / Action	Consequence	Likelihood	Target Risk	Risk Level	Person Responsible
E	**Associated Structures such as Workshops, Garages, On-Site Waste Water Systems, Water or Gas Tanks, Swimming Pools or Tennis Courts**	**9.05**	**N/A to LW205 - LW208 Extraction Area**																
10. Any Other Item of Importance																			
A	**Any Other Item of Importance**	**10.01**	**Personnel or Stock - Exposed to Surface Cracking: - Lemington Road - Alternate Route to Property 130**	Falls, vehicle accidents, stock injuries, wildlife injuries (excluding Lemington Road - covered in Section 2.02)	Stock exclusion zones	Effective	Environment and Community Superintendent	**Isolation**	**(P) Harm to People**	**2**	**D**	**5**	**(L)**	Review and update Public Safety Management Plan to include Lemington Road.	**2**	**D**	**5**	**(L)**	Phil Brown
					Public Safety Management Plan (appended to Extraction Plan)	Effective	Environment and Community Superintendent	**Administrative**											
					Warning Signs installed	Effective	Environment and Community Superintendent	**Administrative**											
					Regular communication with affected stakeholders	Effective	Environment and Community Superintendent	**Administrative**											
					Subsidence Monitoring Program - visual inspections (and remediation as required)	Effective	Mining Surveyor	**Mitigant**											
		10.02	**Roadside Memorial to Tom Adamthwaite on Lemington Road**	Impact on reputation	Is remote and outside of predicted subsidence area				**(R) Impact on Reputation**	**1**	**D**	**2**	**(L)**	Confirm location of the Tom Adamthwaite memorial on Lemington Road and that it is outside of predicted subsidence impact zone.	**1**	**D**	**2**	**(L)**	Jeff Peck

5. RISK CONTROL ACTION / IMPLEMENTATION PLAN

Action No.	RA Item/s	Action	Accountable Person
1	**1.02**	Installation of Borehole Pump 7 (by end 2020) - consideration of flow-rate to consider modelled water inflows if surface to seam cracking (LW206B and LW207B) and significant rainfall event coincide.	Tony Sutherland
2	**1.02**	Review and update Surface and Groundwater Impact Modelling and Assessment to consider increased water inflow (potentially double) from landform changes (Northern Area when mining LW206) and healing of cracking. Refer to previous inflow issues that occurred in LW6B.	Phil Brown
3	**1.02**	Review water storage / management / pumping capability underground especially when mining LW206B and LW207B if there is a scenario of surface cracking connection to ULLD seam coinciding with significant rainfall event.	Tony Sutherland
4	**1.02, 1.03**	Review and update Flora and Fauna Management Plan to consider LW205 - LW208.	Phil Brown
5	**1.02, 1.03**	Review and update Site Water Management Plan to consider LW205 - LW208.	Phil Brown
6	**1.12**	Confirm existence / non-existence GDEs in LW205 - LW208 Extraction area.	Phil Brown
7	**1.13, 1.17**	Implement Nest Box Program in re-established vegetation along Bowmans Creek Diversions (part of annual Flora and Fauna Monitoring).	Phil Brown
8	**2.02**	Consider roadway design post-subsidence including culvert positioning and depth (consider drainage from Western to Eastern side).	Jeff Peck
9	**2.02**	Determine who accesses Southern AGLM Access Road (e.g. commercial composting facility, AGLM, ACOL, etc.) and consider in the Southern AGLM Access Road Asset Management Plan. Consider alternative access.	Phil Brown
10	**2.02**	Extraction Plan - Built Features Management - Asset Management Plan Appendix to include: - Singleton Council (Lemington Road) considering monitoring 24/7 when impacted, remediation / repair plans including regular regrading, traffic control, communication with road users - Rav, HVO, etc., roadway signage, culverts.	Phil Brown
11	**2.02**	Extraction Plan - Built Features Management - Asset Management Plan Appendix to include: - Southern AGLM Access Road considering monitoring when impacted, remediation / repair plans including regular regrading, communication with road users - AGLM, etc., roadway signage, culverts.	Phil Brown
12	**2.02**	Extraction Plan - Built Features Management Plan Appendix to include: - New England Highway.	Phil Brown
13	**2.02, 2.06, 2.13, 4.08**	Review and update Subsidence Monitoring Program to include / incorporate: - Ravensworth UG #5 Ventilation Shaft - Lemington Road for LW205 - LW208 Extraction - mine water supply lines, tailings line, mine dewatering lines and gas pipelines (ACOL owned) and Narama to Mt Owen Water Supply (Glencore owned) for LW205 - LW208 Extraction - Southern AGL Access Road (including fences and gates).	Jeff Peck

Action No.	RA Item/s	Action	Accountable Person
14	**2.06**	Review design of tube bundle pipelines and gas pipelines / depth of pipelines for future pipeline installations to factor in subsidence impacts (e.g. try to keep shallow if possible).	Todd Shumack
15	**2.06**	Survey the Narama to Mt Owen Water Supply Pipeline to confirm location (As Built obtained from Glencore however not accurate).	Jeff Peck
16	**2.06**	Verify detection / monitoring on Narama to Mt Owen Water Supply with Glencore to determine if damage to the pipeline is able to be detected (and notification to ACOL of damage for repair).	Phil Brown
17	**2.08**	Complete subsidence impact assessment of Rav Ops 33kV line and determine ongoing management process with Rav Ops (longwall by longwall basis).	Phil Brown
18	**2.08**	Complete subsidence predictions and advice for management for 11kV Ausgrid lines across LW205 - LW208 block.	Tony Sutherland
19	**2.08**	Rav Ops 33kV Line Pole requires relocation following mining to remove from ponding area.	Tony Sutherland
20	**2.08**	Upgrade of Southern 132kV Ausgrid Line - pole replacement and footings as per Lindsay Dynan (2016) structural assessment	Tony Sutherland
21	**2.08, 2.09**	Review and update Built Features Management Plans (including contingency if damaged) for: - Ausgrid - Transgrid - Telstra - Rav Ops Options: Telstra Cable replaced by mobile, fibre optic placed on surface if able. If fibre optic has to be replaced consider placement along 330kV powerline corridor.	Phil Brown
22	**2.09**	Survey the Rav Ops Fibre Optic Cable to confirm location (Dial before Dig, etc.) and determine with Rav Ops what this cable is used for / what the potential impacts are if damaged.	Jeff Peck
23	**2.11**	Advise DSC prior to mining within the Notification Zone for LW205-LW208 extraction.	Jeff Peck
24	**4.01**	Confirm agistment licence for property states that it is an active mine site and determine management plan for cattle / subsidence repairs.	Phil Brown
25	**4.02**	Consider relocation of cores from Yellow house prior to impact from mine subsidence.	Graham Noon
26	**4.08**	Agistment Licence to include repair requirements for fences, gates and cattle grids.	Phil Brown
27	**5.07**	Consider installation of piezometer in Bayswater Pit if concerned regarding potential source of water inflow into underground.	Phil Brown
28	**5.08**	Review location of Borehole 7 - based on predicted subsidence impact zone (shearing of borehole) or borehole pumps.	Tony Sutherland
29	**8.01**	Notification to NSW Spatial Services regarding impact on state survey marks.	Jeff Peck
30	**10.01**	Review and update Public Safety Management Plan to include Lemington Road.	Phil Brown
31	**10.02**	Confirm location of the Tom Adamthwaite memorial on Lemington Road and that it is outside of predicted subsidence impact zone.	Jeff Peck

6. RISK ASSESSMENT AUTHORISATION / APPROVAL

Non Consensus Matters
Nil

Approval
I confirm that I have reviewed the outcomes of the risk assessment and, agree to the proposed action plan (if any actions not agreed – comment below) and will provide a framework of adequate resources to effectively implement the action plan requirements:

Risk Assessment Owner/s			
Name	**Position**	**Signature**	**Date**
Phil Brown	*Environment & Community Superintendent*		
Mining Engineering Manager (Legislated Risk Assessments)			
Name	**Position**	**Signature**	**Date**
Aaron McGuigan	*Mining Engineering Manager*		

Operations Manager Approval for High and Extreme Residual Risk Levels
I confirm that I have reviewed the identified risks that have an assessed residual risk level (in accordance with the Yancoal Risk Matrix) of High or Extreme and am satisfied they are as low as reasonably practicable (ALARP) providing the identified current and additional controls are implemented and effective and that the following additional controls are also included (if any additional actions required to what has already been identified in the risk assessment – comment below): *1.* *2.* *3.*

Name	**Position**	**Signature**	**Date**
Aaron McGuigan	*Operations Manager*		

7. APPENDICES

7.1 Appendix 1 – Yancoal Risk Matrix

Yancoal Risk Matrix		Effect / Consequence				
Loss Type		1 Insignificant	2 Minor	3 Moderate	4 Major	5 Catastrophic
(P) Harm to People		**Slight injury or health effects** report only (RO) or first aid injury (FAI)	**Minor injury or health effects** – medical treatment injury (MTI) or restricted work injury (RWI)	**Serious bodily injury or health effects** – lost time injury	**Single Fatality**	**Multiple fatalities**
(E) Environmental Impact		**Environmental nuisance** – trivial or negligible, short term impact to area of low significance, minimal or no physical remediation required No regulation. Cost < $1,000	**Minor environmental harm** – short term impact to area of limited local significance, limited physical remediation . Reportable Breach /Minor Non Compliance, potential warning notice, other notices (infringement / prosecution) unlikely. Costs $1K - $50K	**Serious environmental harm** – medium term impact to area of local conservation value, medium term physical remediation, actual community health impacts or significance or pollution or contamination Infringement Notice but Prosecution unlikely Costs $50k - $250k	**Major environmental harm** – long term reversible impacts to area of regional conservation significance, health statistics in community alter as a result of this incident or pollution or contamination Prosecution Costs $250k - $1M	**Extreme environmental harm** – irreversible impacts on environmental values of extreme & widespread areas, or those of national conservation significance, community fatalities or pollution or contamination Prosecution, License revoked Costs > $1M
(O) Asset Damage and Other Consequential Losses		**Slight damage** < $1M or < 1 day disruption to operation	**Minor damage** $1M - $5M or <1 week disruption to operation	**Local damage** $5M - $20M or <1 month disruption to operation	**Major damage** $20M -$100M or <6 months partial loss of operation	**Extreme damage** > $100M or 6 months Substantial or total loss of operation
(R) Impact on Reputation		**Slight impact** – Public awareness may exist but no public concern Isolated compliance failure – no brand damage	**Limited impact** – Some local public concern Intervention of regulating authority – minimal brand damage	**Considerable impact** - Regional public concern Major compliance failure involving fines – medium brand damage	**National impact** – National public concern Temporary withdrawal of license to operate – significant brand damage	**International impact** - International public attention Loss of shareholder confidence – irreparable brand damage
Likelihood	**Likelihood Examples (Guide)**	**Level of Risk**				
A (Almost Certain)	Likely that the unwanted event could occur several times per year in our jurisdiction	11 (M)	16 (H)	20 (H)	**23 (E)**	**25 (E)**
B (Likely)	Likely that the unwanted event could happen annually in our jurisdiction	7 (M)	12 (M)	17 (H)	**21 (E)**	**24 (E)**
C (Possible)	The unwanted event could happen within 10 years in our jurisdiction	4 (L)	8 (M)	13 (H)	18 (H)	**22 (E)**
D (Unlikely)	The unwanted event could happen within 50 years in our jurisdiction	2 (L)	5 (L)	9 (M)	14 (H)	19 (H)
E (Rare)	The unwanted event has never been known to occur is highly unlikely that it could ever occur in our jurisdiction	1 (L)	3 (L)	6 (M)	10 (M)	15 (H)

7.2 Appendix 2 – Risk Assessment Participants (Signed Copy)

Note: Due to COVID restrictions, risk assessment was held remotely via BlueJeans and all participants signed their relevant section of the attendance sheet and emailed it back to the facilitator.

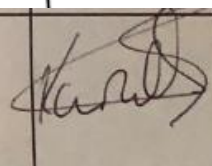
LW205 - LW208 Extraction Plan Subsidence Risk Assessment - Participants

No.	Date	Name Full name of person	Role In Business In RA i.e.: Facilitator, Scribe, Content / Technical Expert, Participant	Experience Record: Industry skills and experience generally (including number of years);	Relevance to this assessment Record: Any formal/technical qualifications; Formal risk assessment qualifications NB: experience must demonstrate relevance to the topic being risk assessed	Consensus (Y/N) If no, non-consensus matter must be recorded in applicable section	Signature
1	5/05/2020	Kylie Hannigan (STAC Consulting)	Facilitator / Scribe	24 years mining experience (both underground and open cut) 21 years health, safety, training and HR experience (including management roles) **Mining Clients:** Yancoal, Glencore/Xstrata, Rio Tinto, BHPBilliton/BMA, AngloAmerican, Peabody, Idemitsu, Various Contractors **Previously worked at:** Ulan Underground, Crinum/Crinum East Underground, Kestrel Underground, Blair Athol Open Cut	Consultant 20+ years Risk Assessment Facilitation Bachelor of Occupational Health and Safety (BOHS) MINE7033 (G3) Risk Management (University of Queensland) Lead Auditor (RABQSA Cert. No. 113053) Australian Institute of Mining and Metallurgy (AusIMM) - Member AIHS (formerly SIA) - Member Australian Institute of Management - Member	Y	

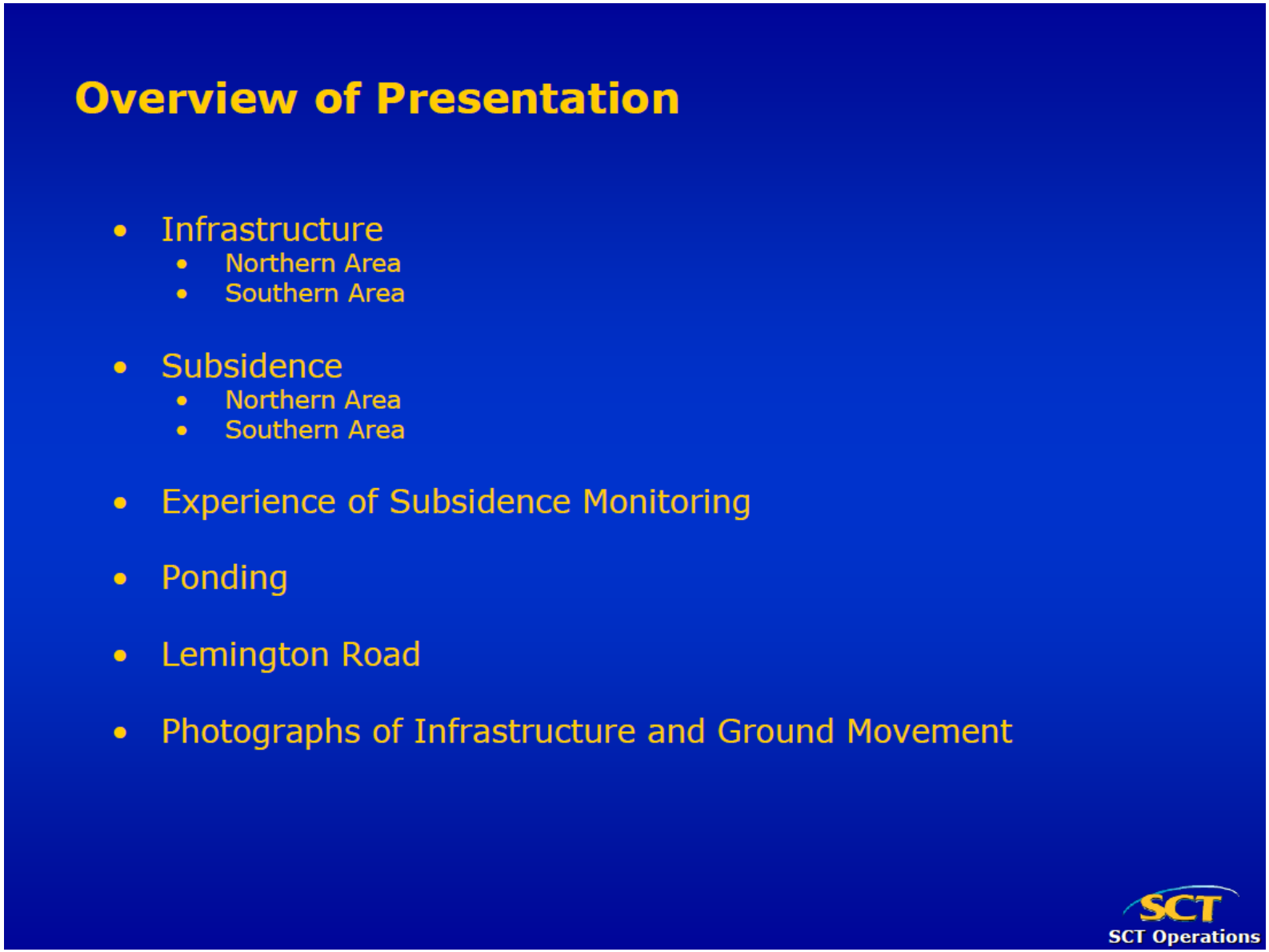
No.	Date	Name Full name of person	Role In Business In RA i.e.: Facilitator, Scribe, Content / Technical Expert, Participant	Experience Record: Industry skills and experience generally (including number of years);	Relevance to this assessment Record: Any formal/technical qualifications; Formal risk assessment qualifications NB: experience must demonstrate relevance to the topic being risk assessed	Consensus (Y/N) If no, non-consensus matter must be recorded in applicable section	Signature
2	5/05/2020	Tony Sutherland	Participant	35 years mining experience (both underground - 33 years and open cut) 3 years at Ashton Previously at Austar, Donaldson Open Cut, Abel, Tasman, North Wambo, Wollemi, United, Dartbrook, Moonee, Hunter Valley No. 1 Open Cut, Chain Valley, Liddell, West Wallsend, Newvale No. 2	**Technical Services Manager** Bachelor of Engineering Degree (Mining) Masters Business & Technology Practising Certificate - Mining Engineering Manager - Underground and Open Cut, Open Cut Examiner, Ventilation Officer and Undermanager Mine Manager's Certificate of Competency (Underground & Open Cut) Mines Rescue trained (20 years) Ventilation Officer (previously at Chain Valley, Dartbrook) G2 Risk Management Qualifications Lead Auditor Qualifications (SAI Global Certification No. C257507) Australian Institute of Mining and Metallurgy (AusIMM) - Member CPD Member - Mine Manager's Association of Australia	Y	
3	5/05/2020	Phil Brown	Participant	22 years experience (environmental - mining), 4 years - Pasminco 3 years at Ashton Previously at Abel, Donaldson, Tasman, Ellalong, Gretley	**Environment and Community Relations Superintendent** Health Inspection Certificate Bachelor of Applied Science (Environmental Health) Masters in Environmental Studies	Yes	

No.	Date	Name Full name of person	Role In Business In RA i.e.: Facilitator, Scribe, Content / Technical Expert, Participant	Experience Record: industry skills and experience generally (including number of years):	Relevance to this assessment Record: Any formal/technical qualifications; Formal risk assessment qualifications NB: experience must demonstrate relevance to the topic being risk assessed	Consensus (Y/N) If no, non-consensus matter must be recorded in applicable section	Signature
4	5/05/2020	Jeff Peck	Participant	38 years mining experience (UG) 12 years at Ashton 40 years - surveying 34 years - registered mine surveyor Previously at Glennies Creek and Lake Macquarie Mines	**Mining Surveyor** Diploma in Mine Surveying Associate Diploma in Civil Engineering Participation in Risk Assessments	Y	
5	5/05/2020	David Cooke	Participant	17 years mining experience (UG) 11 years at Ashton Previously at Dartbrook, Wambo, Blakefield, Ravensworth	**Operator / Site Safety and Health Representative - UG**	Y	
6	5/05/2020	Lachlan Crawford	Participant	21 years mining experience (consulting, research and site) 25 years environmental experience 3 years at Ashton (Contracting) Previously at UQ (Research), BMA - Saraji, various sites consulting, Bloomfield Colliery, E&C Manager (Wambo)	**Environment and Community Coordinator** Bachelor of Applied Science Masters of Mineral Resources	YES	

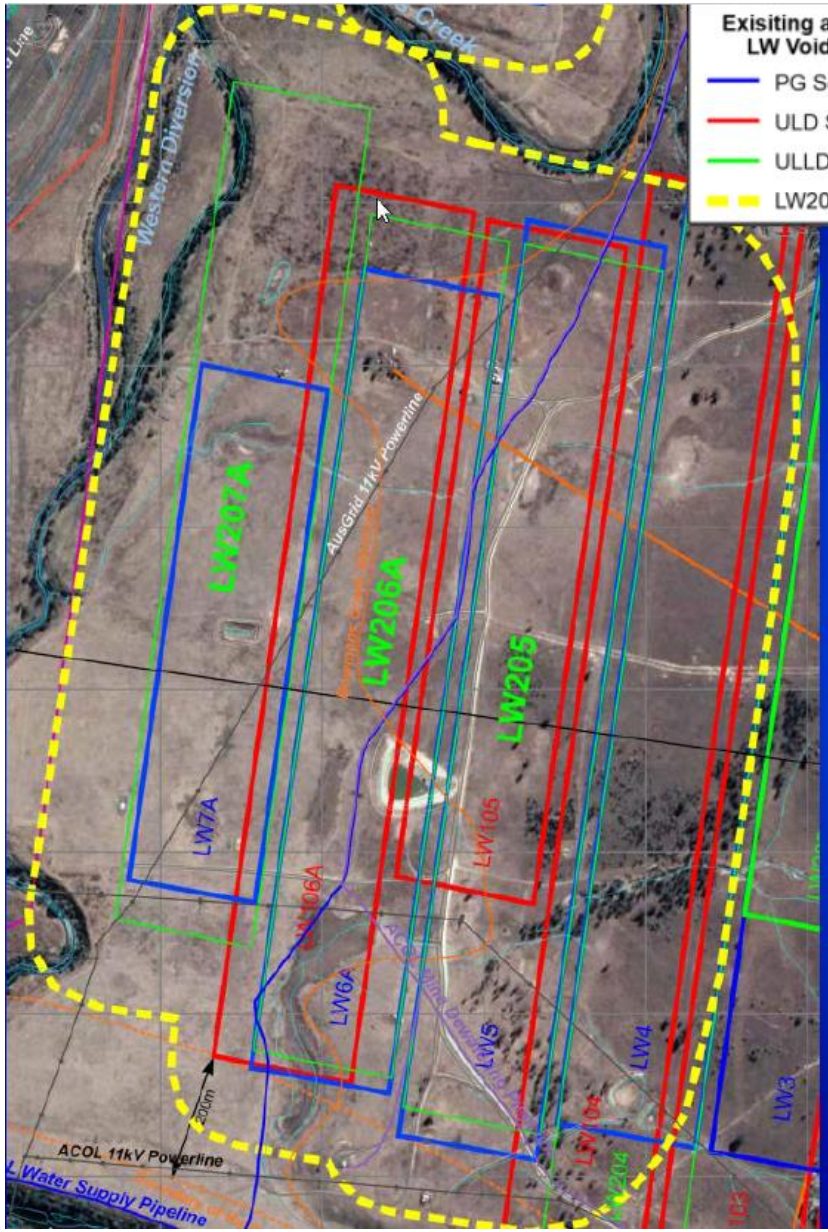
Note: Josh Peters only attended until 10:30am

8	5/05/2020	Matthew Copeland	Participant - Resource Strategies	5 years mining industry (environmental consultant - focus on Approvals and EIS) - open cut and underground Underground sites (NSW and QLD) - Metropolitan, Wambo, Tasman	**Project Manager** Bachelor of Civil and Geotechnical Engineering	Y	
9	5/05/2020	Dr K.W. (Ken) Mills	Content / Technical Expert - SCT	40 years experience as a geotechnical engineer working in field of rock mechanics primarily associated with underground coal mines.	**Principal Geotechnical Engineer / Director - SCT Operations Pty Ltd** PhD - Rock Mechanics Bachelor of Civil Engineering	Y	
10	5/05/2020	Andrew Durick	Participant - AGE Water Consultant	24 years experience (modelling groundwater) Qld State Government and AGE Various sites in Bowen Basin and Hunter Valley	**Director / Principal Modeller - AGE** Bachelor of Engineering and Environmental Engineering Master of Applied Science (Mathematics)	Yes	

7.3 Appendix 3 – Ashton Subsidence Risk Assessment Considerations for Longwalls 205 – 208 Extraction Plan


Overview of Presentation
Infrastructure
Northern Area
Southern Area
Subsidence
Northern Area
Southern Area
Experience of Subsidence Monitoring
Ponding
Lemington Road
Photographs of Infrastructure and Ground Movement
SCT
SCT Operations


Exisiting and Planned LW Void Outlines
PG Seam
ULD Seam
ULLD Seam
LW205-208 EP Area
Northern Area Infrastructure
Natural Features
1. Bowmans Creek and Diversion Channels
2. Bowmans Creek Alluvium
3. Hunter River Alluvium
4. Free draining landform
Public Utilities
1. Lemington Road
2. Culverts
3. New England Highway Road Reserve
4. 11kV AusGrid Powerline
5. 330kV TransGrid Powerline
6. Telstra Cable
7. 132kV AusGrid Powerline (Southern)
8. 11kV AusGrid Powerline (Southern)
Mining Infrastructure (not ACOL's)
1. Rav Ops 33kV Powerline
2. Rav Ops Buried Fibre Optic Cable
3. AGLM South Access Road
4. Disused Sediment Ponds
5. Dams, Roads, Fences and Gates
6. Ravensworth No 2 Bayswater Pit
7. Ravensworth Void 5 Ash Dam
8. Narama to Mt Owen Pipeline
9. RUM No 5 Shaft
10. Void 5 Ash Dam
Mining Infrastructure (ACOL's)
1. Tailings Disposal Line
2. Water Supply Pipeline (Hunter)
3. Mine Dewatering System
4. Gas Management System
5. ACOL 11kV Powerline
6. Farm Infrastructure
SCT
SCT Operations
11kV Powerline
Disused Sediment Ponds
Void 5 Ash Dam
RUM No5 Shaft Site
LEMINGTON ROAD
AGLM South Access Road
XL13 Subsidence Monitoring Line
Culvert
LW208
LW207B
LW7B
LW206B
LW6B
LW6
Eastern Diversion
Ravensworth No2 Opencut
Bayswater Pit Limit
RO 33kV Powerline
Brankers Lane
Telstra Cable
NOW Gauging Station
Bowmans Creek
Ashton



Southern Area Infrastructure

Natural Features

1. Bowmans Creek and Diversion Channels
2. Bowmans Creek Alluvium
3. Hunter River Alluvium
4. Free draining landform

Public Utilities

1. Lemington Road
2. Culverts
3. New England Highway Road Reserve
4. 11kV AusGrid Powerline
5. 330kV TransGrid Powerline
6. Telstra Cable
7. 132kV AusGrid Powerline (Southern)
8. 11kV AusGrid Powerline (Southern)

Mining Infrastructure (not ACOL's)

1. Rav Ops 33kV Powerline
2. Rav Ops Buried Fibre Optic Cable
3. AGLM South Access Road
4. Disused Sediment Ponds
5. Dams, Roads, Fences and Gates
6. Ravensworth No 2 Bayswater Pit
7. Ravensworth Void 5 Ash Dam
8. Narama to Mt Owen Pipeline
9. RUM No 5 Shaft
10. Void 5 Ash Dam

Mining Infrastructure (ACOL's)

1. Tailings Disposal Line
2. Water Supply Pipeline (Hunter)
3. Mine Dewatering System
4. Gas Management System
5. ACOL 11kV Powerline
6. Farm Infrastructure

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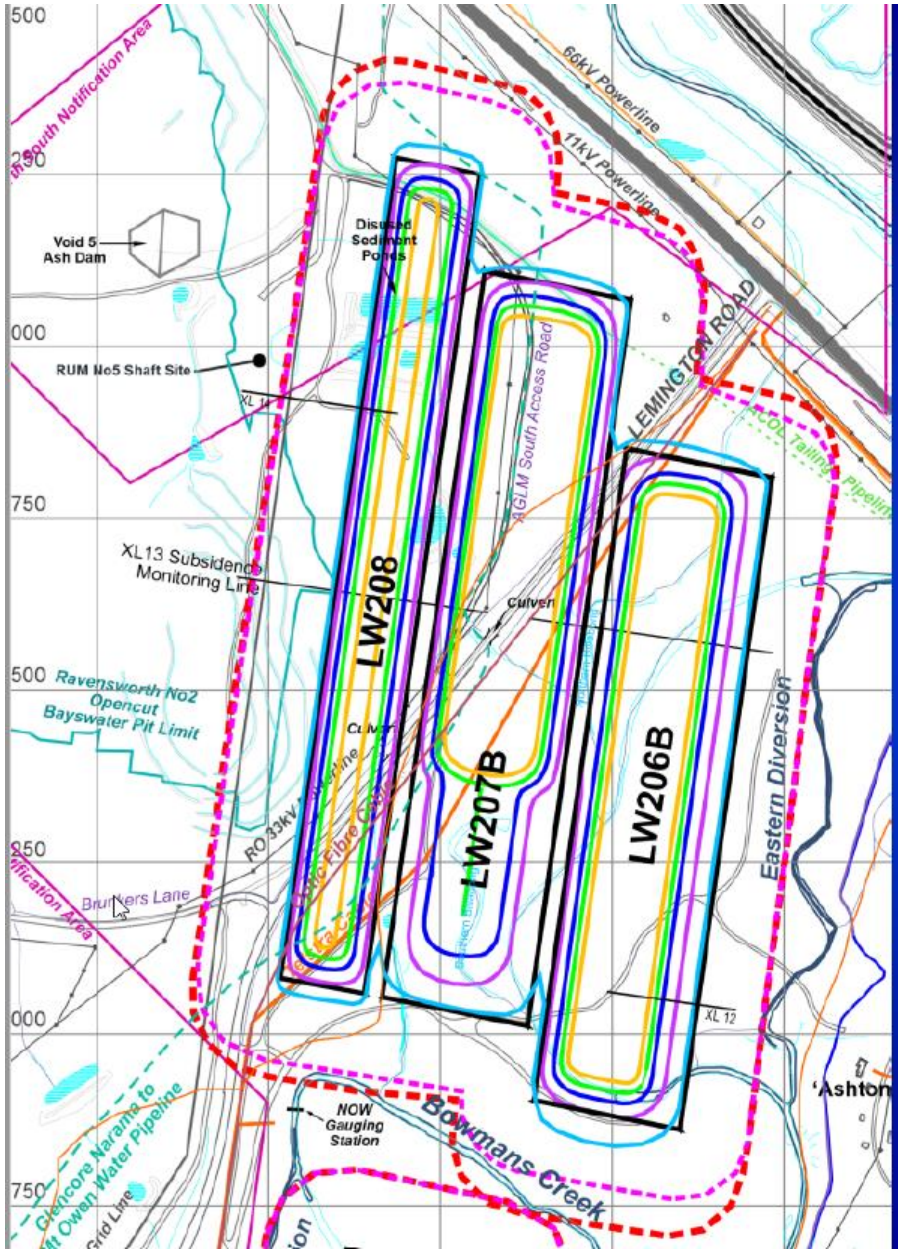
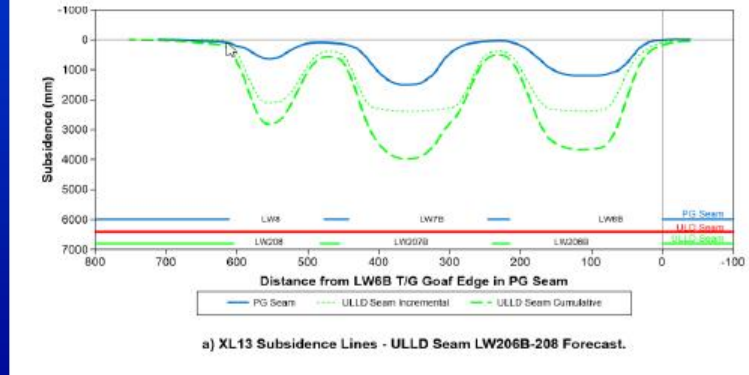
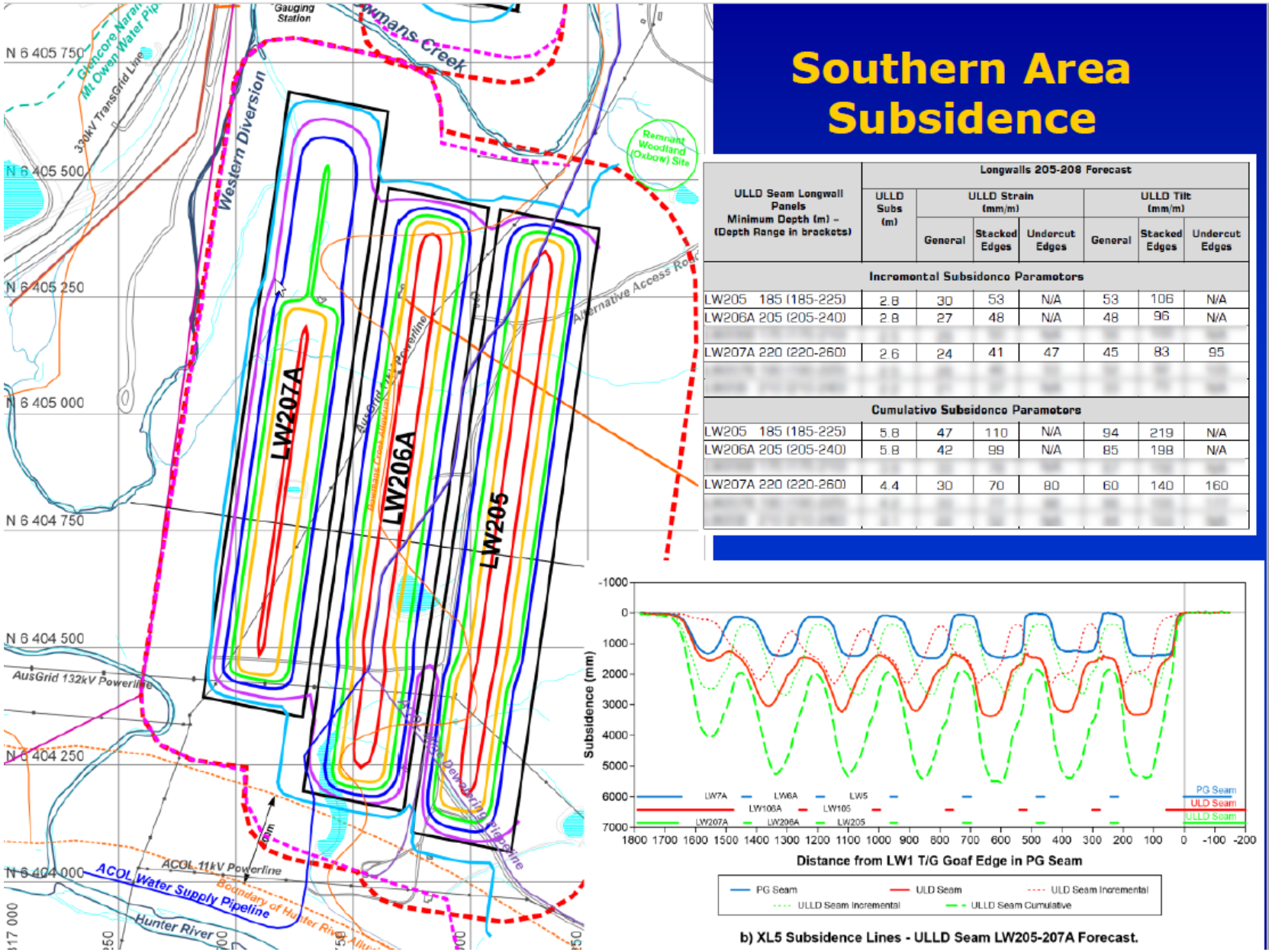


Northern Area Subsidence

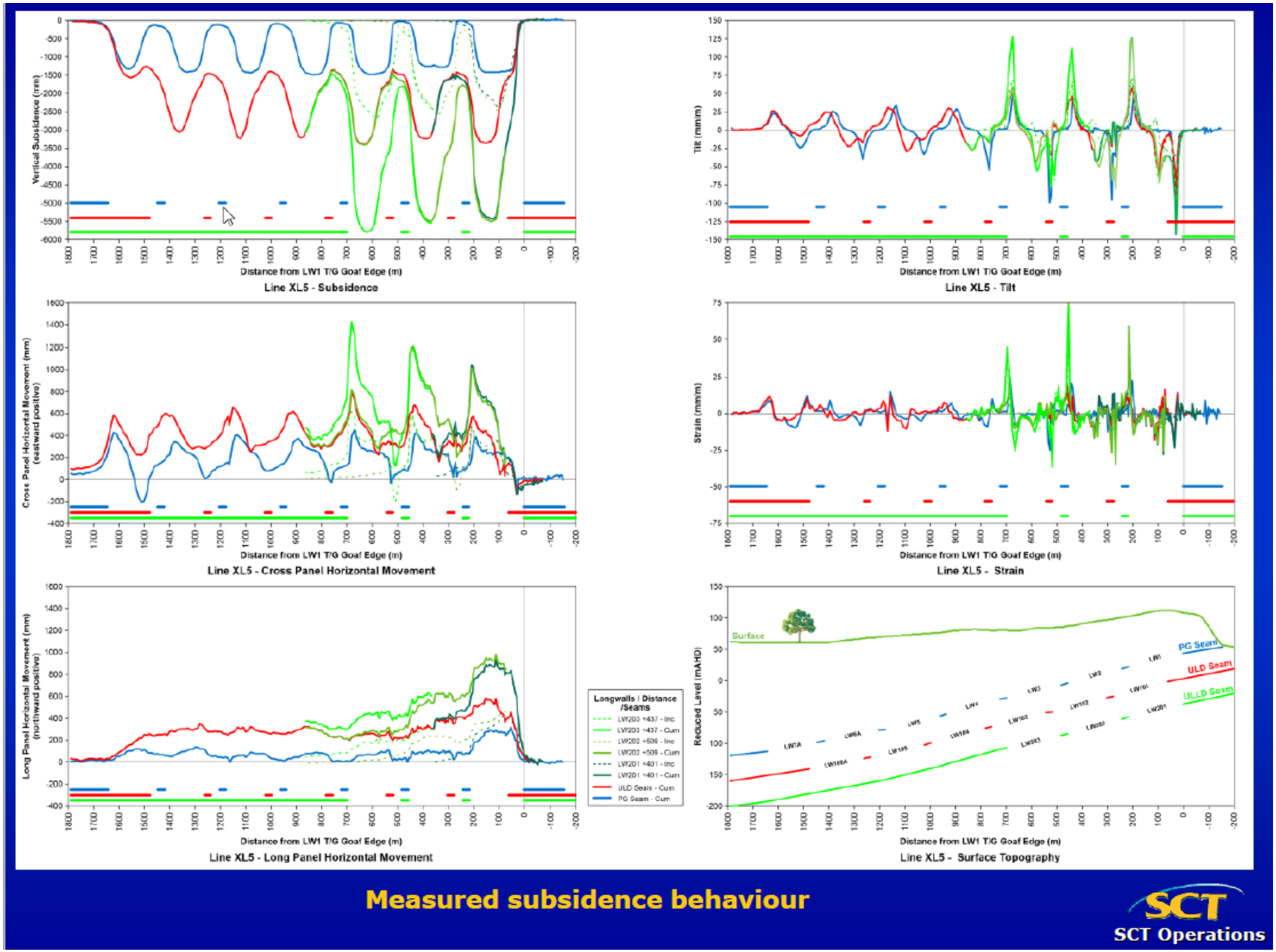
ULLD Seam Longwall Panels Minimum Depth (m) – (Depth Range in brackets)	Longwalls 205-208 Forecast						
	ULLD Subs (m)	ULLD Strain (mm/m)			ULLD Tilt (mm/m)		
		General	Stacked Edges	Undercut Edges	General	Stacked Edges	Undercut Edges
Incremental Subsidence Parameters							
LW206B 175 (175-210)	2.5	29	50	N/A	56	100	N/A
LW207B 190 (190-225)	2.5	26	46	53	52	92	105
LW208 210 (210-240)	2.2	21	37	N/A	33	73	N/A
Cumulative Subsidence Parameters							
LW206B 175 (175-210)	3.9	33	78	N/A	67	156	N/A
LW207B 190 (190-225)	4.2	33	77	88	66	155	177
LW208 210 (210-240)	3.1	22	52	N/A	44	103	N/A



a) XL13 Subsidence Lines - ULLD Seam LW206B-208 Forecast.



ULLD Seam Longwall Panels Minimum Depth (m) – (Depth Range in brackets)	Longwalls 205-208 Forecast						
	ULLD Subs (m)	ULLD Strain (mm/m)			ULLD Tilt (mm/m)		
		General	Stacked Edges	Undercut Edges	General	Stacked Edges	Undercut Edges
Incremental Subsidence Parameters							
LW205 185 (185-225)	2.8	30	53	N/A	53	106	N/A
LW206A 205 (205-240)	2.8	27	48	N/A	48	96	N/A
LW207A 220 (220-260)	2.6	24	41	47	45	83	95
Cumulative Subsidence Parameters							
LW205 185 (185-225)	5.8	47	110	N/A	94	219	N/A
LW206A 205 (205-240)	5.8	42	99	N/A	85	198	N/A
LW207A 220 (220-260)	4.4	30	70	80	60	140	160


Vertical Subsidence (mm)
Distance from LW1 T/G Goaf Edge (m)
Line XL5 - Subsidence
Tilt (mm/m)
Distance from LW1 T/G Goaf Edge (m)
Line XL5 - Tilt
Cross Panel Horizontal Movement (mm) (eastward positive)
Distance from LW1 T/G Goaf Edge (m)
Line XL5 - Cross Panel Horizontal Movement
Strain (mm/m)
Distance from LW1 T/G Goaf Edge (m)
Line XL5 - Strain
Long Panel Horizontal Movement (mm) (northward positive)
Distance from LW1 T/G Goaf Edge (m)
Line XL5 - Long Panel Horizontal Movement
Longwalls / Distance /Seams
LW203 +437 - Inc
LW203 +437 - Cum
LW202 +509 - Inc
LW202 +509 - Cum
LW201 +401 - Inc
LW201 +401 - Cum
ULD Seam - Cum
PG Seam - Cum
Reduced Level (mAHD)
Surface
PG Seam
ULD Seam
ULLD Seam
Distance from LW1 T/G Goaf Edge (m)
Line XL5 - Surface Topography
Measured subsidence behaviour
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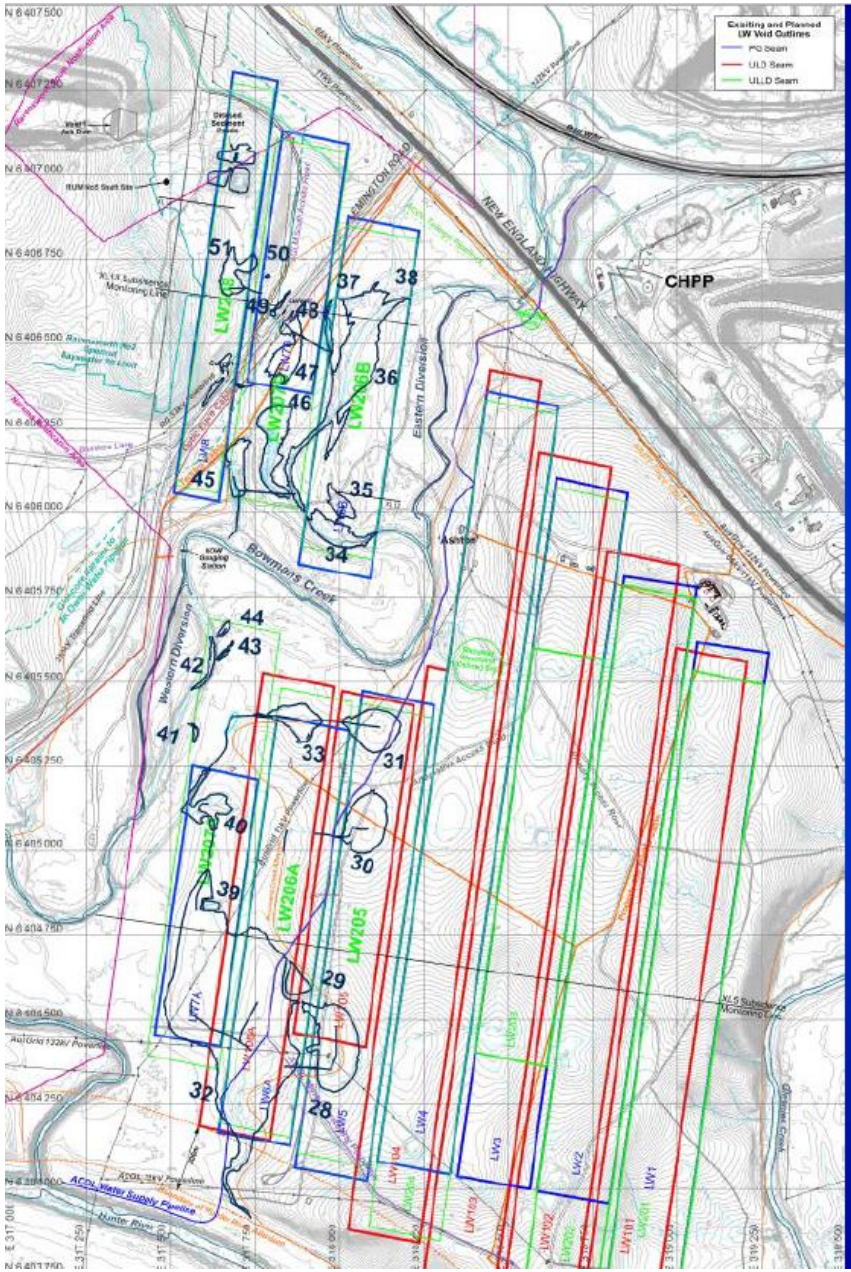
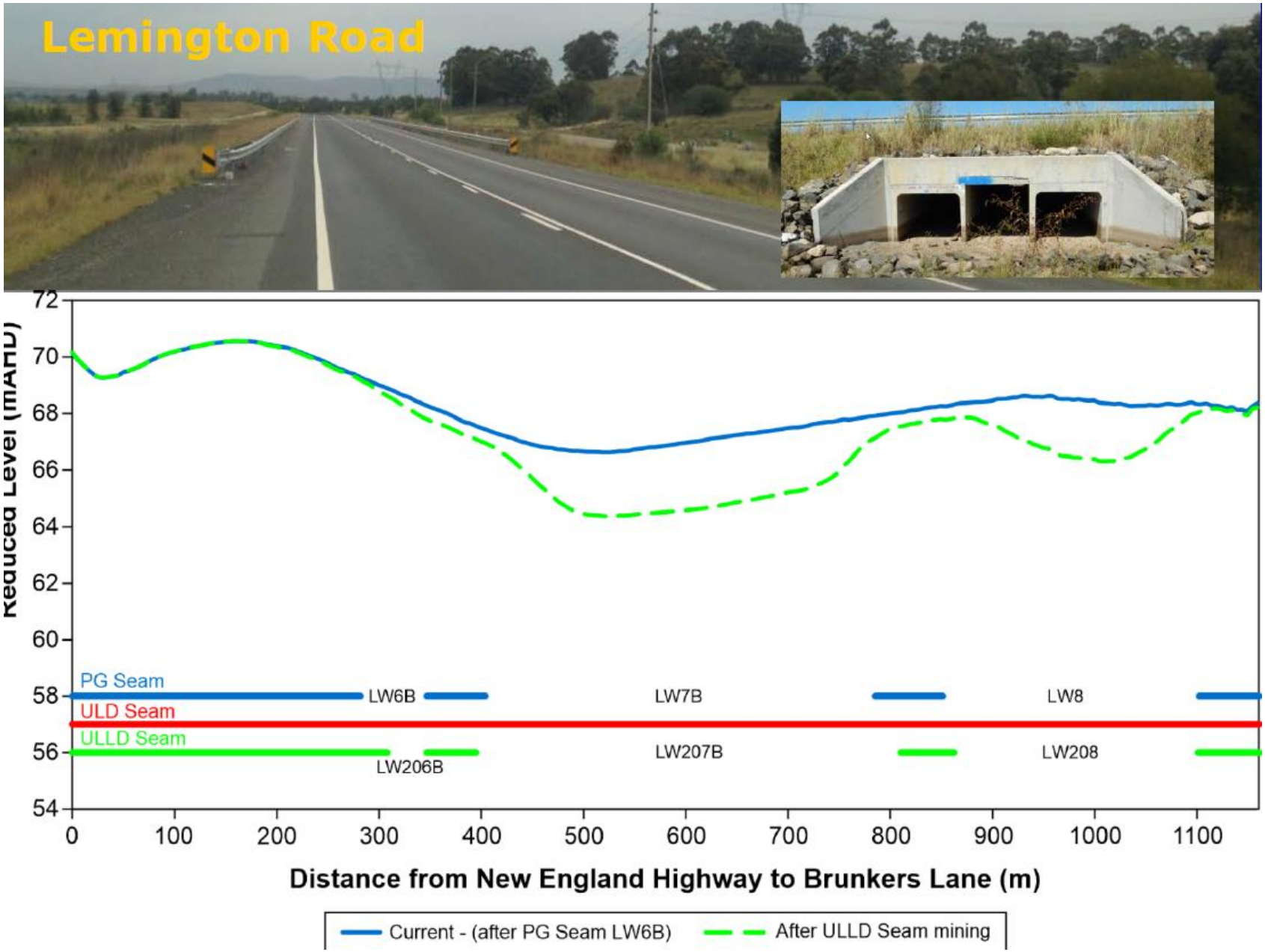
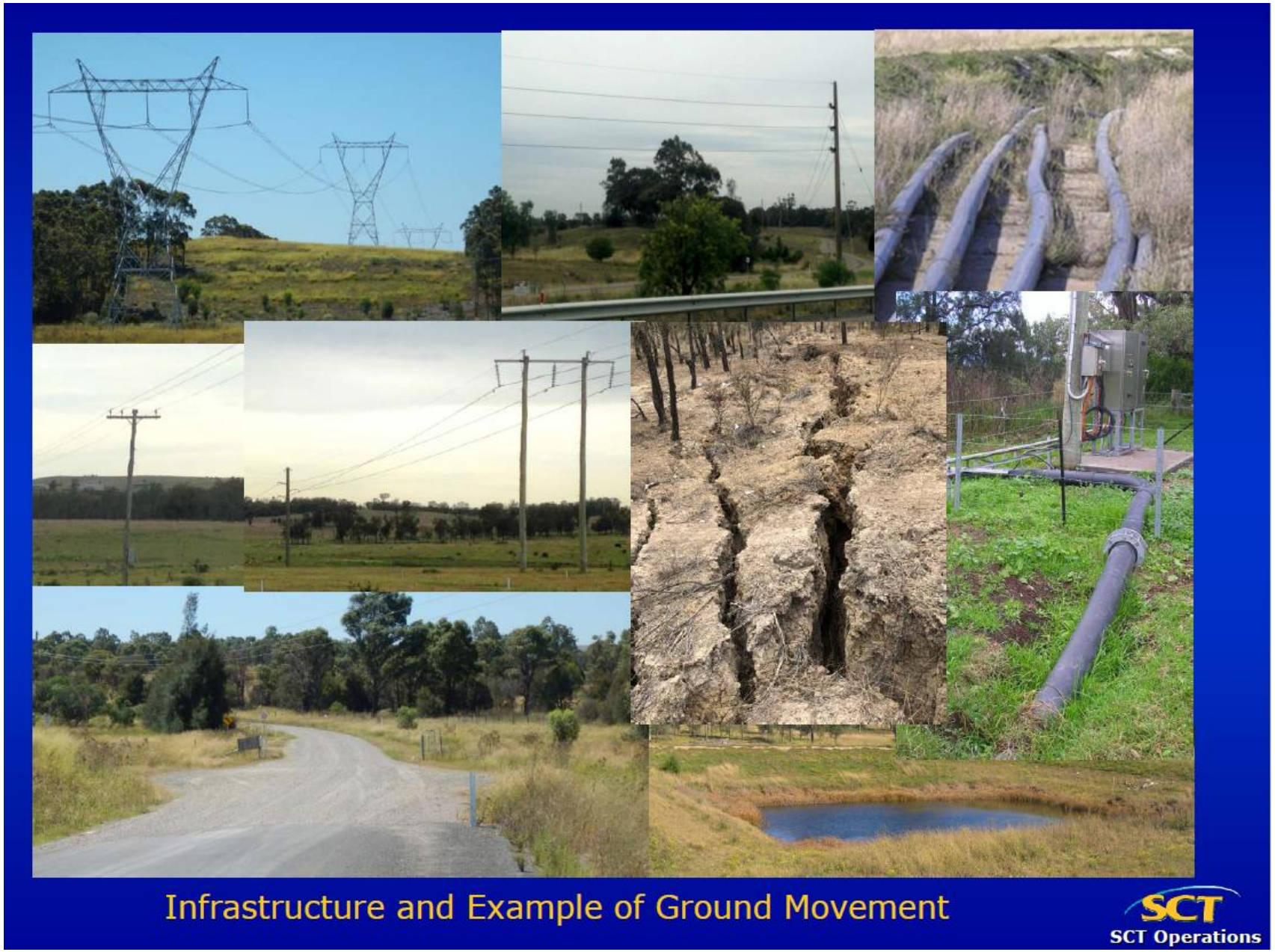


Ponding

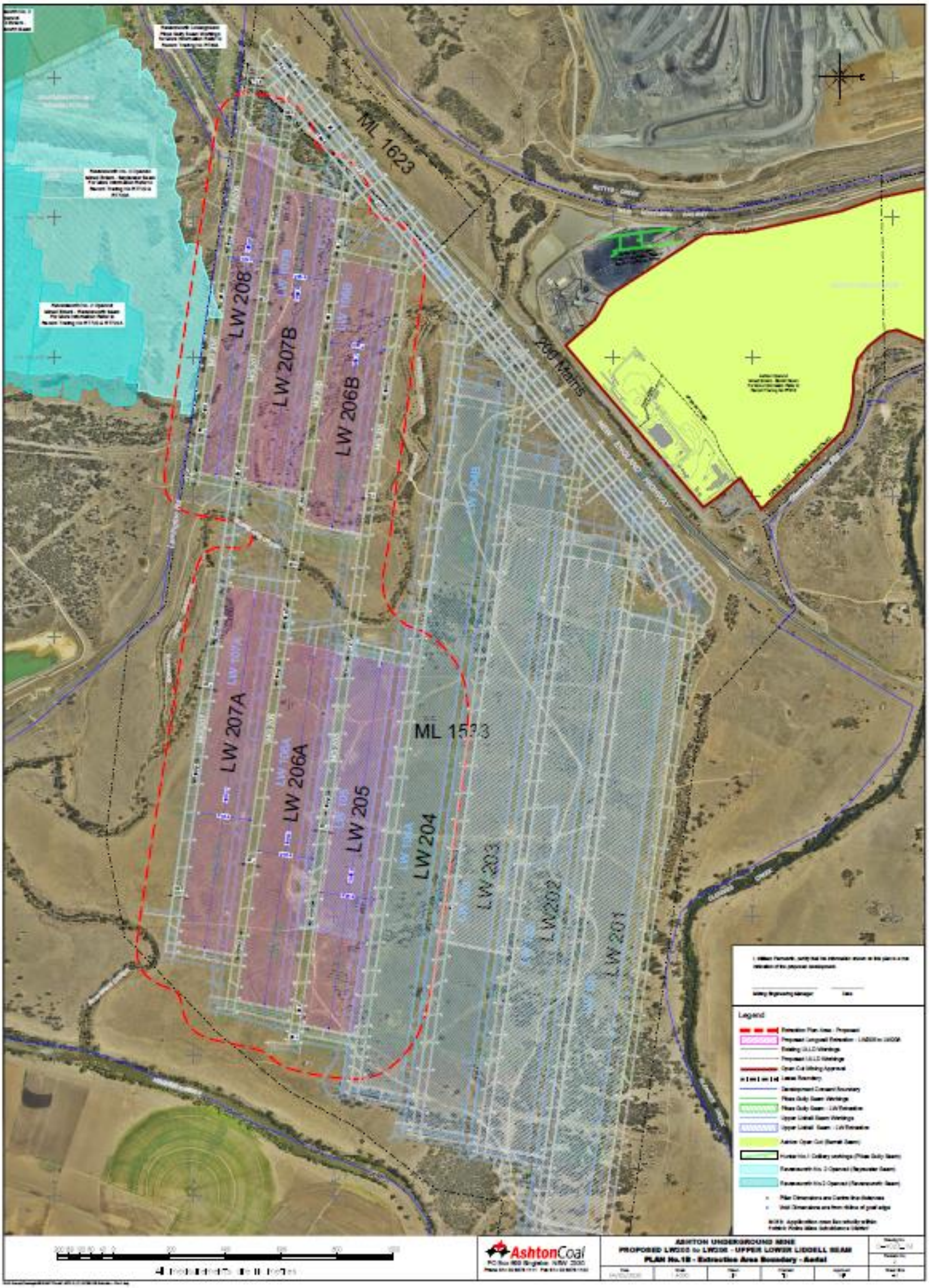
- Ponding requires significant cuts to be free draining
- Increased inflow potential to the underground
- Infrastructure may be compromised or access limited by ponding:
  - AGLM South Access Road
  - Alternative access for Property 130
  - Power poles
  - Goaf drainage holes

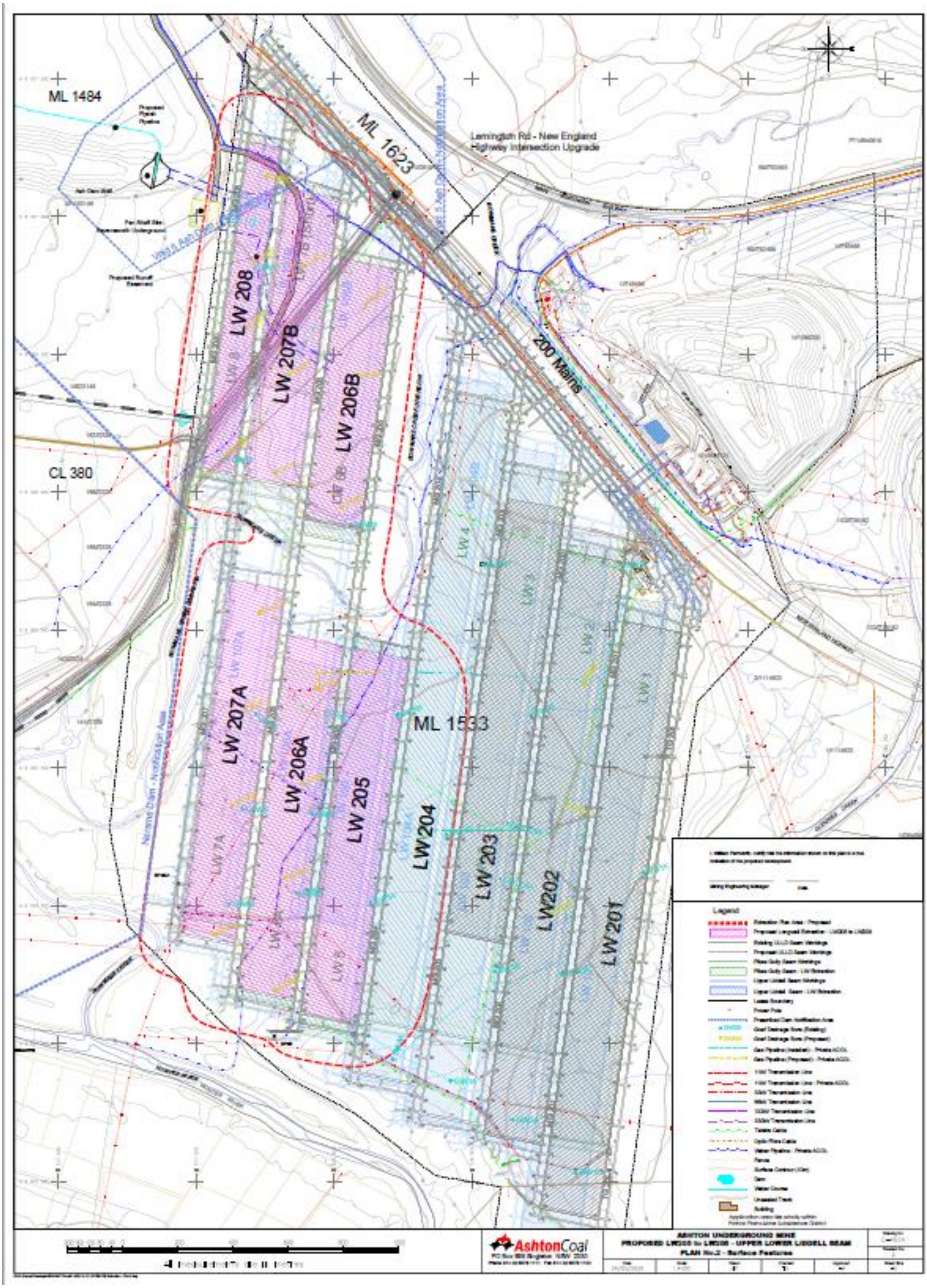
SCT Operations


Lemington Road
Reduced Level (mAHD)
72
70
68
66
64
62
60
58
56
54
PG Seam
ULD Seam
ULLD Seam
LW6B
LW7B
LW8
LW206B
LW207B
LW208
0
100
200
300
400
500
600
700
800
900
1000
1100
Distance from New England Highway to Brunkers Lane (m)
Current - (after PG Seam LW6B)
After ULLD Seam mining


Infrastructure and Example of Ground Movement
SCT
SCT Operations

7.4 Appendix 4 – Ashton Plan of Surface Infrastructure and Scheduled ULLD Longwall Extraction




ML 1484
ML 1623
Lemington Rd - New England Highway Intersection Upgrade
LW 208
LW 207B
LW 206B
200 Mains
CL 380
LW 207A
LW 206A
LW 205
ML 1533
LW 204
LW 203
LW202
LW201
Legend
AshtonCoal
ASHTON UNDERGROUND MINE
PROPOSED LW203 to LW208 - UPPER LOWER LIDDELL SEAM
PLAN No.2 - Surface Features