

METROPOLITAN

Longwall 27 Outburst Events

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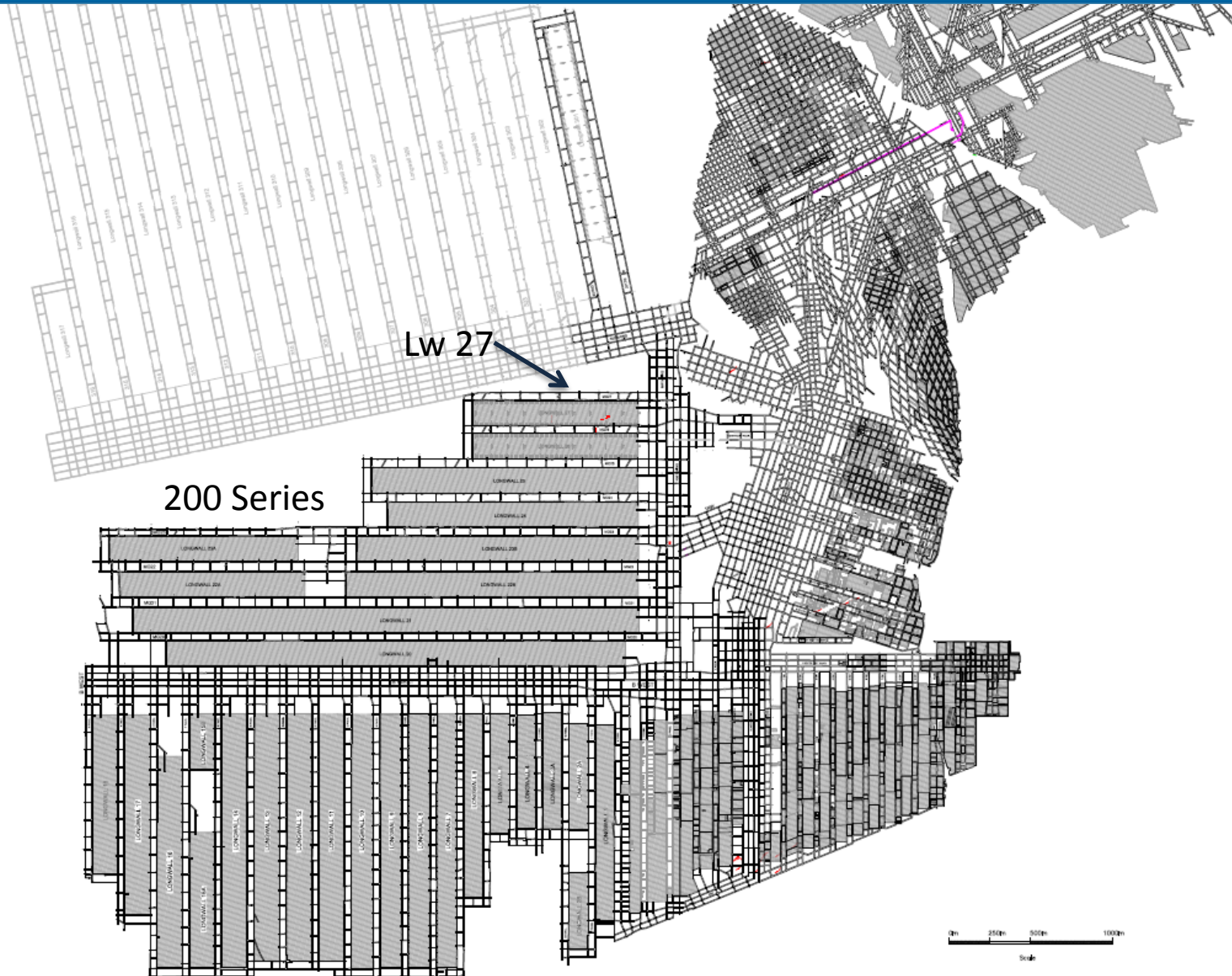
Agenda

- Metropolitan Lw history
- Location Plan
- Geological overview
- Gas Drainage overview
- 200 series Outburst events
- Summary of Lw 27 Outburst Events
- Lw 27 Remote mining techniques
- DMT peer review / study into German Lw outbursts
- Changes to Outburst Control Plan

- Commenced Longwall mining operations 1995
 - 26 Longwalls extracted since 1995
 - Extraction Width 158m
 - #89 shields
 - Lw mined through numerous geological structures with no known or recorded Lw outburst events prior to Lw 27
 - Joy Lw commissioned Lw 23 200 series
 - Average daily Lw tonnes 10,000
-
- Outburst Management Plan Prior to Lw 27 events
- “ The ORC will review the proposed longwall extraction area and issue a PTM for Longwall extraction or part there of”*

Metropolitan Location Plan

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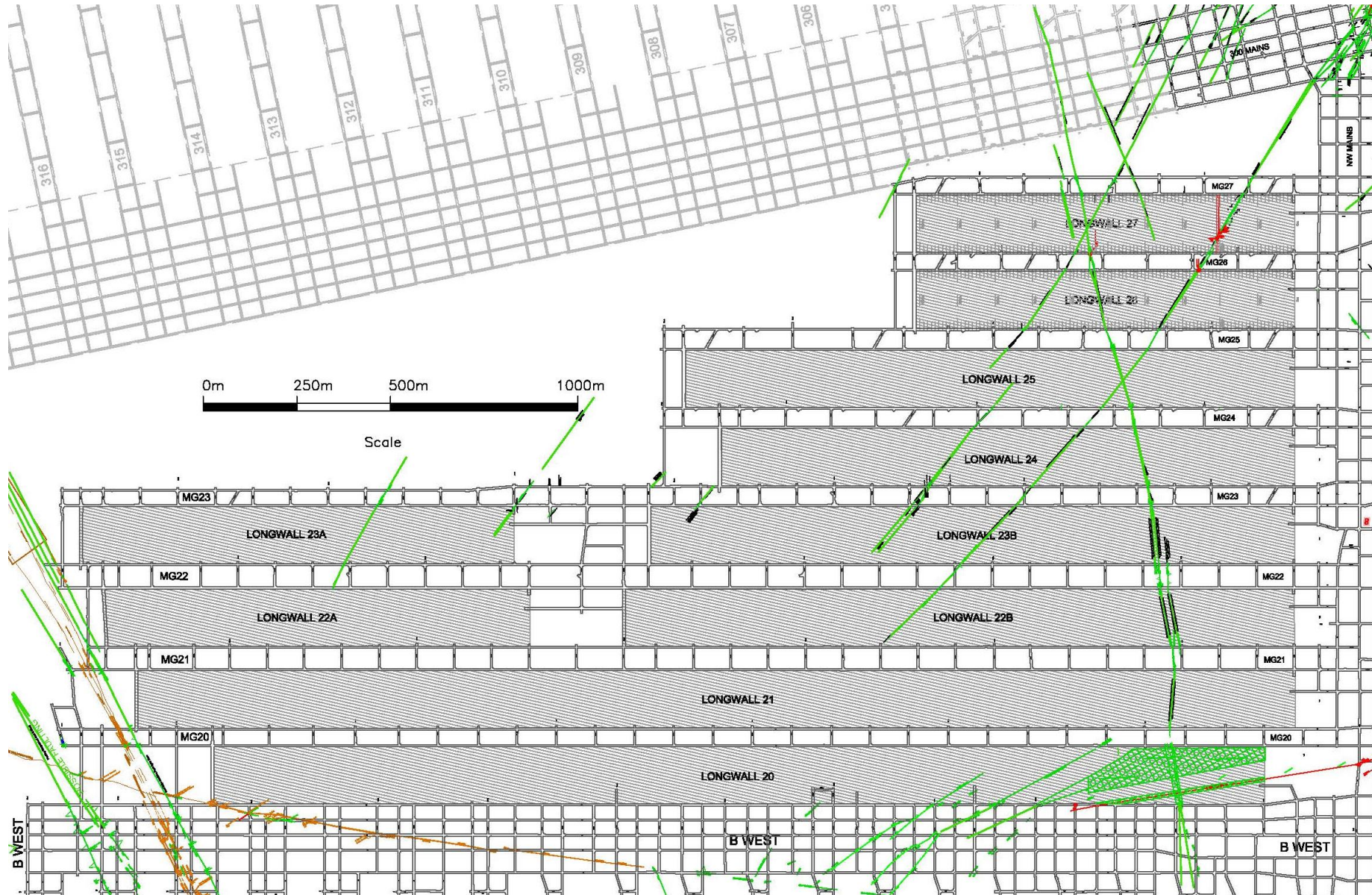


Metropolitan Geological Overview



- Bulli Seam
- Seam height 2.7-3.4m
- Variable topography
- Depth of cover 400m to 540m
- Major stress orientation 045-060° grid north, NE-SW
- Geological structures: dyke zones, strike-slip faults, normal faults and thrust faults
- Well developed persistent coal cleats

Metropolitan Geological Location Plan



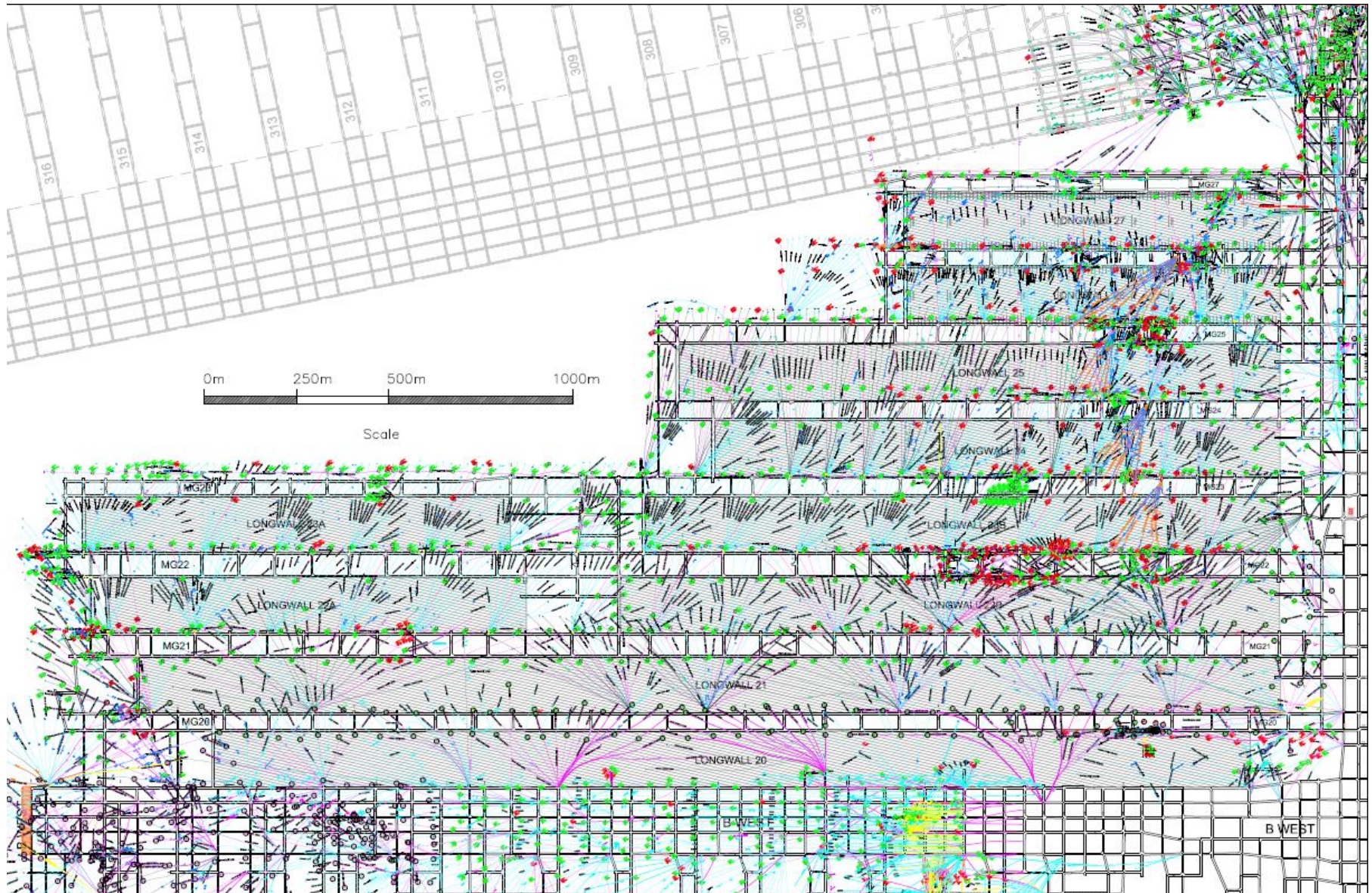
Metropolitan Gas Drainage Overview



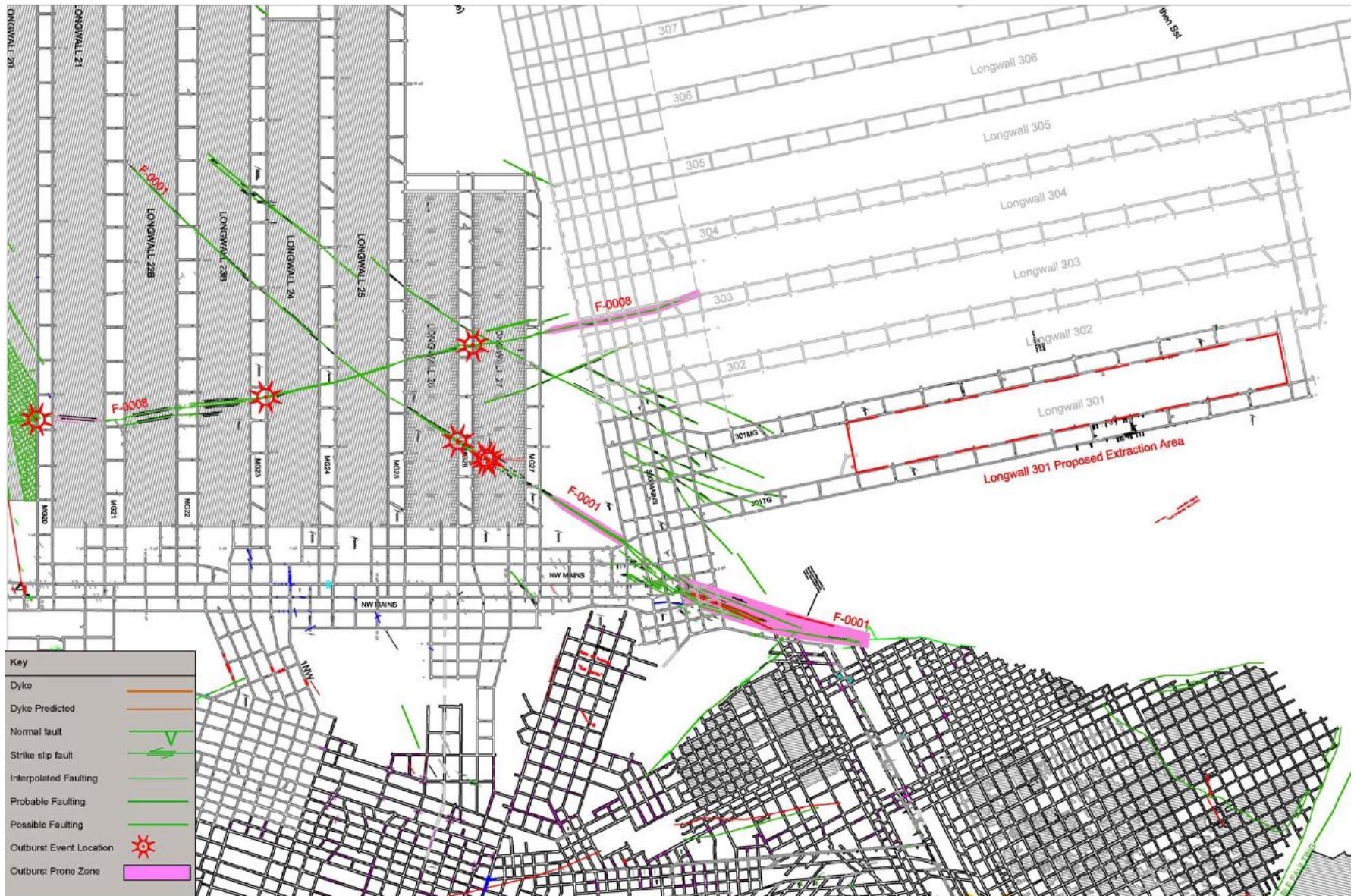
- 200 Series average virgin seam gas content 15m³t at 90-100% Co₂
- Drill Rigs
 - 1 x Lm90
 - 2 x Lm75
- Borehole spacing's 20m or less
- Yearly average drilling metres 60,000 – 80,000m
- Average drainage time to allow below outburst threshold development 5-6 months
- No Gas vacuum plant gas free vented into exhaust shaft

Metropolitan Gas Drainage Location Plan

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Metropolitan 200 Series Outburst Events



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Lw 27 Outburst Event #1



Lw 27 Outburst Event #1

Date: 23-12-2016

Time: 2:10 PM

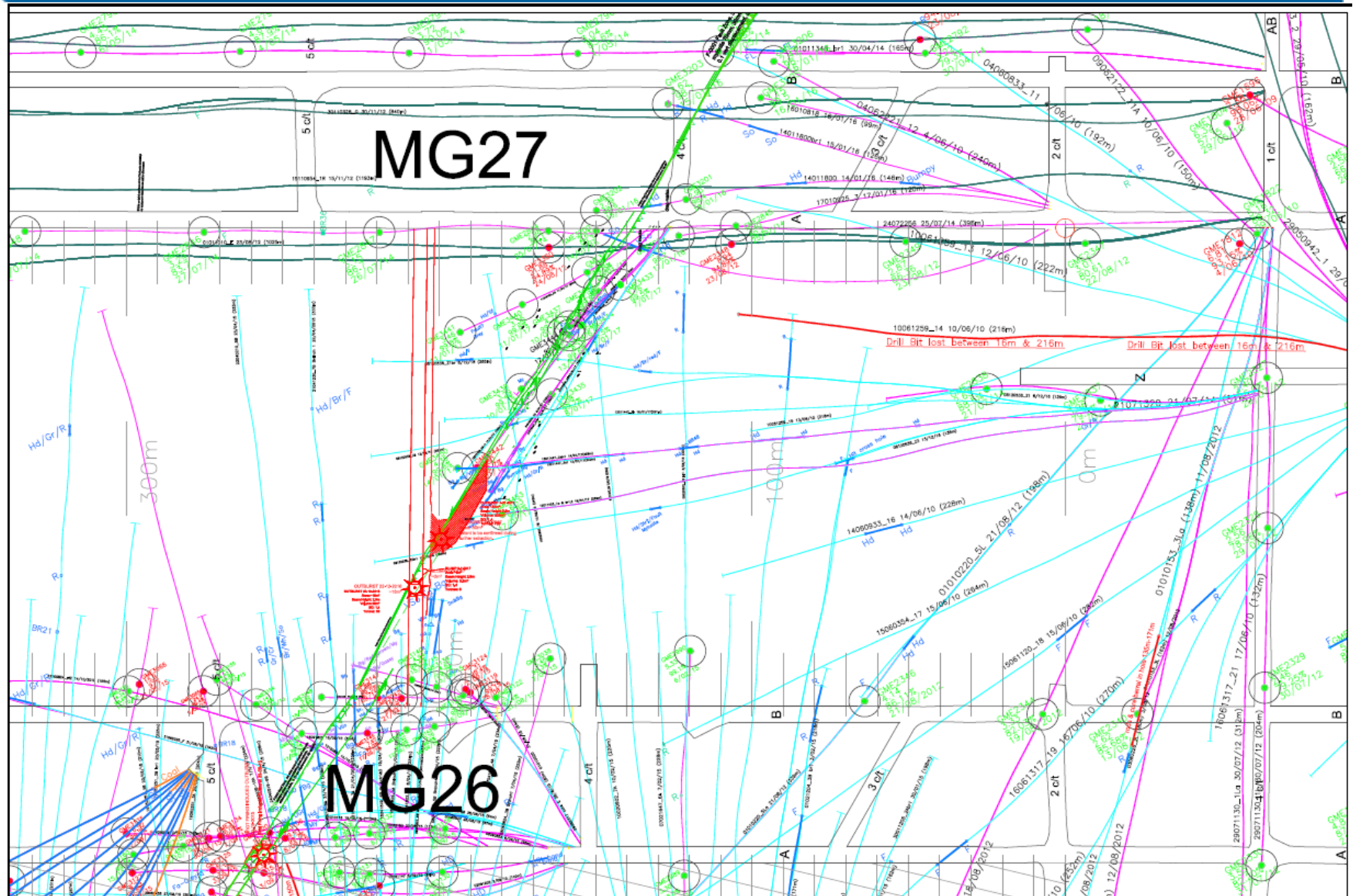
Description: No evidence of forced ejection of material with failed coal largely remaining within cavity AFC was operational. Low energy outburst event.

- MG Chainage: 208m
- TG Chainage: 210.2m
- Cavity Location: 68# and 69#
- F-0001 Fault location: 67/68#
- Volume of material: Estimated to be 65 Tonnes
- Volume of Gas released: 670m³ or 670,000 litres
- Estimated gas content of outburst coal: 10.3m³/t (by calculation)

Metropolitan Lw 27 Outburst Event #1



Metropolitan Lw 27 Outburst Events - Gas Drainage



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Lw 27 Outburst Event #1



- Prohibition notice issued to Metropolitan
- Risk Assessment undertaken
- SOP developed mainly focussing on position of operators
 - 20 shields on M/G side of shearer
 - Minimum manning on face
 - Operators to carry personal gas detectors
- 10 scheduled days before recommencing Lw production – Xmas Shutdown
- Prohibition notice removed

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Lw 27 Outburst Event #2



Lw 27 Outburst Event #2

Date: 3-01-2017

Time: 3:42 PM

Production: 5 shears from event #1

Description: No evidence of forced ejection, toppling failure, coal largely remaining within cavity

- MG Chainage: 203.8m
- TG Chainage: 205.8
- Cavity Location: 65#
- F-0001 Fault location: 63# and 64#
- Shearer TG drum position: 59/60#
- Shearer MG drum position: mid 51#
- Volume of material: Estimated to be 7-8 Tonnes (By calculation)
- Volume of Gas released: 532m³ or 532,000 litres

Metropolitan Lw 27 Outburst Event #2

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Lw 27 Outburst Event #2



- Production ceased
- Area inspected by ORC
- Regulator contacted and briefed
- Operations resumed under SOP

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Lw 27 Outburst Event #3



Lw 27 Outburst Event #3

Date: 4-01-2017

Time: 1:38 PM

Production: 3 shears form event #2

Description: Major outburst event

- MG Chainage: 201.5m
- TG Chainage: 203.5m
- Cavity Location: between 55# to 62#
- F-0001 Fault location: 61#
- Shearer TG drum position: 58#
- Shearer MG drum position: 49#
- Volume of material: Estimated to be 750 tonnes
- Volume of Gas: Tailgate 6,382m³ or 6,382,000 litres (sensor max out 15 mins)

Metropolitan Lw 27 Outburst Event #3 M/G

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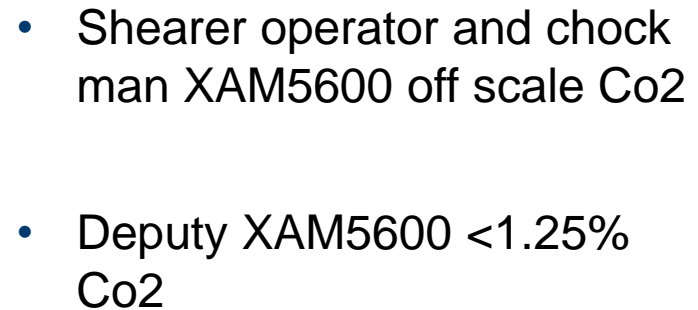


Metropolitan Lw 27 Outburst Event #3 T/G

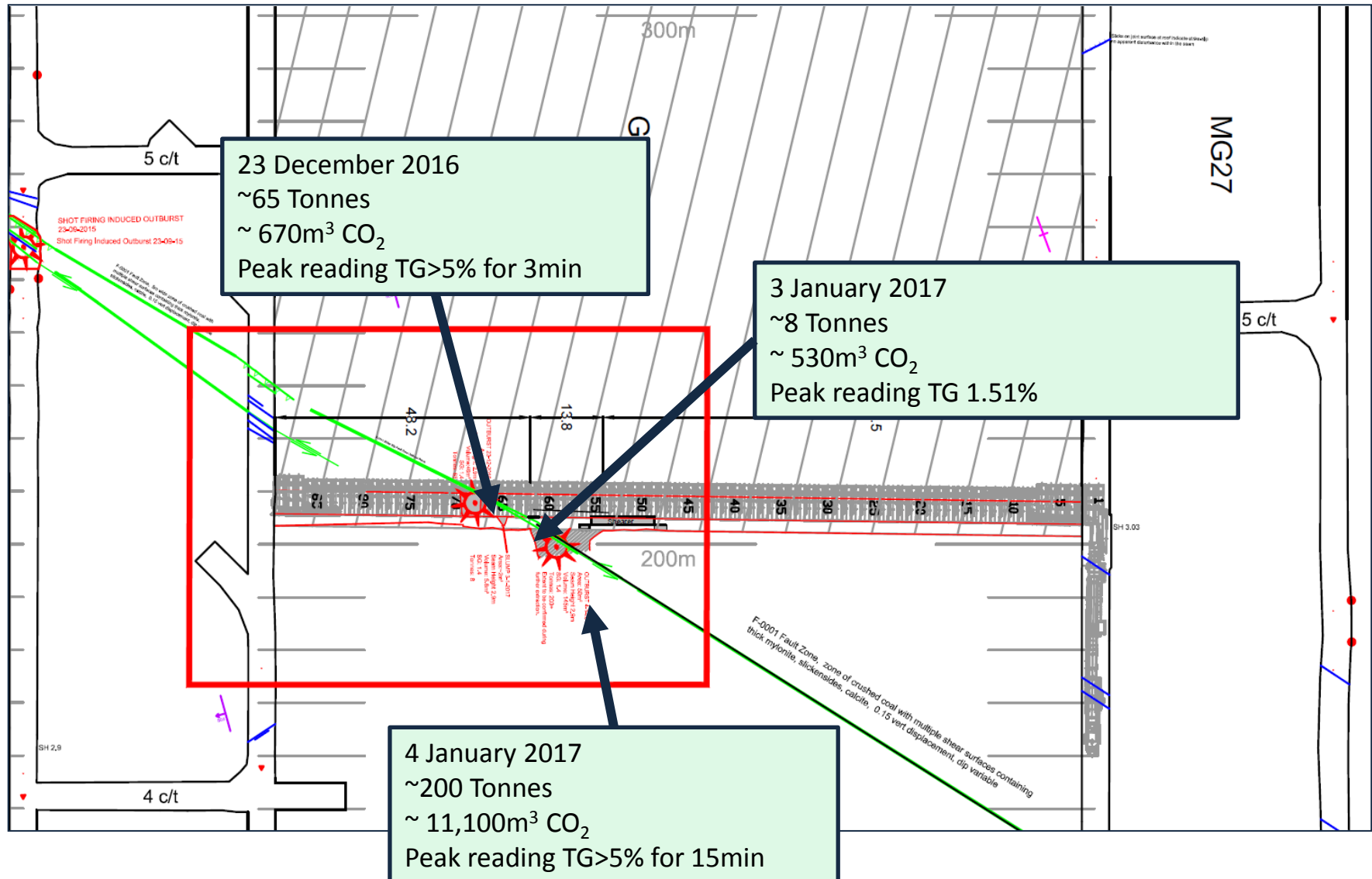
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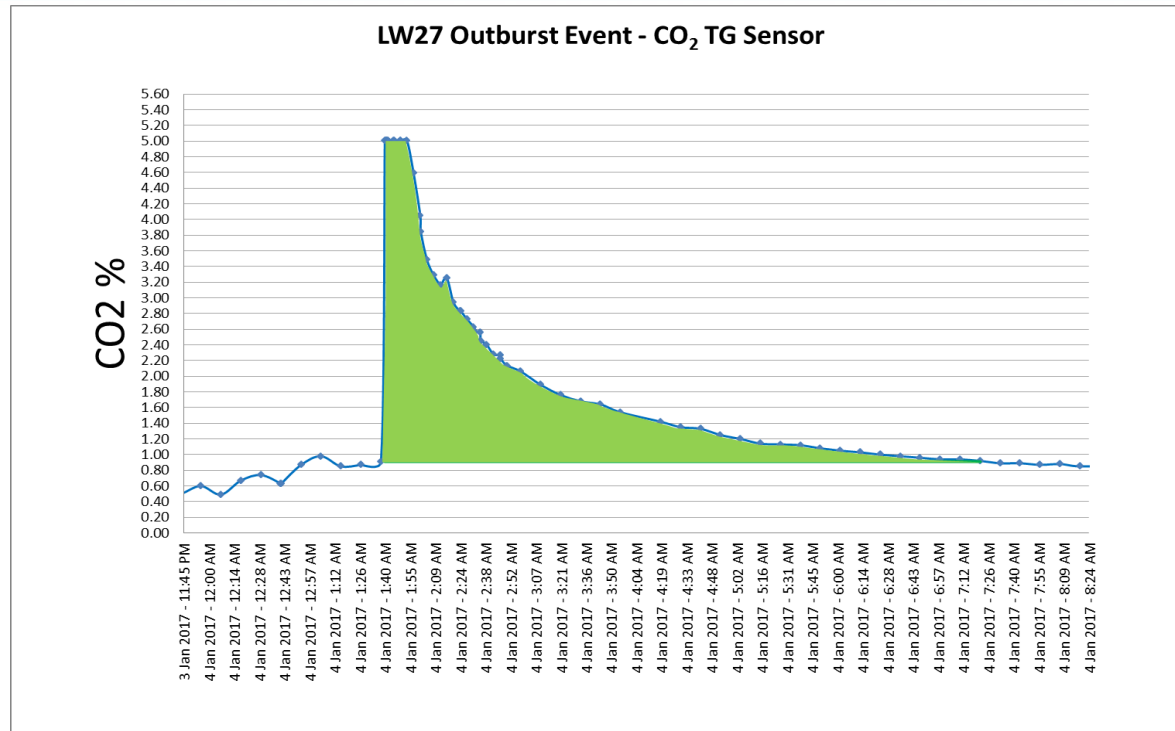


Metropolitan Lw 27 Outburst Events - Gas Data



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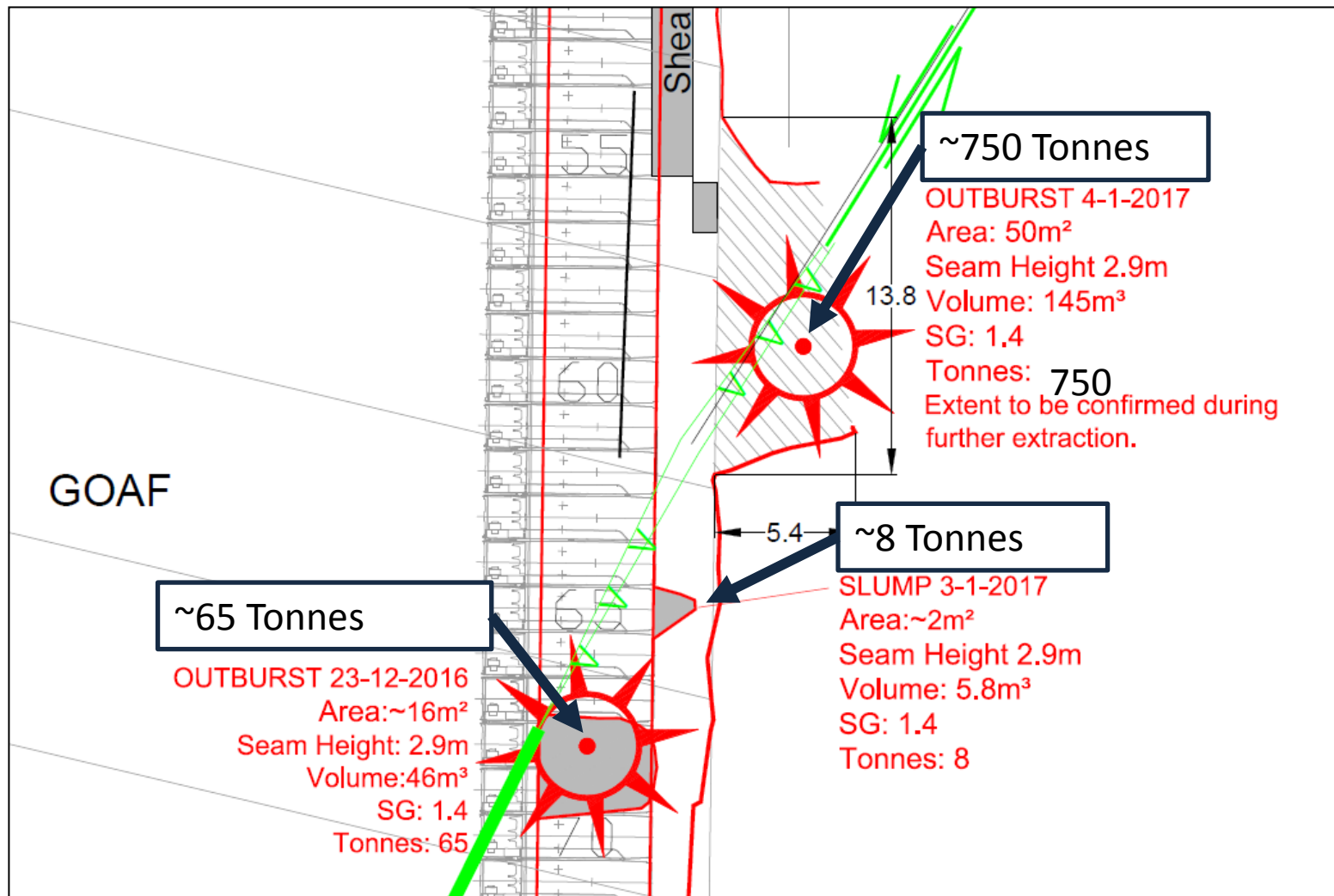
Lw 27 Outburst Event #3 - Gas Data



- LW27 Outburst Event - 4th January 2017 starting at 1:38am
- Total Duration above background 5.7hrs (343 minutes)
- Background CO₂ 0.9% (Pre & Post event)
- Peak Reading CO₂ 5% at 1:40am (15mins above sensor scale)
- Additional volume of gas measured at TG - approx 6,600 m³ CO₂

Metropolitan Lw 27 Outburst Events - Tonnages

Each event moved approximately the following coal tonnages:



Metropolitan North West Mains Fault



Main West Fault Zone

- Strike Slip
- ~ 4km strike length
- Fault orientation ~062° GN
- Seam displacement ~ 0.15m (vertical)
- Mylonite thickness 100-350mm
- Fault zone width 1.2m to 7m
- Overburden thickness 420m
- Major Horizontal Stress orientation 045-060° GN
- Elevated stress (development)
- Face Cleat 280° GN typically inclined 85 ° West



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Lw 27 Outburst Event #3

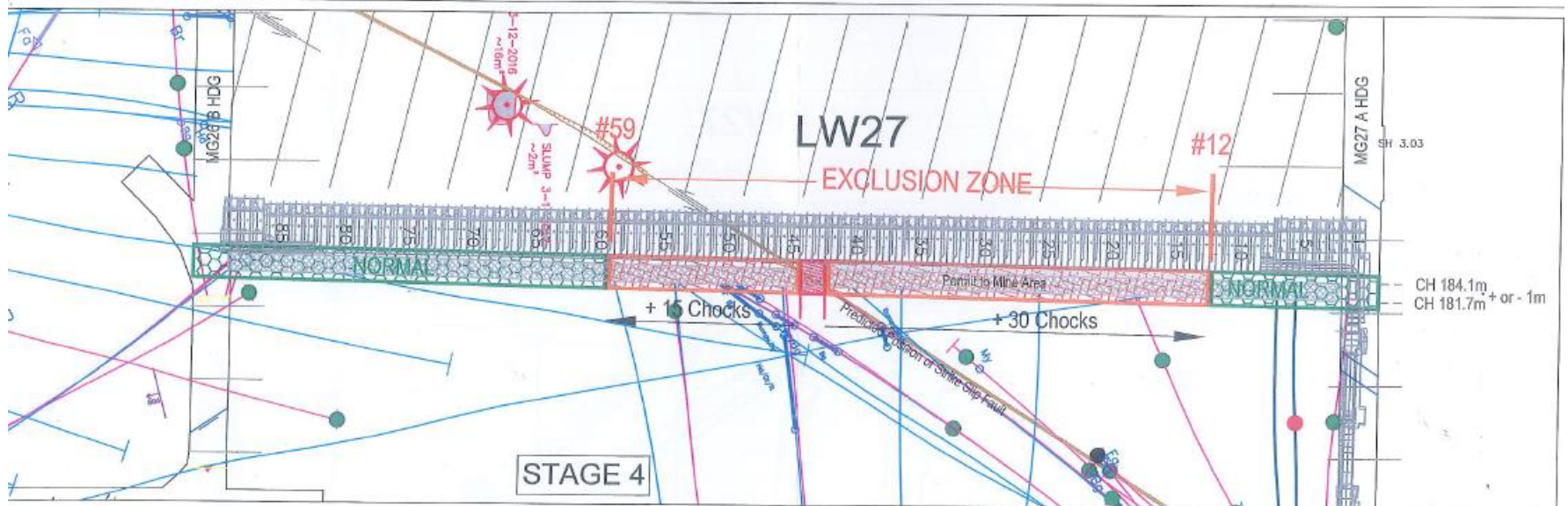
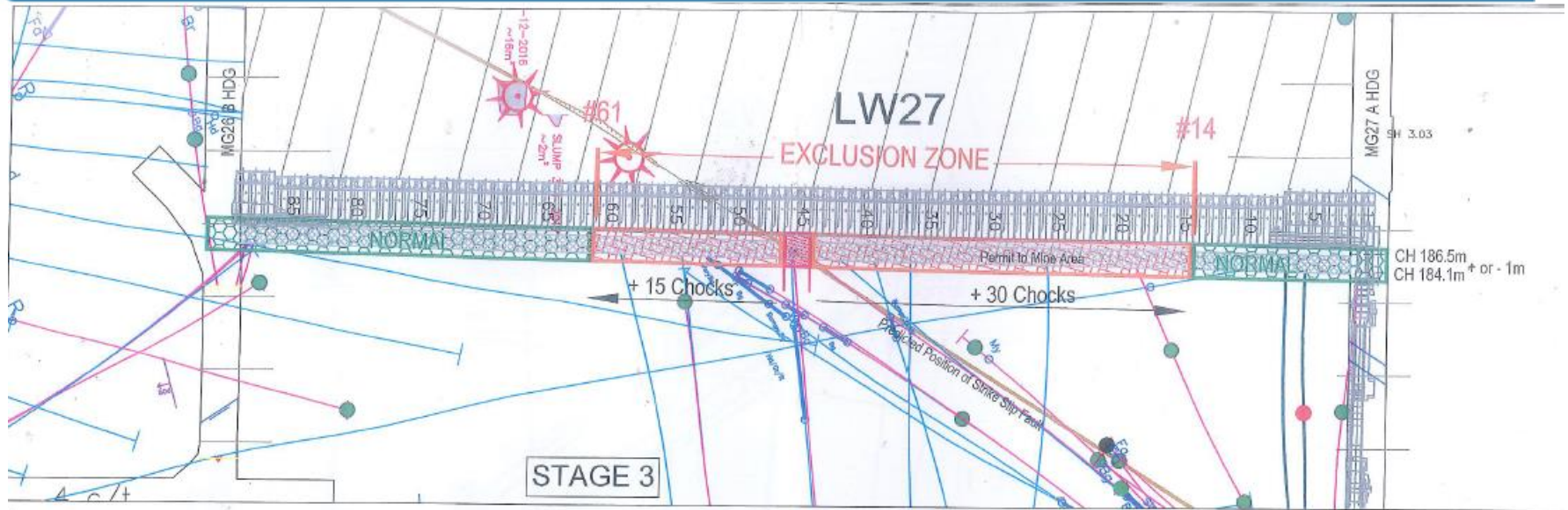


- Prohibition notice issued to Metropolitan

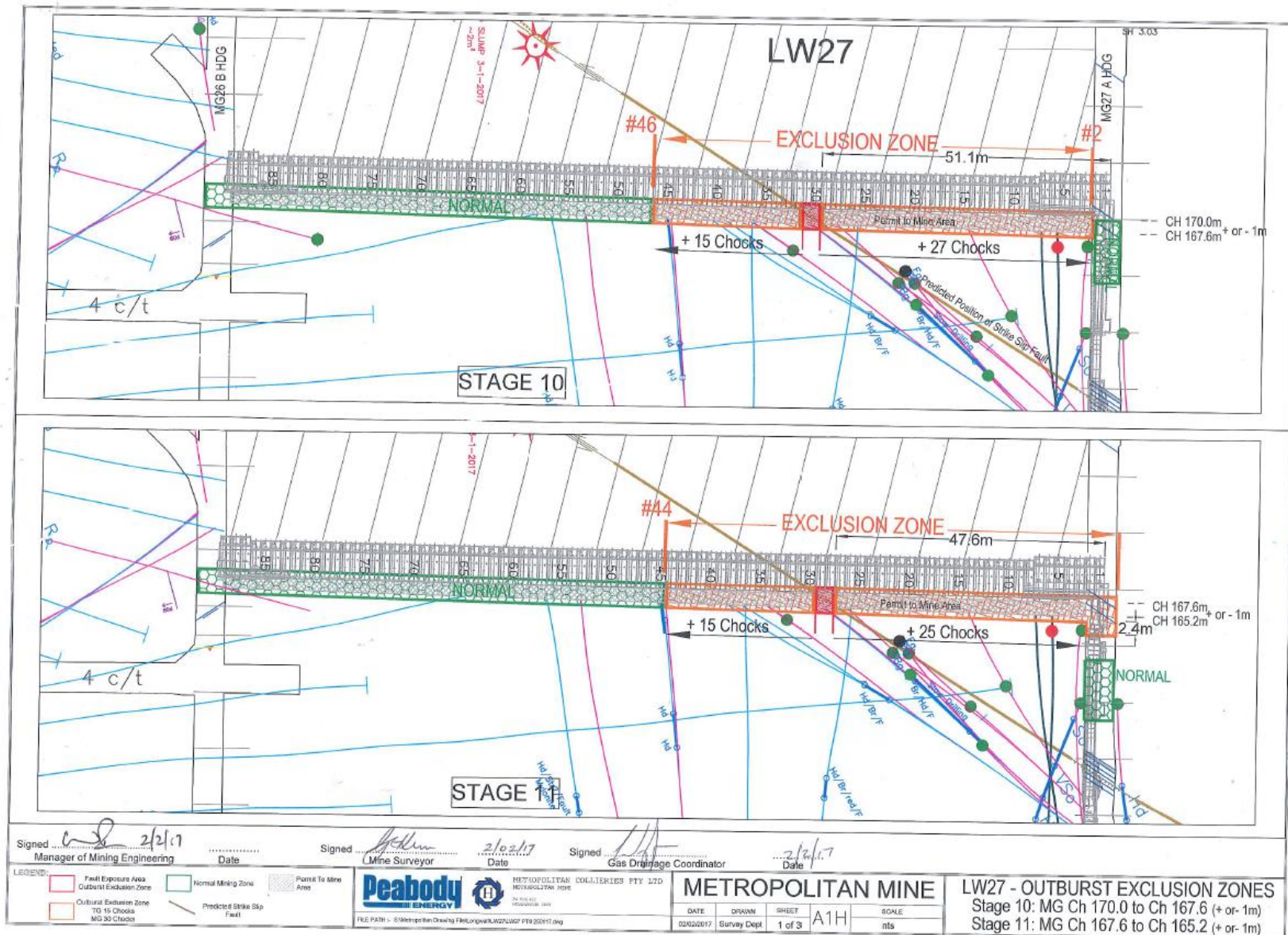
“no normal mining to occur on Lw 27 through outburst prone structure F-0001”

- Core sampling program undertaken either side of geotechnical structure F-0001
- Lw Remote mining techniques reviewed
 - 50m no go zone from M/G end of outburst prone structure
 - 20min wait time after structure has been disturbed

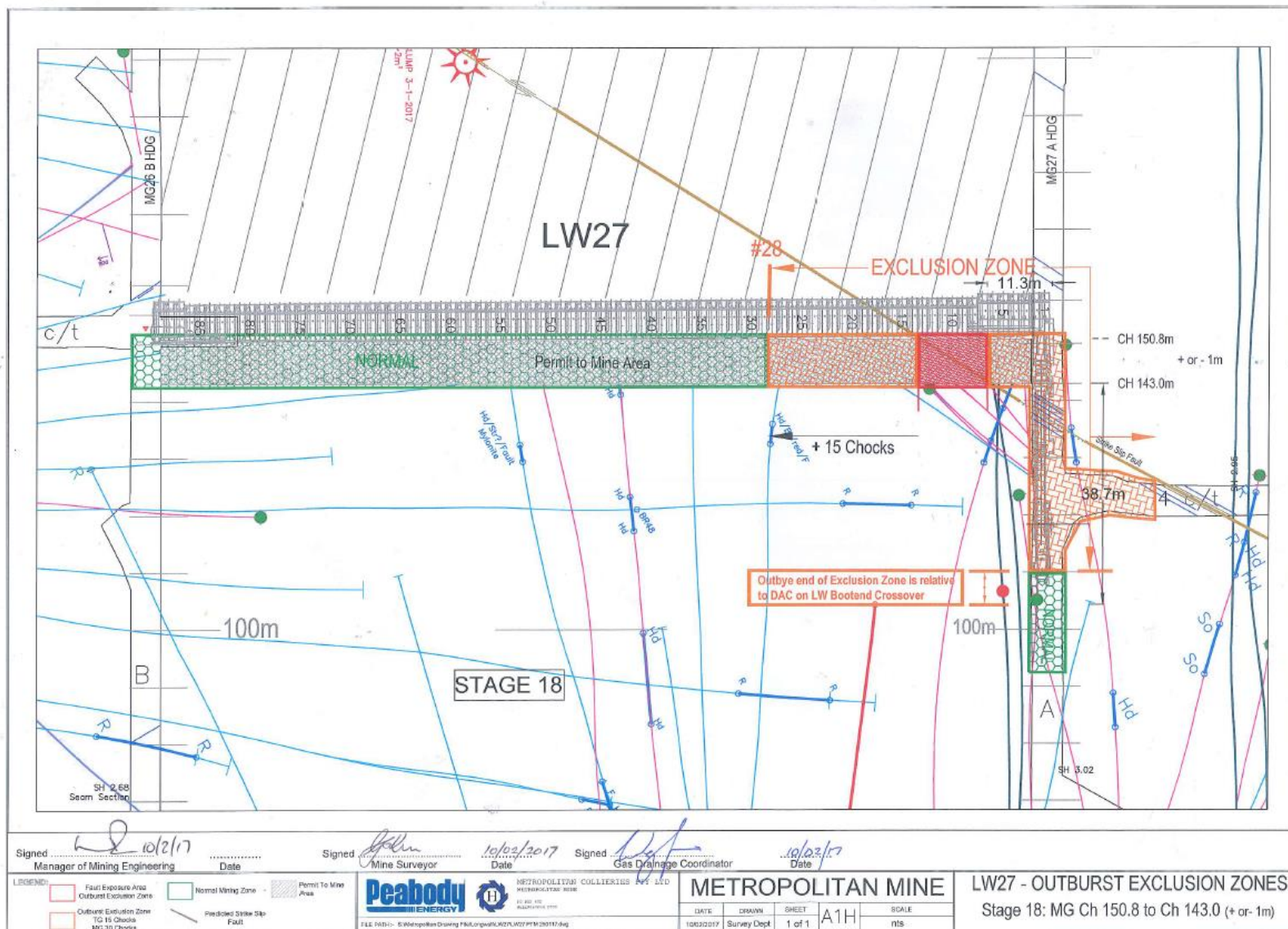
Metropolitan Lw Remote mining from CME



Metropolitan LW Remote mining from face DCB



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Lw 27 Remote Mining Control Measures



Key Control Measures:

- ORC to determine outburst mining control zone when LW is mining through outburst prone geological structures
- PTM to be issued in increments of 10m of retreat distance per permit.
- The Exclusion Zone and structure location is to be demarcated on the LW face using reflective markers
- Whilst LW is producing through outburst control zone, maximum manning levels on return side of CME is to be 3 persons.
- Once the shearer has passed to the tailgate side of the exclusion zone and any 'double-chocking' (if required) in the Exclusion Zone has been undertaken, a 20 minute wait time will commence. After this time has elapsed, normal production can continue on the Tailgate side of the Exclusion Zone

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Lw 27 Remote Mining Control Measures



Shearer Operations:

- Cycle time to be increased by reducing shearer speed on MG cut run from 10m/min to 5m/min. Flit speed to be maintained as per normal operations.
- As a minimum the exclusion zone will be set a minimum of 30 shields on the MG side and 15 shields on the TG side of the structure position (as determined by the ORC), relative to the projected structure position and retreat distance authorised in the PTM
- Each PTM will specify the shearer remote operating position to meet the requirements of the Exclusion Zone
- Shearer operator to carry gas monitor at all times whilst on return side of CME
- Should CO₂ levels reach 3.0% or greater on the TG Face CO₂ monitors, than shearer haulage is to be automatically stopped until gas levels decline under 3.0%.

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Lw 27 Remote Mining Control Measures



Shield Operations:

- The PTM will specify the 'Shield Operator' off siding the shearer operator remote operating position to meet the requirements of the exclusion zone
- Shield operator to carry gas monitor at all times whilst on return side of CME
- Shield advance to be operated on automation
- Turn on Landmark to allow automated face alignment
- If shield does not advance on automation, the shield is to be operated remotely using the new Roadway Remote Mimic. If double chocking is required through faulted area – these shields are to be operated remotely using the new Roadway Remote Mimic. An additional 20 minute wait time is to apply prior to proceeding to continue normal production on the inbye side of any double chocked shields in the structure zone

Metropolitan DMT Mining Outburst Peer Review



- Engaged DMT Mining Consultancy (Germany) to review other LW outburst events worldwide. DMT has over 700 full time specialists and has investigated outburst events in Europe and North & South America
- A number of outbursts have occurred in Germany on LW faces however these are at depths of up to 1500m. Gas contents of 12-22m³/t
- The long term experience with gas outbursts at the German coal fields 424 gas outburst since 1903 shows that the occurrence of coal and gas outbursts in longwalls involves following factors:
 - high gas content,
 - presence of tectonic structures with coal of reduced strength or mylonite,
 - an active impact on the coal and
 - high stress.

Determination of gas content for Longwall Extraction

- To determine a representative gas content for an extraction area of the Longwall block, the Longwall block will be assessed by the ORC in the following 2 categories:
- Proposed Longwall extraction area with no outburst prone geological structure
- Proposed Longwall extraction area with known outburst prone geological structure

Extraction Area with no known outburst prone geological structure

- This area will be assessed by the ORC, and shall not contain any outburst prone geological structures.
- Drainage in the proposed Longwall extraction area must have boreholes where the spacing is not greater than a nominal 30m.
- The ORC shall review borehole drainage performance considering virgin core samples and then core samples taken on development advance as well as borehole gas flow monitoring.
- Core samples that are taken on gate road development advance, these cores are taken on the extremities of the Longwall maingate and tailgate areas. Core results in these areas indicate drainage performance well before the Longwall is extracted through this area and shall be assessed by ORC. Core sampling in the centre of the Longwall extraction area should occur at interval not exceeding 60m in worst case position between drainage holes.
- The ORC shall review gas drainage performance and core samples and issue a PTM for the longwall under either normal mining or specific procedures for extraction.

Extraction Area with known outburst prone geological structure

- This area will be assessed by the ORC, and where it contains a outburst prone geological structures the following is required to allow mining through the structure:
- Gas drainage holes intersected through the geological structure should attempt to be no greater than a nominal 20m.
- Core samples are to be taken within 10m either side of the outburst prone geological structure in the worst case location of gas drainage boreholes.
- Where core samples are below outburst threshold levels, the ORC shall issue a PTM for normal mining through the outburst prone geological structure.
- Where core samples are above outburst threshold levels, the ORC shall issue a PTM for restricted mining carried out under the specific operating procedures.

Questions