MORRISON Natalie

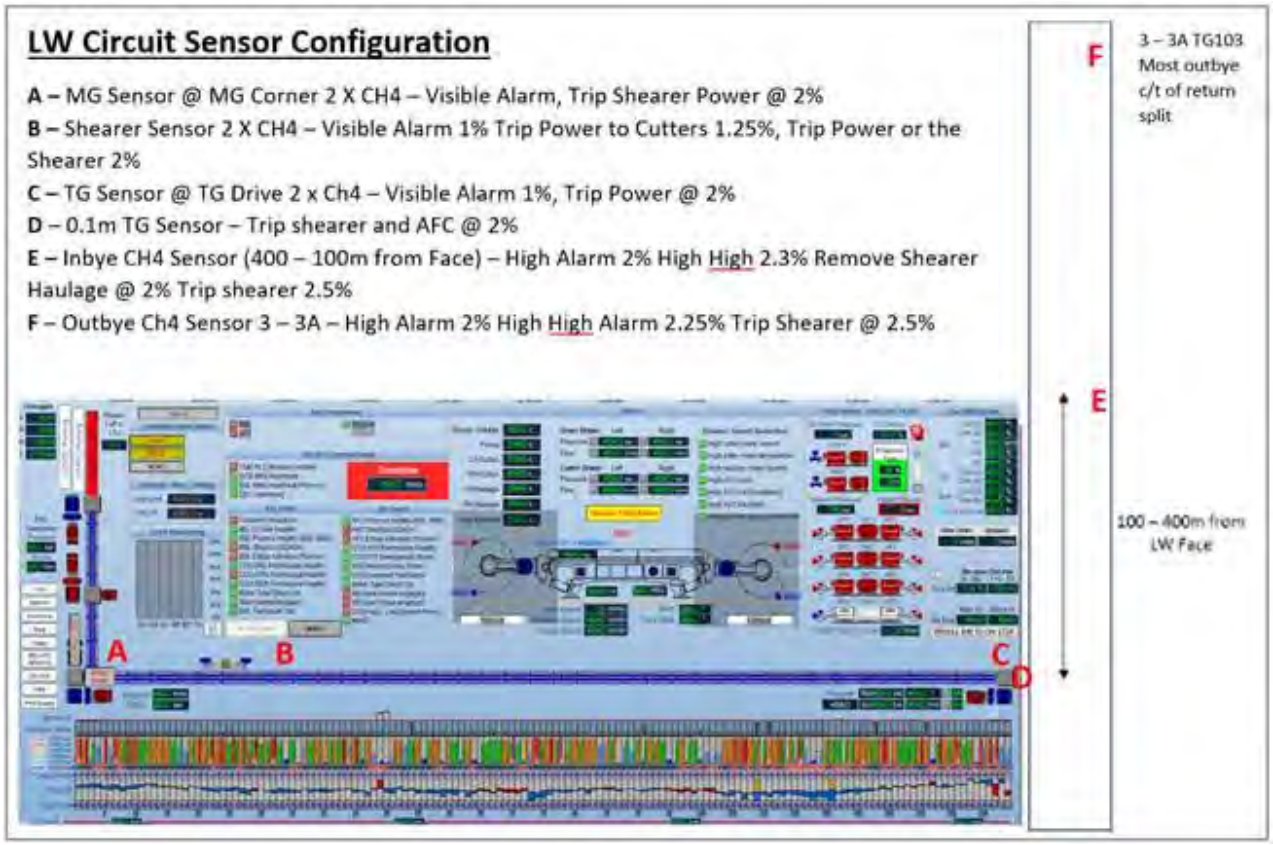
From: SMITH Stephen (Mining Inspector)
Sent: Wednesday, 8 April 2020 1:24 PM
To: DOBSON Shaun
Subject: FW: CH4 monitors
Attachments: GRO-10671-RA-LW104 Secondary Extraction.docx

From: Niehaus, Wouter [redacted]
Sent: Wednesday, 8 April 2020 1:00 PM
To: SMITH Stephen (Mining Inspector); BRENNAN Keith
Cc: Grosvenor Mine Record; Griffiths, Trent
Subject: RE: CH4 monitors

Good afternoon Stephen,

As requested please find attached RA.

Grosvenor included the installation of the additional CH4 sensor as required by Regs sec 243A (2) in our Secondary Extraction Risk Assessment. Sensor D on the diagram below.



In addition to the sensor required in Regs sec 243A(2) we have an additional sensor located within 400m of the LW face to control the gas concentration in the entire LW return roadway at below 2.5% (Sensor E)

I understand that we have had a number of CH4 exceedances during the past weeks as our LW goaf is still forming and we have not passed square on the block as yet. All our controls have been adequate and we have stopped LW

cutting operations well in time to ensure that the shearer had not been cutting or been closer than 60m to the TG corner on all occasions.

Please let me know if you have any questions or require any additional information regarding this matter.

Kind Regards
Wouter Niehaus
Underground Mine Manager
Grosvenor

AngloAmerican

E [redacted]
D [redacted]
M [redacted]

COAL
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A member of the Anglo American plc group

From: SMITH Stephen (Mining Inspector) <Stephen.Smith2@dnrme.qld.gov.au>
Sent: Tuesday, 7 April 2020 10:53 AM
To: Niehaus, Wouter <[redacted]>
Subject: CH4 monitors

Hi Wouter

Would you forward me a copy of the risk assessment(s) conducted regarding the installation of the CH4 monitor in the shield canopy of the last tailgate shield and the CH4 monitor in the tailgate roadway within 400 metres of the faceline please?

Regards

Queensland Government

Stephen Smith
Regional Inspector of Coal Mines – North Region
Mines Inspectorate | Resources Safety and Health
Department of Natural Resources, Mines and Energy

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Weekend Duty officer number: 1300 882 096

CONTEXT			
DATE WRAC WAS CONDUCTED:	04/12/19	**WRAC FACILITATOR:**	Ravindu Goonawardene

1. SCOPE *In this section enter the topic, item, process, plant in relation to its physical location, boundary, limits or operations at GCM*

To identify hazards & potential unwanted events in order to develop adequate control measures to reduce the risk associated with conducting second workings of the LW104 panel at the Grosvenor Coal Mine and ensure compliance to the Qld Coal Mining Safety & Health Regulation 2017.

This scope and the above objectives have been reviewed and approved by: Trent Griffiths and Rob Nowell
In line with Section 317 of the Coal Mining Safety and Health Regulation 2017, this risk assessment shall address all aspects of planning for safe working in regard to the secondary workings of the LW104 panel. These will include, but are not limited to:

a) Any surface features, artificial structures and water reserves that may create a hazard if disturbed by the workings;
b) All adjacent workings, including abandoned workings and those of other mines;
c) The known geology affecting the intended workings;
d) The anticipated gas make;
e) Structural stability;
f) The proposed method and sequence of coal extraction, including seam and extracted thickness;
g) Proposed methods of:
    i. Strata control and support,
    ii. Ventilation, and
    iii. Controlling spontaneous combustion;
h) Support methods necessary to control the goaf edges of active panel; and
i) The suitability of the plant and its control systems used for the workings

This risk assessment addresses the high-level risks associated from CH4381 to CH0 in LW104. A separate risk assessment will be conducted for LW ramp up, Bolt-up and Salvage to manage the specific risks associated with these relevant tasks which is different from routine longwall operating activities.

CONTEXT

2. BACKGROUND & DESCRIPTION OF ACTIVITY/EVENT/HAZARD/ISSUE BEING ASSESSED

The purpose of this document is to:

- Document the risk assessment conducted to assess all risks associated with the secondary extraction of LW104 in accordance with Sec. 317 of the CMSHR 2017.
- Document the process used to identify foreseen hazards and analyse the risk associated with the hazards.
- Develop a prescribed way that will achieve an acceptable level of risk when conducting the designated task.

Background information

Longwall 104 is the fourth longwall block to be extracted at Grosvenor Mine. Similar conditions are expected to those that have been encountered in LW101, LW102 and LW103. Second Workings for LW104 are expected to commence Q1 2020 with an expected completion date of June 2021.

3. ASSUMPTIONS

Assumption relating to this risk assessment and task include;

- Introduction to site has been completed for all equipment
- PPE is available and used by coal mine workers
- Personnel are trained, competent and authorised to undertake any works that they complete
- Personnel use personal risk management tools (SLAM/JSEA) as required and appropriately
- ERZ Controllers undertake routine inspections
- Standard electrical installations requirements implemented
- Equipment is only used for its intended purpose
- Equipment pre-start inspections are conducted before use

CONTEXT

4. WORK ENVIRONMENT

The Anglo American Metallurgical Coal Grosvenor Coal Mine (Mining Lease Application 70378) is located directly north of the township of Moranbah in Central Queensland, approximately 150 km south-west of Mackay.

The physical environment within the scope of the risk assessment is all the activities to be undertaken by coal mine workers in the LW104 second workings processes

5. RISK ASSESSMENT METHODOLOGY:

This Risk Assessment was conducted in accordance with QLD Coal Mining Legislation, Recognised Standard 02 – Control of Risk Management Practices & AS/NZS ISO 31000:2009 – Risk Management. Initial Risk is calculated in the context of proposed controls for site. Residual Risk is calculated in the context of proposed and additional actions required.

6. COMPLIANCE CHECKLIST ☑ *all items to be checked for relevance & included as part of the RA process*

- ☐ DME Hazard Database https://www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining/hazards/hazards
- ☐ CMSHA Act 1999 https://www.legislation.qld.gov.au/view/pdf/2017-03-30/act-1999-039
- ☐ CMHRS Regulation 2017 https://www.legislation.qld.gov.au/view/pdf/asmade/sl-2017-0165
- ☐ WHS Regulation 2011 https://www.legislation.qld.gov.au/view/pdf/inforce/current/sl-2011-0240
- ☐ QLD Codes of Practice https://www.worksafe.qld.gov.au/laws-and-compliance/codes-of-practice
- ☐ Anglo Fatal Risk Standards https://www.angloamerican.com/~/media/Files/A/Anglo-American-PLC-V2/documents/supplier/fatal_risk_standards.pdf
- ☐ Anglo Safety Golden Rules https://www.angloamerican.com/~/media/Files/A/Anglo-American-PLC-V2/documents/approach-and-policies/safety-and-health/safety-golden-rules.pdf

CONTEXT
☐ QLD Mines Recognised Standards https://www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining/legislation-standards/recognised-standards
☐ QLD Mines Guidelines https://www.business.qld.gov.au/industries/mining-energy-water/resources/safety-health/mining/legislation-standards/recognised-standards
☐ Relevant GCM PHMP, HMP, SOP or SWI's (search on Anglo Docs)

7. REFERENCE MATERIALS *add any additional references as required to this generic list*

- 215056_Moranbah_North_Grosvenor_Flood_Modelling_v01 - Flood modelling for pre and post subsidence
- Anglo Fatal Risk Standards
- Anglo Geotechnical OMS Standards.
- Anglo Safety Golden Rules
- Arrow Energy & Anglo American interaction Management Plan (JIMP)
- Borehole database (Acquire Database)
- DME Hazard Database
- GRO - 10 -PHMP Spontaneous Combustion
- GRO - 10208-RA LW103 Secondary Extraction
- GRO - 10221-SOP LW103 Second Workings
- GRO - 10563 -TARP-LW Return Methane General Body Contaminants
- GRO -14 - PHMP Gas management (Monitoring)
- GRO - 1431-TARP-Cyclones
- GRO - 1432-TARP Lightning
- GRO - 1434-TARP-Flooding
- GRO - 1436-TARP-High Winds
- GRO – 15 – PHMP – Ventilation
- GRO - 16 -PHMP-Methane Drainage

CONTEXT

- GRO-750-TARP-General Body Contaminant
- GRO-10563-TARP-LW Return Methane General Body Contaminants
- GRO - 160 -TARP-Heat Management
- GRO - 1629 -HMP- Introduction of Underground Equipment
- GRO - 200 -PRO Change Management
- GRO - 204 -PRO- Training Competence Scheme
- GRO - 215 -PRO - Personnel On Boarding
- GRO - 241 -SOP- Control of Energy
- GRO - 2561 -PLAN- Soil and Vegetation Management Plan
- GRO - 27 -HMP-Location of Electrical Equipment Underground
- GRO - 300 - HMP Disturbance, Penetration, Excavation and Rehabilitation
- GRO - 314 -SWI - Managing Extreme Weather Events
- GRO - 3223 -SWI- Operational No Go Zones
- GRO - 3231 -PRO - Grosvenor Commissioning Execution Plan
- GRO - 3303 -HMP Control of Frictional Ignition
- GRO - 3313 -RA Mine Earthing Lightning
- GRO - 3385 -PRO - Permit to Mine
- GRO - 3446 -RA Arrow Energy & Anglo American interaction -Data collection from arrow
- GRO - 3595 -HMP – Intersecting Boreholes
- GRO - 3602 -CHK – Borehole Intersection Notice
- GRO - 3985 -PRO – Grosvenor Coal Mine Arrow Energy well handover procedure
- GRO - 4164 -PLAN-Water Management Plan
- GRO - 42 -HMP – Mine Inspection system
- GRO - 4200 -PMT Grosvenor Coal Mine Environmental Authority (EA)

CONTEXT

- GRO - 4201 -PLAN- Grosvenor Plan of operation
- GRO - 48 -HMP-Management of Heat
- GRO - 4801 -STD-Longwall Standard Area Management System
- GRO - 5314 -PRO - Equipment Hazard Zones
- GRO - 5372 -STD – Longwall Operational Standards
- GRO – 5454 – STD –Longwall periodic weighting and cavity management standard
- GRO – 5609 – TARP –Longwall Creep and Face Alignment
- GRO – 5833 -TARP- Strata Control Longwall Face Operations
- GRO - 5861 -STD Mine Planning Standard
- GRO - 64 - SOP-Using Portable Electrical Equipment Underground
- GRO - 7481 -PLAN-Subsidence Management Plan
- GRO - 750 -TARP – General Body Contaminants
- GRO - 77 -SOP – Underground Workplace Inspections system
- GRO - 7731 -EVP-Subsidence Rehabilitation Procedure
- GRO - 7732 -PRO - Cultural Heritage Planning
- GRO – 7774 -TARP- Strata Control Longwall Gate end roadways – adjacent roadways
- GRO - 7820 -EVP-Environmental monitoring Procedure
- GRO - 830 -EVP- Cultural heritage management
- GRO - 8427 -SOP – Intersecting underground gas drainage boreholes
- GRO - 8480-PMT Permit to Drill (Surface)
- GRO - 8515 -TARP Longwall frictional ignition
- GRO - 8804 -PMT Permit to Drill (surface boreholes)
- GRO – 9 – PHMP- Inrush
- Grosvenor Mine - Borehole Earthing & Lightning Protection Study

CONTEXT
• LW 103 Hazard plan DRG-15155 • LW 104 Hazard plan DRG-15175 • QLD Coal Mining Safety & Health Act 1999 • QLD Coal Mining Safety & Health Regulation 2017 • QLD Mines Guidelines • QLD Mines Recognised Standards • Recognised Standard 02 Control of risk management practices • Subsidence modelling and monitoring MSEC1010 – Subsidence Model Review Q4 2018 • WHS Regulation 2011

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GROSVENOR COAL MINE
RA-LW104 Secondary Extraction

TEAM SHEET

In accordance with Section 10(1)(a) of the Coal Mining Safety and Health Regulation 2017 a list of all persons contributing to the risk assessment process together with their organisational roles, experience and qualifications is to be recorded below.

Name	Company	Role & Qualifications	Date	Industry Experience (yrs)	Consensus (Y/N)	Signature
Ravindu Goonawardene	Anglo	Tech Services Super Facilitator S1, S2, S3, G2	4/12/19	10	Y	[redacted]
Matthew Wakeford	Anglo	LW Automation	4/12/19	14	Y	
GRAHAM WEST	ANGLO	LWS COMPLIANCE COORD.	4/12/19	19.	Y	
Joshua Lancaster	Anglo	LW Co-ordinator / ERZ Controller	4.12.19	18	Y	
Ben Thomson	Anglo	LW Co-ordinator (Mech)	4/12/19	7	Y	
Matt Gleeson	OKR	LW Co-ordinator (Electrical) S1, S2, S3, G2, ElecTrade.	4/12/19	8	Y	
Bevin Mulcahy	Anglo	Seam gas Supervisor	4/12/19	12	Y	
HAYDEN HEARNE	ANGLO	VENTILATION & GAS SENIOR S1, S2, S3, G2 VO	4.12.19	13	Y	
Brad Stall	Anglo	Overhauls Co-ordinator Mech	4-12-19	17	Y	
IAN BAILEY	ANGLO	EEM, S1|S2|S3|G2	4.12.19	28	Y	

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GROSVENOR COAL MINE
RA-LW104 Secondary Extraction

TEAM SHEET

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Name	Company	Role & Qualifications	Date	Industry Experience (yrs)	Consensus (Y/N)
N Gilbert	AN 10	ENG. PROJECTS SUPT S1, S2, S3 G2	4/12/19	13	Y
R Kostowski	Anglo	Gas Drainage Coord S1, S2, S3 G2	4/12/19	9	Y
SCOTT BUCKLEY	ANGLO	MINING ENGINEER BI SPECIALIST S123G2	4/12/19	8	Y
CHRIS STEBBINGS	ANGLO	MINE MANAGER COAL SUPERVISORY DEPUTY S1,S2,S3, G2 NSW DIPLOMA	4/12/19	15	Y
WADE WEHRMANN	ONE KEY	LONGWALL TRADE FITTER	04-12-19	15	Y
Stephen Liese	Anglo	Geotech + Geology Super	04/12/19	6	Y
LEE MORSE	SEAM SURVEYS	SURFACE SURVEY	04/12/19	6	Y
MICK BRITTEN	ANGLO	ENGINEERING SUPERINTENDENT	04-12-19	25	Y
Adam Goldsworthy	One Key	LW Trade Electrical	04/12/19	11	Y
LUKE JENKINS	ONE KEY	COMPLIANCE OFFICER	04/12/19	9	Y

[redacted]

TEAM SHEET

In accordance with Section 10(1)(a) of the Coal Mining Safety and Health Regulation 2017 a list of all persons contributing to the risk assessment process together with their organisational roles, experience and qualifications is to be recorded below.

Name	Company	Role & Qualifications	Date	Industry Experience (yrs)	Consensus (Y/N)	Signature
Leon Treziše	Ole	Shearer operator	4-12-19	23	Y	[redacted]
Owen Hannigan	Anglo	MEM	4/12/19	24	Y	
JEFF PEARCE	ANGLO	SHE SUPER	04/12/19	20	Y	
DANNY MOORE	ANGLO	FEMALES COACHINATOR S1,2,3 G2. MEGA TRADE	4/12/19	13	Y	
Daniel Perrin	Anglo	Environmental Coordinator S1,2,3 G2	4/12/19	8	Y	
Matt Manning	ANGCO	Outbye Operations Coordinator	4/12/19	23	Y	
James Mackay	Anglo	Survey Coordinator	4/12/19	8	Y	
James McGuiness	BK	Geologist	4/12/19	15	Y	

AngloAmerican

GROSVENOR COAL MINE
RA-LW104 Secondary Extraction

17/02/20 REVIEW TEAM SHEET

TEAM SHEET

In accordance with Section 10(1)(a) of the Coal Mining Safety and Health Regulation 2017 a list of all persons contributing to the risk assessment process together with their organisational roles, experience and qualifications is to be recorded below.

Name	Company	Role & Qualifications	Date	Industry Experience (yrs)	Consensus (Y/N)	Signature
Dwayne Baxbridge	OKR	Fitter	17-2-20	8	Y	[redacted]
David Bunn	OKR	Electrical	17/2/20	8	Y	
Matt Fitzpatrick	OKR	Operator	17/2/20	11	Y	

ADDITIONAL CONTROLS *All additional controls to be entered in Enablon*					
Line Ref No.	**Hazard/Issue**	**Additional Controls**	**Action by Whom**	**Target Date**	**Enablon No.**
1	Access to Gas Plant/Surface – Seam/Loss of access to north side of Isaac river due to adverse weather	Build an all weather landing pad	C Englebrecht	20/02/2020	TS.01218672
1	Access to Gas Plant/Surface – Seam/Loss of access to north side of Isaac river due to adverse weather	Confirm plan showing emergency wet weather access via MN is applicable for LW104	J Mackey	20/02/2020	TS.01218717
2	Access to Gas Plant/Surface – Seam/Surface ponding of water above workings due to ineffective drainage of subsidence zones.	Develop strategy for LW103 subsidence surface dewatering	A Heap	15/02/2020	TS.01218727
2	Access to Gas Plant/Surface – Seam/Surface ponding of water above workings due to ineffective drainage of subsidence zones.	Flood Model to be reviewed to ensure LW104 is covered	A Heap	05/02/2020	TS.01218735
3	Access to Gas Plant/Surface – Seam/Uncontrolled / excessive surface clearing for drilling or access (gas drainage) leading to disturbance to environmentally or culturally significant areas	Confirm sufficient environmental offsets for surface works above LW104	A Heap	05/02/2020	TS.01218741
4	Access to Gas Plant/Surface – Seam/Flood plain – impacts on the Service boreholes etc leading to operational delays	Confirm DSI procedures to manage flood conditions are in line with Grosvenor Procedure (regarding PCB batching facility on the surface)	T Evans	10/02/2020	TS.01218754

4	Access to Gas Plant/Surface – Seam/Flood plain – impacts on the Service boreholes etc leading to operational delays	Confirm location and impacts in relation to a flood event of any Stonedust boreholes on LW104	A Heap	05/02/2020	TS.01218756
5	Access to Gas Plant/Surface – Seam/Cumulative impacts on LW104 with an adjacent and subsided LW103 block leading to potential for environmental event (not witnessed at this operation previously)	Flood Model to be reviewed to ensure LW104 is covered	A Heap	05/02/2020	TS.01218758
5	Access to Gas Plant/Surface – Seam/Cumulative impacts on LW104 with an adjacent and subsided LW103 block leading to potential for environmental event (not witnessed at this operation previously)	Update Subsidence Crossline of LW104	L Morse	28/01/2020	TS.01218762
6	Access to Gas Plant/Surface – Seam/Inability to drill adequate goaf drainage holes due to enviro or Cultural heritage restrictions	Develop plan around scar trees in the planned 70m clearance corridor with Seamgas	D. O'Sullivan	10/02/2020	TS.01218767
6	Access to Gas Plant/Surface – Seam/Inability to drill adequate goaf drainage holes due to enviro or Cultural heritage restrictions	Review availability of offsets if additional goaf drainage holes required.	A Heap	10/02/2020	TS.01218776
7	Access to Gas Plant/Surface – Seam/Loss of access to MIA, MSF and any Other Projects causing production loss due to adverse weather	Consider bridge to access across river	R. Goonawardene	01/03/2020	TS.01218778

8	Access to Gas Plant/Adverse weather/Business loss due to lack of access to boreholes during, wind, cyclones, lighting, and flooding	Complete an audit against the report and TARP for lightning and earthing protection for GCM LW104	B. Mulcahy	10/02/2020	TS.01218781
8	Access to Gas Plant/Adverse weather/Business loss due to lack of access to boreholes during, wind, cyclones, lighting, and flooding	Obtain copy of the report and strategy for lightning and protection for GCM LW104	C. Englebrecht	25/01/2020	TS.01218785
9	Access to Gas Plant/Adverse weather/Lightning strike leading to ignition underground or electric shock	Review lightning and earthing strategy	I Bailey	25/01/2020	TS.01218788
9	Access to Gas Plant/Adverse weather/Lightning strike leading to ignition underground or electric shock	Review lightning TARP in regard to actions to be taken working adjacent to a gas riser	I Bailey	25/01/2020	TS.01218791
10	Access to Gas Plant/Subsidence due to secondary extraction/Damage to mine surface infrastructure and third party infrastructure (P seam SIS)	Notify Arrow of the pending subsidence of LW104	C Englebrecht	10/02/2020	TS.01218794
10	Access to Gas Plant/Subsidence due to secondary extraction/ Damage to mine surface infrastructure and third party infrastructure (P seam SIS)	Powerline clearance survey post subsidence	I Bailey	1/03/2020	TS.01218796
10	Access to Gas Plant/Subsidence due to secondary extraction/ Damage to mine surface infrastructure and third party infrastructure (P seam SIS)	Review electrical services (e.g. PED loops and PED hut) impacted by subsidence and if any work is required to protect surface infrastructure.	Mick Britton	10/02/2020	TS.01218797

10	Access to Gas Plant/Subsidence due to secondary extraction/ Damage to mine surface infrastructure and third party infrastructure (P seam SIS)	Review pieplines impacted by subsidence and if any work is required to protect surface infrastructure.	C Englebrecht	10/02/2020	TS.01218798
10	Access to Gas Plant/Subsidence due to secondary extraction/ Damage to mine surface infrastructure and third party infrastructure (P seam SIS)	Update signposting at crossings	I Bailey	10/02/2020	TS.01218800
10	Access to Gas Plant/Subsidence due to secondary extraction/ Damage to mine surface infrastructure and third party infrastructure (P seam SIS)	Update training package for light vehicles for awareness of subsidence cracks	P Borg	10/02/2020	TS.01218802
11	Access to Gas Plant/Subsidence due to secondary extraction/Subsidence cracking connecting mine workings with Isaac River - Inflow of water into workings	Check water head rating for seals / bulkheads confirm max water RL based on these head ratings	H Hearne	25/02/2020	TS.01218803
11	Access to Gas Plant/Subsidence due to secondary extraction/Subsidence cracking connecting mine workings with Isaac River - Inflow of water into workings	Confirm MG seals are specified based on requirements for TG105	H Hearne	25/02/2020	TS.01218804
11	Access to Gas Plant/Subsidence due to secondary extraction/Subsidence cracking connecting mine workings with Isaac River - Inflow of water into workings	Review Inflow Potential from major flood event for an extended period of time	A Heap	25/02/2020	TS.01218806
11	Access to Gas Plant/Subsidence due to secondary extraction/Subsidence	Review that goaf seals secondary support can withstand double abutment loading	S Giese	25/02/2020	TS.01218808

	cracking connecting mine workings with Isaac River - Inflow of water into workings				
14	Access to Gas Plant/Mining through an un-grouted borehole / gas-well/Inflow of water into workings leading to potential for injury to personnel	Review ungrouted boreholes in LW104 block	L Morse	25/02/2020	TS.01218811
14	Access to Gas Plant/Mining through an un-grouted borehole / gas-well/Inflow of water into workings leading to potential for injury to personnel	Setup automated report for ungrouted boreholes in LW014 block (similar to LW103 seal up grouted borehole report)	L Morse	10/02/2020	TS.01218812
17	Access to Gas Plant/Mining through an un-grouted borehole / gas-well/Intersection of open borehole resulting in air leak increased potential of Spontaneous Combustion - Air leakage in into goaf from untreated hole	Sealing Management Plan for LW104	H Hearne	18/02/2020	TS.01218814
19	Mining under the 132,000 Volt Powerlink line to Townsville/LW104 Subsidence causing damage to the powerlines/If the jacks cannot be installed in time to combat the subsidence, there is a risk of the LW104 start date being delayed and causing production loss	Communicate the management plan to Grosvenor superintendents and SLT	N Gilbert	15/02/2020	TS.01218815
20	Hole into other workings/Inrush/Inrush into mine workings from adjoining/above workings	Confirm barrier pillar design between MNM and GRV operations	S Giese	10/02/2020	TS.01218816

21	Gas liberation into face area exceeding operational and legal requirements [CH4% >2.5%]/Gas concentrations prevent operation of face equipment	Communicate the status of the project and the timelines to increased drainage capacity to 17,000l/s	C Englebrecht	15/02/2020	TS.01218817
21	Gas liberation into face area exceeding operational and legal requirements [CH4% >2.5%] / Gas concentrations prevent operation of face equipment	Confirm and communicate shearer speed sensor trigger points and limits for LW104 kick off to CROs	J Agustin	15/02/2020	TS.01218818
21	Gas liberation into face area exceeding operational and legal requirements [CH4% >2.5%]/Gas concentrations prevent operation of face equipment	Ensure that the additional infrastructure is monitored through Citect	C Englebrecht	15/02/2020	TS.01218819
21	Gas liberation into face area exceeding operational and legal requirements [CH4% >2.5%]/Gas concentrations prevent operation of face equipment	Finalise RA for LW104 Goaf drainage strategy/review	C Englebrecht	15/02/2020	TS.01218820
23	Gas release during mining/Goaf collapse / caving expels large volumes of gas creating a general body exceeding operational and legal requirements [CH4% >2.5%]/Gas concentrations prevent operation of face equipment	NB - separate risk assessment including wind blast for first goaf formation	R Goonawardene	10/02/2020	TS.01218821
27	Floor gas emissions risk due to thin interburden resulting in production delays/Gas concentrations prevent operation of face equipment	Develop a gas predictive model for a longwall situation taking to account the effects of the abutment loading	S Giese	10/03/2020	TS.01218822

28	Floor Gas zone not defined accurately/Not defining the floor gas zone can result in production delays section of the LW104 which is not planned	Implement piezo monitoring from the MG pillar to assist with identifying the source of floor gas	H Hearne	10/02/2020	TS.01218823
31	Gas release during mining/Barometric drop results in migration of toxic / irrespirable atmosphere into mine workings/Exposure to Toxic / Irrespirable atmospheres causing personal injury	Confirm a hard barriers separating the C Heading roadway outbye the 103 EPS is in place prior to commencing LW104 operation	H Hearne	10/02/2020	TS.01218824
31	Gas release during mining/Barometric drop results in migration of toxic / irrespirable atmosphere into mine workings/Exposure to Toxic / Irrespirable atmospheres causing personal injury	Produce SWI for managing C heading roadway outbye the 103 EPS. Include hard controls for stonedust, gas monitoring, barricading, access, etc.)	H Hearne	15/02/2020	TS.01218825
34	Increased CH4 in TG drive/shearer during start-up due to low (velocity) ventilation until first Goaf formation/Gas concentrations prevent operation of face equipment	Complete a First Goaf risk assessment for LW104	R Goonawardene	1/02/2020	TS.01218826
36	Accessing the LW face for recovery purposes resulting in a personal injury due to poor strata conditions, Poor face stability causing slabbing and injuring person working on face side of AFC during face recovery	Review procedure for installing standpipes / lances for face recovery on a face height greater than 4.2m	S Giese	15/02/2020	TS.01218827

39	Known Geology/Extraction adjacent to edges of sandstone channels/Failure of roof on LW face causing production loss	Review options for the last 200m of LW104 retreat focusing on roof management, considering the learnings from LW101 and LW102, LW103 including bolt up.	S Giese	1/04/2020	TS.01218828
40	Known Geology/Extraction adjacent to edges of sandstone channels/Failure of roof adjacent to Gate ends causing production loss	Review business case for the cut profile for development versus cut horizon for the longwall in the MG and TG roadways	R Nowell	1/04/2020	TS.01218830
41	Known Geology/Gravity/Strata failure at gate-ends	Develop consolidation plan for gate ends	S Giese	15/02/2020	TS.01218832
42	Known Geology/Gravity/shotfiring in floor gas hazard zone in development causing delays (e.g. poor floor conditions)	Provide plan of area where shotfiring and/ PIFfing occurred	R Goonawardene	1/04/2020	TS.01218833
43	Known Geology/Gravity/Floor heave causing equipment clearance issues and/ or damage, Clearance for BSL, Monorail hoses dragging on the ground	Develop and distribute as mined cut profile in TG and MG roadway highlighting areas of low clearance	R Goonawardene	1/04/2020	TS.01218834
47	Known Geology/Mining through geological anomalies/Loss of horizon control or face stability issues causing production loss	LW Flight plans to be known structures	S Giese	25/02/2020	TS.01218836
52	Geotechnical considerations/Mining through non-standard driveage (i.e. tripper drives), This includes mining through known gateroad cavity zones/Roof / rib failure causing personal injury	Confirm the roadway is not greater than 5.0m high along the length of the block	J Mackey	25/02/2020	TS.01218837

53	Geotechnical considerations/Mining into pre-driven roadways /Strata failure / cavities in gas drainage stubs causing personal injury or production loss	Design flight plans / excavation plans and false roof for LW104 chute roads to allow transition for bolt up and back fill floor to bolt row 1	S Giese	1/06/2020	TS.01218839
53	Geotechnical considerations/Mining into pre-driven roadways /Strata failure / cavities in gas drainage stubs causing personal injury or production loss	Develop a standard for backfilling stubs	S Giese	25/02/2020	TS.01218840
54	Geotechnical considerations/Increased stress as retreating face approaches previous install face/Roof fall in TG roadway or cut-through causing personal injury or production loss, Stress notch	Ensure that no significant planned maintenance activities occur in the stress notch zone	J Agustin	25/02/2020	TS.01218842
72	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Less than adequate operation of the inertisation plant and/or inertisation plant stops and causes TARP trigger to be reached and delay the mining operations	Confirm inert line is installed into the existing goaf seals prior to startup.	H Hearne	15/02/2020	TS.01218846
72	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Less than adequate operation of the inertisation plant and/or inertisation plant stops and	Investigate additional flow meters on UG nitrogen pipeline so we can measure what we are doing	H Hearne	01/05/20	TS.01268158

	causes TARP trigger to be reached and delay the mining operations				
77	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Oxygen ingress in to the goaf – Due to increased bleeder pressure across goaf resulting in possible increase in spon comb risk resulting in production delay triggered by TARPs	Plan to seal perimeter road when end of panel shaft is online	H Hearne	15/02/2020	TS.01218850
79	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Ingress of oxygen into the goaf due to UIS holes open through MG pillar	Conduct audit on intersected UIS holes in MG104	R Kostowski	25/02/2020	TS.01218853
91	Plant/Mining equipment not fit for purpose/Longwall equipment suitable to maintain acceptable level of risk for personnel working on the longwall face	Confirm road heights in belt road and TG roadway are outside 3.6m to 4.2m in height	J Mackey	20/02/2020	TS.01218856
92	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Additional gas and heat in the rear walkway, Change in ventilation pathway through the longwall equipment profile	Review the effectiveness of the ventilation change from 103 to 104 due to the MG103 EPS	H Hearne	25/02/2020	TS.01218860
93	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business	Complete RCA on Hyena effect	M.Wakeford	25/02/2020	TS.01218869

	interruption/Personnel ergonomics due to the increased cut height working in the rear walkway				
93	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Personnel ergonomics due to the increased cut height working in the rear walkway	Review design of sprays in rear walkway to be in a more appropriate position Flushing or dust suppression	B.Thomson	15/02/2020	TS.01218872
93	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Personnel ergonomics due to the increased cut height working in the rear walkway	Review requirement of the dust gutters in rear walkway and remove if not required	B.Thomson	15/02/2020	TS.01218874
94	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Risk of slabbing/ face spalling	Investigate sprag extensions	B Thomson	15/02/2020	TS.01218878
94	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Risk of slabbing/ face spalling	Review procedure to add relocating control equipment to the rear walkway prior to cutting at heights above 4.2m	J.Agustin	15/02/2020	TS.01218879
95	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Maintenance of all Longwall face equipment (e.g. FI checks, Shearer, AFC, Bretby, PRS,	Ensure the maintenance strategy for cutting at heights above 4.2m reduces exposure to personnel (i.e. stables, flipper extensions, supported face)	J Agustin	25/02/2020	TS.01218882

	DACs, Phones, Interchock hoses) exposing a CMW to falling material				
95	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Maintenance of all Longwall face equipment (e.g. FI checks, Shearer, AFC, Bretby, PRS, DACs, Phones, Interchock hoses) exposing a CMW to falling material	Review GRO-5314-PRO-Equipment Hazard Zones in regards to cutting at heights above 4.2m	J.Agustin	25/02/2020	TS.01218886
97	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Operational capacity of longwall conveyance system with increased cutting rates due to increased cutting height above 4.2m	Investigate optimising the side shields to increase operating area for personnel in the rear walk way	J Agustin	15/02/2020	TS.01218891
97	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Operational capacity of longwall conveyance system with increased cutting rates due to increased cutting height above 4.2m	Perform bottleneck analysis on coal clearance systems to ensure capacity for mining at greater heights	J Agustin	25/02/2020	TS.01218901
97	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Operational capacity of longwall conveyance system with	Review conveyor system capacity	M Shields	15/02/2020	TS.01218904

	increased cutting rates due to increased cutting height above 4.2m				
98	Plant/Failure or damage of Longwall components resulting in the business interruption/Failure of Longwall components	Maintenance strategy for major components to align component failure cycle and physical locations adequate for the changeout of those components (e.g. planned down drive change out)	R Skinner	25/02/2020	TS.01218907
98	Plant/Failure or damage of Longwall components resulting in the business interruption/Failure of Longwall components	Moranbah North style flushing shields to be used in LW104 (Change management to be completed)	B.Starr	5/02/2020	TS.01218910
98	Plant/Failure or damage of Longwall components resulting in the business interruption/Failure of Longwall components	Review issues with AFC pan wear around articulation joints during LW103 and remediation strategy for LW104	B.Starr	1/02/2020	TS.01218914
98	Plant/Failure or damage of Longwall components resulting in the business interruption/Failure of Longwall components	Review issues with Anti topple encountered in LW103 and remediation strategy for LW104	B.Thomson	1/02/2020	TS.01218919
98	Plant/Failure or damage of Longwall components resulting in the business interruption/Failure of Longwall components	Review issues with electrical crossover and impact on the Bretby and remediation strategy for LW104	S.Wood	1/02/2020	TS.01218921
98	Plant/Failure or damage of Longwall components resulting in the business interruption/Failure of Longwall components	Review longwall 104 monitoring strategy for deck wear	B.Thomson	1/02/2020	TS.01218922
98	Plant/Failure or damage of Longwall components resulting in the business	Review the Komatsu service agreement	M Britton	15/02/2020	TS.01218923

	interruption/Failure of Longwall components				
99	Plant/Business interruption due to failure of stonedust application in TG for LW production/Stonedust pipeline blocks up	Communicate LW104 stonedusting strategy	J.Simonds	5/02/2020	TS.01218928
99	Plant/Business interruption due to failure of stonedust application in TG for LW production/Stonedust pipeline blocks up	Ensure that 2 x bulk dusters are available for the longwall in the event the stonedust dropholes fail	J Lancaster	5/02/2020	TS.01218930
99	Plant/Business interruption due to failure of stonedust application in TG for LW production/Stonedust pipeline blocks up	Provide schedule and location for services boreholes based on development intersection dates	R Goonawardene	25/01/2020	TS.01218931
100	Plant/Supply of Components /Failure to meet time lines causing delays, Lack of spares for Becker equipment, Turn-around time for repairs, POCVs and Solenoid availability	BCO to provide report when min/max stock levels for spares are altered	W Peyper	3/02/2020	TS.01219654
100	Plant/Supply of Components /Failure to meet time lines causing delays, Lack of spares for Becker equipment, Turn-around time for repairs, POCVs and Solenoid availability	Investigation for using local supplier for critical spares ongoing	I Bailey	1/02/2020	TS.01218934
100	Plant/Supply of Components /Failure to meet time lines causing delays, Lack of spares for Becker equipment, Turn-around time for repairs, POCVs and Solenoid availability	Review min max levels of spares (Becker, DACs, solonoids, POCVs, etc.) in stores to ensure they are sufficient	J Agustin	1/02/2020	TS.01218936

102	Plant/Dewatering /LOM dewatering insufficient to manage water on the longwall face, Water gathering at the low point in the (TG drive)	Communicate the LOM dewatering strategy	N Gilbert	01/02/2020	TS.01218938
102	Plant/Dewatering /LOM dewatering insufficient to manage water on the longwall face, Water gathering at the low point in the (TG drive)	Develop a strategy to dewater the longwall face	B Thomson	15/02/2020	TS.01218940
102	Plant/Dewatering /LOM dewatering insufficient to manage water on the longwall face, Water gathering at the low point in the (TG drive)	Investigate sealed area water capacity	N Gilbert	25/02/2020	TS.01218942
102	Plant/Dewatering /LOM dewatering insufficient to manage water on the longwall face, Water gathering at the low point in the (TG drive)	Review capability to install additional crossblock holes	N Gilbert	01/02/2020	TS.01218948
103	Plant/Compressed air supply insufficient/Compressor failure	Review the LOM compressed air capacity requirements	N Gilbert	15/02/2020	TS.01218951
104	Plant/Raw water supply insufficient, Competing with MNM for water volume from Eungella, Moranbah wash plant running out of water taking priority from Grosvenor, Raw water quality being insufficient/Compressor failure	Investigate using arrow waste water to prop up raw water consumption	A Heap	20/02/2020	TS.01218952
104	Plant/Raw water supply insufficient, Competing with MNM for water volume from Eungella, Moranbah wash plant running out of water taking priority from	Review who is required in the Water Steering Committee for managing water across the Moranbah-Grosvenor complex to mitigate the shortage of water	K Bachmann	25/02/2020	TS.01218957

	Grosvenor, Raw water quality being insufficient/Compressor failure				

NON-CONSENSUS ITEMS *All Non-Consensus Items to be entered into Enablon for immediate follow up*				
Line Ref No.	**Item or Issue**	**Reason for Non-Consensus**	**Immediate Follow up by Whom**	**Date**

NO NON-CONSENSUS ITEMS

HAZARDS/ISSUES RANKED *Taken From Initial Risk Rank IRR and Initial Consequence Rankings in IRR*					
Line Ref No.	**List A - Hazard/Issue**	**IRR**	**Line Ref No.**	**List B - Hazard/Issue**	**Conseq**
19	Mining under the 132,000 Volt Powerlink line to Townsville/LW104 Subsidence causing damage to the powerlines/If the jacks cannot be installed in time to combat the subsidence, there is a risk of the LW104 start date being delayed and causing production loss	18S	9	Access to Gas Plant/Adverse weather/Lightning strike leading to ignition underground or electric shock	4S
31	Gas release during mining/Barometric drop results in migration of toxic / irrespirable atmosphere into mine workings/Exposure to Toxic / Irrespirable atmospheres causing personal injury	18S	16	Access to Gas Plant/Mining through an un-grouted borehole / gas-well/Shearer intersecting poly / PVC/ Fibreglass or abandoned drilling materials (ie BHA) within the mining horizon - Flying objects / projectiles leading to personal injury, e.g. 3 x steel in seam hazards in block, Crossblock dewatering hole	4S

39	Known Geology/Extraction adjacent to edges of sandstone channels/Failure of roof on LW face causing production loss	18S	17	Access to Gas Plant/Mining through an un-grouted borehole / gas-well/Intersection of open borehole resulting in air leak increased potential of Spontaneous Combustion - Air leakage in into goaf from untreated hole	4S
47	Known Geology/Mining through geological anomalies/Loss of horizon control or face stability issues causing production loss	18S	31	Gas release during mining/Barometric drop results in migration of toxic / irrespirable atmosphere into mine workings/Exposure to Toxic / Irrespirable atmospheres causing personal injury	4S
95	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Maintenance of all Longwall face equipment (e.g. FI checks, Shearer, AFC, Bretby, PRS, DACs, Phones, Interchock hoses) exposing a CMW to falling material	18S	36	LW Recovery - Geology/LW Recovery - Geology/Accessing the LW face for recovery purposes resulting in a personal injury due to poor strata conditions, Poor face stability causing slabbing and injuring person working on face side of AFC during face recovery	4S
40	Known Geology/Extraction adjacent to edges of sandstone channels/Failure of roof adjacent to Gate ends causing production loss	17S	95	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Maintenance of all Longwall face equipment (e.g. FI checks, Shearer, AFC, Bretby, PRS, DACs, Phones, Interchock hoses) exposing a CMW to falling material	4S
98	Plant/Failure or damage of Longwall components resulting in the business interruption/Failure of Longwall components - Drums, Down drives, AFC sprockets, AFC gear boxes, BSL Sprockets, Chains (Flight Bars), Bolts, Deck Wear in the ramp area, drive gear boxes, interchock hoses, cables, flippers cylinders, crushed hammer, promos and lock out, Solenoids/ POCV	17S	19	Mining under the 132,000 Volt Powerlink line to Townsville/LW104 Subsidence causing damage to the powerlines/If the jacks cannot be installed in time to combat the subsidence, there is a risk of the LW104 start date being delayed and causing production loss	4M

36	LW Recovery - Geology/LW Recovery - Geology/Accessing the LW face for recovery purposes resulting in a personal injury due to poor strata conditions, Poor face stability causing slabbing and injuring person working on face side of AFC during face recovery	14S	39	Known Geology/Extraction adjacent to edges of sandstone channels/Failure of roof on LW face causing production loss	4M
10	Access to Gas Plant/Subsidence due to secondary extraction/Damage to mine surface infrastructure and third party infrastructure (P seam SIS), NB- the Powerlink line to Townscville	13S	47	Known Geology/Mining through geological anomalies/Loss of horizon control or face stability issues causing production loss	4M
22	Gas release during mining/Gas liberation into face area exceeding operational and legal requirements [CH4% >2.5%]/Gas concentrations prevent operation of diesel equipment in TG roadway causing production loss	13S	38	Known Geology/Loading, failure and caving of over-laying strata/Converging event causing personnel injury	3S
54	Geotechnical considerations/Increased stress as retreating face approaches previous install face/Roof fall in TG roadway or cut-through causing personal injury or production loss, Stress notch	13S	69	Ventilation/Heat generated by mining equipment and geo-thermal gradient influencing mine conditions/Inadequate Ventilation / cooling causing production loss or personnel injury	3S
65	Edges of Goaf Areas/Goaf edge overruns support Gate-end/Goaf flushing causing production loss	13S	84	Frictional ignition/Managing Frictional Ignition/Gas sources (blowers in the floor, gas under the pan, gas out of the roof) result in increased safety risk to CMWs or loss of production	3S
21	Gas release during mining/Gas liberation into face area exceeding operational and legal requirements [CH4% >2.5%]/Gas concentrations prevent operation of face equipment	12M	91	Plant/Mining equipment not fit for purpose/Longwall equipment suitable to maintain acceptable level of risk for personnel working on the longwall face	3S
23	Gas release during mining/Goaf collapse / caving expels large volumes of gas creating a general body	12M	93	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business	3S

	exceeding operational and legal requirements [CH4% >2.5%]/Gas concentrations prevent operation of face equipment			interruption/Personnel ergonomics due to the increased cut height working in the rear walkway	
26	Gas release during mining/Inadequate gas post-drainage (goaf), resulting in >2.5% TG CH4%, and production delays/Gas concentrations prevent operation of face equipment	12M	11	Access to Gas Plant/Subsidence due to secondary extraction/Subsidence cracking connecting mine workings with Isaac River - Inflow of water into workings	3M
27	Gas release during mining/Floor gas emissions risk due to thin interburden resulting in production delays/Gas concentrations prevent operation of face equipment	12M	12	Access to Gas Plant/Subsidence due to secondary extraction/Subsidence cracking connecting mine workings from basalt aquifer - Inflow of water into workings	3M
28	Gas release during mining/Floor Gas zone not defined accurately/Not defining the floor gas zone can result in production delays section of the LW104 which is not planned	12M	22	Gas release during mining/Gas liberation into face area exceeding operational and legal requirements [CH4% >2.5%]/Gas concentrations prevent operation of diesel equipment in TG roadway causing production loss	3M
29	Gas release during mining/Increased gas ingress due to propagation through geological structures/Faults in the longwall block may promote fracturing to both lower and upper seams increasing gas ingress	12M	37	Known Geology/Loading, failure and caving of over-laying strata/Increased propensity for weighting causing production loss	3M
48	Known Geology/Mining through geological anomalies/Exposing GML seam resulting in increased gas make on the longwall face	12M	40	Known Geology/Extraction adjacent to edges of sandstone channels/Failure of roof adjacent to Gate ends causing production loss	3M
99	Plant/Business interruption due to failure of stonedust application in TG for LW production/Stonedust pipeline blocks up	12M	41	Known Geology/Gravity/Strata failure at gate-ends	3M
101	Plant/Hydraulic integrity/Loss of hydraulic integrity, Pump station reliability,Replacement POCVs and solenoids not being fit for purpose	12M	49	Known Geology/Automation failure/Loss of horizon control or face stability issues causing production loss	3M

9	Access to Gas Plant/Adverse weather/Lightning strike leading to ignition underground or electric shock	10M	51	Known Geology/Retreat extraction of the seam at a grade/Excessive Creep	3M
16	Access to Gas Plant/Mining through an un-grouted borehole / gas-well/Shearer intersecting poly / PVC/ Fibreglass or abandoned drilling materials (ie BHA) within the mining horizon - Flying objects / projectiles leading to personal injury, e.g. 3 x steel in seam hazards in block, Crossblock dewatering hole	10M	54	Geotechnical considerations/Increased stress as retreating face approaches previous install face/Roof fall in TG roadway or cut-through causing personal injury or production loss, Stress notch	3M
17	Access to Gas Plant/Mining through an un-grouted borehole / gas-well/Intersection of open borehole resulting in air leak increased potential of Spontaneous Combustion - Air leakage in into goaf from untreated hole	10M	57	Geotechnical considerations/Roadway failure/Loss of services (water, compressed air, monitoring, de-water, communications, power)	3M
11	Access to Gas Plant/Subsidence due to secondary extraction/Subsidence cracking connecting mine workings with Isaac River - Inflow of water into workings	9M	58	Geotechnical considerations/MG103 EPS issues/Abutment load impacting the MG103 EPS	3M
12	Access to Gas Plant/Subsidence due to secondary extraction/Subsidence cracking connecting mine workings from basalt aquifer - Inflow of water into workings	9M	59	Geotechnical considerations/Roof/floor convergence/ out of tolerance driveage results in BSL/LW infrastructure becoming iron bound in belt road/BSL/LW infrastructure becoming “iron-bound” in belt road causing production loss	3M
37	Known Geology/Loading, failure and caving of over-laying strata/Increased propensity for weighting causing production loss	9M	65	Edges of Goaf Areas/Goaf edge overruns support Gate-end/Goaf flushing causing production loss	3M
41	Known Geology/Gravity/Strata failure at gate-ends	9M	98	Plant/Failure or damage of Longwall components resulting in the business interruption/Failure of Longwall components - Drums, Down drives, AFC sprockets, AFC gear boxes, BSL Sprockets, Chains	3M

				(Flight Bars), Bolts, Deck Wear in the ramp area, drive gear boxes, interchock hoses, cables, flippers cylinders, crushed hammer, promos and lock out, Solenoids/ POCV	
51	Known Geology/Retreat extraction of the seam at a grade/Excessive Creep	9M	10	Access to Gas Plant/Subsidence due to secondary extraction/Damage to mine surface infrastructure and third party infrastructure (P seam SIS), NB- the Powerlink line to Townscville	3 M
59	Geotechnical considerations/Roof/floor convergence/ out of tolerance driveage results in BSL/LW infrastructure becoming iron bound in belt road/BSL/LW infrastructure becoming “iron-bound” in belt road causing production loss	9M	33	Gas release during mining/Goaf collapse / caving expels large volumes of gas creating oxygen deficient atmosphere/Exposure to oxygen deficient atmospheres	2S
69	Ventilation/Heat generated by mining equipment and geo-thermal gradient influencing mine conditions/Inadequate Ventilation / cooling causing production loss or personnel injury	9M	34	Gas release during mining/Increased CH4 in TG drive/shearer during start-up due to low (velocity) ventilation until first Goaf formation/Gas concentrations prevent operation of face equipment	2S
91	Plant/Mining equipment not fit for purpose/Longwall equipment suitable to maintain acceptable level of risk for personnel working on the longwall face	9M	35	Gas release during mining/Progressive sealing required during extraction/Exposure to Toxic / Irrespirable atmospheres due to sealing installation not in place, Failure to build a seal in time	2S
93	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Personnel ergonomics due to the increased cut height working in the rear walkway	9M	45	Known Geology/Hardness of coal and stone hardness when cutting out of seam/Increased fly rock	2S
3	Access to Gas Plant/Surface – Seam/Uncontrolled / excessive surface clearing for drilling or access (gas drainage) leading to disturbance to environmentally or culturally significant areas	8M	60	Geotechnical considerations/Operating the LW/Face support system failure, resulting in increased risk of cavities and injury to CMWs due to falling debris and remediation work, e.g US Flippers	2S

7	Access to Gas Plant/Surface – Seam/Loss of access to MIA, MSF and any Other Projects causing production loss due to adverse weather	8M	61	Geotechnical considerations/Operating the LW/Face support system failure, resulting in increased risk of cavities and loss of production	2S
15	Access to Gas Plant/Mining through an un-grouted borehole / gas-well/Mining through an unknown borehole leading to Inflow of gas into workings	8M	63	Geotechnical considerations/Excessive loading during Longwall cutting / retreating/Uncontrolled failure of pillars	2S
24	Gas release during mining/Changes in ERZ-NERZ Boundaries/Non-Hazardous Area Certified electrical equipment operating in the ERZ1 zone	8M	64	Edges of Goaf Areas/Gap between chocks/Goaf materials falling between shields causing personal injury	2S
25	Gas release during mining/Caving / subsidence closing off gas drainage wells/Loss of gas drainage capability causing production loss	8M	70	Ventilation/Change ventilation from Homotropal to Antitropal/Ventilation changes affecting mining environment and leading to delays	2S
30	Gas release during mining/Ineffective ventilation and gas monitoring/Non-Hazard Area Certified electrical equipment operating in the ERZ1 zone	8M	71	Ventilation/Ventilation Reversal inbye of LW/Pressure change on face leads to production delay	2S
50	Known Geology/Changes in seam gradient whilst mining/Loss of horizon control or face stability issues.	8M	74	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Improperly stored stowage in gateroads against existing seals drawing oxygen across the stow,	2S
55	Geotechnical considerations/Loss of creep control or misalignment of MG 104/Inability to access the face via designated walkway causing personal injury or production loss	8M	81	Frictional ignition/Managing Frictional Ignition/Steel strike (drum hitting TG bolts, steel, chocks, etc.) causing a spark results in increased FI risk	2S
60	Geotechnical considerations/Operating the LW/Face support system failure, resulting in increased risk of cavities and injury to CMWs due to falling debris and remediation work, e.g US Flippers	8M	82	Frictional ignition/Managing Frictional Ignition/MG or TG support setting against bolts causing spark in roadway leading to increased frictional ignition risk	2S

61	Geotechnical considerations/Operating the LW/Face support system failure, resulting in increased risk of cavities and loss of production	8M	83	Frictional ignition/Managing Frictional Ignition/Cutting hard material (e.g., pyrite or sandstone) results in increased potential for a frictional ignition	2S
66	Coal Extraction Sequence/Long term exposure to respirable dust, High ventilation velocities raises dust, Dry coal due to gas drainage increasing dust make/Exposure above the respirable dust OEL	8M	89	Frictional ignition/Managing Frictional Ignition/Shearer intersecting metallic objects/artefacts in boreholes / gas-well leading to delays in operation	2S
68	Ventilation/Main fans stoppage, VCD fail, open / short circuit , flooded roadways etc./Insufficient Ventilation causing production loss or personnel injury	8M	90	Frictional ignition/Managing Frictional Ignition/Cutting concrete or shotcrete increasing frictional ignition risk	2S
73	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Geological anomalies increases spontaneous combustion potential and risks to operations	8M	94	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Risk of slabbing/ face spalling	2S
75	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Incomplete goafing creates air path to goaf until square up, resulting in increased spontaneous combustion risk and production delays	8M	1	Access to Gas Plant/Surface – Seam/Loss of access to north side of Isaac river due to adverse weather	2M
76	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Air wash zone not adequately controlled (floxal), resulting in increased spontaneous combustion risk and production delays	8M	2	Access to Gas Plant/Surface – Seam/Surface ponding of water above workings due to ineffective drainage of subsidence zones.	2M
77	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Oxygen ingress in to the goaf – Due to increased bleeder pressure across goaf resulting in possible increase in	8M	4	Access to Gas Plant/Surface – Seam/Flood plain – impacts on the Service boreholes etc leading to operational delays	2M

	spon comb risk resulting in production delay triggered by TARPs				
78	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Failed goaf seal introduces oxygen into goaf causing production delay	8M	6	Access to Gas Plant/Surface – Seam/Inability to drill adequate goaf drainage holes due to enviro or Cultural heritage restrictions	2M
79	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Ingress of oxygen into the goaf due to UIS holes open through MG pillar	8M	7	Access to Gas Plant/Surface – Seam/Loss of access to MIA, MSF and any Other Projects causing production loss due to adverse weather	2M
92	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Additional gas and heat in the rear walkway, Change in ventilation pathway through the longwall equipment profile	8M	8	Access to Gas Plant/Adverse weather/Business loss due to lack of access to boreholes during, wind, cyclones, lighting, and flooding	2M
94	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Risk of slabbing/ face spalling	8M	20	Hole into other workings/Inrush/Inrush into mine workings from adjoining/above workings	2M
96	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Design of electrical equipment suitable for greater cut height (e.g. cable length, voltage drop)	8M	25	Gas release during mining/Caving / subsidence closing off gas drainage wells/Loss of gas drainage capability causing production loss	2M
97	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Operational capacity of longwall conveyance system with increased cutting rates due to increased cutting height above 4.2m	8M	26	Gas release during mining/Inadequate gas post-drainage (goaf), resulting in >2.5% TG CH4%, and production delays/Gas concentrations prevent operation of face equipment	2M

100	Plant/Supply of Components /Failure to meet time lines causing delays, Lack of spares for Becker equipment, Turn-around time for repairs, POCVs and Solenoid availability	8M	27	Gas release during mining/Floor gas emissions risk due to thin interburden resulting in production delays/Gas concentrations prevent operation of face equipment	2M
102	Plant/Dewatering /LOM dewatering insufficient to manage water on the longwall face, Water gathering at the low point in the (TG drive)	8M	28	Gas release during mining/Floor Gas zone not defined accurately/Not defining the floor gas zone can result in production delays section of the LW104 which is not planned	2M
103	Plant/Compressed air supply insufficient/Compressor failure	8M	29	Gas release during mining/Increased gas ingress due to propagation through geological structures/Faults in the longwall block may promote fracturing to both lower and upper seams increasing gas ingress	2M
104	Plant/Raw water supply insufficient, Competing with MNM for water volume from Eungella, Moranbah wash plant running out of water taking priority from Grosvenor, Raw water quality being insufficient/Insufficient water	8M	30	Gas release during mining/Ineffective ventilation and gas monitoring/Non-Hazard Area Certified electrical equipment operating in the ERZ1 zone	2M
38	Known Geology/Loading, failure and caving of over-laying strata/Converging event causing personnel injury	6M	32	Gas release during mining/Loss of vacuum to goaf plant/Gas concentrations prevent operation of face equipment	2M
49	Known Geology/Automation failure/Loss of horizon control or face stability issues causing production loss	6M	42	Known Geology/Gravity/shotfiring in floor gas hazard zone in development causing delays (e.g. poor floor conditions)	2M
57	Geotechnical considerations/Roadway failure/Loss of services (water, compressed air, monitoring, de-water, communications, power)	6M	43	Known Geology/Gravity/Floor heave causing equipment clearance issues and/ or damage, Clearance for BSL, Monorail hoses dragging on the ground	2M

58	Geotechnical considerations/MG103 EPS issues/Abutment load impacting the MG103 EPS	6M	44	Known Geology/Hardness of coal and stone hardness when cutting out of seam/Increased frequency of pick changes on shearer drum	2M
84	Frictional ignition/Managing Frictional Ignition/Gas sources (blowers in the floor, gas under the pan, gas out of the roof) result in increased safety risk to CMWs or loss of production	6M	46	Known Geology/Loss of horizon control/Low yield - coal quality	2M
1	Access to Gas Plant/Surface – Seam/Loss of access to north side of Isaac river due to adverse weather	5L	48	Known Geology/Mining through geological anomalies/Exposing GML seam resulting in increased gas make on the longwall face	2M
2	Access to Gas Plant/Surface – Seam/Surface ponding of water above workings due to ineffective drainage of subsidence zones.	5L	50	Known Geology/Changes in seam gradient whilst mining/Loss of horizon control or face stability issues.	2M
4	Access to Gas Plant/Surface – Seam/Flood plain – impacts on the Service boreholes etc leading to operational delays	5L	52	Geotechnical considerations/Mining through non-standard driveage (i.e. tripper drives), This includes mining through known gateroad cavity zones/Roof / rib failure causing personal injury	2M
5	Access to Gas Plant/Surface – Seam/Cumulative impacts on LW104 with an adjacent and subsided LW103 block leading to potential for environmental event (not witnessed at this operation previously)	5L	53	Geotechnical considerations/Mining into pre-driven roadways /Strata failure / cavities in gas drainage stubs causing personal injury or production loss	2M
6	Access to Gas Plant/Surface – Seam/Inability to drill adequate goaf drainage holes due to enviro or Cultural heritage restrictions	5L	55	Geotechnical considerations/Loss of creep control or misalignment of MG 104/Inability to access the face via designated walkway causing personal injury or production loss	2M
8	Access to Gas Plant/Adverse weather/Business loss due to lack of access to boreholes during, wind, cyclones, lighting, and flooding	5L	56	Geotechnical considerations/Strata failures in Bleeder Road / Perimeter Rd /Restricted access to VCDs and	2M

				bleeder / perimeter road causing personal injury or production loss	
13	Access to Gas Plant/Subsidence due to secondary extraction/Extent of subsidence breaches authority/licence to operate agreement	5L	62	Geotechnical considerations/Abutment load being transferred onto seal sites/Catastrophic Failure of goaf seal releases goaf gases or water into mine workings from adjacent workings/goaf	2M
14	Access to Gas Plant/Mining through an un-grouted borehole / gas-well/Inflow of water into workings leading to potential for injury to personnel	5L	67	Coal Extraction Sequence/Equipment damage/Insufficient clearance for service installations	2M
18	Access to Gas Plant/Mining through an un-grouted borehole / gas-well/Old asbestos pipeline (BMA) has been diverted - Potential connections or damage to the pipeline due to subsidence impacts causing business interruptions/ financial impacts (only very small section at end of LW/mains)	5L	68	Ventilation/Main fans stoppage, VCD fail, open / short circuit , flooded roadways etc./Insufficient Ventilation causing production loss or personnel injury	2M
20	Hole into other workings/Inrush/Inrush into mine workings from adjoining/above workings	5L	72	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Less than adequate operation of the inertisation plant and/or inertisation plant stops and causes TARP trigger to be reached and delay the mining operations	2M
32	Gas release during mining/Loss of vacuum to goaf plant/Gas concentrations prevent operation of face equipment	5L	73	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Geological anomalies increases spontaneous combustion potential and risks to operations	2M
33	Gas release during mining/Goaf collapse / caving expels large volumes of gas creating oxygen deficient atmosphere/Exposure to oxygen deficient atmospheres	5L	75	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Incomplete goafing creates air path to goaf until square up, resulting in increased spontaneous combustion risk and production delays	2M

34	Gas release during mining/Increased CH4 in TG drive/shearer during start-up due to low (velocity) ventilation until first Goaf formation/Gas concentrations prevent operation of face equipment	5L	76	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Air wash zone not adequately controlled (floxal), resulting in increased spontaneous combustion risk and production delays	2M
35	Gas release during mining/Progressive sealing required during extraction/Exposure to Toxic / Irrespirable atmospheres due to sealing installation not in place, Failure to build a seal in time	5L	77	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Oxygen ingress in to the goaf – Due to increased bleeder pressure across goaf resulting in possible increase in spon comb risk resulting in production delay triggered by TARPs	2M
42	Known Geology/Gravity/shotfiring in floor gas hazard zone in development causing delays (e.g. poor floor conditions)	5L	78	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Failed goaf seal introduces oxygen into goaf causing production delay	2M
43	Known Geology/Gravity/Floor heave causing equipment clearance issues and/ or damage, Clearance for BSL, Monorail hoses dragging on the ground	5L	79	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Ingress of oxygen into the goaf due to UIS holes open through MG pillar	2M
44	Known Geology/Hardness of coal and stone hardness when cutting out of seam/Increased frequency of pick changes on shearer drum	5L	80	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Surface cracking leading to ingress of oxygen into the goaf	2M
45	Known Geology/Hardness of coal and stone hardness when cutting out of seam/Increased fly rock	5L	96	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Design of electrical equipment suitable for greater cut height (e.g. cable length, voltage drop)	2M
46	Known Geology/Loss of horizon control/Low yield - coal quality	5L	97	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Operational capacity of longwall	2M

				conveyance system with increased cutting rates due to increased cutting height above 4.2m	
53	Geotechnical considerations/Mining into pre-driven roadways /Strata failure / cavities in gas drainage stubs causing personal injury or production loss	5L	100	Plant/Supply of Components /Failure to meet time lines causing delays, Lack of spares for Becker equipment, Turn-around time for repairs, POCVs and Solenoid availability	2M
56	Geotechnical considerations/Strata failures in Bleeder Road / Perimeter Rd /Restricted access to VCDs and bleeder / perimeter road causing personal injury or production loss	5L	101	Plant/Hydraulic integrity/Loss of hydraulic integrity, Pump station reliability,Replacement POCVs and solenoids not being fit for purpose	2M
62	Geotechnical considerations/Abutment load being transferred onto seal sites/Catastrophic Failure of goaf seal releases goaf gases or water into mine workings from adjacent workings/goaf	5L	102	Plant/Dewatering /LOM dewatering insufficient to manage water on the longwall face, Water gathering at the low point in the (TG drive)	2M
64	Edges of Goaf Areas/Gap between chocks/Goaf materials falling between shields causing personal injury	5L	103	Plant/Compressed air supply insufficient/Compressor failure	2M
67	Coal Extraction Sequence/Equipment damage/Insufficient clearance for service installations	5L	104	Plant/Raw water supply insufficient, Competing with MNM for water volume from Eungella, Moranbah wash plant running out of water taking priority from Grosvenor, Raw water quality being insufficient/Insufficient water	2M
70	Ventilation/Change ventilation from Homotropal to Antitropal/Ventilation changes affecting mining environment and leading to delays	5L	3	Access to Gas Plant/Surface – Seam/Uncontrolled / excessive surface clearing for drilling or access (gas drainage) leading to disturbance to environmentally or culturally significant areas	2L&R
71	Ventilation/Ventilation Reversal inbye of LW/Pressure change on face leads to production delay	5L	15	Access to Gas Plant/Mining through an un-grouted borehole / gas-well/Mining through an unknown borehole leading to Inflow of gas into workings	2L&R

72	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Less than adequate operation of the inertisation plant and/or inertisation plant stops and causes TARP trigger to be reached and delay the mining operations	5L	18	Access to Gas Plant/Mining through an un-grouted borehole / gas-well/Old asbestos pipeline (BMA) has been diverted - Potential connections or damage to the pipeline due to subsidence impacts causing business interruptions/ financial impacts (only very small section at end of LW/mains)	2L&R
80	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Surface cracking leading to ingress of oxygen into the goaf	5L	21	Gas release during mining/Gas liberation into face area exceeding operational and legal requirements [CH4% >2.5%]/Gas concentrations prevent operation of face equipment	2L&R
81	Frictional ignition/Managing Frictional Ignition/Steel strike (drum hitting TG bolts, steel, chocks, etc.) causing a spark results in increased FI risk	5L	23	Gas release during mining/Goaf collapse / caving expels large volumes of gas creating a general body exceeding operational and legal requirements [CH4% >2.5%]/Gas concentrations prevent operation of face equipment	2L&R
82	Frictional ignition/Managing Frictional Ignition/MG or TG support setting against bolts causing spark in roadway leading to increased frictional ignition risk	5L	24	Gas release during mining/Changes in ERZ-NERZ Boundaries/Non-Hazardous Area Certified electrical equipment operating in the ERZ1 zone	2L&R
83	Frictional ignition/Managing Frictional Ignition/Cutting hard material (e.g., pyrite or sandstone) results in increased potential for a frictional ignition	5L	99	Plant/Business interruption due to failure of stonedust application in TG for LW production/Stonedust pipeline blocks up	2L&R
89	Frictional ignition/Managing Frictional Ignition/Shearer intersecting metallic objects/artefacts in boreholes / gas-well leading to delays in operation	5L	14	Access to Gas Plant/Mining through an un-grouted borehole / gas-well/Inflow of water into workings leading to potential for injury to personnel	2H
90	Frictional ignition/Managing Frictional Ignition/Cutting concrete or shotcrete increasing frictional ignition risk	5L	66	Coal Extraction Sequence/Long term exposure to respirable dust, High ventilation velocities raises dust, Dry coal due to gas drainage increasing dust make/Exposure above the respirable dust OEL	2H

85	Frictional ignition/Managing Frictional Ignition/Incendive sparking from sandstone bodies/ free stone on the AFC / BSL causing production loss	4L	92	Plant/Increasing the cut height to greater than 4.2m causing personal safety or business interruption/Additional gas and heat in the rear walkway, Change in ventilation pathway through the longwall equipment profile	2H
63	Geotechnical considerations/Excessive loading during Longwall cutting / retreating/Uncontrolled failure of pillars	3L	5	Access to Gas Plant/Surface – Seam/Cumulative impacts on LW104 with an adjacent and subsided LW103 block leading to potential for environmental event (not witnessed at this operation previously)	2E
74	Method of Controlling Spontaneous Combustion/Spontaneous Combustion/Improperly stored stowage in gateroads against existing seals drawing oxygen across the stow,	3L	13	Access to Gas Plant/Subsidence due to secondary extraction/Extent of subsidence breaches authority/licence to operate agreement	2E
52	Geotechnical considerations/Mining through non-standard driveage (i.e. tripper drives), This includes mining through known gateroad cavity zones/Roof / rib failure causing personal injury	2L	87	Frictional ignition/Managing Frictional Ignition/Excessive heat from chain rerouters causing ignition	1S
86	Frictional Ignition/Managing Frictional Ignition/TG STD Support - shearer cutting into the steel cans/ PCBs containing steel mesh leading to regulatory breach, NB: potential for cold spark being initiated	2L	88	Frictional ignition/Managing Frictional Ignition/Excessive heat from trapping shoe wear / shear pin on the AFC causing production delay	1S
87	Frictional ignition/Managing Frictional Ignition/Excessive heat from chain rerouters causing ignition	2L	85	Frictional ignition/Managing Frictional Ignition/Incendive sparking from sandstone bodies/ free stone on the AFC / BSL causing production loss	1M
88	Frictional ignition/Managing Frictional Ignition/Excessive heat from trapping shoe wear / shear pin on the AFC causing production delay	2L	86	Frictional Ignition/Managing Frictional Ignition/TG STD Support - shearer cutting into the steel cans/ PCBs containing steel mesh leading to regulatory breach, NB: potential for cold spark being initiated	1L&R

MANAGEMENT APPROVAL

The Authorising Persons Shall Be either:

- The Process Manager for activities and the Statutory Manager; or
- The Site Senior Executive.

Signing below acknowledges that they have reviewed the risk assessment, authorise the additional controls and accept that the residual risk rank (RRR) is at an acceptable level

Name	Position		Date
Rob Nowell	Process Manager	[redacted]	23/1/2020
Wouter Niehaus	Statutory Manager		7/2/2020
Trent Griffiths	Site Senior Executive		17/2/2020
Logan Mohr	Process Manager		21/2/20

Generic Energy Hazard	Definition
Biological	Potential for positive or negative impacts resulting from interaction of activities with biological agents. This could be harm by exposure to biological hazards, flora and fauna including insect stings, bites, bacteria and other disease agents, viruses and natural poisons or environmental harm to biodiversity.
Chemical	Potential for harm by chemicals, includes acids, alkalis, organic substance (e.g. gases, fuels, lubes, degreasers, solvents, paints) ozone depleting substances etc.
Climate / Natural Events	Potential for harm by exposure to extreme natural, environmental or climate sources and events (including lightning, high winds flooding).
Dust / Inhalable Particulates	Potential for harm by exposure to fine dry particles of matter in the air. Dusts, mists, vapours and aerosols (Coal dust, silica dust, environmental nuisance/community complaints).
Electrical	Potential for harm to people, equipment/assets or the environment by exposure to electrical sources.
Ergonomics	Potential for exposure to physical actions or forces, including poor design, thus presenting the potential for harm associated with exertion, excessive, unnatural or repetitive movement, poor posture or other undesired physical stress on the human body.
Explosives	Potential for harm by exposure to explosive material (e.g. unexploded detonators, tie down lines etc).
External Threats	Potential for harm resulting from an external event outside of the operations direct control (e.g. legislation., government actions, community lobby groups etc).
Fire	Potential for harm by exposure to a burning mass of material (e.g. building fires, spontaneous combustion).
Gravitational (Objects)	Potential for harm by exposure to falling objects, unexpected movement (ground, slope, structure) due to uncontrolled gravitational forces.
Gravitational (People)	Potential for harm to people caused by their being subject to falling, unexpected movement or in any other way resulting from their being exposed to uncontrolled gravitational forces (including slips, trips, falls).
Land	Potential harm on the naturally occurring environment due to the use or management of land resulting from pollution, clearance or any other degradation.
Lighting	Potential for harm resulting from excessive light or inadequate lighting in the workplace.
Mechanical (Fixed)	Potential for harm by exposure to interaction with sources of fixed mechanical energy (including those powered by electrical, hydraulic, pneumatic, combustion etc).
Mechanical (Mobile)	Potential for harm by exposure to interaction with sources of mobile (self-propelled) mechanical energy (including those powered by electrical, hydraulic, pneumatic, combustion etc).
Magnetic	Potential for harm to people, equipment/assets or the environment by exposure to magnetic sources (including handling metal objects in strong magnetic fields).
Noise	Potential for harm by exposure to sudden or prolonged exposure to excessive noise or community complaints.
Personal / Behaviour	Potential for harm associated with intentional undesired behavioural actions, stresses or stressors.
Pressure / Explosions	Potential for harm by exposure to sudden release of pressure from a specific source (including pressure waves from explosions, pressurised systems, cylinders, springs, chains, flying bits, or community complaints associated with air blast overpressure etc).
Psychological	Potential for harm associated with stressors from situations, conditions or events that could create negative emotional, cognitive or behavioural outcomes.
Radiation	Potential for harm by exposure to radiation waves whether natural or manufactured sources (characterised as either ionising or non-ionising sources).
Social / Cultural	Potential for positive or negative impacts resulting from interaction of business activities with social or cultural expectations (includes social licences to operate).
Thermal	Potential for harm by exposure to or variations in temperature (hot or cold) but excludes anything that is on fire which has a separate category.
Vibration	Potential for harm resulting from prolonged exposures to excessive vibration or blast vibration.
Waste	Potential for harm caused by the inappropriate use of resources, inadequate management or disposal of waste material (including pollution and green house gases).
Water	Potential for harm caused by the inappropriate use of water resources or inappropriate management or disposal of water.
Other	Potential for harm by exposure to other hazards/aspects e.g. friction, bio-chemical.

CONSEQUENCE LEVEL (Consider the maximum reasonable potential consequence of the event)						
Consequence Type (Additional "Impact Types" may exist for an event, iden ify & rate accordingly)		**1 - Insignificant**	**2 - Minor**	**3 - Moderate**	**4 - High**	**5 - Major**
(S) Harm to People - Safety		First aid case	Medical treatment case	Lost time injury	Permanent disability or single fatality	Numerous permanent disabilities or mul iple fatalities
(H) Harm to People - Occupational Health		Exposure to heal h hazard resul ing in temporary discomfort	Exposure to health hazard resulting in symptoms requiring medical intervention and full recovery (no lost time)	Exposure to health hazards/ agents (over the OEL) resulting in reversible impact on health (with lost time) or permanent change with no disability or loss of quality of life	Exposure to health hazards/ agents (significantly over the OEL) resulting in irreversible impact on health with loss of quality of life or single fatality	Exposure to heal h hazards/ agents (significantly over the OEL) resulting in irreversible impact on health with loss of quality of life of a numerous group/population or mul iple fatalities
(E) Environmental Impact		Lasting days or less; limited to small area (metres); receptor of low significance/ sensitivity (industrial area)	Lasting weeks; reduced area (hundreds of metres); no environmentally sensitive species/ habitat)	Las ing months; impact on an extended area (kilometres); area with some environmental sensitivity (scarce/ valuable environment).	Lasting years; impact on sub-basin; environmentally sensitive environment/ receptor (endangered species/ habitats)	Permanent impact; affects a whole basin or region; highly sensitive environment (endangered species, we lands, protected habitats)
(S) Social / Community Impact		Minor disturbance of culture/ social structures	Some impacts on local population, mos ly repairable. Single stakeholder complaint in reporting period	On going social issues. Isolated complaints from community members/ stakeholders	Significant social impacts. Organized community protests threatening continuity of operations	Major widespread social impacts. Community reaction affecting business continuity. "License to operate" under jeopardy
(L&R) Legal & Regulatory		Technical non-compliance. No warning received; no regulatory repor ing required	Breach of regulatory requirements; report/involvement of authority. Attracts administrative fine	Minor breach of law; report/investigation by authority. Attracts compensation/ penalties/ enforcement action	Breach of the law; may attract criminal prosecution, penal ies/ enforcement action. Individual licence temporarily revoked	Significant breach of the law. Individual or company law suits; permit to operate substantially modified or withdrawn
(M) Material Losses / Damage / Business Interruption		< 0.01 % of Annual Revenue / Total Assets	0.01 - 0.1 % of Annual Revenue / Total Assets	0.1 - 1.0 % of Annual Revenue / Total Assets	1 - 5 % of Annual Revenue / Total Assets	> 5 % of Annual Revenue / Total Assets
(R) Reputation		Minor impact; awareness/ concern from specific individuals	Limited impact; concern/ complaints from certain groups/ organizations (e.g. NGOs) period	Local impact; public concern/ adverse publicity localised within neighbouring communities	Suspected reputational damage; local/ regional public concern and reactions	Noticeable reputational damage; national/ international public attention and repercussions
LIKELIHOOD Considering the presence and magnitude of the hazard and the exposure to that hazard (number of people and frequency of the tasks exposing those people), as also the status of existing controls						
5 - Almost Certain	The unwanted event is almost certain to happen within the LOM (Life of Mine). In the case of repetitive/frequent tasks the unwanted event has or will occur in order of one or more times per year. In terms of major events, as also in the case of long term health, environmental or social impacts, it may happen only once in the LOM.	**11 (Medium)**	**16 (Significant)**	**20 (Significant)**	**23 (High)**	**25 (High)**
4 - Likely	There is a high probability that the unwanted event will occur within the LOM. In the case of repetitive/frequent tasks the unwanted event has occurred or is likely to occur in order of less than once per year. In terms of major events, as also in the case of long term health, environmental or social impacts, it might happen once in he LOM.	**7 (Medium)**	**12 (Medium)**	**17 (Significant)**	**21 (High)**	**24 (High)**
3 - Possible	It is possible that the unwanted event can occur within the LOM. In the case of repetitive/frequent tasks, the unwanted event has occurred or is likely to occur in order of once every 5-10 years. In terms of major events, as also in the case of long term health, environmental or social impacts, there is a low probability for the event to happen in he LOM.	**4 (Low)**	**8 (Medium)**	**13 (Significant)**	**18 (Significant)**	**22 (High)**
2 - Unlikely	There is a low probability for he unwanted event to occur within the LOM. In the case of repetitive/frequent tasks, the unwanted event has occurred some time or is likely to occur not more than once every 10-20 years. In terms of major events, as also in the case of long term health, environmental or social impacts, there is a low probability for he event to happen in the LOM.	**2 (Low)**	**5 (Low)**	**9 (Medium)**	**14 (Significant)**	**19 (Significant)**
1 - Rare	There is a very low probability for the unwanted event to occur within the LOM. In the case of repetitive/frequent tasks there are no records of the event occurring or it is highly unlikely that it will occur within the next 20 years. In terms of major events, as also the case of long term health, environmental or social impacts, there is a very low probability for the event to ever happen.	**1 (Low)**	**3 (Low)**	**6 (Medium)**	**10 (Medium)**	**15 (Significant)**

Risk Rating	Risk Level	Guidelines for Risk Matrix
21 to 25	High	A high risk exists that management's objectives may not be achieved. Appropriate mitigation strategy to be devised immediately
13 to 20	Significant	A significant risk exists that management's objectives may not be achieved. Appropriate mitigation strategy to be devised as soon as possible
6 to 12	Medium	A moderate risk exists that management's objectives may not be achieved. Appropriate mitigation strategy to be devised as part of the normal management process.
1 to5	Low	A low risk exists that management's objectives may not be achieved. Monitor risk, no further mitigation required.

Surface Features

1. **Isaac River**

The Isaac River is situated across LW104 from CH1185 to CH0939; see Figure 1. Depth of cover below the river ranges from 255m to 285m. Experience from the adjacent Moranbah North Mine, that has subsided the river in prior longwall panels at shallower depths show that the likelihood of water ingress into the goaf following extraction is negligible. The Grosvenor Subsidence Management Plan outlines the impact to the Isaac River 1st, 2nd, 3rd and 4th order watercourse, and possible percolation to the basalt aquifer if fracturing reaches channel inverts, and the monitoring arrangements of impact are as per GRO – 4164 – PLAN – Water Management Plan is a requirement of the Grosvenor Coal Mine Environmental Authority (EA). There are *no* subsidence mitigation piles driven into the bank through the LW104 section.

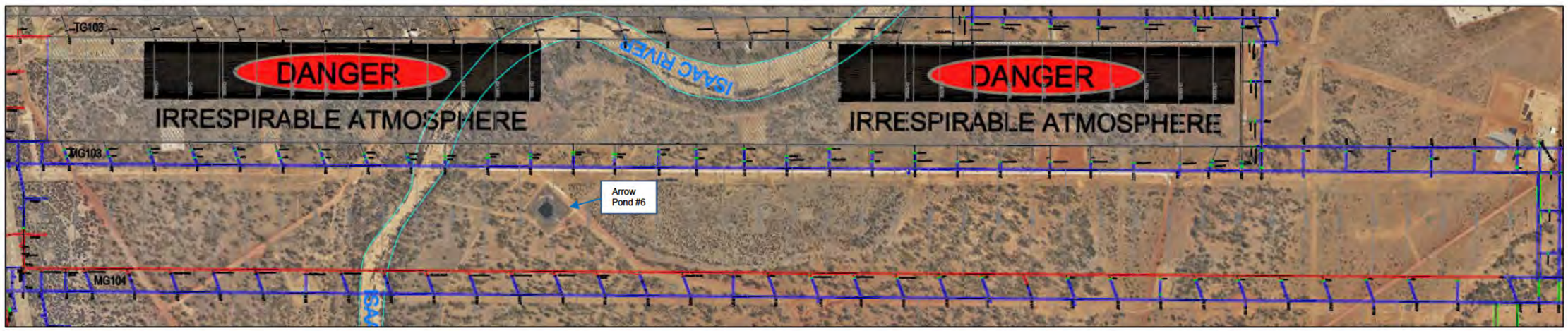


Figure 1 - Surface Features

Teviot Brook crosses the bleeder road as shown in Figure 2.

Figure 2 - Teviot Brook crossing bleeder road

2. Ped Lines

Ped Loop 1 runs along the TG side of 104, and Ped Loop2 runs along the MG side of 104 as shown (purple) in Figure 3.

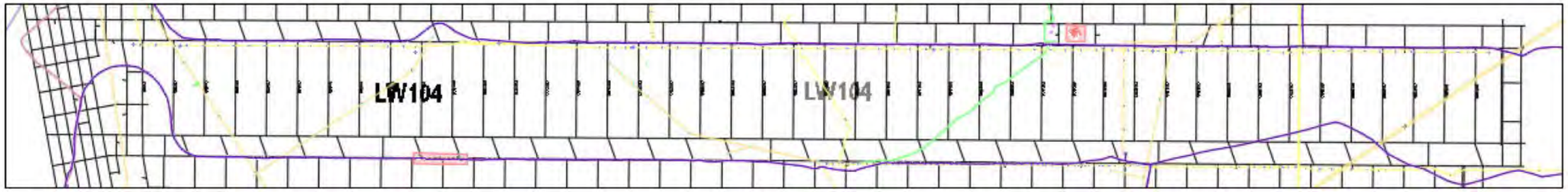


Figure 3 - Ped loop

3. Powerlink Powerline

A major Powerlink powerline runs across LW104 approx. from CH3900 to bleeder road. Three Powerlink towers are predicted to be immediately affected by subsidence (#2254, #2255, #2256). A study was completed by Downer/MSEC to establish procedures to identify, measure, control, mitigate and repair potential impacts that might occur on Powerlink's power line potentially or directly affected by mining operations as a result of the mining of LW104. Actions from this report, MSEC926 - Powerlink Subsidence Management Plan for Grosvenor LW104 Rev B 191119, have been put in the system.

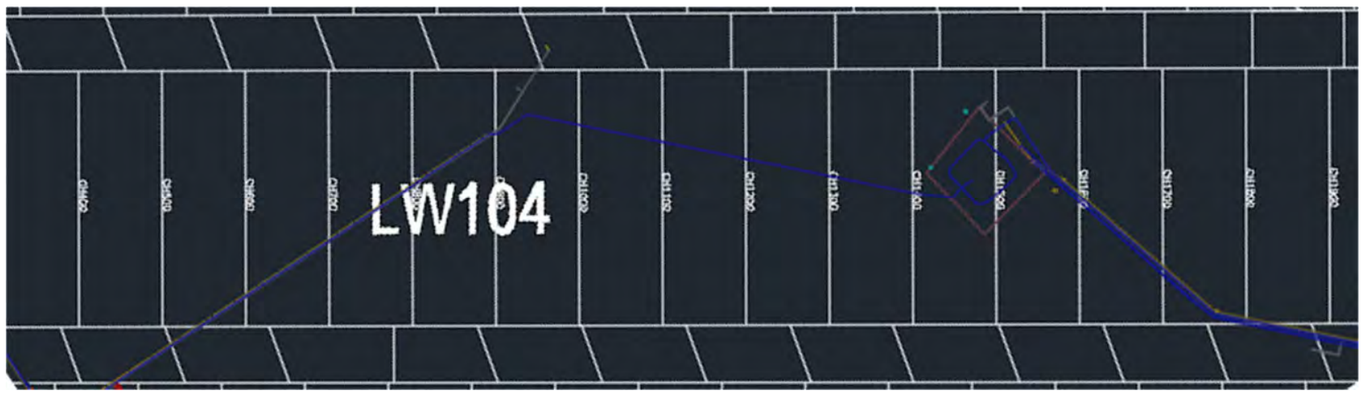
Figure 4 - Powerlink Powerline

4. Arrow Power, gas and water reticulation lines

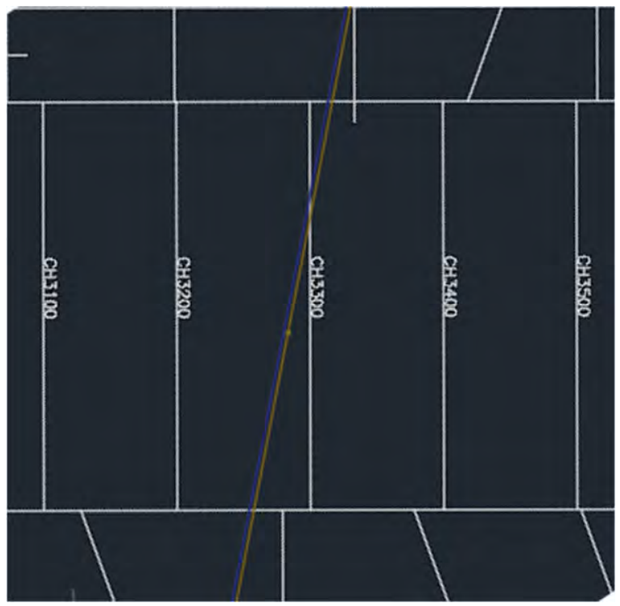
Arrow gas lines cross the block in the following locations:

- From TG CH100 to MG CH300

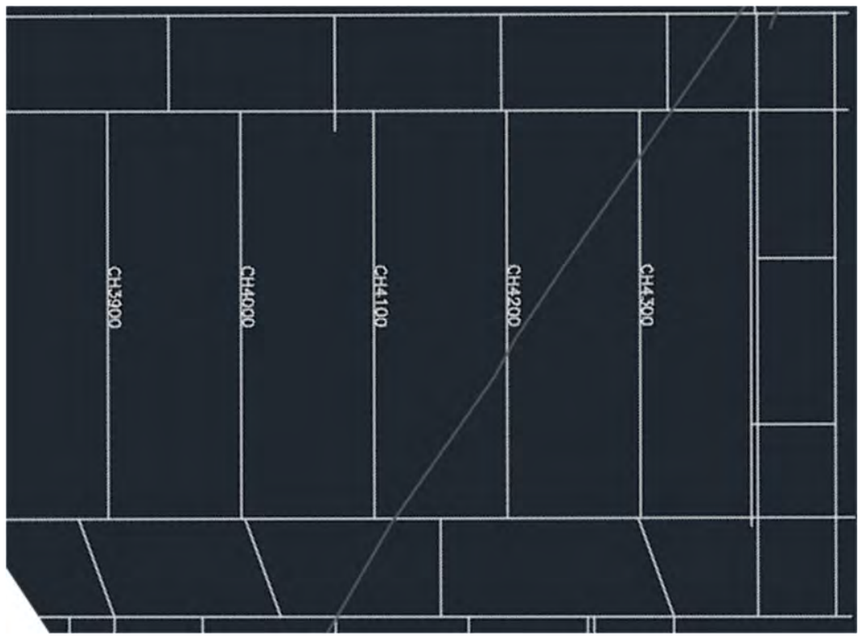
- From MG CH500 through the centre of the panel and exiting again on the MG side at CH 1900



- From MG CH3250 to TG CH3320



- There is a decommissioned gas line from MG Ch4100 to TG CH 4350



- Arrow have their own monitoring regime for subsidence
- Arrow have a subsidence mitigation method for their pipelines

Raw water line runs across the block from Ch 2555 in the MG to Ch2925 in the TG; see Figure 5. To capture goaf gas a gas line runs:

- 5m inside the TG rib from Ch4343 to the take-off face;
- From Ch2268 in the MG to Ch2116 in the TG; and
- From Ch3730 in the MG and the TG.

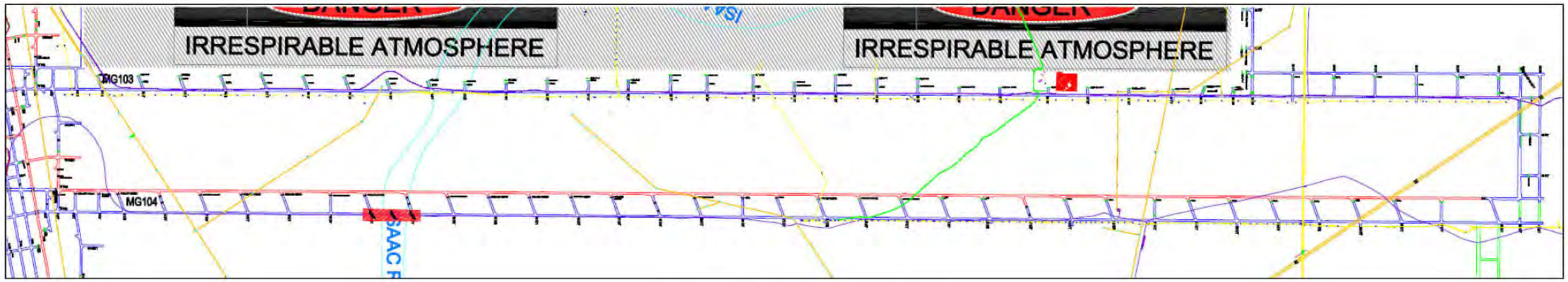


Figure 5 - Electrical, Water and Gas services

5. Areas of significant cultural heritage

The area above LW104 panel, as well as designated areas for the face line boreholes and goaf drainage holes has been surveyed for cultural artefacts. Cultural Heritage surveys have identified scar trees within the panel area to be subsided, there are scar trees adjacent to the TG104 goaf drainage clearing. All other artefacts have been collected and preserved as part of the cultural heritage survey activities.

6. Dams

Arrow Pond #6 is located above LW104, at approximately CH1500, and there is a project to relocate the contents of this dam prior to subsiding that area.

Figure 6 - Arrow Pond

- Action is underway to install pipeline and tanks to remove water from Pond #6 (~ 2-4ML)
- Pond #6 contains waste water / process water from Arrow Node #2 and seam water from Pod #5 and Pod #6
- Is included in the Arrow Handover / Subsidence schedule (updated monthly with MOP process
- An arrow dam is south of LW104 in the mains, the distance from CH00 to the dam is approx. 220m
- The mains dams are evaporation ponds

Figure 7 - Arrow Dam

7. Roads

The current life of mine road (Arrow 201 Rd) crossed LW104 from TG CH50 to MG CH300

Plan to divert this road past Shaft 16 around to MG107 (over the mains)

Figure 8 - Life Of Mine Road

A service road to the mid-block Arrow dam runs from MG CH1900 to the dam at CH1500. A road runs across the block from MG CH3250 to TG3320

Figure 9 - Mid-block road

A road runs to the Gas Plant from MG CH3900 to bleeder road.

Figure 10 - Road to Gas Plant

8. Temporary buildings

There are no temporary structures above LW104.

No.	ISSUE OR STEP IN OPERATION	ENERGY/HAZARD/ISSUE THAT MAY BE PRESENT	DESCRIBE THE RISK	EXISTING CONTROLS	INITIAL RISK RATING (IRR)			ADDITIONAL CONTROLS	RESIDUAL RISK RATING (RRR)			Acceptable *YES = RRR below 13 NO = RRR above 13 and enter into High Risk (>13s) & Non-Consensus Items Table*
					C	L	R		C	L	R	
1	Access to Gas Plant	Surface – Seam	Loss of access to north side of Isaac river due to adverse weather	• Air support services to access surface areas • Alternate travel routes via MNM • GRO-314-SWI - Managing Extreme Weather Events with regards to access to the mine gas and ventilation surface Infrastructure due to wet weather • GRO-204-PRO- Training Competence Scheme • GRO-215-PRO-Personnel On Boarding • Gas drainage infrastructure includes remote monitoring via Citect. • Critical assets are built outside of the 1:1000yr flood level. • Approval from MNM SSE for access to the gas plant from MNM	2M	2	5L	Confirm plan showing emergency wet weather access via MN is applicable for LW104 – J Mackey Build an all weather landing plan – C Englebrecht	2M	2	5L	
2			Surface ponding of water above workings due to ineffective drainage of subsidence zones.	• Low potential inflow into working low due to high depth of cover • Pumping of ponded water from LW101 during wet season to reduce risk of overflow into 102 and 103 • GRO-4201-PLAN- Grosvenor Plan of operation • GRO-7481-PLAN-Subsidence Management Plan • GRO-7731-EVP Subsidence Rehabilitation procedure • 215056_Moranbah_North_Grosvenor_Flood_Modelling_v01 - Flood modelling for pre and post subsidence • GRO-7481-PLAN-Subsidence Management Plan includes management of surface ponding of water • GRO-4200-PMT Grosvenor Coal Mine Environmental Authority (EA)	2M	2	5L	Flood Model to be reviewed to ensure LW104 is covered – A Heap Develop strategy for LW103 subsidence surface dewatering – A Heap	2M	2	5L	
3			Uncontrolled / excessive surface clearing for drilling or access (gas drainage) leading to disturbance to environmentally or culturally significant areas	• Splitting of goaf drainage clearing either side of river and directional drilling outside of river and riparian zone where possible • GRO-300- HMP Disturbance, Penetration, Excavation and Rehabilitation • GRO-4201-PLAN- Grosvenor Plan of operation • GRO-830-EVP- Cultural heritage management • Biodiversity offsets • GRO-4200-PMT Grosvenor Coal Mine Environmental Authority (EA) • GRO-3385-PRO-Permit to Mine • Permit to Work Process	2L &R	3	8M	Confirm sufficient environmental offsets for surface works above LW104 – A Heap	2L &R	3	8M	

4			Flood plain – impacts on the Service boreholes etc leading to operational delays	• Floodplain in and around LW104 – very low chance of water migration • GRO-300- HMP Disturbance, Penetration, Excavation and Rehabilitation • GRO-4201-PLAN- Grosvenor Plan of operation • GRO-314-SWI - Managing Extreme Weather Events with regards to access to the mine gas and ventilation surface Infrastructure due to wet weather • Stonedust line across the longwall face (contingency if stonedust borehole is unavailable)	2M	2	5I	Confirm location and impacts in relation to a flood event of any Stonedust boreholes on LW104 – A Heap Confirm DSI procedures to manage flood conditions are in line with Grosvenor Procedure (regarding PCB batching facility on the surface) – T Evans	2M	2	5I	
5			Cumulative impacts on LW104 with an adjacent and subsided LW103 block leading to potential for environmental event (not witnessed at this operation previously)	• Subsidence monitoring • GRO-7481-PLAN-Subsidence Management Plan • Surface Water Monitoring • GRO-5861-STD Grosvenor mine planning standard • Mine design & Depth of cover • Historical data from adjacent panels LW101/102 • GRO-4164-PLAN-Water Management Plan • GRO-4200-PMT Grosvenor Coal Mine Environmental Authority (EA) • B215056_Moranbah_North_Grosvenor_Flood_Modelling_v01 - LW 102 Inflow potential report • GRO – 9 – PHMP- Inrush • LW 103 Hazard plan DRG-15155 • GRO-3385-PRO-Permit to Mine • Borehole database (Acquire Database) • GRO-3595-HMP – Intersecting Boreholes • GRO-8427-SOP – Intersecting underground gas drainage boreholes • GRO-3602-CHK – Borehole Intersection Notice • GRO-42-HMP – Mine Inspection system, • GRO-77-SOP – Underground Workplace Inspections system - ERZ controller inspection • GRO-8804-PMT Permit to Drill (UIS) • Arrow Energy & Anglo American interaction Management Plan (JIMP)	2E	2	5L	Flood Model to be reviewed to ensure LW104 is covered – A Heap Update Subsidence Crossline of LW104 – L Morse	2E	2	5L	
6			Inability to drill adequate goaf drainage holes due to enviro or Cultural heritage restrictions	• Preparation work completed to plan directional drilling and hole locations, offset availability confirmed • GRO-830-EVP- Cultural heritage management – CH clearance in place along entire LW103 • GRO-2561-PLAN- Soil and Vegetation Management Plan • GRO-7732-PRO- Cultural Heritage Planning	2M	2	5L	Review availability of offsets if additional goaf drainage holes required. – A Heap Develop plan around scar trees in the planned 70m clearance corridor with Seamgas – A Heap	2M	2	5L	

				• GRO-300-HMP- Disturbance, Penetration, excavation and rehabilitation, Permit to Disturb system • GRO-5861-STD Grosvenor Mine Planning Standard - Identified & on mine plan • Approved biodiversity offset strategy • Drilling options around environmental no go zones on LW103 surface • Arrow handover process (JIMP) for planning and permits • GRO-7481-PLAN-Subsidence Management Plan includes known boreholes • GRO-4200-PMT Grosvenor Coal Mine Environmental Authority (EA) Planned Drilling Program during the dry season.								
7			Loss of access to MIA, MSF and any Other Projects causing production loss due to adverse weather	• Air support services to access surface areas • GRO-314-SWI - Managing Extreme Weather Events with regards to access to the mine gas and ventilation surface Infrastructure due to wet weather • GRO-4164-PLAN-Water Management Plan • 2x fuel farms at MIA, Fuel tank at MSF (shaft 3) • Infrastructure includes remote monitoring via Citect. • Fuel Tank at Seamgas Compound • Critical assets are built outside of the 1:1000yr flood level.	2M	3	8M	Consider bridge to access across river – Already Actioned	2M	3	8M	
8		Adverse weather	Business loss due to lack of access to boreholes during, wind, cyclones, lighting, and flooding	• GRO-3313-RA Mine Earthing Lightning • Inertisation capabilities • GRO-314-SWI-Managing Extreme Weather Events • GRO-1432-TARP Lightning • GRO-1431-TARP-Cyclones • GRO-1436-TARP-High Winds • GRO-1434-TARP-Flooding • GRO-4801- STD LW standard area management system - Cable recovery and pipe management • Site has had assessment completed for earthing and lightning protection • Grosvenor Mine - Borehole Earthing & Lightning Protection Study • Live tracking of the lightning	2M	2	5L	Obtain copy of the report and strategy for lightning and protection for GCM LW104 - for C Englebrecht Complete an audit against the report and TARP for lightning and earthing protection for GCM LW104	2M	2	5L	
9		Adverse weather	Lightning strike leading to ignition underground or electric shock	• GRO-3313-RA Mine Earthing Lightning • Inertisation capabilities • GRO-1432-TARP Lightning • GRO-4801- STD LW standard area management system - Cable recovery and pipe management	4S	1	10 M	Review lightning TARP in regard to actions to be taken working adjacent to a gas riser – R Kostowski Review lightning and earthing strategy – I Bailey	4S	1	10 M	

				• The mine intersects workings with cased boreholes • BIN and stand offs requirements • Site has had assessment completed for earthing and lightning protection • Borehole data base • Lightning Study • Live tracking of the lightning • Goaf UIS borehole TARP-1430							
10		Subsidence due to secondary extraction	Damage to mine surface infrastructure and third party infrastructure (P seam SIS) NB- the Powerlink line to Townsville is covered ijn	• Survey plan • Survey Subsidence monitoring and modelling • Anglo-Arrow co-development agreement (JIMP) • GRO-3985-PRO – Grosvenor Coal Mine Arrow Energy well handover procedure • Dedicated easements • GRO-7481-PLAN-Subsidence Management Plan • GRO-4200-PMT Grosvenor Coal Mine Environmental Authority (EA) • GRO-7731-EVP-Subsidence Rehabilitation Procedure • Permit to Mine • 6 Monthly Powerline Survey • GRO-7820-EVP-Environmental monitoring Procedure • Signposting of subsidence area	3 M	3	13 S	Notify Arrow of the pending subsidence of LW104 – C Englebrecht Powerline clearance survey post subsidence – I Bailey Update signposting at crossings – I Bailey Review pieplines impacted by subsidence and if any work is required to protect surface infrastructure. – C Englebrecht Review electrical services (e.g. PED loops and PED hut) impacted by subsidence and if any work is required to protect surface infrastructure. – Mick Britton Update training package for light vehicles for awareness of subsidence cracks – P Borg	3M	2	9M	
11			Subsidence cracking connecting mine workings with Isaac River - Inflow of water into workings	• GRO-5861-STD Grosvenor mine planning standard - Mine Design • Depth of cover minimum 200m • Historical data from adjacent mined LW101/102/LW103 • GRO-7481-PLAN-Subsidence Management Plan • GRO-4164-PLAN-Water Management Plan • GRO-4200-PMT Grosvenor Coal Mine Environmental Authority (EA) • B215056_Moranbah_North_Grosvenor_Flood_Modelling_v01 - LW 102 Inflow potential report • Subsidence modelling and monitoring • GRO – 9 – PHMP- Inrush • GRO-16-PHMP-Methane Drainage • LW 103 Hazard plan DRG – 15155 • GRO-3385-PRO-Permit to Mine • Borehole database (Acquire database) • GRO-3602-CHK – Borehole Intersection Notice	3M	2	9M	Review Inflow Potential from major flood event for an extended period of time – A Heap Review that goaf seals secondary support can withstand double abutment loading – S Giese Check water head rating for seals / bulkheads confirm max water RL based on these head ratings – H Hearne Confirm MG seals are specified based on requirements for TG105 – H Hearne	3M	2	9M	

				• GRO-42-HMP – Mine Inspection system, • GRO-77-SOP – Underground Workplace Inspections system - ERZ controller inspection • GRO-8804-PMT Permit to Drill (UIS) • GRO-3985-PRO – Grosvenor Coal Mine Arrow Energy well handover procedure • Subsidence controls installed along the river • Realtime monitoring of Isaac River water levels and rainfall • Goaf seals are rated for 10m water head from TG104 33 to 22ct • Arrow Energy & Anglo American interaction Management Plan (JIMP)								
12			Subsidence cracking connecting mine workings from basalt aquifer - Inflow of water into workings	• GRO-5861-STD Grosvenor mine planning standard - Mine design • Depth of cover – 150-180m ABOVE • Historical data from adjacent mined LW101/2 • GRO-7481-PLAN-Subsidence Management Plan • GRO-4164-PLAN-Water Management Plan • GRO-4200-PMT Grosvenor Coal Mine Environmental Authority (EA) • B215056_Moranbah_North_Grosvenor_Flood_Modelling_v01 - LW 102 Inflow potential report • Subsidence modelling and monitoring MSEC1010 – Subsidence Model Review Q4 2018 • GRO – 9 – PHMP- Inrush • LW 103 Hazard plan DRG – 15155 • GRO-3385-PRO-Permit to Mine • Borehole database • GRO-3595-HMP – Intersecting Boreholes • GRO-3602-CHK – Borehole Intersection Notice • GRO-42-HMP – Mine Inspection system, • GRO-77-SOP – Underground Workplace Inspections system - ERZ controller inspection • GRO-8804-PMT Permit to Drill (UIS) • Arrow Energy & Anglo American interaction Management Plan (JIMP)	3M	2	9M		3M	2	9M	
13			Extent of subsidence breaches authority/licence to operate agreement	• Subsidence monitoring • Subsidence modelling • GRO-4201-PLAN- Grosvenor Plan of operation • GRO-5861-STD Grosvenor mine planning standard - Mine Design • GRO-7481-PLAN-Subsidence Management Plan • GRO-4200-PMT Grosvenor Coal Mine Environmental Authority (EA)	2E	2	5L					

14		Mining through an un-grouted borehole / gas-well	Inflow of water into workings leading to potential for injury to personnel	• GRO – 9 – PHMP- Inrush • GRO – 16 – PHMP- Gas Drainage • GRO -1434-TARP- Flooding • LW 103 Hazard plan • GRO-3385-PRO-Permit to Mine • GRO-4164-PLAN-Water Management Plan • Borehole database • GRO-3595-HMP – Intersecting Boreholes • GRO-3602-CHK – Borehole Intersection Notice • GRO-5609-TARP – Longwall Creep and Face Alignment • GRO-8804-PMT Permit to Drill (surface boreholes) • GRO-42-HMP – Mine Inspection system • GRO-77-SOP – Underground Workplace Inspections system • GRO-7481-PLAN-Subsidence Management Plan includes known boreholes • GRO-4200-PMT Grosvenor Coal Mine Environmental Authority (EA) • GRO-3985-PRO Arrow Energy & Anglo American well head handover procedure • GRO-3446-RA Arrow Energy & Anglo American interaction -Data collection from arrow • Water Management through the pumps • RA for LOM dewatering strategy •	2H	2	5L	Review ungrouted boreholes in LW104 block – L Morse Setup automated report for ungrouted boreholes in LW014 block (similar to LW103 seal up grouted borehole report) – L Morse	2H	2	5L	
15			Mining through an unknown borehole leading to Inflow of gas into workings	• GRO – 9 – PHMP- Inrush • GRO-42-HMP – Mine Inspection system, • GRO-77-SOP – Underground Workplace Inspections system - ERZ controller inspection • GRO – 15 – PHMP – Ventilation • Gas Monitoring and interlocking controls • Arrow Handover process	2L &R	3	8M					
16			Shearer intersecting poly / PVC/ Fibreglass or abandoned drilling materials (ie BHA) within the mining horizon - Flying objects / projectiles leading to personal injury e.g. 3 x steel in seam hazards in block Crossblock dewatering hole	• LW 104 Hazard plan • Borehole database • ERZ Controller Inspections • GRO-3595-HMP – Intersecting Boreholes • GRO-3602-CHK – Borehole Intersection Notice • GRO-8804-PMT Permit to Drill (UIS) • GRO-3385-PRO-Permit to Mine • GRO-5372-STD- LW Operational standards- Face/Pick Sprays • GRO-3223-SWI-Operational No go zones • Stat inspections • GRO-3303-HMP control of frictional ignition	4S	1	10 M					

				• GRO-8515-TARP Longwall frictional ignition • Cross block dewatering hole management plan								
17			Intersection of open borehole resulting in air leak increased potential of Spontaneous Combustion - Air leakage in into goaf from untreated hole	• Hazard plan LW104 • GRO-3385-PRO-Permit to Mine • GRO-10-PHMP Spontaneous Combustion • GRO-14-PHMP Gas management (Monitoring) • Gas monitoring (Tube bundle) • GRO-3602-CHK – Borehole Intersection Notice • Borehole database (Acquire Database) • GRO-42-HMP – Mine Inspection system • GRO-77-SOP – Underground Workplace Inspections system - ERZ controller inspection • Work orders regarding, goaf monitoring and sampling	4S	1	**10 M**	• Sealing Management Plan for LW104 – H Hearne	4S	1	**10 M**	
18			Old asbestos pipeline (BMA) has been diverted - Potential connections or damage to the pipeline due to subsidence impacts causing business interruptions/ financial impacts (only very small section at end of LW/mains)	• Captured by Mine Survey and enviro PTD mapping • Known location of the pipe • Monitoring of potential exposure during subsidence • Communication with BMA regarding the pipe • GRO-300-HMP- Disturbance, Penetration, excavation and rehabilitation, Permit to Disturb system • GRO-5861-STD Grosvenor Mine Planning Standard - Identified & on mine plan • Not expected to be subsided in LW104 extraction.	2L &R	2	**5L**		2L &R	2	**5L**	
19	Mining under the 132,000 Volt Powerlink line to Townsville	LW104 Subsidence causing damage to the powerlines	If the jacks cannot be installed in time to combat the subsidence, there is a risk of the LW104 start date being delayed and causing production loss	• Project team from BCO liaising with Powerlink to gain access to work on the jacks • The team has been inducted on site and ready to commence work as soon as Powerlink provides access • Routine updates on the progress of the project with the aim of completion by the 30th of January	4M	3	**18 S**	Communicate the management plan to Grosvenor superintendents and SLT – N Gilbert	4M	3	**18S**	

Other Workings

No.	ISSUE OR STEP IN OPERATION	ENERGY/HAZARD/ISSUE THAT MAY BE PRESENT	DESCRIBE THE RISK	EXISTING CONTROLS	INITIAL RISK RATING (IRR)			ADDITIONAL CONTROLS	RESIDUAL RISK RATING (RRR)			Acceptable *YES = RRR below 13 NO = RRR above 13 and enter into High Risk (>13s) & Non-Consensus Items Table*
					C	L	R		C	L	R	
20	Hole into other workings	Inrush	Inrush into mine workings from adjoining/above workings	• Mine Plans Submitted to department • Survey of current mine layout • No Working above current block • Registered Surveyor	2M	2	5L	Confirm barrier pillar design between MNM and GRV operations – R Goonawardene	2M	2	5L	

Gas Drainage

Recommendations for the LW104 goaf gas management are based on observations from LW101, LW102 and LW103. A specific objective is to mitigate events of greater than 2.5% CH_4 in the longwall tailgate, further, that the normal operating conditions in the LW return should be less than 2.0% CH_4.

The longwall face goes beneath the Isaac River which prevents drilling of vertical goaf drainage. Additionally, during the initial goaf formation of LW103 tailgate CH_4 levels were higher than planned until the goaf holes came online.

Measures proposed for LW104 are intended to address these issues specifically in the first 500m of retreat.

1. **Isaac River**

The Isaac River traverses the longwall from the 11ct in MG104 to 14ct in TG104. This requires additional slant holes to be drilled from areas on surface not effected by the Isaac River. There are 4 slant/ directional wells to be drilled in this section of LW104. With limited space surface room available there will be slant wells drilled from mid panel of LW 104 and goaf effected areas of LW103. All slant wells will be drilled as 17 $^{1/2}$" to production 13 $^{3/8}$" casing depth and completed 12 $^{1/4}$" drilled hole and cased with 9 $^{5/8}$" perforated casing.

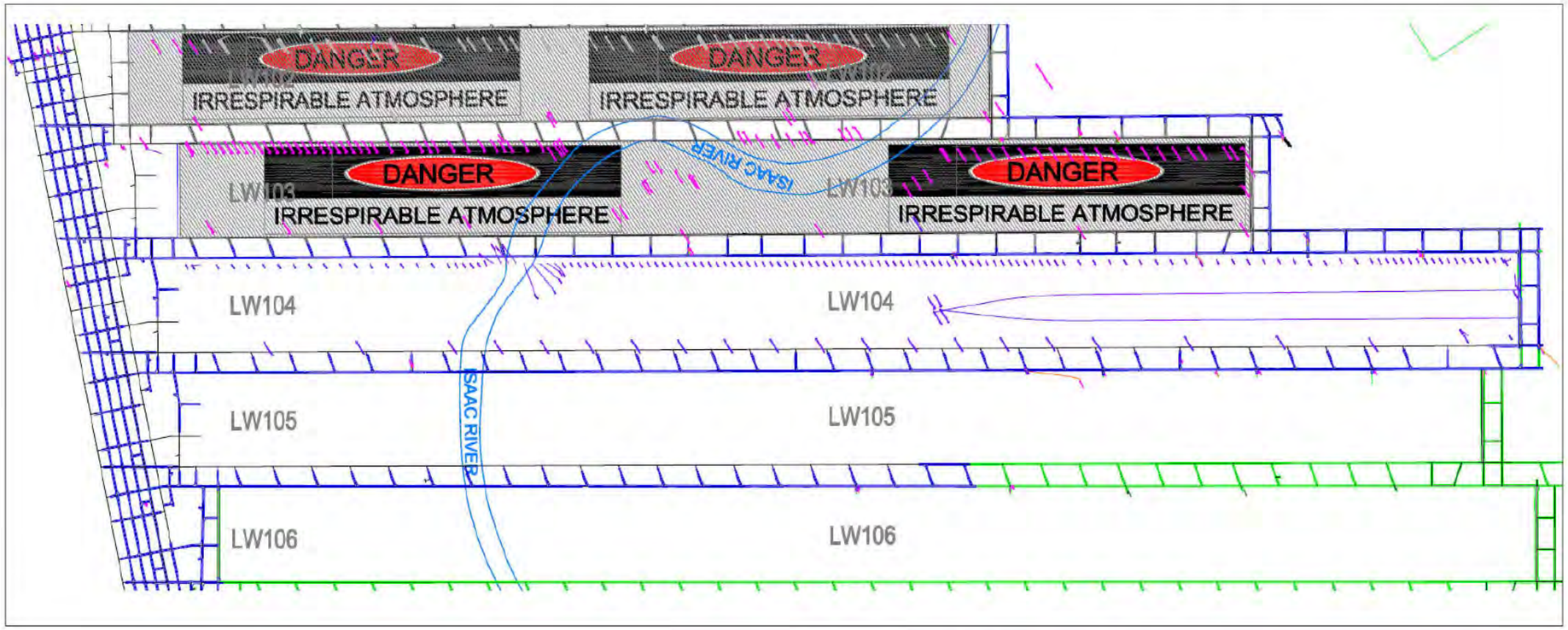


Figure 11 - Proposed goaf hole locations LW104

2. **Longwall 104 surface features**

The long wall face will start in an area without significate surface feathers, which will not prevent drilling of vertical goaf drainage. Additionally, during the initial goaf formation of LW103 tailgate CH_4 levels were higher than planned until the goaf holes came online.

Measures proposed for LW104 that intended to address these issues specifically in the first 500m of retreat. For the Start-up of LW104 the goaf drainage strategy will consist of 4 x 17.5" vertical goaf holes at 5 to 30m above the GM seam to aid in the early goaf drainage with minimal caving profile and 25m hole spacing for the first 500m retreat.

Initial Caving Conditions

TG gas levels during initial LW103 goaf formation exceeded 2% before the first two goaf wells came on stream. The origin of the early gas was considered from the floor and from localised roof fall/bed separation along the face which did not connect with the vertical goaf holes.

GRO4V001 - 5m below P Seam

GRO4V002A - 10m above GM Seam (connect to P seam lateral)

GRO4L001 - 10m Above GM seam

GRO4L002 - 15m Above GM seam

GRO4V003 - 15m Above GM seam

GRO4V004.5 - 20m Above GM seam

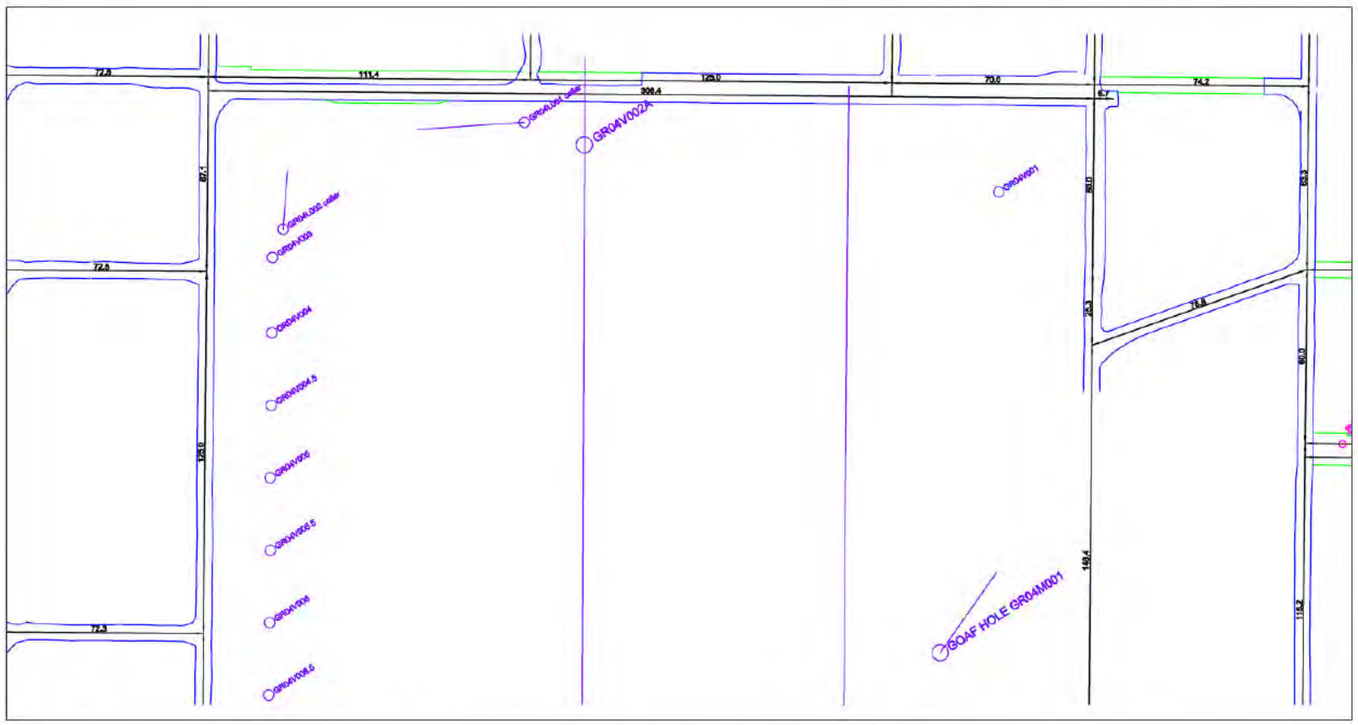


Figure 12 - Proposed surface horizontal goaf holes

3. Lateral Wells

The goaf holes were drilled at 8 ½" diameter, reamed to 17 ½" diameter then fitted with slotted 9 5/8" casing to the end of hole. Gas production from the three wells was poor – A hole was drilled at varying elevations above the Goonyella Middle seam with good performance when in active goaf of LW103.The four LW104 Lateral wells have been designed, to be drilled in the P seam to capture the gas released with the yielding/unloading of the strata below the P seam. This may allow the post mining gas to be captured prior to being released to the longwall mining area.

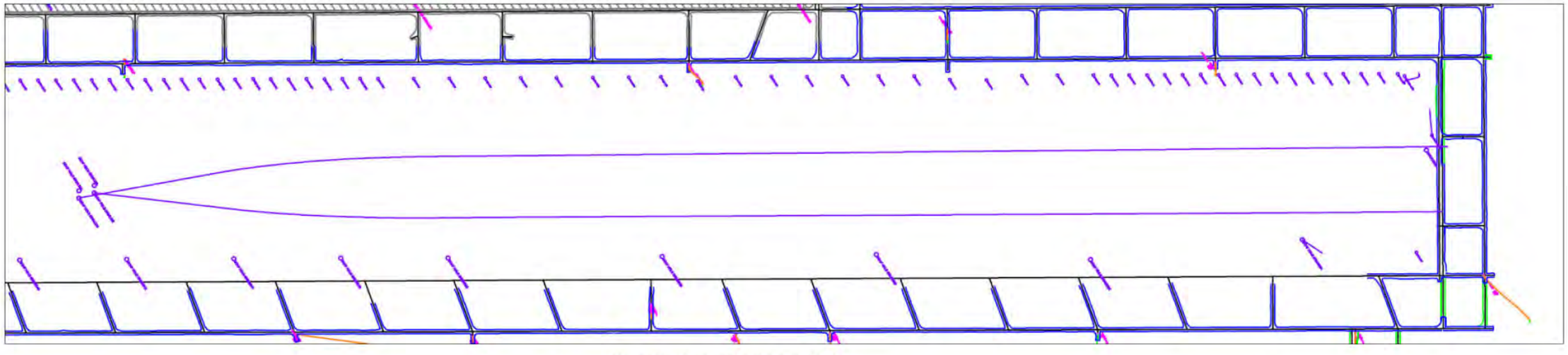


Figure 13 – Proposed LW104 goaf holes

Pre drainage

- Pre-drainage of the GM-Seam has been conducted from a combination of both SIS (owned by Arrow) and infilling of UIS drilling where required to achieve gas content of <4m^3/t for development production and <2m^3/t for Longwall production. Gas content of the GM seam is proven to be below 2m3/t outbye of CH1600 (MG104 17c/t) and no additional gas drainage has been implemented for this region.
- Pre-drainage of the P-Seam over LW104 has been conducted from SIS Boreholes drilled from Arrow. UIS drilling of the P-Seam was attempted from MG104 22c/t that resulted in 837m of drill string being stuck in the P-Seam inbye of MG104 22c/t.
- No pre drainage of the GML seam has been conducted for LW104 and is expected to release gas readily due to the GML reservoir size combined with proximity to the working seam up to approximately CH4000-2000 (MG104 20-36c/t)

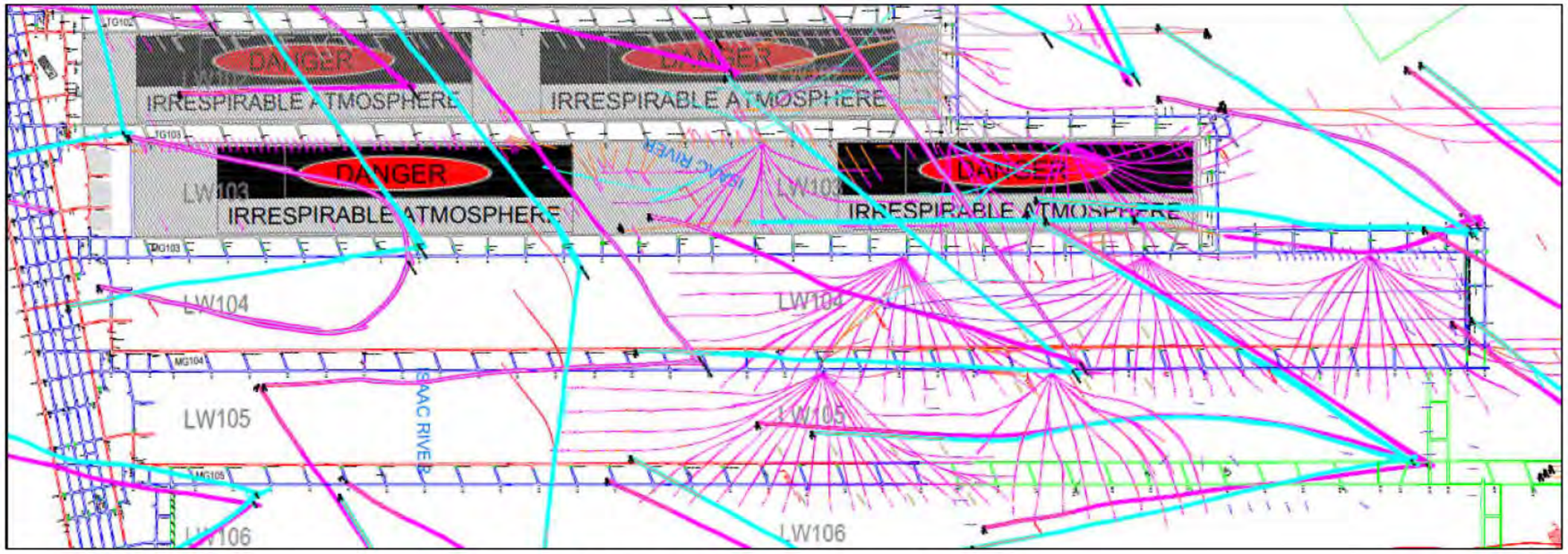


Figure 148 – Existing UIS & SIS Gas Drainage Boreholes

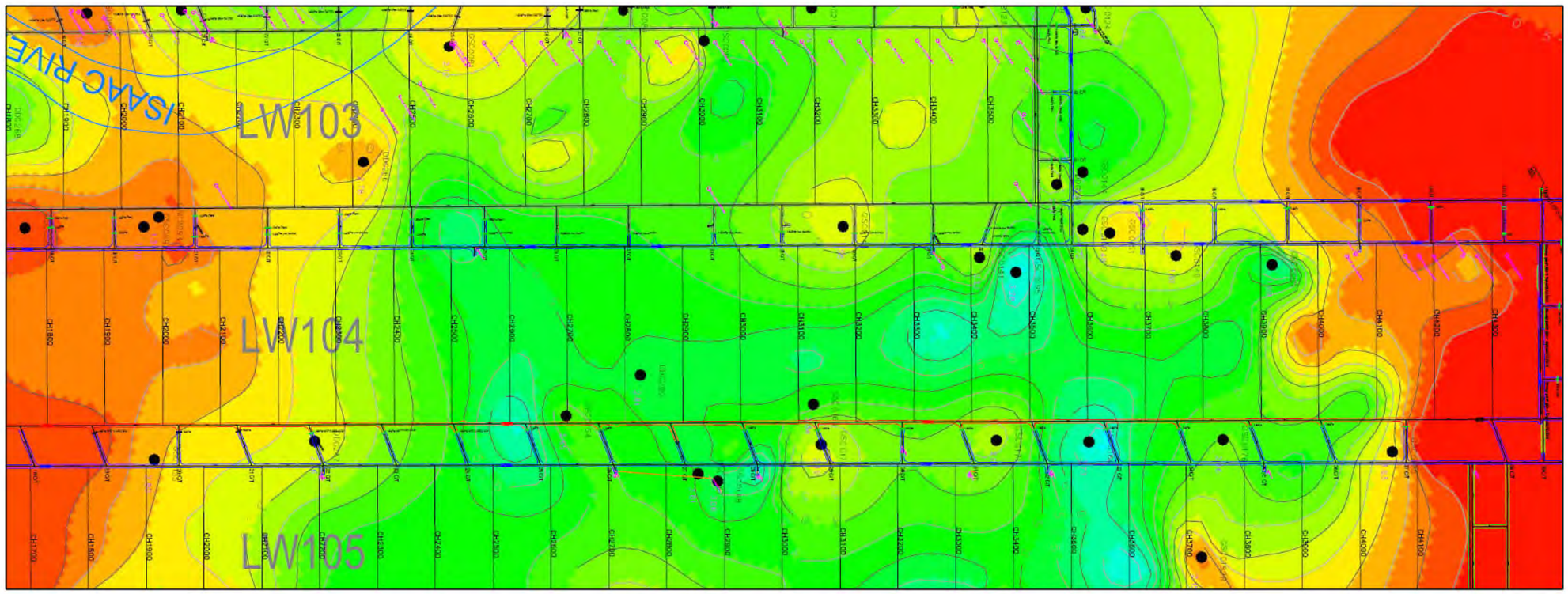


Figure 159 – Estimated GML gas reservoir size (m3 of gas per m2 of area)

Gas content from previous cores taken from 2017 onwards indicates that the P-Seam gas content varies from 4-6m^3/t at the commencement of the longwall block. There will be increased goaf emissions until LW104 meets the install roadway of LW103 as there will be gas desorbing from 3 sides, instead of 2. Diagram below for description:

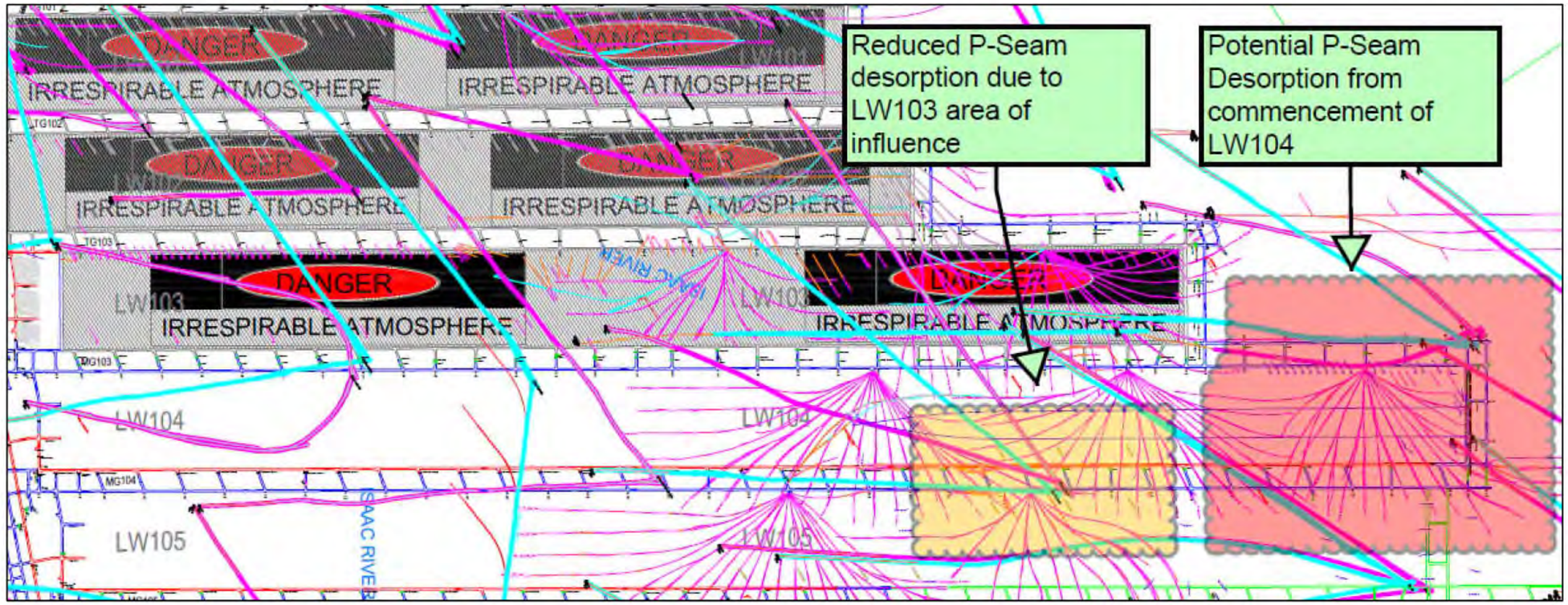
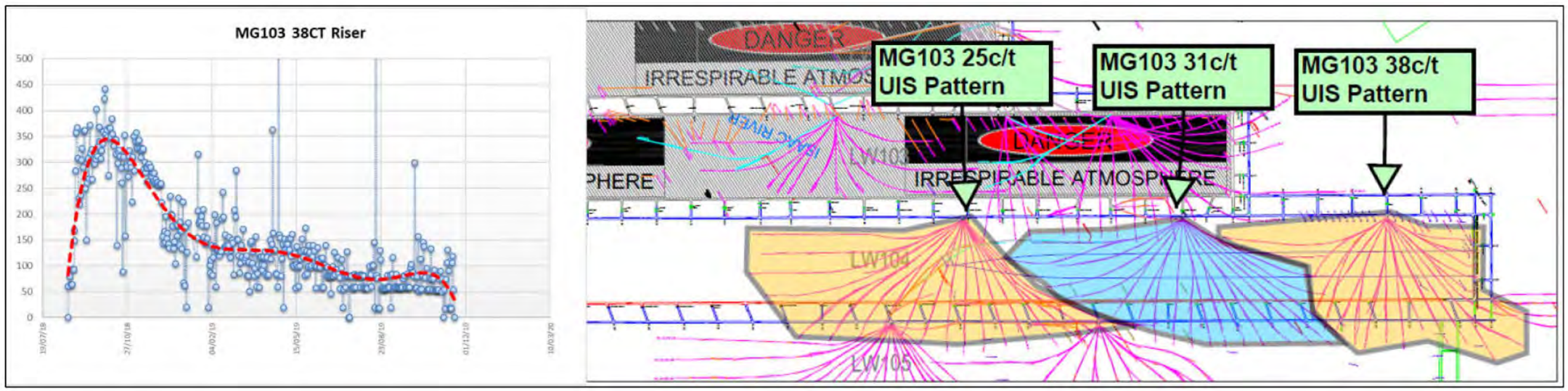
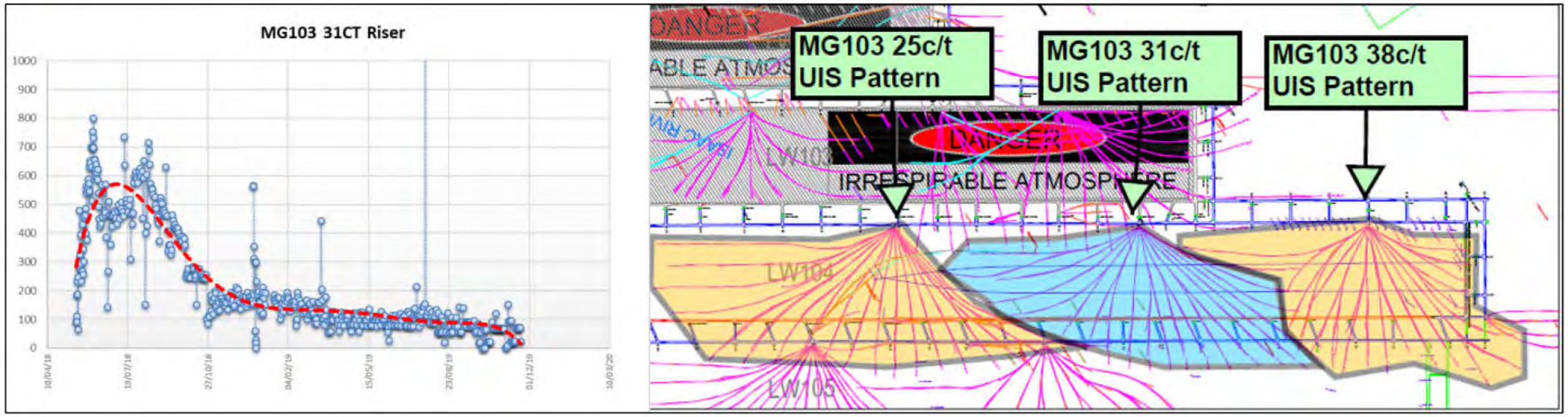


Figure 167 – P-Seam Area of Influence

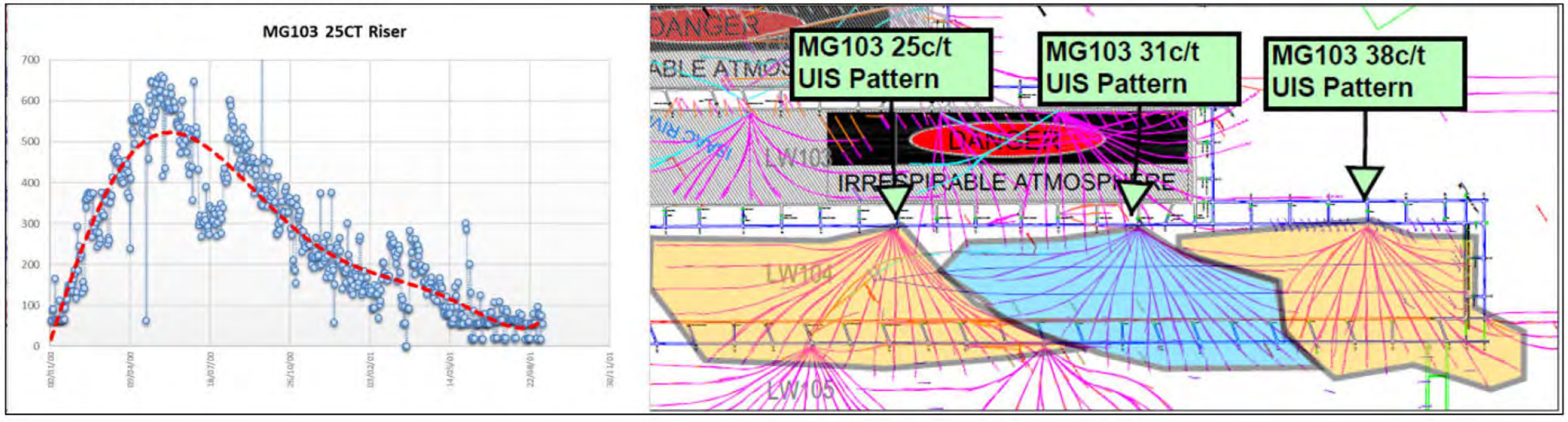
Total UIS borehole flow performance – MG103 38c/t



Total UIS borehole flow performance – MG103 31c/t



Total UIS borehole flow performance – MG103 25c/t



4. Vertical Goaf Holes

Vertical goaf holes will be drilled on the north and south side of the river on the tailgate side of the longwall where surface conditions allow. Goaf hole spacing of 25-50m should be maintained unless otherwise indicated by flow monitoring results (potential vertical goaf hole interaction with directional goaf hole). Except for the face start line (FSL) hole spacing would be no less than 20- 30 apart, nominally 15-40m from the tailgate rib.
Main gate Verticals are planned at 140m to 350m hole spacing, to mitigate for high gas emission's during high production of the long wall.

The first two vertical holes may be offset from the rib by 25-30m to accommodate reduced bed separation due to cantilever support of the solid. Vertical goaf holes adjacent to LW103 goaf may be reasonably offset 15-35m from the tailgate rib. A main gate goaf hole is possible within 20m of the face start line. This location has worked well in the past for high gas level in the LW mining horizon.

Chainage	TG104 Spacing	TG104 Holes	MG104 Spacing	MG104 Holes	∑ Holes
4500m-3900m	25m	24	300m	2	26
3900m-2900m	50m	20	300m	3	23
2900m-900m	25m	80	150m	13	93
900m-0m	50m	18	300m	3	21
					163

5. Surface Infrastructure

The goaf holes will be fitted with real time flow and composition monitoring to manage tailgate gas levels and purity level being removed from Goaf.

A second connection to the goaf drainage plant by an alternative river crossing for LW102 via TG104 goaf pipeline. This will reduce capacity restrictions due to water make at the existing river low point.

At planned production rates where daily tonnage is consistently greater than 30,000 tonnes then increased goaf capture is sought to improve capture efficiency. This may be achieved by systematic maingate goaf drainage holes (trialling directional lateral holes). These holes would cover the longwall reserves >250m cover, nominally 2000m of retreat.

6. Gas Capture Reticulation System

Gas reticulation will use the existing 630mm buried HDPE pipeline, modelling indicates a peak capacity of 14000 L/s with the vacuum plant operating at 58 kPa and 3 blower units on the south side of the river. This flow rate is excess of the anticipated peak gas emission from the longwall. If higher gas flows arise due to poor gas composition wellhead venturi ejectors may be used.

7. Gas Monitoring

Gas monitoring sensors in the 104 panel include the following:

- Real-time NERZ/ERZ1
- Real-time Atmosphere (oxygen, methane, carbon monoxide, carbon dioxide)
- Real-time Pressure Differential
- Real-time Velocity
- Tube bundle
- Gas Chromatograph analysis of bag samples
- ERZ controller inspections with hand held units

Figure 17 presents typical longwall gas monitoring locations and type.

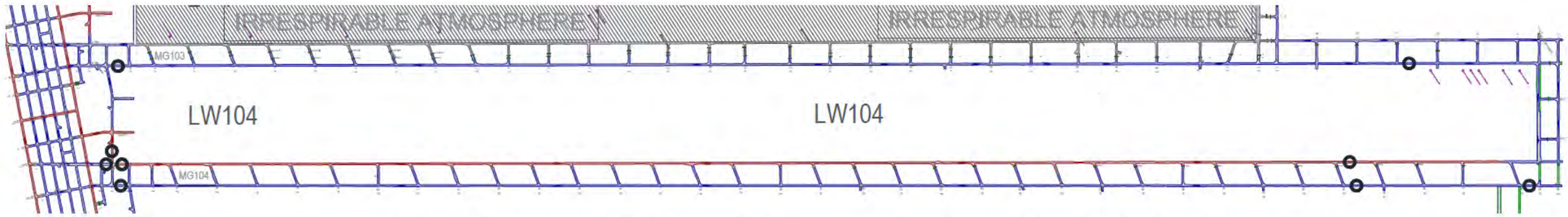
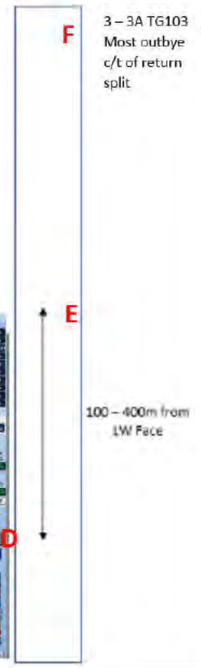


Figure 17 - Typical Longwall Tube Bundle Gas Monitoring Locations – Spread out across the block for goaf monitoring

LW Circuit Sensor Configuration

A – MG Sensor @ MG Corner 2 X CH4 – Visible Alarm, Trip Shearer Power @ 2%
B – Shearer Sensor 2 X CH4 – Visible Alarm 1% Trip Power to Cutters 1.25%, Trip Power or the Shearer 2%
C – TG Sensor @ TG Drive 2 x Ch4 – Visible Alarm 1%, Trip Power @ 2%
D – 0.1m TG Sensor – Trip shearer and AFC @ 2%
E – Inbye CH4 Sensor (400 – 100m from Face) – High Alarm 2% High High 2.3% Remove Shearer Haulage @ 2% Trip shearer 2.5%
F – Outbye Ch4 Sensor 3 – 3A – High Alarm 2% High High Alarm 2.25% Trip Shearer @ 2.5%



3 – 3A TG103 Most outbye c/t of return split

Figure 18: LW Realtime gas Monitoring Layout

No.	ISSUE OR STEP IN OPERATION	ENERGY/HAZARD/ISSUE THAT MAY BE PRESENT	DESCRIBE THE RISK	EXISTING CONTROLS	INITIAL RISK RATING (IRR)			ADDITIONAL CONTROLS	RESIDUAL RISK RATING (RRR)			Acceptable *YES = RRR below 13 NO = RRR above 13 and enter into High Risk (>13s) & Non-Consensus Items Table*
					C	L	R		C	L	R	
21		Gas liberation into face area exceeding operational and legal requirements [CH4% >2.5%]	Gas concentrations prevent operation of face equipment	• Sufficient vent quantity across face • Goaf Management Procedure – MG Goaf Drainage • Tube bundle monitoring/ sensors • Face monitoring - Gate end, Shearer monitors, NERZ/ERZ boundaries • Maingate Wing • Gas guard sensors installed on face to trip power at 2% • Gas content and specific emissions modelled • ERZ Controllers inspections • Gas pre-drainage & Goaf drainage • Gas sampling cores (known gas contents) • Permit to Mine • Longwall Standards (TG roadway and alignment) • GRO-750-TARP – General Body Contaminants • GRO-10563-TARP-LW Return Methane General Body Contaminants • TG Shearer speed sensor in place (Refer to longwall standard) • Control of adjacent goaf emission via Adjacent Goaf drainage • Mine Production schedule and Plan • Ventilation standards • Goaf drainage strategy • MG103 EPS as intake • Gas monitoring maintenance regime • Additional goaf hole skids • Plan to cut at reduced rate (e.g. uni-di, reduced shearer speeds) through higher gas hazard zones as required	2L &R	4	12 M	Communicate the status of the project and the timelines to increased drainage capacity to 17,000l/s – C Englebrecht Ensure that the additional infrastructure is monitored through Citect – C Englebrecht Confirm and communicate shearer speed sensor trigger points and limits for LW104 kick off to CROs – J Agustin Finalise RA for LW104 Goaf drainage strategy/review – C Englebrecht	2L &R	4	12 M	
22		Gas liberation exceeding operational and legal requirements [CH4 >1%]	Gas concentrations prevent operation of diesel equipment in TG roadway causing production loss	• Standard vent quantity (~60m3/s) • Tube bundle monitoring/TG sensors/ realtime monitoring • Methanometers fitted to vehicle • Gas drainage • Goaf drainage • ERZ Controller Inspections • Maintenance scheduling • Longwall ventilation strategy • TG forcing fan for TG entry/maintenance activities • Plan to have all TG works completed prior to commencing LW104	3M	3	13S					

23		Goaf collapse / caving expels large volumes of gas creating a general body exceeding operational and legal requirements [CH4% >2.5%]	Gas concentrations prevent operation of face equipment	• Known geology and roof zones • Monitoring of subsidence profile • Ventilation standards • Goaf drainage - MG Goaf drainage • First goafing management plan • Gate end monitoring with interlocking • Ventilation strategy (use of brattice wing/MG brattice curtain) • Face Mapping – ERZ Controller and Geologist /geotechnical engineer. • GRO-750-TARP-General Body Contaminants • TG roadway secondary support incorporates learnings from TG102	2L &R	4	12 M	NB – separate risk assessment including wind blast for first goaf formation				
24		Changes in ERZ-NERZ Boundaries	Non-Hazardous Area Certified electrical equipment operating in the ERZ1 zone	• Gas monitoring and tripping interlocking • Gas sensors with NERZ/ ERZ boundary relocation process and NERZ relocation RA • LW Pre-start check list /signoff • GRO-27-HMP-Location of Electrical Equipment Underground • Ventilation/Electrical compliance audits • Boundary move check list/audit ensures that all non-Approved electrical equipment is decommissioned and removed before and area is rezoned • Flame proof tripper drives planned for LW 104 • UPEE • Ventilation change permit • Critical control inspections	2L &R	3	8M					
25		Caving / subsidence closing off gas drainage wells	Loss of gas drainage capability causing production loss	• Hazard plan LW104 • GRO-8804-PMT Permit to Drill (UIS) • Borehole flow monitoring • GRO-5861-STD Grosvenor Mine Planning Standard - Borehole design – spacing & casing • Standard of fitting the perforated casing to goaf hole above working section • GRO-7481-PLAN-Subsidence Management Plan • GRO-3602-CHK – Borehole Intersection Notice • Increased goaf hole density from prevous block • Goaf hole mandatory dipping program • History of no failed holes in LW103	2M	3	8M					
26		Inadequate gas post-drainage (goaf), resulting in >2.5% TG CH4%, and production delays	Gas concentrations prevent operation of face equipment	• Sufficient vent quantity across face • Goaf Management Procedure – MG Goaf Drainage • Tube bundle monitoring/ sensors • Face monitoring - Gate end, Shearer monitors, NERZ/ERZ boundaries • Maingate Wing	2M	4	12 M	Finalise RA for LW104 Goaf drainage strategy/review – C Englebrecht	2M	4	12 M	

				• Gas guard sensors installed on face to trip power at 2% • Gas content and specific emissions modelled • ERZ Controllers inspections • Gas pre-drainage & Goaf drainage • Gas sampling cores (known gas contents) • Permit to Mine • Longwall Standards (TG roadway and alignment) • GRO-750-TARP – General Body Contaminants • GRO-10563-TARP-LW Return Methane General Body Contaminants • TG Shearer speed sensor in place (Refer to longwall standard) • Control of adjacent goaf emission via Adjacent Goaf drainage • Mine Production schedule and Plan • Ventilation standards • Goaf drainage strategy • MG103 EPS as intake • Gas monitoring maintenance regime • Additional goaf hole skids Plan to cut at reduced rate (e.g. uni-di, reduced shearer speeds) through higher gas hazard zones as required							
27		Floor gas emissions risk due to thin interburden resulting in production delays	Gas concentrations prevent operation of face equipment	• Pre-drainage of P Seam and GM seam • Post drainage of P Seam and Gm seam • Gas monitoring • Ventilation management plans • Gas detectors • ERZ Controllers inspections • GRO-750-TARP-General Body Contaminants	2M	4	12 M	Develop a gas predictive model for a longwall situation taking to account the effects of the abutment loading – S Giese			
28		Floor Gas zone not defined accurately	Not defining the floor gas zone can result in production delays section of the LW104 which is not planned	• Development Floor gas zone have been defined which has been used as a guide • Geological modelling	2M	4	12 M	Implement piezo monitoring from the MG pillar to assist with identifying the source of floor gas – H Hearne			
29		Increased gas ingress due to propagation through geological structures	Faults in the longwall block may promote fracturing to both lower and upper seams increasing gas ingress	• Pre-drainage of P Seam and GM seam • Post drainage of P Seam and Gm seam • Gas monitoring • Ventilation management plans • Gas detectors • ERZ Controllers inspections • GRO-750-TARP-General Body Contaminants • Business plan for next year has the LW104 cutting at a reduced rate (e.g. uni-di, reduced shearer speed) through this section • PTM process identifies structures • Face mapping • Geological modelling	2M	4	12 M				

				• 3D seismic							
30		Ineffective ventilation and gas monitoring	Non-Hazard Area Certified electrical equipment operating in the ERZ1 zone	• Boundary Zones • Vent Change Authority • Gas Sensor relocation authority • UPEE procedure • Boundary move check list/audit ensures that all non-approved electrical equipment is decommissioned and removed before and area is rezoned. • Face ventilation plan and gas sensor positions defines ERZ boundaries and zones • Boundary moves driven from sequence control • Permit to Energise Form • Critical control inspections	2M	3	8M					
31		Barometric drop results in migration of toxic / irrespirable atmosphere into mine workings	Exposure to Toxic / Irrespirable atmospheres causing personal injury	• Ventilation standards • Barricading/ restricted access • ERZC Inspections • Signage (mine plan "Do Not Enter" signage) • Gas monitoring systems • Barometric monitoring • Temporary VCD's • Rated seal designs • Goaf seal design checklist and sign off (QA/QC) • Adjacent goaf management control • Weather event TARP • GRO-750-TARP-General Body Contaminants	4S	3	18S	Produce SWI for managing C heading roadway outbye the 103 EPS. Include hard controls for stonedust, gas monitoring, barricading, access, etc.) – H Hearne Confirm a hard barriers separating the C Heading roadway outbye the 103 EPS is in place prior to commencing LW104 operation – H Hearne	4S	1	10 M	
32		Loss of vacuum to goaf plant	Gas concentrations prevent operation of face equipment	• Venturi ejector operation capabilities at bore holes using mobile compressors • Gas Management TARPs • Gas monitoring and alarms 24/7 Seam Gas Coverage (Pager linked to alarms)	2M	2	5L					
33		Goaf collapse / caving expels large volumes of gas creating oxygen deficient atmosphere	Exposure to oxygen deficient atmospheres	• CABA & self-rescuer (as per escape strategy for LW103) • LW Operational Standards • ERZ controller inspections • Gas monitoring • First goafing management plan • GRO-750-TARP-General Body Contaminants • Ventilation system	2S	2	5L					
34		Increased CH4 in TG drive/shearer during start-up due to low (velocity) ventilation until first Goaf formation	Gas concentrations prevent operation of face equipment	• Brattice curtains to reduce cross-sectional area and increase velocities • Gas detectors • ERZ Controllers inspections • GRO-750-TARP-General Body Contaminants • SIS and UIS pre-drainage • Ventilation standards	2S	2	5L	Complete a First Goaf risk assessment for LW104 – R Goonawardene				

				• Pillar stability calculations • Maingate wing							
35		Progressive sealing required during extraction	Exposure to Toxic / Irrespirable atmospheres due to sealing installation not in place Failure to build a seal in time	• Ventilation standards • ERZC Inspections • Barricading/ restricted access • Portable gas detectors • Seal standard defines build location to reduce the stub length and standard for ventilating goaf seal stubs • Permit to work • Permit to mine	2S	2	5L					

Known Geology

1. **Seam Characteristics**

The geology for LW104 is similar to LW101 through LW103. The below table summarises the main seam characteristics for LW104;

Characteristics;	0CH	500CH	1000CH	1500CH	2000CH	2500CH	3000CH	3500CH	4000CH
Seam Thickness (m)	5.2	5.0	4.6	4.6	4.6	5.6	5.6	5.6	5.7
Depth of Cover (m)	205m	242m	265m	311m	350m	378m	390m	390m	390m
Seam Grade	1:13	1:13	1:13	1:13	1:16	1:100	1:100	1:100	1:100
GML Interburden Thickness	9.0m	9.0m	9.0m	7.5m	5.5m	4.0m	2.0m	0.5m	2.0m

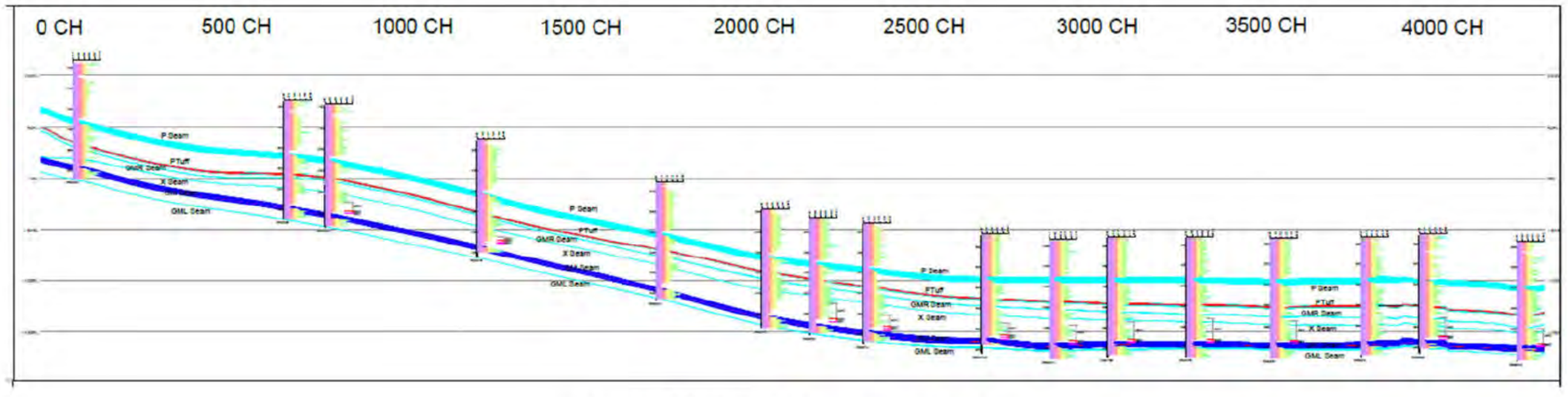


Figure 19 - LW104 showing exaggerated seam grade

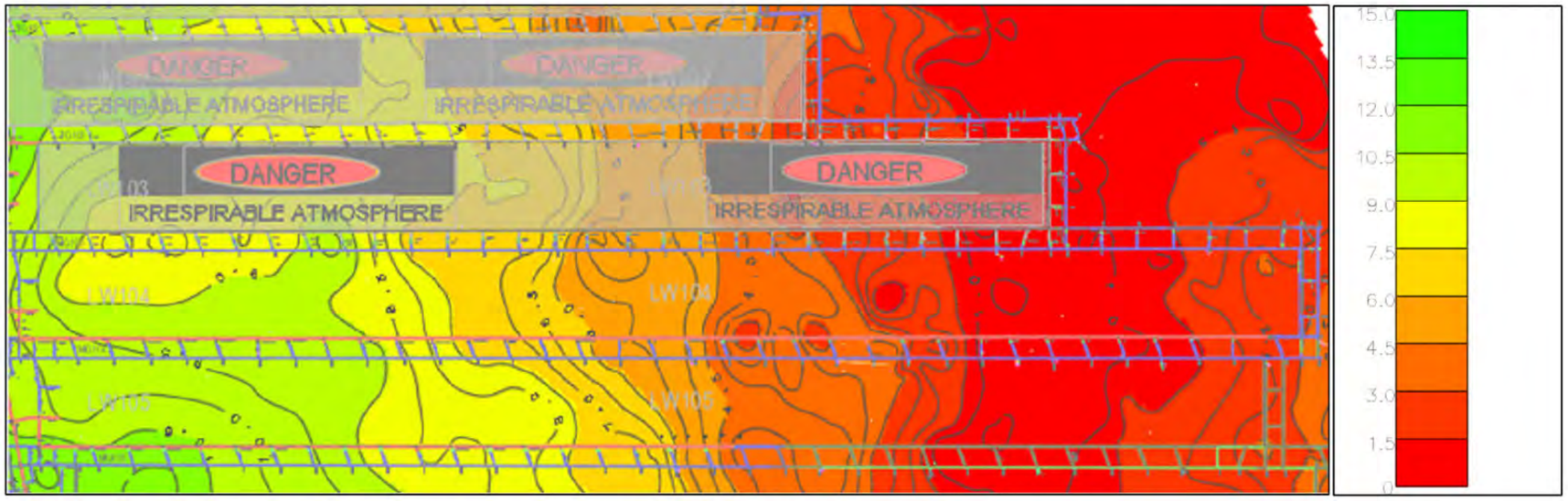


Figure 20 - LW104 showing GML interburden thickness

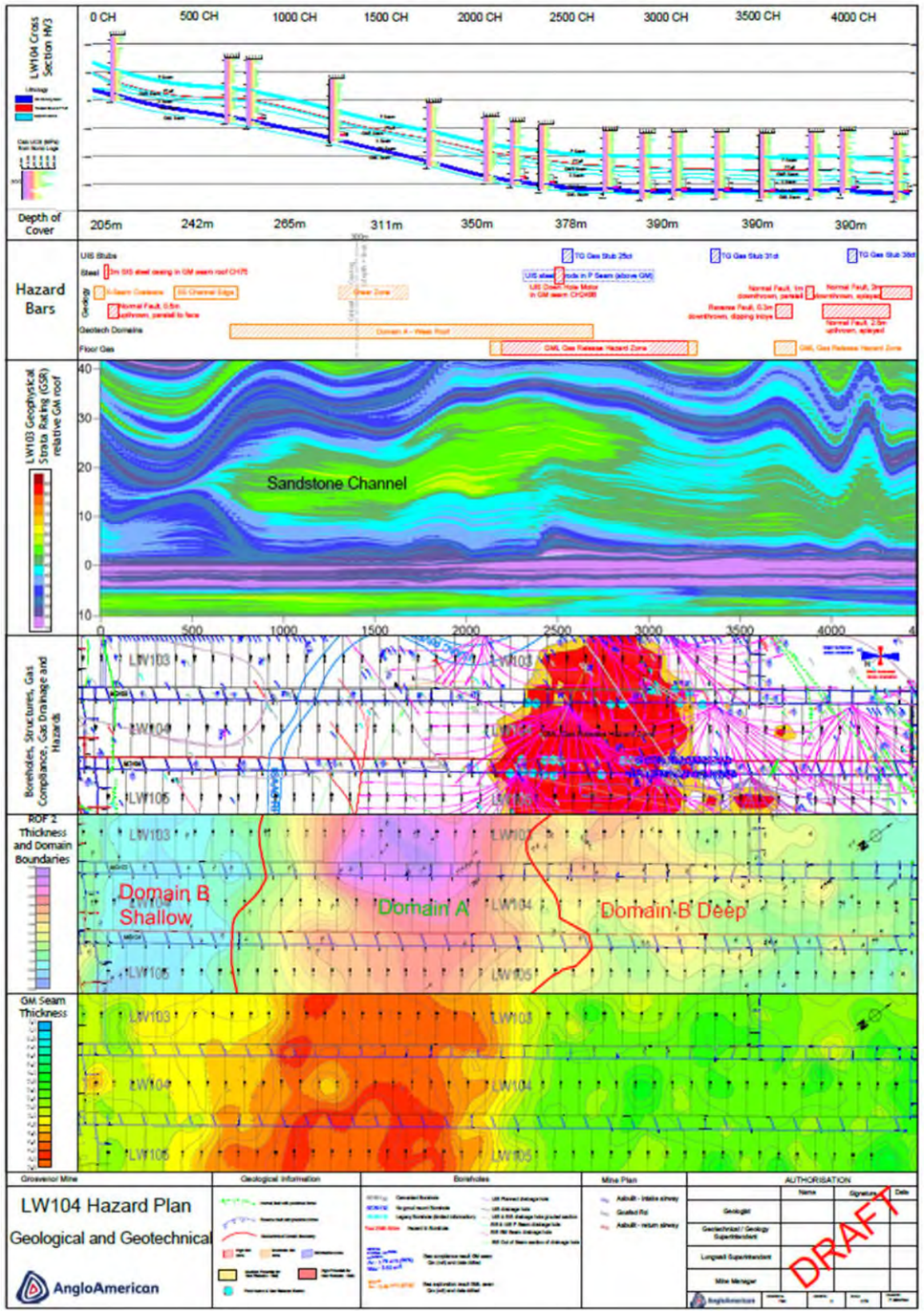


Figure 21 - LW104 Hazard plan

Cut heights have initially been planned to maintain a 400mm coal beam, thickening to 600mm beam on the outbye end, however specific cut heights may be subject to review pending observed conditions during mining of LW104.

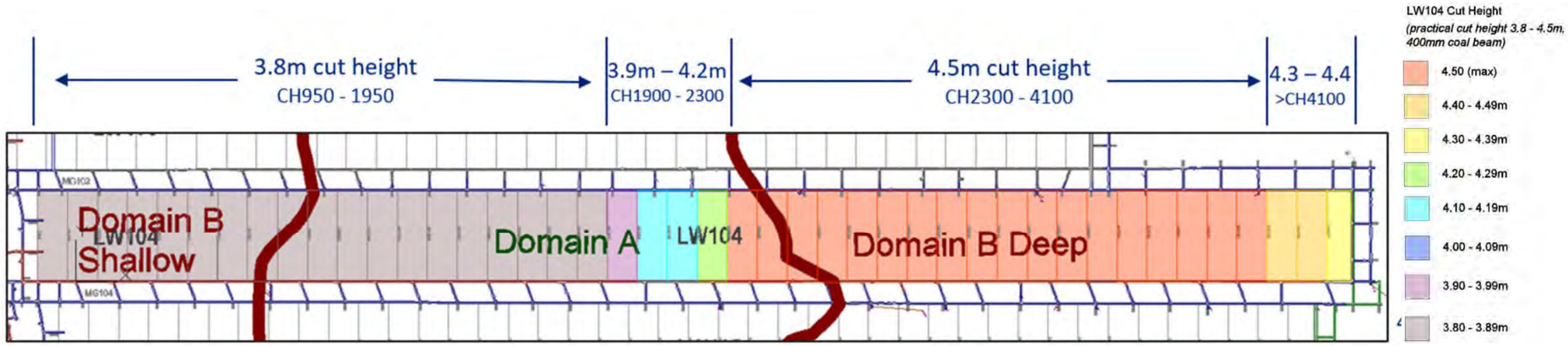


Figure 22 – LW104 Proposed Cut Heights

2. GM Seam features

There are a number of faults that will be intersected during LW104 retreat, as summarised below.

MG Chainage	TG Chainage	Throw	Comments
N/A (FL104)	4243	2.0m	Normal, tight
4222	3919	1.9m	Normal, associated shears
N/A (doesn't propagate to MG)	3840	1.0m	Normal
3680	N/A (doesn't propagate to TG)	0.3m	Re-activated reverse
1510	1690	N/A	Shear zone
100	110	0.5m	Normal, affected LW102 & LW103

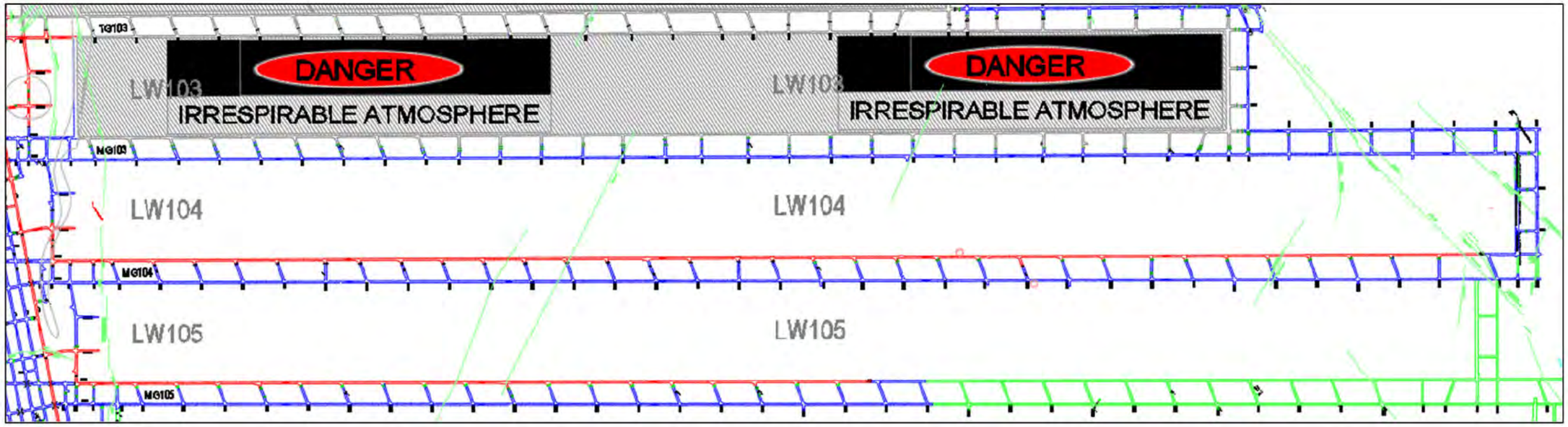


Figure 23 – LW104 Structures

1. Drilling Artefacts

The following drilling artefacts have been confirmed within the LW104 boundary:

- CH 3000m to 2300m: UIS hole, steel in P Seam to 837m hole length
- CH 2498m: Downhole motor within GM seam
- CH 75m: Steel casing in hole GM07RL (RL indicates above GM seam, however arrow data logs indicates it is within GM seam)

Geotechnical

1. Stress Environment

The depth of cover for LW103 ranges from 390m at installs to 205 at takeoff. In the figure below the horizontal stress map for Grosvenor mine is illustrated in detail. This shows clearly that for LW104 panel the principal horizontal stress is generally orientated in a NNE/SSW to NE/SW direction. This will lead to minimal horizontal stress concentrations in the gates during longwall retreat which is favourable for a weak roof environment like Grosvenor, however the cut throughs will experience a stress concentration as the longwall approaches. Total stress magnitude is expected to vary as a function of the rock mass (modulus), depth and structural setting, with a major stress ratio of 1.5:1 not an unreasonable assumption to generalise.

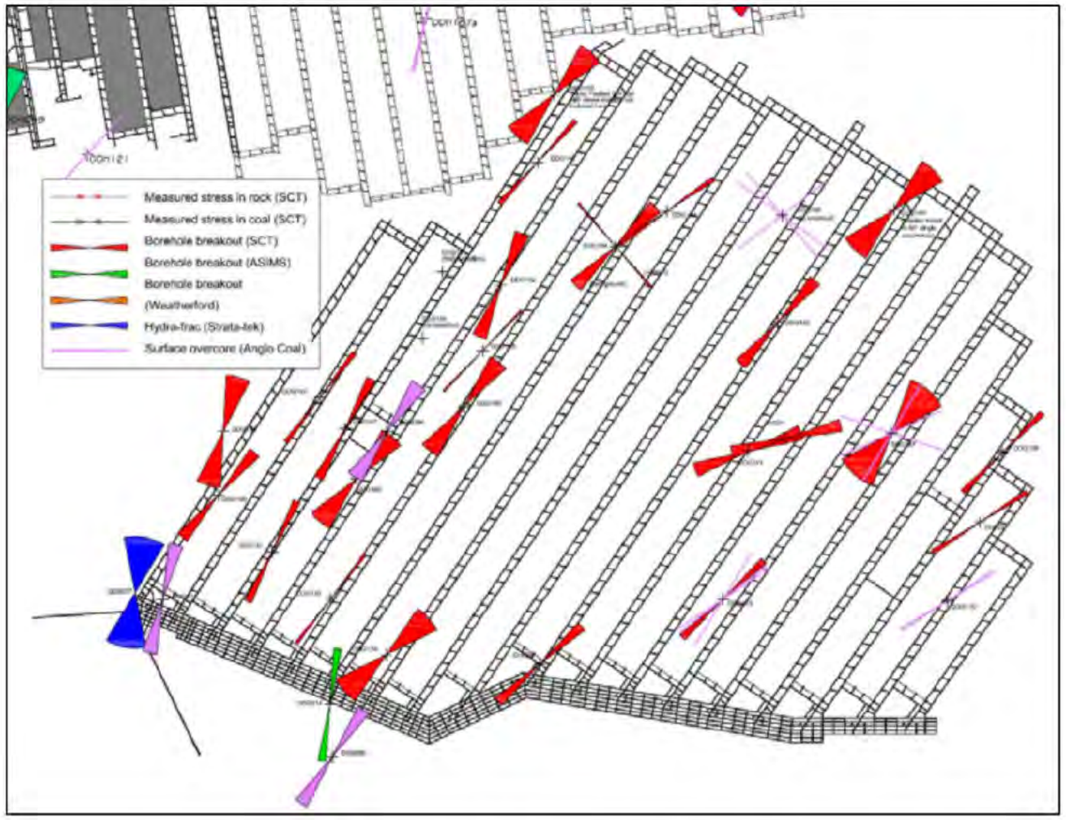


Figure 24 – Grosvenor Mine Horizontal Stress Map

2. Rock Mass Information

a. Geotechnical Domains

Longwall mining will occur through three main geotechnical domains as follows:

- Domain B deep, located from the install road to approximately MG 23 CT
- Domain A (deteriorated zone), located from 23 to MG 11 CT
- Domain B shallow, located from 11 CT to take-off

b. Roof Units

Grosvenor has three distinct geomechanical units. Unit 1 is determined as the coal thickness immediately above the development cut roof. Unit 2 is the weak typically carbonaceous and fissile shaly material overlaying the coal seam (above Unit 1). This is regarded as a transitional material between the coal seam and the sandstone channels above. Unit 3 is the overlaying sandstone/siltstone sequence. This unit is typically 10-25m thick. Contacts between units 1-3 are almost always weak or sharp resulting in a weak contact deduction, which is important particularly for lower strength material when calculating CMRR. The geophysical logs (density, sonic derived UCS and gamma) for borehole DDG201 are shown below, including the roof units.

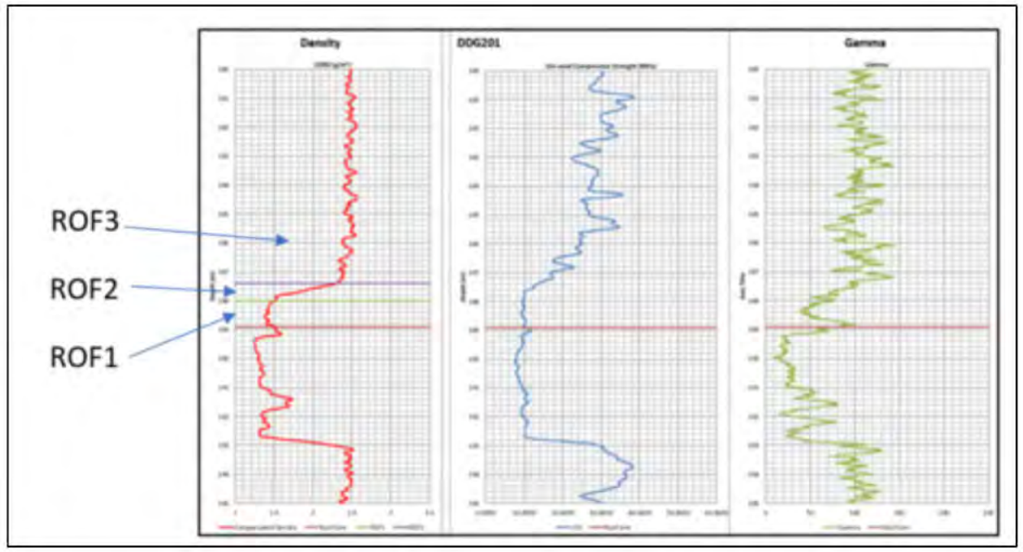


Figure 25 - Geophysical Logs and Roof Units – DDG201

These geomechanical units have been used to refine the geotechnical domain boundaries, to ensure that appropriate hazards are identified and that secondary support strategies are implemented to control the expected conditions. In the following plot, the distribution of roof units as a cumulative thickness can be seen for MG104 & TG104.

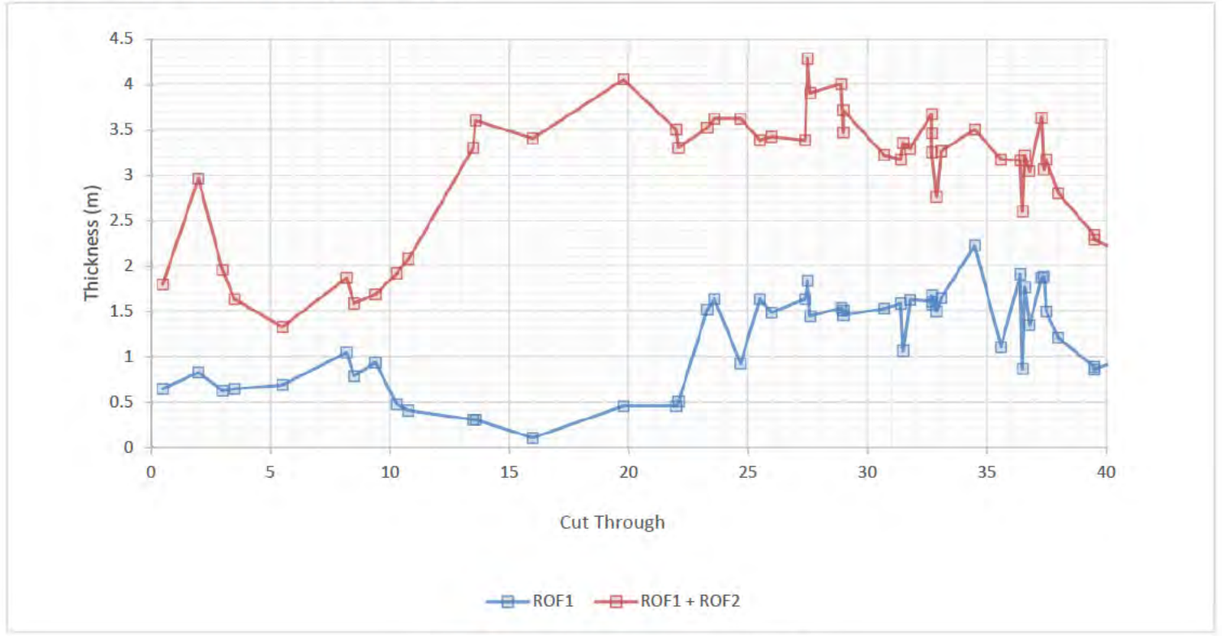


Figure 26 – Roof Unit Thickness (m) MG104

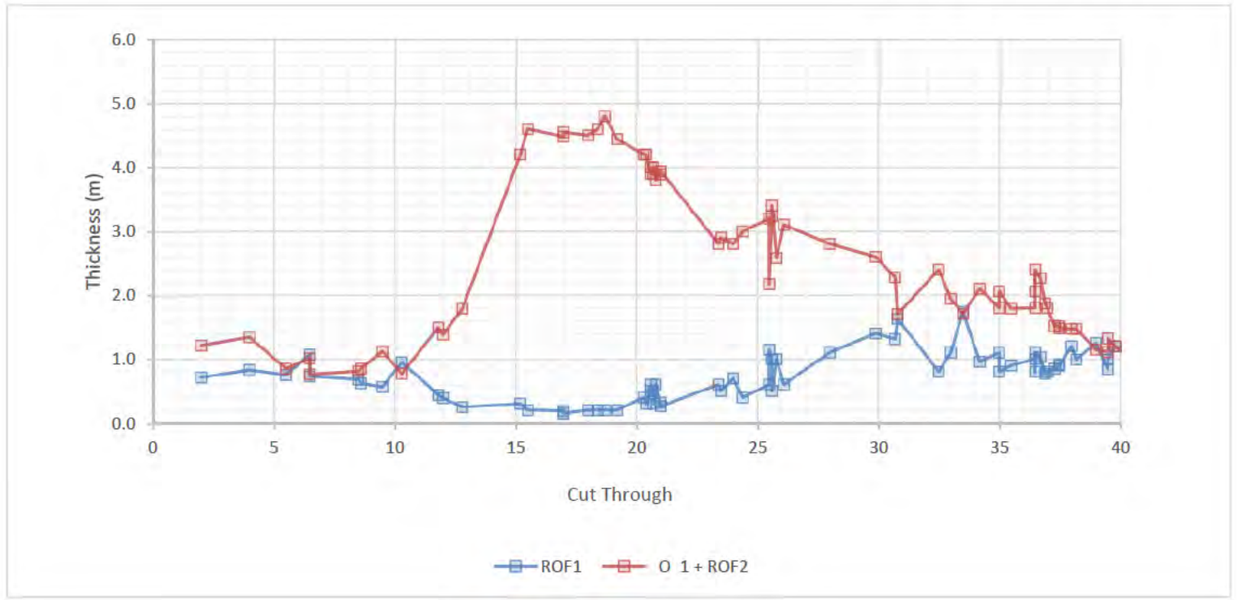


Figure 27 – Roof Unit Thickness (m) TG104

a. Uniaxial Compressive Strength (UCS)

Although not showing a large variance it is still useful to look at the uniaxial compressive strength of the immediate roof at Grosvenor. Calculating the median over the units shows relatively consistent ROF1 at 9-11MPa, larger variation for ROF2 from 10-15MPa, and steadily increasing ROF3 UCS inbye of 10ct to +30MPa (Domain B Deep). It should be noted that the sonic derived UCS formula for rocks at the lower end of the strength spectrum (ROF1 and ROF2) should be taken with caution, and used as a guide only. Laboratory values should be used for design purposes where possible.

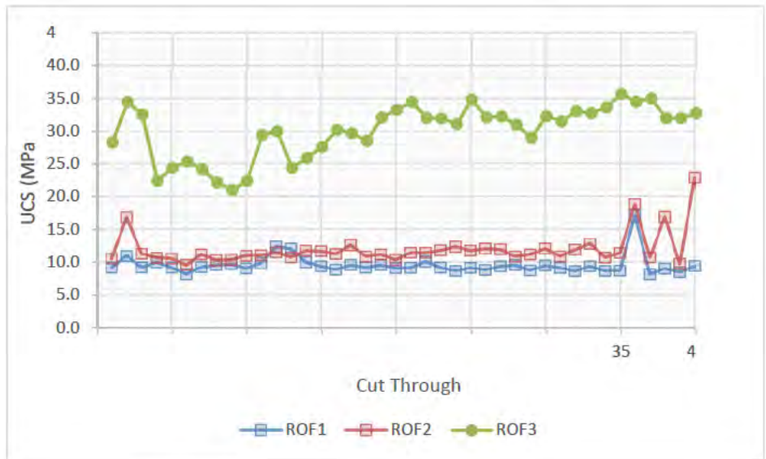


Figure 28 – Sonic UCS (MPa) along MG104

b. Coal Mine Roof Rating (CMRR)

Historically the coal mine roof rating (CMRR) has been difficult to calculate for Grosvenor due to a lack of diametral point load test data (any material resembling coal was taken for either gas sampling or coal quality testing) in the first 3-5m of roof above the planned 3.9m cut horizon. Fortunately, a recent study by Colwell (2018) for LW103 maingate/LW104 tailgate secondary support has given more credible estimates by pooling the available data set by unit type for 22 boreholes along the length of the gateroad. Using this method gives a mean CMRR of 28.6 for 104 TG with a range of 25.1 to 33.7. This CMRR is classed as weak to very weak, with a 25 the lowest possible score. This same method was then replicated in MG104 giving near identical values and a similar range validating it as an effective means of calculating the CMRR at Grosvenor mine. Note that these values are significantly lower than those calculated previously at Grosvenor and go some way to explain the difficulties encountered utilising empirical based design methods in the early days at Grosvenor.

c. Geophysical Strata Rating (GSR)

The third rock mass rating system evaluated for LW104 panel is the geophysical strata rating (GSR). The GSR estimates rock mass competency by evaluating downhole geophysical logs (Medhurst and Hatherly, 2006). In addition to being a rock mass rating system, this method also forms a powerful visualisation tool as shown in the figure below, as it estimates rock mass competency over the entire length of the borehole. It is for this purpose the GSR is used to evaluate LW104 panel. In terms of the cross section below, ROF1 and ROF2 form the purple and pink colours immediately above the 0 mark on the Y-axis. Note that they are often indiscernible with each other using GSR hence the importance of using the roof unit system for demarcating them. What is more obvious though is the change in ROF3 along the length of the panel, with increasing GSR to the right of the screen as a channel sandstone sits above the immediate roof from ~800CH inbye. It was when retreating outbye under the edge of this channel transitioning from Domain A to Domain B shallow where the most difficult conditions were encountered across the face in terms of cavity management and horizon control. Based on the observed conditions in LW102 & to an extent in LW103 panel it can be assumed that ground conditions will again be difficult to manage from ~500-800CH again in LW104 panel due to the sandstone channel and associated edge effects (fracturing, bedding plane shear, differential compaction, stress change etc.). Maintaining operational control by closely monitoring the interaction between the strata and roof supports (shield advance sequence, shearer speed and distance from lead drum to advancing shield) will be critical to maintaining roof stability in this zone.

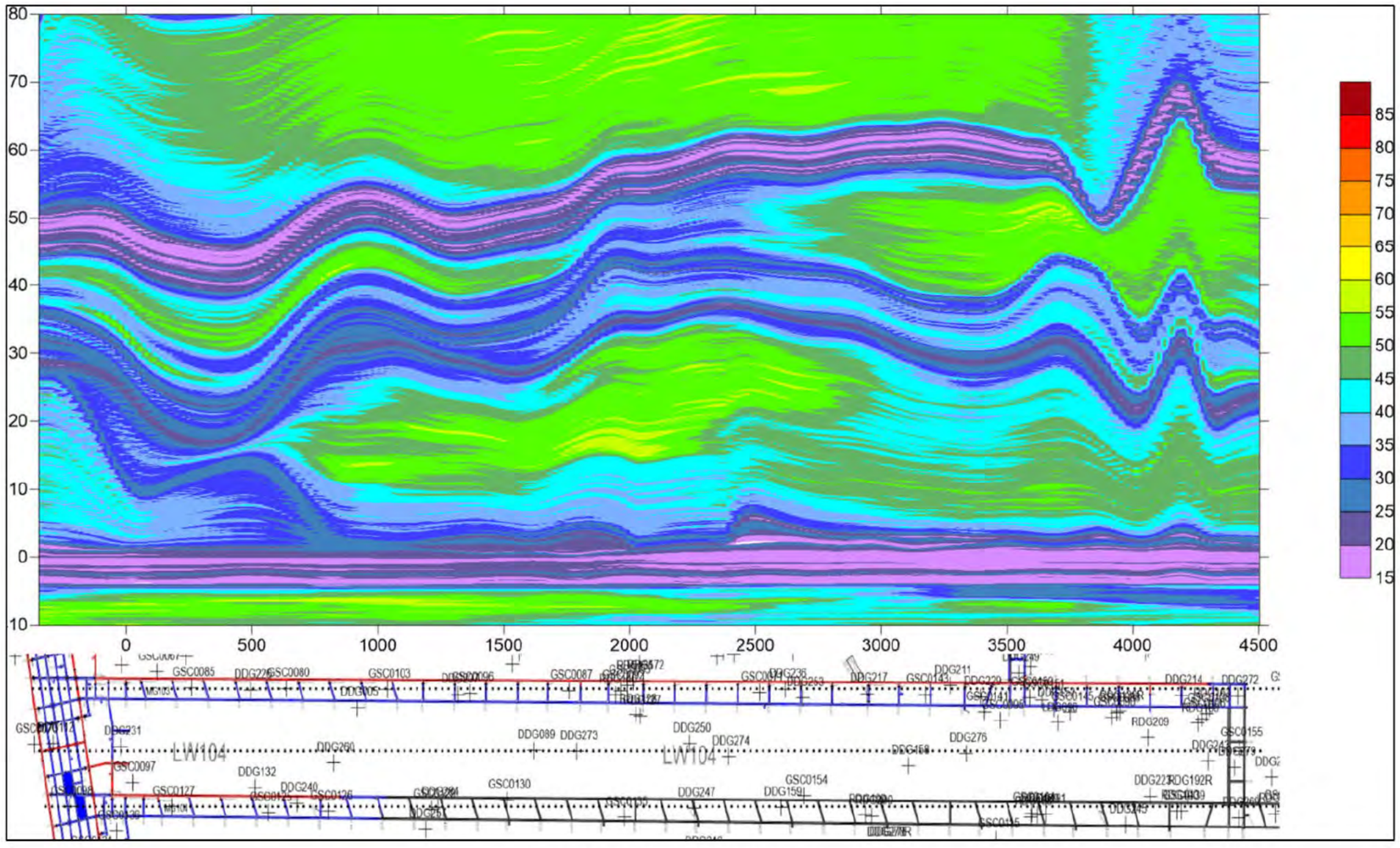


Figure 29 – LW104 Median GSR (80m)

3. Pillar Stability

No changes to the original gateroad pillar design by Mills (2013) have been made for LW104 panel. The chain pillars at Grosvenor Mine will not pose a pillar stability issue with the current geometry and factors of safety. The specifications for both maingate and tailgate are shown below using the UNSW formula.

Table 1 - LW103 Gateroad Pillar Factor of Safety

103 PILLAR SYSTEM	Maximum Depth (m)	Pillar Width (m)	Pillar Length (m)	Pillar height (m)	Factor of Safety (FoS) (Single Abutment Loading)	Factor of Safety (FoS) (Double abutment Loading)
Tailgate (under double abutment)	390	71	84	3.8	3.1	2.0
Maingate	390	76	74	3.8	3.3	N/A
Face/Bleeder Rd	390	59	70	3.8	1.8	N/A

4. Support Design

The secondary support design has been completed and peer reviewed for both TG104 and MG104, incorporating all experiences gained from LW101 through LW103 retreat. The maingate secondary support is similar to what has been installed in previous panels, with the exception of reduced overall density in Domain B Deep, which in LW103 was shown to experience significant hangups, attributed to the overall support installed.

Table 2 – LW104 Maingate Secondary Support Summary

Section	Location	Roadway	Cable Density
1	3 to 11	HDG	2/m
		INT	3.5/m
2	11 to 23	HDG	2.5/m
		INT	4.0/m
3	23 to 27	HDG	2.3/m
		INT	3.5/m
4	27 to 36	HDG	1.8/m
		INT	3.0/m
5	36 to 29	HDG	1.7/m
		INT	3.0/m

For the tailgate, the largely improved support design that was implemented for LW103 will be replicated. This primarily involved using cable trusses through the weak geotechnical domain A and closing up the can spacing through the same area to 3.0m centres. Note that the other main change to the TG support strategy is the installation of additional rib support in the blockside rib at cover depths greater than 350m. This is to assist in maintaining rib integrity on the blockside corner, the lack of which was shown in LW103 to be a key contributor to a number of cavity events that occurred.

Table 3 – LW104 Tailgate Secondary Support Summary

Section	Location	Roadway	Cable Density	Standing support Density
1	2-11ct	HDG	2.5/m	1/4m
		INT	3.5/m	2/4m
2	Inbye 11-24ct	HDG	3.0/m	1/3m
		INT	5.0/m	2/3m
3	Inbye 24 to 31 ct	HDG	2.5/m	1/4m
		INT	3.5/m	2/4m
4	Inbye 31 to 35 ct (stress notch)	HDG	4.0/m	1/3m
		INT	5.25/m	2/3m
5	Inbye 35 to 41 ct	HDG	2.5/m	1/4m
		INT	3.5/m	2/4m

5. Pre Consolidation

During retreat of 103 panel pre-consolidation was conducted in the gateroads using polymeric resins. This was largely successful in preventing propagation of deterioration along the face and into the gateroads on several occasions. A program of pre-consolidation in the gateroads will again be undertaken as a matter of course during Permit to Mine pre-inspections for LW103 panel, with a full inspection of both gates already conducted and prioritised list developed in SMA 2019_068.

6. Longwall Bolt up and Salvage

Both LW102 and LW103 experienced challenging conditions leading into the final take-off position (note LW103 at CH80m at the time of this WRAC), which a varied geotechnical sub-domain is being experienced. A significant increase in the density of mapped structure on each face map was noted from approximately Ch400m outbye to CH0m, with cavities forming more readily than they would in inbye areas. This issue is compounded by the presence of structures and the X-Seam (small rider seam) coalescing zone, which significant cavities requiring extensive consolidation are experienced. Extrapolating these structures out to LW104 take off (see below figure), this area is not anticipated to be affected by any significant structures, however the X-Seam coalescing zone is potentially present around the take-off location.

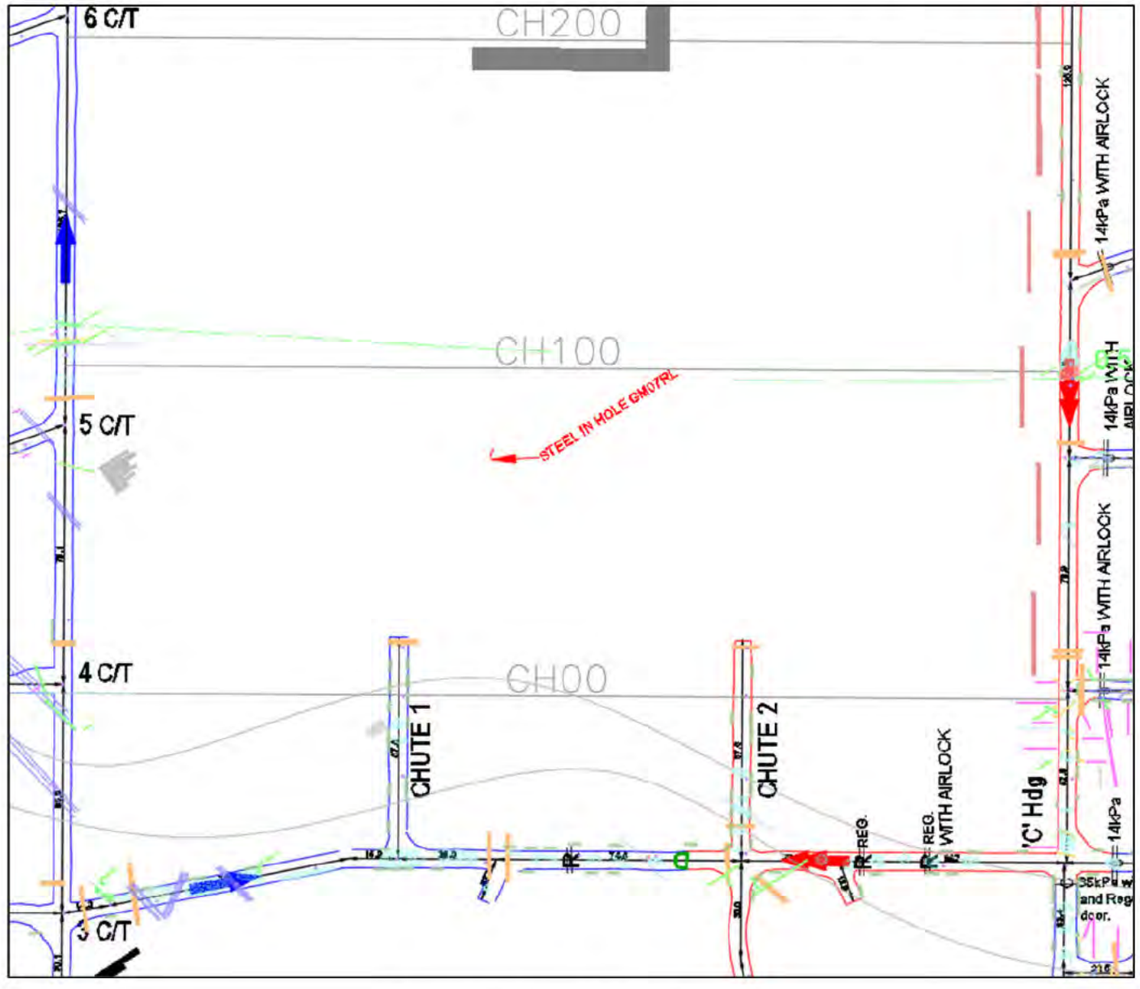


Figure 30 – LW104 Take-Off Structures

No.	ISSUE OR STEP IN OPERATION	ENERGY/HAZARD/ISSUE THAT MAY BE PRESENT	DESCRIBE THE RISK	EXISTING CONTROLS	INITIAL RISK RATING (IRR)			ADDITIONAL CONTROLS	RESIDUAL RISK RATING (RRR)			Acceptable *YES = RRR below 13 NO = RRR above 13 and enter into High Risk (>13s) & Non-Consensus Items Table*
					C	L	R		C	L	R	
36			Accessing the LW face for recovery purposes resulting in a personal injury due to poor strata conditions Poor face stability causing slabbing and injuring person working on face side of AFC during face recovery	• No-Go/restricted zones • Cut height management • LW Standards –GRO-4801 and 5372 • GRO-77-SOP-Underground Workplace Inspections • GRO-42-HMP-Mine Inspections System • Face sprags • Face side access bolting plan • Improved access over AFC (step every 5 shields) • Procedure for Entering AFC for maintenance of any face-side of AFC equipment, including remote isolation and face support/barring down and stabilisation • ERZ inspections	4S	2	**14S**	Review procedure for installing standpipes / lances for face recovery on a face height greater than 4.2m – S Giese	4S	2	**14S**	
37	Known Geology	Loading, failure and caving of over-laying strata	Increased propensity for weighting causing production loss	• Equipment design (Longwall capacity) • Planned Maintenance strategies (hydraulic health) • Mine planning strategies (timing and location for stoppages) • Cutting horizon plan • LW Standards –GRO-4801, 5372 • Hazard Plan LW103 • Geological model • Face Mapping & Inspections • LVA Monitoring and LVA training of LW personnel • GRO – 5833 -TARP- Strata Control Longwall Face Operations • GRO – 5609 – TARP –Longwall Creep and Face Alignment • GRO – 5454 – STD –Longwall periodic weighting and cavity management standard • MST considered for the longwall take into consideration maintenance during loading and cavity events • Shot firing capability, magazine and appointed competent people for shotfiring activities • GRO-3385-PRO-Permit to Mine • GRO-77-SOP – Underground Workplace Inspections system - ERZ controller inspection • GRO-5861-STD Grosvenor mine planning standard - Mine design • GRO-42-HMP – Mine Inspection system	3M	2	**9M**					

38			Converging event causing personnel injury	• Equipment design (Longwall capacity) • Planned Maintenance strategies (hydraulic health) • Mine planning strategies (timing and location for stoppages) • GRO-5861-STD Grosvenor mine planning standard - Mine design • Cutting horizon • LW Standards –GRO-4801, 5372 • Hazard Plan LW103 • Geological model • Face Mapping & Inspections • GRO-42-HMP – Mine Inspection system, • GRO-77-SOP – Underground Workplace Inspections system - ERZ controller inspection • LVA Monitoring and training of LW personnel	3S	1	**6M**					
39	Known Geology	Extraction adjacent to edges of sandstone channels	Failure of roof on LW face causing production loss	• Equipment design (Longwall capacity) • Planned Maintenance strategies (hydraulic health) • Mine planning strategies (timing and location for stoppages) • GRO-5861-STD Grosvenor mine planning standard - Mine design • Cutting horizon • LW Standards –GRO-4801, 5372 • Hazard Plan LW103 • Geological model • Face Mapping & Inspections • GRO-42-HMP – Mine Inspection system, • GRO-77-SOP – Underground Workplace Inspections system - ERZ controller inspection • LVA Monitoring and training of LW personnel • Shot firing capability • GRO – 5609 – TARP –Longwall Creep and Face Alignment • GRO – 5833 -TARP- Strata Control Longwall • GRO – 5454 – STD –Longwall periodic weighting and cavity management standard	4M	3	**18S**	Review options for the last 200m of LW104 retreat focusing on roof management, considering the learnings from LW101 and LW102, LW103 including bolt up. – S Giese				
40	Known Geology	Extraction adjacent to edges of sandstone channels	Failure of roof adjacent to Gate ends causing production loss	• Equipment design (Longwall capacity and upgrade of 149 flushing shield) • Planned Maintenance strategies (hydraulic health) • Mine planning strategies (timing and location for stoppages) • GRO-5861-STD Grosvenor mine planning standard - Mine design • Cutting horizon • LW Standards –GRO-4801, 5372 • Hazard Plan LW103 • Geological model	3M	4	**17S**	Review business case for the cut profile for development versus cut horizon for the longwall in the MG and TG roadways – R Nowell	3M	4	**17S**	

				• Face Mapping & Inspections • GRO-42-HMP – Mine Inspection system, • GRO-77-SOP – Underground Workplace Inspections system - ERZ controller inspection • LVA Monitoring and training of LW personnel • GRO – 5609 – TARP –Longwall Creep and Face Alignment • GRO – 5833 -TARP- Strata Control Longwall • GRO – 5454 – STD –Longwall periodic weighting and cavity management standard							
41	Known Geology	Gravity	Strata failure at gate-ends	• Rib support • Horizon control at gate end cuts • Sprags on TG shields • NO GO Zones • Roof monitoring • Slothing plates on shearer • LW Standards –GRO-4801and 5372 • Ability to install remedial support gate-end corner • GRO-42-HMP – Mine Inspection system, • GRO-77-SOP – Underground Workplace Inspections system - ERZ controller inspection • TARP LW Strata Control • Geological face mapping • Pre-consoldiation for gate ends	3M	2	**9M**	Develop consolidation plan for gate ends				
42			shotfiring in floor gas hazard zone in development causing delays (e.g. poor floor conditions)	• Longwall standards • PIF zone identified on the hazard plan • Survey pickups • ERZ inspection •	2M	2	**5L**	Provide plan of area where shotfiring and/ PIFfing occurred – R Goonawardene	S	2	**5L**	
43			Floor heave causing equipment clearance issues and/ or damage. Clearance for BSL Monorail hoses dragging on the ground	• Longwall standards • Survey pickups • ERZ inspection • Procedure to manage offline drivage • Development standards •	2M	2	**5L**	Develop and distribute as mined cut profile in TG and MG roadway highlighting areas of low clearance – R Goonawardene	2M	2	**5L**	
44	Known Geology	Hardness of coal and stone hardness when cutting out of seam	Increased frequency of pick changes on shearer drum	• LW Standards –GRO-4801 and 5372 • Hazard plans/face mapping • Cut height management • Face mapping by geologists • Control of haulage speed through GRO-750-TARP-General Body Contaminant • Revised drum and pick design • LW Automation • HMP controlling frictional ignition, LW frictional ignition standards and controls	2M	2	**5L**					

45	Known Geology	Hardness of coal and stone hardness when cutting out of seam	Increased fly rock	• LW Standards –GRO-4801 and 5372 • Hazard plans/face mapping • Cut height management • Face mapping by geologists • No Go Zones	2S	2	5L					
46	Known Geology	Loss of horizon control	Low yield - coal quality	• Face mapping • Grade plans • Ash and Yield monitoring/reconciliation • CHPP communications (anticipated yield) daily face mapping report • Permit to Mine • LW Automation • LW Operation standard	2M	2	5L					
47	Known Geology	Mining through geological anomalies	Loss of horizon control or face stability issues causing production loss	• LW Standards –GRO-4801, 5372 • LVA • Strata Consolidation Capability • Horizon Control and face mapping • GRO-42-HMP – Mine Inspection system, • GRO-77-SOP – Underground Workplace Inspections system - ERZ controller inspection • Cut height management • Geological model • GRO-3385-PRO-Permit to Mine • GRO – 7774 -TARP- Strata Control Longwall Gate end roadways • GRO – 7774 -TARP- Strata Control Longwall Gate end roadways – adjacent roadways • GRO – 5833 -TARP- Strata Control Longwall Face Operations • GRO – 5609 – TARP –Longwall Creep and Face Alignment	4M	3	18S	• LW Flight plans to be known structures – S Giese	4M	3	18S	
48		Mining through geological anomalies	Exposing GML seam resulting in increased gas make on the longwall face	• Gas monitoring • Ventilation management plans • Gas detectors • ERZ Controllers inspections • GRO-750-TARP-General Body Contaminants • Gas complance boreholes •	2M	4	12 M					
49	Known Geology	Automation failure	Loss of horizon control or face stability issues causing production loss	• LW Standards –GRO-4801, 5372 • LVA • Strata Consolidation Capability • Horizon Control and face mapping • GRO-42-HMP – Mine Inspection system, • GRO-77-SOP – Underground Workplace Inspections system - ERZ controller inspection • Cut height management • Geological model • GRO-3385-PRO-Permit to Mine • GRO – 7774 -TARP- Strata Control Longwall Gate end roadways • GRO – 7774 -TARP- Strata Control Longwall Gate end roadways – adjacent roadways	3M	1	6M					

				• GRO – 5833 -TARP- Strata Control Longwall Face Operations • GRO – 5609 – TARP –Longwall Creep and Face Alignment • Maintenance programme • Third party monitoring of automation							
50	Known Geology	Changes in seam gradient whilst mining	Loss of horizon control or face stability issues.	• LW Standards –GRO-4801, 5372 • GRO-42-HMP – Mine Inspection system, • GRO-77-SOP – Underground Workplace Inspections system - ERZ controller inspection • GRO-3385-PRO-Permit to Mine • Hazard plans and face mapping • Geological model • GRO – 5609 – TARP –Longwall Creep and Face Alignment • GRO – 7774 -TARP- Strata Control Longwall Gate end roadways • GRO – 7774 -TARP- Strata Control Longwall Gate end roadways – adjacent roadways • GRO – 5833 -TARP- Strata Control Longwall Face Operations	2M	3	**8M**					
51	Known Geology	Retreat extraction of the seam at a grade	Excessive Creep	• Ability to lead and lag face • LW Standards –GRO-4801 and 5372 • Gateroad survey (offline driveage identified) • Fly cuts/ moderation cuts • GRO – 7774 -TARP- Strata Control Longwall Gate end roadways • GRO – 7774 -TARP- Strata Control Longwall Gate end roadways – adjacent roadways • GRO – 5833 -TARP- Strata Control Longwall Face Operations • GRO – 5609 – TARP –Longwall Creep and Face Alignment • Monitoring plan to correlate lead-lag vs RL variance and impact on creep • Face Boss • GRO-3385-PRO-Permit to Mine • GRO-42-HMP – Mine Inspection system, • GRO-77-SOP – Underground Workplace Inspections system - ERZ controller inspection	3M	2	**9M**					
52	Geotechnical considerations	Mining through non-standard driveage (i.e. tripper drives) *This includes mining through known gateroad cavity zones*	Roof / rib failure causing personal injury	• Mined to the specifications of the equipment • Equipment design (Longwall capacity) • Planned Maintenance strategies (hydraulic health) • Mine planning strategies (timing and location for stoppages) • GRO-5861-STD Grosvenor mine planning standard • Mine design, Supports Design and OEM approval • Cutting horizon	2M	1	**2L**	• Confirm the roadway is not greater than 5.0m high along the length of the block – J Mackey				

				• LW Standards –GRO-4801, 5372 • Hazard Plan LW103 • Geological model, Face Mapping & Inspections • GRO-42-HMP – Mine Inspection system, • GRO-77-SOP – Underground Workplace Inspections system - ERZ controller inspection • LVA Monitoring and training of LW personnel • Shot firing capability • GRO – 7774 -TARP- Strata Control Longwall Gate end roadways – adjacent roadways • GRO – 5833 -TARP- Strata Control Longwall Face Operations • GRO – 5609 – TARP –Longwall Creep and Face Alignment • GRO-3385-PRO-Permit to Mine • Mine managers support rules								
53		Mining into pre-driven roadways	Strata failure / cavities in gas drainage stubs causing personal injury or production loss	• Support Design standards • Install schedule for standing support • Manager's Support rules • Strata Monitoring • Specified minimum distance for secondary support • ERZ Controller inspections • Permit to Mine for LW includes UG inspection • Peer review of support standard • Gas drainage stub decommissioning standard	2M	2	**5L**	Design flight plans / excavation plans and false roof for LW104 chute roads to allow transition for bolt up and back fill floor to bolt row 1 – S Giese Develop a standard for backfilling stubs – S Giese	2M	2	**5L**	
54		Increased stress as retreating face approaches previous install face	Roof fall in TG roadway or cut-through causing personal injury or production loss Stress notch	• Primary and secondary support designs • Strata Monitoring • ERZ Controller inspections • LW Operational Standards • Strata TARPS / SCARPS • Permit to Mine • GRO – 7774 -TARP- Strata Control Longwall Gate end roadways – adjacent roadways • GRO – 5833 -TARP- Strata Control Longwall Face Operations • GRO – 5609 – TARP –Longwall Creep and Face Alignment • Learnings out of the LFI in LW103 stress notch failure	3M	3	**13S**	Ensure that no significant planned maintenance activities occur in the stress notch zone – J Agustin	3M	3	**13S**	
55		Loss of creep control or misalignment of MG 104	Inability to access the face via designated wa kway causing personal injury or production loss	• Surveyed roadways • Target line (face Alignment) • Ability to lead and lag face • LW Operational standards • Short interval control (shear by shear) • Fly cuts/ moderation cuts • Development Standards • Gate road driving tolerances • GRO – 5833 -TARP- Strata Control Longwall Face Operations	2M	3	**8M**					

				• GRO – 5609 – TARP –Longwall Creep and Face Alignment • ERZ Controller inspections							
56		Strata failures in Bleeder Road / Perimeter Rd	Restricted access to VCDs and bleeder / perimeter road causing personal injury or production loss	• Support Design standards • TARPs • Strata Monitoring in place • Geotechnical and geological mapping • GRO-77-SOP-Underground Workplace Inspections' • Strata PHMP	2M	2	**5L**				
57		Roadway failure	Loss of services (water, compressed air, monitoring, de-water, communications, power)	• Multiple communication systems (DAC, UG phones, mobile/pit phones/PED loop, MST comms) • Multiple roadways/routes • Surface borehole access • Roadway support design • Geological mapping and strata control checks • TARPs • Telltales	3M	1	**6M**				
58		MG103 EPS issues	Abutment load impacting the MG103 EPS	• Stability report from PDR Engineers • Lies outside the predicted subsidence zone	3M	1	**6M**				
59		Roof/floor convergence/ out of tolerance driveage results in BSL/LW infrastructure becoming iron bound in belt road	BSL/LW infrastructure becoming "iron-bound" in belt road causing production loss	• Secondary support • Roadway design upon development (3.8 cut height in belt road) • Belt road survey – check survey prior to commissioning • MG Plough under BSL • Telltale in GR • Shotfiring capability • Alternate access to LW gear (crawl way over BSL)	3M	2	**9M**				
60		Operating the LW	Face support system failure, resulting in increased risk of cavities and injury to CMWs due to falling debris and remediation work e.g US Flippers	• LW Operational Standards • LW Operational TARP/Management plans • Maintenance scheduling • OEM on site • LVA • Commissioning once installed • Intro to site process for overhauled equipment • Leg set procedure on start-up •	2S	3	**8M**				
61		Operating the LW	Face support system failure, resulting in increased risk of cavities and loss of production	• LW Operational Standards • LW Operational TARP/Management plans • Maintenance scheduling • OEM on site • LVA • Commissioning once installed • Intro to site process for overhauled equipment • Leg set procedure on start-up	2S	3	**8M**				

62		Abutment load being transferred onto seal sites	Catastrophic Failure of goaf seal releases goaf gases or water into mine workings from adjacent workings/goaf	• Primary and secondary support • ERZ inspections • Seal inspections • RPEQ Seal design – including rib/roof support • ERZ inspections VCD maintenance inspections • Ventilation system • Gas monitoring • Seal and installation sign off and checklist (QA/QC) • Rated seal designs with P-Trap and water head 5m or more • Mine dewatering system	2M	2	**5L**					
63		Excessive loading during Longwall cutting / retreating	Uncontrolled failure of pillars	• Pillar design • Anglo Geotechnical OMS Standards. • Geologist / Geotechnical Engineer inspections regarding roof and rib stability. • TARPS • Strata Monitoring regime • Mine inspection regime • Strata support (secondary, primary) • Strata PHMP • SMA process	2S	1	**3L**					
64	Edges of Goaf Areas	Gap between chocks	Goaf materials falling between shields causing personal injury	• LW Operational Standards • ERZ Controllers Inspections • No go / Restricted cutting zones • Anti-topple ram MG & TG • Side shields • Ability to fit temporary guarding (tensar mesh) between shields • Cavity fill options	2S	2	**5L**					
65		Goaf edge overruns support Gate-end	Goaf flushing causing production loss	• TG and MG Primary support • Seal protection support - goaf side standing support • Rated Seal design • ERZ Controller Inspections • Creep management for RL difference • Flushing shield installed • Breaker line support • Maintenance strategies • Geological Inspections	3M	3	**13S**					

Coal Extraction Method and Sequence

Extraction of the LW104 block will be completed using a retreating longwall methodology; being predominantly bi-directional cutting and with uni-di cutting if required to better manage face conditions. Cutting will be confined to the Goonyella middle seam. The extraction section will vary dependent on the roof coal beam thickness requirements, equipment capability and operational requirements to manage conditions present on the face. Longwall 104 parameters are presented in Table 4.

Table 4 - Longwall 104 Parameters

LW104 DATA	
Planned Panel Start Date – MOP011 2019	25 February 2020
Planned Panel Finish Date – MOP11 2019	6 May 2021
Block Width (solid m)	301
Block Length (m)	4,381
Total ROM Data	
Run-of-Mine Tonnes	8.6mt
Product Tonnes	5.9mt @ 11.5%
Cutting Rates	
Cutting Rate (t/h) MOP11 2019	~ 1841
Cutting Rate (h/w) MOP11 2019	~ 95

Maximum cutting height is defined by the planned coal roof beam as directed by the Geology and Geotechnical department as a control for cavity formation. Beam thickness requirements will be reviewed continuously and managed using risk-based logic. No floor coal will be maintained; however, some floor stone may be cut if required. Cutting height is as per instruction from the Longwall Superintendent as long as it meets the equipment requirements and maintains the coal roof beam.

In accordance with CMSH s326 and s327, upon completion of the extraction process, a Sealing Management Plan will be developed to determine the method of sealing the panel. Notice of the proposed sealing will be given to the Mines Inspector and to the Site Safety and Health Representative at least 30 days prior to sealing. Seals are based upon the estimated water level inside the goaf.

No.	ISSUE OR STEP IN OPERATION	ENERGY/HAZARD/ISSUE THAT MAY BE PRESENT	DESCRIBE THE RISK	EXISTING CONTROLS	INITIAL RISK RATING (IRR)			ADDITIONAL CONTROLS	RESIDUAL RISK RATING (RRR)			Acceptable *YES = RRR below 13 NO = RRR above 13 and enter into High Risk (>13s) & Non-Consensus Items Table*
					C	L	R		C	L	R	
66	Coal Extraction Sequence	Long term exposure to respirable dust High ventilation velocities raises dust Dry coal due to gas drainage increasing dust make	Exposure above the respirable dust OEL	• PPE • Dust monitoring • Dust HMP • Dust TARP • Dust mitigation • No go zones • VO targeting 60m³/s • Operational Standards (washing supports) • Roadway maintenance	2H	3	8M					
67	Coal Extraction Sequence	Equipment damage	Insufficient clearance for service installations	• Standard roadway designs • Development panel standards • 70m long cut throughs Plan in place to Muck/grub floor in odd C/T's to ensure clearance for LW TX & Pump carts	2M	2	5L					

Ventilation

1. **Longwall Retreat and Installation Ventilation**

Shaft #6 at A heading 11 c/t in the Mains is the exhaust shaft for the mine with 3 main fans. Ventilation intakes will include the travel drift, belt drift, Shaft #4 (2.2m) and Shaft #5 (2.2m). Refrigeration infrastructure has been installed on shaft #4, shaft #5, men and materials drift and planned for MG103EP Shaft

LW104 will be ventilated with a homotropal maingate and tailgate B heading return *(**Error! Reference source not found.**31.*

MG103EP shaft has a single fan and cooling available to ventilate B Hdg inbye the longwall.

The ventilation circuit will change to an antitropal Maingate as part of the longwall recovery process and some regulation may be required.

TG103 34-40c/t will be dual returns. Man doors will be used to control ventilation through to C Hdg, barriers and barricades will prevent access into this area.

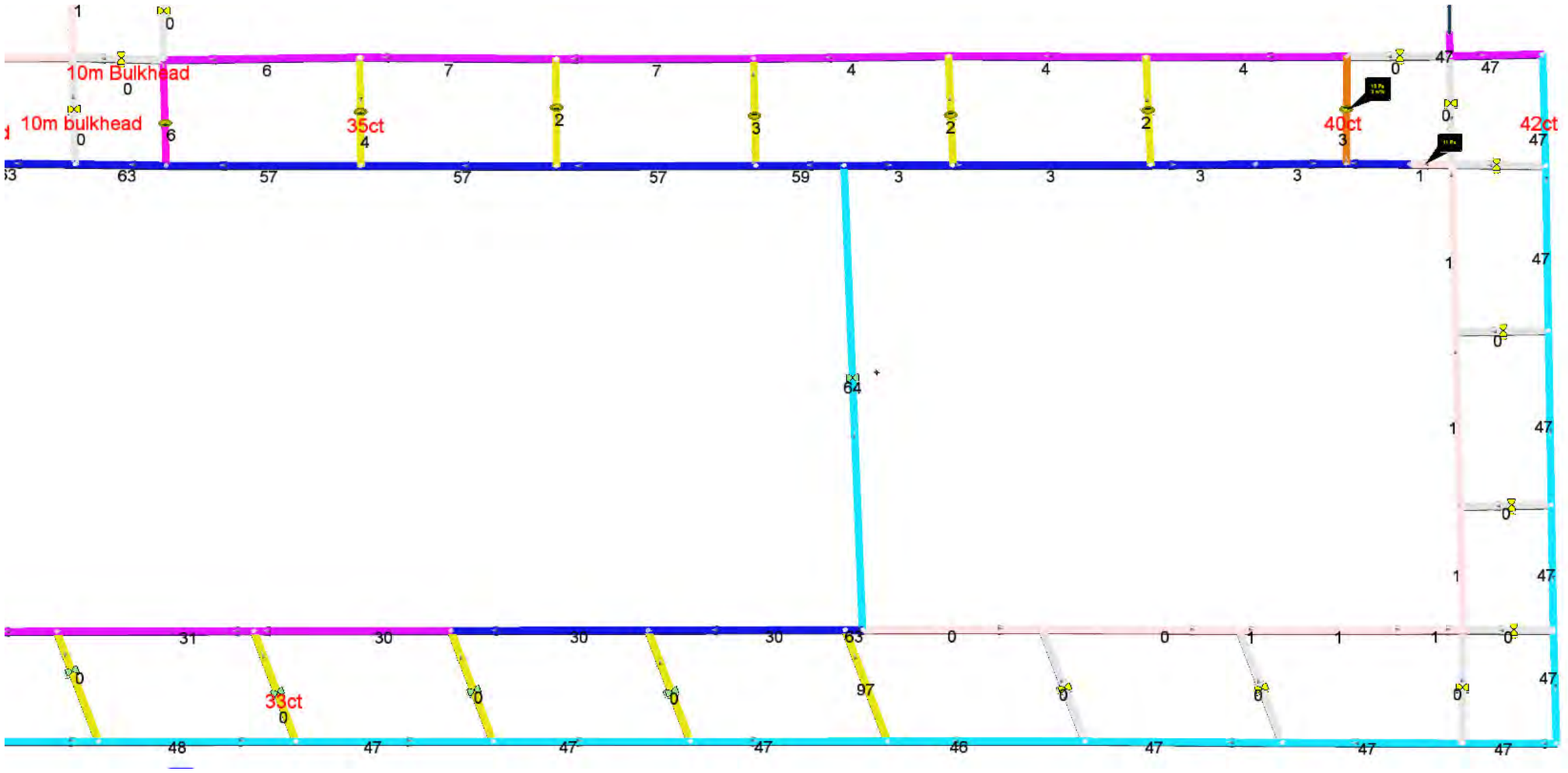


Figure 31 - Homotropal Maingate and inbye ventilation

No.	ISSUE OR STEP IN OPERATION	ENERGY/HAZARD/ISSUE THAT MAY BE PRESENT	DESCRIBE THE RISK	EXISTING CONTROLS	INITIAL RISK RATING (IRR)			ADDITIONAL CONTROLS	RESIDUAL RISK RATING (RRR)			Acceptable *YES = RRR below 13 NO = RRR above 13 and enter into High Risk (>13s) & Non-Consensus Items Table*
					C	L	R		C	L	R	
68	Main fans stoppage, VCD fail, open / short circuit , flooded roadways etc.		Insufficient Ventilation causing production loss or personnel injury	• Sufficient ventilation system (design) • Ventilation PHMP • Face ventilation quantity sufficient to dilute predicted gas make. • Stat inspections • Ventsim model • External consultant modelling (Ventsim) • Gas drainage system (pre and post) • Vent change Process • Tube bundle monitoring/ sensors • Permit to Mine • Automated generator starts up for main vent fans with CITEC capable remote switching in LW104 • GRO-xxxxx-TARP- General Body	2M	3	8M					
69	Heat generated by mining equipment and geo-thermal gradient influencing mine conditions		Inadequate Ventilation / cooling causing production loss or personnel injury	• Sufficient ventilation system (include BAC and Fans) • GRO-15-PHMP-Ventilation • GRO-160-TARP-Heat Management • Face ventilation quantity • Mine cooling system on surface (BAC) • GRO-48-HMP-Management of Heat • LW operational standards • Competent ERZ controllers taking work place measurements (stat responsibility) • Air movers • Permit to Mine	3S	2	9M					
70	Change ventilation from Homotropal to Antitropal		Ventilation changes affecting mining environment and leading to delays	• Sufficient ventilation system (include BAC and Fans) • Ventilation PHMP • Face ventilation quantity sufficient to dilute predicted gas make. • Stat inspections • Ventsim model • Gas drainage system (pre and post) • Vent change Process • Tube bundle monitoring/ real time sensors and change permit	2S	2	5L					
71	Ventilation Reversal inbye of LW	GAS	Pressure change on face leads to production delay	• Gas monitoring system • Vent change modelling • Vent change permit process • Planned work to set up an upcast shaft inbye the longwall would require change management and risk assessment as per standard procedure at grosvenor	2S	2	5L					

1. Controlling Spontaneous Combustion

Goaf seal designs are certified by a RPEQ and a quality assurance process will be implemented during the construction process. A seal site secondary support plan has been developed to protect the seal site area from strata deterioration.

There is a commissioned Floxal system on site and will be used for the pro-active inertisation of the panel, as well as managing any TARP triggered. Underground inertisation range will be installed to deliver inert gas into the active goaf and the floxal unit is visible on Citect.

The mine currently has the capability to run over 4,000m³/hr of inert gas with two different inert gas generators. Both floxal units will be used for the pro-active inertisation of the panel, as well as managing any TARP exceedances. Three TARPs will be used throughout the life of the panel consisting of the following stages, active, newly sealed and sealed. In addition, a Tomlinson boiler is available to increase the inertisation capabilities.

Spontaneous combustion testing was carried out for Grosvenor (CB3 Technical report TR009, CB3 Technical report TR014, CB3 Technical report TR047 and Draft B3 Technical Report 2019TR019 Spontaneous combustion assessment of core samples from boreholes at Grosvenor Mine). The R70 self-heating rate values recorded for the samples ranges from 0.02 to 0.40ºC/h, which is consistent with the coal rank and type, and rates the coal as having low intrinsic spontaneous combustion reactivity. These results are similar to those obtained for Moranbah North and Moranbah South.

No.	ISSUE OR STEP IN OPERATION	ENERGY/HAZARD/ISSUE THAT MAY BE PRESENT	DESCRIBE THE RISK	EXISTING CONTROLS	INITIAL RISK RATING (IRR)			ADDITIONAL CONTROLS	RESIDUAL RISK RATING (RRR)			Acceptable *YES = RRR below 13 NO = RRR above 13 and enter into High Risk (>13s) & Non-Consensus Items Table*
					C	L	R		C	L	R	
72	Method of Controlling Spontaneous Combustion		Less than adequate operation of the inertisation plant and/or inertisation plant stops and causes TARP trigger to be reached and delay the mining operations	• 2xFloxal units • Spontaneous Combustion PHMP • TARPs • Gas monitoring • Safety Alert – CO monitoring on the floxal plant has been installed. • Real time monitoring on floxal units • Maintenance regime (including inspections) of the floxal plant	2M	2	5L	Confirm inert line is installed into the existing goaf seals prior to startup. – H Hearne Install flow meters on UG nitrogen pipeline so we can measure what we are doing				
73	Method of Controlling Spontaneous Combustion		Geological anomalies increases spontaneous combustion potential and risks to operations	• Goaf Management Procedure • Inertisation capability. • Spontaneous Combustion PHMP/TARPs • Monitoring • Bag sample regime • Seal design • Geological mapping /geotechnical inspection • ERZ Controller Inspections	2M	3	8M					
74	Method of Controlling Spontaneous Combustion		Improperly stored stowage in gateroads against existing seals drawing oxygen across the stow,	• Stowage management plan and permits • PHMP for Spontaneous Combustion • Gas monitoring systems • ERZ Controller inspection	2S	1	3L					
75	Method of Controlling Spontaneous Combustion		Incomplete goafing creates air path to goaf until square up, resulting in increased spontaneous combustion risk and production delays	• Gas monitoring • Goaf stream bag samples • Spontaneous Combustion PHMP • Spontaneous Combustion TARPs • ERZ Controller inspections STD.LW.0001 LW Operational Standards	2M	3	8M					
76	Method of Controlling Spontaneous Combustion		Air wash zone not adequately controlled (floxal), resulting in increased spontaneous combustion risk and production delays	• Spontaneous Combustion PHMP • Spontaneous Combustion TARPs • Gas Monitoring • Bag sample regime • Floxal Safety Management Plan • ERZ Controllers inspections • Proactive inertisation Permit to Mine	2M	3	8M					
77	Method of Controlling Spontaneous Combustion		Oxygen ingress in to the goaf – Due to increased bleeder pressure across goaf resulting in possible increase in spon comb risk resulting in production delay triggered by TARPs	• Spontaneous Combustion PHMP/TARPs • Monitoring/sensors • Bag sample regime • Seal design • Inertisation available (floxal/boiler) • Mine inspection regime • Depth of cover in case of surface to working • Ventilation modelling and ventilation surveys • Goaf management plan	2M	3	8M	Plan to seal perimeter road when end of panel shaft is online – currently in process	2M	3	8M	

				• Regulators on shaft bottom and top • Inspection regime for high ventilation areas and defined frequencies • Inertisation capability in Spontaneous Combustion TARP • Longwall goaf management plan Pressure differential monitoring on seals								
78	Method of Controlling Spontaneous Combustion		Failed goaf seal introduces oxygen into goaf causing production delay	• Spontaneous Combustion PHMP/TARP • ERZ inspections • Seal inspections • Seal design – including rib/roof support • ERZ inspections VCD maintenance inspections • Ventilation system • Gas monitoring Seal and installation sign off and checklist (QA/QC)	2M	3	8M					
79	Method of Controlling Spontaneous Combustion		Ingress of oxygen into the goaf due to UIS holes open through MG pillar	• Goaf Drainage monitoring • Goaf Drainage PHMP • Gas Monitoring and TARPS • Spontaneous Combustion PHMP • Grouting of UIS and SIS holes • BINs on development intersection stipulate treatment method	2M	3	8M	Conduct audit on intersected UIS holes in MG104 – R Kostowski	2M	3	8M	
80			Surface cracking leading to ingress of oxygen into the goaf	• Depth of cover • Mine design • Subsidence Modelling Spontaneous Combustion PHMP/TARP	2M	2	5L					

Friction Ignition

Frictional ignition will be managed in accordance with the controls dictated in the HMP Controlling Frictional Ignition

No.	ISSUE OR STEP IN OPERATION	ENERGY/HAZARD/ISSUE THAT MAY BE PRESENT	DESCRIBE THE RISK	EXISTING CONTROLS	INITIAL RISK RATING (IRR)			ADDITIONAL CONTROLS	RESIDUAL RISK RATING (RRR)			Acceptable *YES = RRR below 13 NO = RRR above 13 and enter into High Risk (>13s) & Non-Consensus Items Table*
					C	L	R		C	L	R	
81	Frictional ignition	Managing Frictional Ignition	Steel strike (drum hitting TG bolts, steel, chocks, etc.) causing a spark results in increased FI risk	• Adequate ventilation • Fit for purpose equipment • Sprays • Ventilation standards • Gas monitoring • ERZ controller inspections • Permit to Mine • Face automation • TG support design offset from block side rib • Longwall Panel Standards • Stone dusting regime • Maintenance regime • Frictional Ignition Management Plan /TARP • TG roadway monitoring • Anti-collision software • Removal of gas drainage infrastructure at drilling stubs • Firefighting equipment	2S	2	5L					
82	Frictional ignition	Managing Frictional Ignition	MG or TG support setting against bolts causing spark in roadway leading to increased frictional ignition risk	• Ventilation • ERZ Controller inspections • Stone dusting regime • Environmental Monitoring • Shield Cycling • Frictional Ignition Management Plan/TARP • Support offset into TG roadway • Sprays Gas drainage	2S	2	5L					
83	Frictional ignition	Managing Frictional Ignition	Cutting hard material (e.g., pyrite or sandstone) results in increased potential for a frictional ignition	• Adequate ventilation • Fit for purpose equipment • LW maintenance strategy • Sprays • Ventilation standards • Gas monitoring • ERZ controller inspections • Permit to Mine • Geological mapping • Longwall Panel Standards • Frictional Ignition Management Plan/TARP FI checks	2S	2	5L					
84	Frictional ignition	Managing Frictional Ignition	Gas sources (blowers in the floor, gas under the pan, gas out of the roof) result in increased safety risk to CMWs or loss of production	• Adequate ventilation • Sprays • Ventilation standards • Gas monitoring • ERZ controller inspections • Permit to Mine	3S	1	6M					

				• TARPs for ventilation, gas management, & frictional ignition • Automation • Longwall Panel Standards • Historical data (driveage) • Horizon control • Gas drainage • Borehole intersection notices • LW face mapping Speed sensor in TG Dust and FI checks							
85	Frictional ignition	Managing Frictional Ignition	Incendive sparking from sandstone bodies/ free stone on the AFC / BSL causing production loss	• Gas Drainage • Dust Suppression • Water sprays • Horizon control management • Ventilation PHMP • Geological Hazard Plan • FI checks -pick standard • Gas monitoring • ERZ controller inspections • Permit to Mine • Longwall Panel Standards • Frictional Ignition Management Plan/TARP LW face mapping	1M	3	4L					
86	Frictional Ignition	Managing Frictional Ignition	TG STD Support - shearer cutting into the steel cans/ PCBs containing steel mesh leading to regulatory breach NB: potential for cold spark being initiated	• No steel cans planned in the TG roadway • Support design for the TG roadway • Shearer Sprays • Adequate ventilation • Fit for purpose equipment • Sprays • Ventilation standards • Gas monitoring • ERZ controller inspections • Permit to Mine • Shearer automation • TG support design offset from block side rib • Longwall Panel Standards • Stone dusting regime • Maintenance regime • Frictional Ignition Management Plan/TARP TG roadway monitoring	1L &R	2	2L					
87	Frictional ignition	Managing Frictional Ignition	Excessive heat from chain rerouters causing ignition	• Mexican sprays (bottom race/underside spray) on the MG and TG rerouters • LW operation standards • Stat inspections/inspection regime • Auto chain tensioner • Chain tension checks • GRO-3303-HMP Control of Frictional Ignition	1S	2	2L					

				• GRO-1629-HMP- Introduction of Underground Equipment • GRO-4801-STD – Longwall Standards • GRO-5372-STD – Longwall Operational Standards GRO-42-HMP – Mine Inspection System							
88	Frictional ignition	Managing Frictional Ignition	Excessive heat from trapping shoe wear / shear pin on the AFC causing production delay	• Coal friction co-efficient survey – • OEM design • GRO-1629-HMP- Introduction of Underground Equipment • GRO-3303-HMP Control of Frictional Ignition Maintenance strategy and monitor the wear	1S	2	2L					
89	Frictional ignition	Managing Frictional Ignition	Shearer intersecting metallic objects/artefacts in boreholes / gas-well leading to delays in operation	• Grade/flight plans for gas risers • LW103 Hazard plan • Borehole database • GRO-15-PHMP Ventilation • GRO-3303-HMP Control of Frictional Ignition • GRO-3385 – PRO- Permit to Mine • Face/Pick Sprays • GRO-8804-PMT Permit to Drill (UIS) • GRO-8480-PMT Permit to Drill (Surface) • GRO-3595 HMP Intersecting Boreholes • Stat inspections • Borehole Completion reports • GRO-3223-SWI- Operational No Go Zones • GRO-241-SOP- Control of Energy • Standard for decommissioning stubs (removes all metallic objects in the stub)	2S	2	5L					
90			Cutting concrete or shotcrete increasing frictional ignition risk	• Water sprays • Horizon control management • Ventilation PHMP • FI checks -pick standard • ERZ controller inspections • Frictional Ignition Management Plan/TARP •	2S	2	5L					

Suitability of Plant

A single 4,500tph 300m wide longwall system is operating at Grosvenor. Table 5 below details the specification of Grosvenor longwall specifications.

Table 5 - Longwall Equipment Capabilities

Equipment	Requirement

Roof Supports	Operating Height Max open: 5.0m Min operating: 3.5m Min transport: 2.4m Leg Capability Support rating: 1750 tonnes Yield: 875 tonnes Set: 766 tonnes Set to yield 87% Canopy Length Face side: 3.9m Goaf side: 1.8m Canopy ratio 2.14:1 Width 1.9m Roof contact area 11m2 Roof set pressure 2.5Mpa Base Floor contact area 5.8m2 Floor set pressure 1.3Mpa Flipper Tip load 2 → 21 tonne Two leg, IFS canopy and single side shield Full electro-hydraulic system Suit longwall automation. Integrated dust suppression sprays Structural life – 70,000 cycles
Shearer	Double ended ranging arm multi-motor shearer Suit 4,500tph Nameplate Capacity longwall Radio remote control Bi-directional data communication system Suit longwall automation Shearer Height Cut height Maximum: 5.0m Minimum: 3.5m Tunnel Capacity 5037tph Utilisation @ 13m/min 61% Sloughing plate Machine height currently 2.6m Machine height minimum 2.2m (must be horizontal) Drum Profile Drum configuration MG: 2.5m TG: 2.5m
Armoured Face Conveyor (AFC)	Continuous rating 4,500tph, peak volumetric capacity 5,000tph Capable of a reserve chain pull of 170 tonnes during starting Automatic chain tensioning system
Beam Stage Loader (BSL)	Continuous rating 5,000tph Automatic chain tensioning system Full dust cover and system including dust extraction
Crusher	Continuous rating 5,000tph Output regulation <4,700tph Output material sizing to <300mm
Boot End	Skid type with steering, side shift and levelling Overlap to suit two face advances Belt conveyor tail pulley to transfer load to the stage loader Belt lifting unit to assist with conveyor structure salvage Suit 1,600mm belt width maingate conveyor

Longwall Pump Station	Tracked mounted pumps and tanks, capable of being relocated underground by tramming or towing with mine LHD vehicles Located in cut though outbye of the longwall face, one station connected to longwall system by monorail system, second station on maintenance, ready for re-connection to monorail upon services relocation Services provided by station: Hydraulic supply for roof supports with 20% reserve capacity. Water supply for shearer cooling and dust suppression sprays. Water supply for roof support dust suppression sprays
Monorail System	Suit 250m of longwall retreat between retractions Included 110m movement materials management system Includes monorail installation and salvage platforms and relocation sleds etc.
Electrical System	Incoming supply – 11kV Face voltage 3.3kV Designed to limit voltage drop during AFC overloaded starts to 20% of nominal motor voltage Inter-systems integration via Ethernet IP Allen Bradley Control Logix PLC based control system Includes face, BSL, monorail area lighting
Automation System	Includes LASC standards

No.	ISSUE OR STEP IN OPERATION	ENERGY/HAZARD/ISSUE THAT MAY BE PRESENT	DESCRIBE THE RISK	EXISTING CONTROLS	INITIAL RISK RATING (IRR)			ADDITIONAL CONTROLS	RESIDUAL RISK RATING (RRR)			Acceptable *YES = RRR below 13 NO = RRR above 13 and enter into High Risk (>13s) & Non-Consensus Items Table*
					C	L	R		C	L	R	
91	Plant	Mining equipment not fit for purpose	Longwall equipment suitable to maintain acceptable level of risk for personnel working on the longwall face	• Longwall equipment has been designed to operate in anticipated conditions o Support capacity shields (1750 ton) o Modelled Shield height limits (3.7-5.0m) o Shield capable of 1000mm advance o Hydraulic capacities ; 6 system pumps & 2 Hi-set pumps o 930l/min shearer water booster pump o Geological model used in design of the LW system • LW commissioning documents • Longwall maintenance strategies • GRO-1629-HMP- Introduction of Underground Equipment • GRO-5609-TARP – Longwall Hydraulic Integrity • GRO-4801-STD – Longwall Standards • GRO-5372-STD – Longwall Operational Standards • GRO-42-HMP – Mine Inspection System • GRO-4801-STD-Longwall Standard Area Management System • Longwall operational systems • GRO-241-SOP- Control of Energy • GRO-200-PRO Change Management • GRO-5861-STD Mine Planning Standard • GRO-3231-PRO-Grosvenor Commissioning Execution Plan • Ramp up procedure • LW Operational RA	3S	2	9M	Confirm road heights in belt road and TG roadway are outside 3.6m to 4.2m in height – J Mackey	3S	2	9M	
92		Increasing the cut height to greater than 4.2m causing personal safety or business interruption	Additional gas and heat in the rear walkway Change in ventilation pathway through the longwall equipment profile	• Vent model • GRO-15-PHMP-Ventilation • ERZ Inspections • Pre and post drainage • Use of venturis if required • Brattice wings / sails • Option for Bulk air coolers from the 103 EPS • Heat Management TARP • Gas PHMP • General Body contaminants TARP	2H	3	8M	Review the effectiveness of the ventilation change from 103 to 104 due to the MG103 EPS – H Hearne	2H	3	8M	
93			Personnel ergonomics due to the increased cut height working in the rear walkway	• Manual handling SOP • Maintenance work orders • Operational procedures • Chock washdown hoses	3S	2	9M	Complete RCA on Hyena effect – M.Wakeford Review requirement of the dust gutters in rear walkway and remove if not required – B.Thomson	3S	2	9M	

								Review design of sprays in rear walkway to be in a more appropriate position – Flushing or dust suppression – B.Thomson				
94			Risk of slabbing/ face spalling	• GRO-5314-PRO-Equipment Hazard Zones • GRO-5372-STD – Longwall Operational Standards • Flippers • Remote operating standard	2S	3	8M	Investigate sprag extensions – B Thomson Review procedure to add relocating control equipment to the rear walkway prior to cutting at heights above 4.2m – J.Agustin	2S	3	8M	
95			Maintenance of all Longwall face equipment (e.g. FI checks, Shearer, AFC, Bretby, PRS, DACs, Phones, Interchock hoses) exposing a CMW to falling material	• GRO-5372-STD – Longwall Operational Standards • Flippers • GRO-5314-PRO-Equipment Hazard Zones	4S	3	18S	Ensure the maintenance strategy for cutting at heights above 4.2m reduces exposure to personnel (i.e. stables, flipper extensions, supported face) - J.Agustin Review GRO-5314-PRO-Equipment Hazard Zones in regards to cutting at heights above 4.2m – J.Agustin	3S	2	9M	
96			Design of electrical equipment suitable for greater cut height (e.g. cable length, voltage drop)	• Current overhaul for LW104 longwall equipment is designed to cut up to 5.0m	2M	3	8M					
97			Operational capacity of longwall conveyance system with increased cutting rates due to increased cutting height above 4.2m	• Current longwall design is for 4,500 t/h continuous and peak loading of 5,000 t/h	2M	3	8M	Review conveyor system capacity – M Shields Perform bottleneck analysis on coal clearance systems to ensure capacity for mining at greater heights – J Agustin (Investigate optimising the side shields to increase operating area for personnel in the rear walk way	2M	2	5L	
98		Failure or damage of Longwall components resulting in the business interruption -	Failure of Longwall components - Drums - Down drives - AFC Sprockets - AFC gear boxes - BSL Sprockets - Chains (Flight Bars) - Bolts - Deck Wear in the ramp area - Drive gear boxes - Interchock hoses - Cables	• Maintenance and Overhaul strategy developed from events experienced in mining LW101, 102, 103	3M	4	17S	Moranbah North style flushing shields to be used in LW104 (Change management to be completed) – B.Starr Review issues with Anti topple encountered in LW103 and remediation strategy for LW104 – B.Thomson Review issues with electrical crossover and impact on the Bretby and remediation strategy for LW104 – S.Wood	3M	3	13S	

			- Flipper cylinders - Crusher hammer - Promos and lock out - Solenoids / POCV					Review issues with AFC pan wear around articulation joints during LW103 and remediation strategy for LW104 – B.Starr Review longwall 104 monitoring strategy for deck wear – B.Thomson Review the Komatsu service agreement – M Britton Maintenance strategy for major components to align component failure cycle and physical locations adequate for the changeout of those components (e.g. planned down drive change out) – R Skinner				
99		Business interruption due to failure of stonedust application in TG for LW production	Stonedust pipeline blocks up	• Stonedusting STD • Secondary stonedust line running across the panline	2L &R	4	**12 M**	Communicate LW104 stonedusting strategy – J.Simmonds Provide schedule and location for services boreholes based on development intersection dates – R Goonawardene Ensure that 2 x bulk dusters are available for the longwall in the event the stonedust dropholes fail – J Lancaster	2L &R	4	**12 M**	
100		Supply of Components	Failure to meet time lines causing delays Lack of spares for Becker equipment Turn-around time for repairs POCVs and Solenoid availability	• Stock levels • Monthly contractor meetings with OEM • Defect liabilities in OEM contracts •	2M	3	**8M**	Review min max levels of spares (Becker, DACs, solonoids, POCVs, etc.) in stores to ensure they are sufficient – J Agustin Investigation for using local supplier for critical spares ongoing– I Bailey BCO to provide report when min/max stock levels for spares are altered – Procurement (W Peyper)	2M	3	**8M**	
101		Hydraulic integrity	Loss of hydraulic integrity Pump station reliability Replacement POCVs and solenoids not being fit for purpose	• Pump station overhauls scheduled to be complete for LW104 • Hydraulic integrity TARP • Actions as per the RCA from Brisbane •	2M	4	**12 M**					

102		Dewatering	LOM dewatering insufficient to manage water on the longwall face Water gathering at the low point in the (TG drive)	• LOM Dewatering strategy and risk assessment • Screamer pump available • Cross block dewatering hole • Seam profile is relatively level (MG to TG) from kick off to 26ct	2M	3	**8M**	Communicate the LOM dewatering strategy – N Gilbert Develop a strategy to dewater the longwall face – B Thompson Investigate sealed area water capacity – N Gilbert Review capability to install additional crossblock holes – N Gilbert	2M	2	**5L**	
103		Compressed air supply insufficient	Compressor failure	• Compressed air system audit completed • 4 x hire compressors installed	2M	3	**8M**	Review the LOM compressed air capacity requirements – N Gilbert	2M	3	**8M**	
104		Raw water supply insufficient Competing with MNM for water volume from Eungella Moranbah wash plant running out of water taking priority from Grosvenor Raw water quality being insufficient		• Flow metres • Raw water TARPs • New filter plant is on order (available for use Q3 2020) • Ability to preference water to the longwall • Ability to trucking water in	2M	3	**8M**	Investigate using arrow waste water to prop up raw water consumption– A Heap Review who is required in the Water Steering Committee for managing water across the Moranbah-Grosvenor complex to mitigate the shortage of water – K Bachmann	2M	3	**8M**	