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Mount Pleasant Rail Loop Stage 2

Mine Subsidence Assessment Report

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Mine Subsidence Assessment Report

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Executive Summary

This report documents a detailed geotechnical investigation of former underground mine workings in the vicinity of the Mt Pleasant Mine Stage 2 rail infrastructure. This report aims to advise Subsidence Advisory NSW of the findings of the geotechnical investigations and seek their endorsement of the findings.

The geotechnical investigations were planned and undertaken by qualified geotechnical engineering consultants, experienced in assessing the mine subsidence risk to infrastructure projects. The investigations were undertaken in two phases (herein termed Phase 1 and Phase 2) with the aim of assessing the extent of mine workings and the risk of mine subsidence in relation to the proposed rail works.

Subsidence Advisory NSW was consulted after the Phase 1 investigations were complete to inform the authority of the results of the earlier work and provide the scope and aims of the Phase 2 investigations.

The location and extent of the existing Overton Colliery workings were confirmed by the detailed geotechnical investigations and it was confirmed that the floor of the proposed rail cut falls at least 20m clear of the zone formed by a 35° angle of draw extended from the closest mapped workings. On this basis the risk of mine subsidence due to disturbance associated with subsidence of the Overton Colliery Workings is very low.

The voids encountered during the Phase 1 investigation were further investigated in Phase 2 and it has been determined that these voids are very unlikely to be present as a result of former mining and are more likely to be due to geological processes. Hence, mine subsidence risk from these features can be considered to be low.

The following recommendations are included to ensure the geotechnical stability of the Mt Pleasant Stage 2 rail infrastructure:

- face mapping by an experienced geotechnical engineer or engineering geologist during construction
- excavation and geotechnical logging of test pits extending below the level of the floor of the cutting during bulk earthworks
- where the ground conditions encountered are materially different to anticipated, notification and additional consultation with Subsidence Advisory NSW.

1.0 Introduction

1.1 Background

The Mt Pleasant coal mine is located west of Muswellbrook, NSW and was purchased by MACH Energy in 2015 from Rio Tinto.

To export from the mine, the MACH Energy constructed the Stage 1 rail loop and train load out (TLO) to the south of the coal handling and preparation plant (CHPP). This Stage 1 rail loop and TLO is located on the southern side of Wybong Road, on land owned by the Bengalla Mining Company (BMC), in accordance with established agreements.

The land on which the Stage 1 rail loop is located must be handed back to Bengalla Mine no later than October 2022. Subsequently MACH Energy are pursuing the construction of the "Stage 2 – Train Load Out Infrastructure Project" rail loop and associated works as a replacement.

The "Stage 2 – Train Load Out Infrastructure Project" seeks to achieve this through the provision of a new rail loop, associated civil works, materials handling system (linking old to new) and the demolition of redundant infrastructure within the Bengalla Mining Lease. This Stage 2 infrastructure must be commissioned with sufficient time to allow the decommissioning of the Stage 1 works.

1.2 Proposed development

MACH Energy (MACH Energy Pty Ltd) submitted an application to modify the Mt Pleasant Mine Development Consent DA 92/97 to the NSW Department of Planning and Environment (DP&E) on 18 December 2017. The modification (MOD 4) was approved on 16 November 2018. In general, the scope of the Stage 2 project includes:

- mainline rail connection, signalling, spur line and balloon loop including associated infrastructure, bulk earthworks, drainage and civils, rail and track work
- relocation of an existing unsignalised level crossing
- rail bridge structures including elevated rail viaduct structure along floodplains and rail bridge over Wybong Rd (east)
- road bridge structure over the rail alignment along Overton Rd
- modification of onsite and offsite services including 66kV, 22kV and 11KV transmission lines, Telstra underground telecommunication cables, and water pipelines
- new Hunter River water intake and transfer system
- unsealed tracks to provide access to the new infrastructure
- modification and existing conveyors and construction of a new conveyor system to supply the TLO facility
- construction of a new TLO facility
- decommissioning and removal of the existing Stage 1 infrastructure.

An overview of the proposed MOD4 (Stage 2 rail loop infrastructure) is provided in Figure 1.

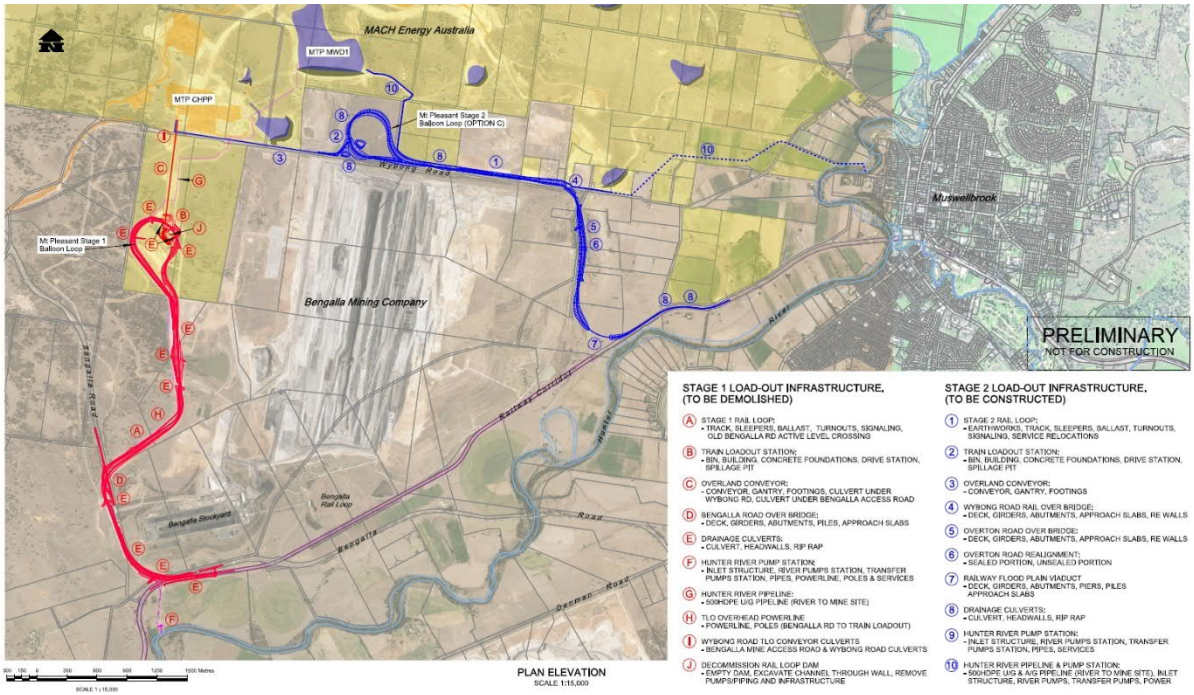


Figure 1 Site location and proposed infrastructure

1.3 Purpose of this report

The purpose of this subsidence assessment report is to assess the risk of mine subsidence to the proposed works.

The proposed rail viaduct and cutting falls partially within a declared Mine Subsidence District, shown in Figure 2. This area is referred to as 'Bengalla' on the Muswellbrook Mine Subsidence District Map (REF: PP5222) and is believed to be associated with historical underground mine workings (commonly referred to as the "Overton Workings").

New overhead power poles supporting 66kV and 11kV conductors are also located within the Bengalla Mine Subsidence District.

In addition, the preliminary geotechnical investigations for the project encountered voids that were not associated with the mapped Overton Colliery workings. These voids are located west of the mapped Overton Colliery workings and generally within the vicinity of the future rail alignment.



Figure 2 Extract from NSW Government's online ePlanning Spatial Viewer (date 25 June 2019)

As the new infrastructure will be sited partially within the Bengalla Mine subsidence district, approval from Subsidence Advisory NSW (SA NSW) under the *Mine Subsidence Compensation Act will* be required prior to commencement of construction.

In addition to this statutory approval, consultation with SA NSW is also required under the development consent (CoA 44A):

> *The Application must carry out a detailed geotechnical investigation of former underground mine workings in the vicinity of the MOD4 rail infrastructure. This investigation must:*
>
> *(a) Be undertaken by suitably qualified and experienced persons*
>
> *(b) Be undertaken in consultation with SA NSW*
>
> *(c) Determine the extent of underground workings*
>
> *(d) Provide recommendations to ensure the geotechnical stability of MOD 4 rail infrastructure;*
>
> *(e) Be conducted and reported to the satisfaction of the Secretary.*
>
> *A final report detailing the outcomes of the geotechnical investigation must be submitted to the Secretary. The Applicant must not commence MOD4 construction works in the vicinity of the former underground mine until the Geotechnical Investigation Report is approved by the Secretary.*

A status summary of the compliance with the above requirements is provided in Table 1.

Table 1 Compliance with DA 92/97 MOD4 requirements

Consent condition	Requirement	Comment
44A(a)	The investigation must be undertaken by suitably qualified and experience persons.	This investigation and reporting has been undertaken and prepared by Mr Tim Rannard and Mr Henk Buys of AECOM Australia Pty Ltd. Copies of their curricula vitae demonstrating their relevant qualifications and experience has been provided to SA NSW with this report.
44A(b)	The investigation must be undertaken in consultation with SA NSW.	Geotechnical investigations and preparation of this report were undertaken in consultation with SA NSW including meetings on 2 May 2019 and 6 February 2020.
44A(c)	The investigation must determine the extent of underground workings	Refer to section 4.0
44A(d)	The investigation must provide recommendations to ensure the geotechnical stability of MOD4 rail infrastructure	Refer to section 5.0 and 6.0
44A(e)	The investigation must be conducted and reported to the satisfaction of the Secretary	Following review, acceptance and endorsement of the geotechnical investigation by SA NSW, this report will be provided to DPIE for review.

2.0 Existing data

2.1 Desktop studies

A number of desktop studies have been undertaken on the Overton Colliery Workings. These reports are listed in Table 2 and copies are attached in Appendix A.

Table 2 Schedule of desktop studies

Title	Date	Comments
Mt Pleasant Mod 4 Consent Requirements – Overton Colliery Workings Investigations	2 March 2019	Georeferencing of mine plans and discussion of potential mine subsidence risks
Formal Mine Survey Plans Project – 2A-(6) Archival Research	21 January 2013	Undertaken for Bengalla Mine by Christopher Nixon (BOSSI Candidate No. 8722)
Bengalla Mining Company Pty Ltd – European Heritage Management Plan	13 February 2008	Undertaken for Bengalla Mine

The above reports focus exclusively on the former Overton Colliery and do not address the unexpected voids (which had not been identified at that time).

Important outcomes from the desktop studies are summarised below:

- The owners of Overton Colliery had opened their own mine on the estate close to the homestead to provide coal for the Overton Butter Factory in the later stages of the 1870's.
- The development of the Muswellbrook to Merriwa Railway between 1912 and 1915 facilitated the development of a small coal mine. In 1921 the Overton Colliery Company Ltd was registered and the mine opened in 1922.
- It is unclear if the 1922 mine workings are in the same location of the earlier (1870's) mining.
- RT580 shows three seams, with workings mapped in the second and third seam. It was inferred that the second seam equates to the Ram Rod 2 ply and the third seam equates to the Ram Rod 3 Ply (see section 2.2 below).
- The Overton Colliery was classed as abandoned on 14th May 1925. The last date of workings on RT580 is 2nd February 1925, indicating a worst-case scenario of up to three months of unrecorded mining.
- The location of the mapped Overton Colliery workings has been constrained to an accuracy of ±7m.

2.2 Regional geology

Reference to the Hunter Coalfield Regional Geology 1:100,000 Series Sheet indicates that the Overton Colliery worked seams in the lower section of the Vane Sub-Group that outcrop on the escarpment above the Hunter River Floodplain and dip gently to the west north west.

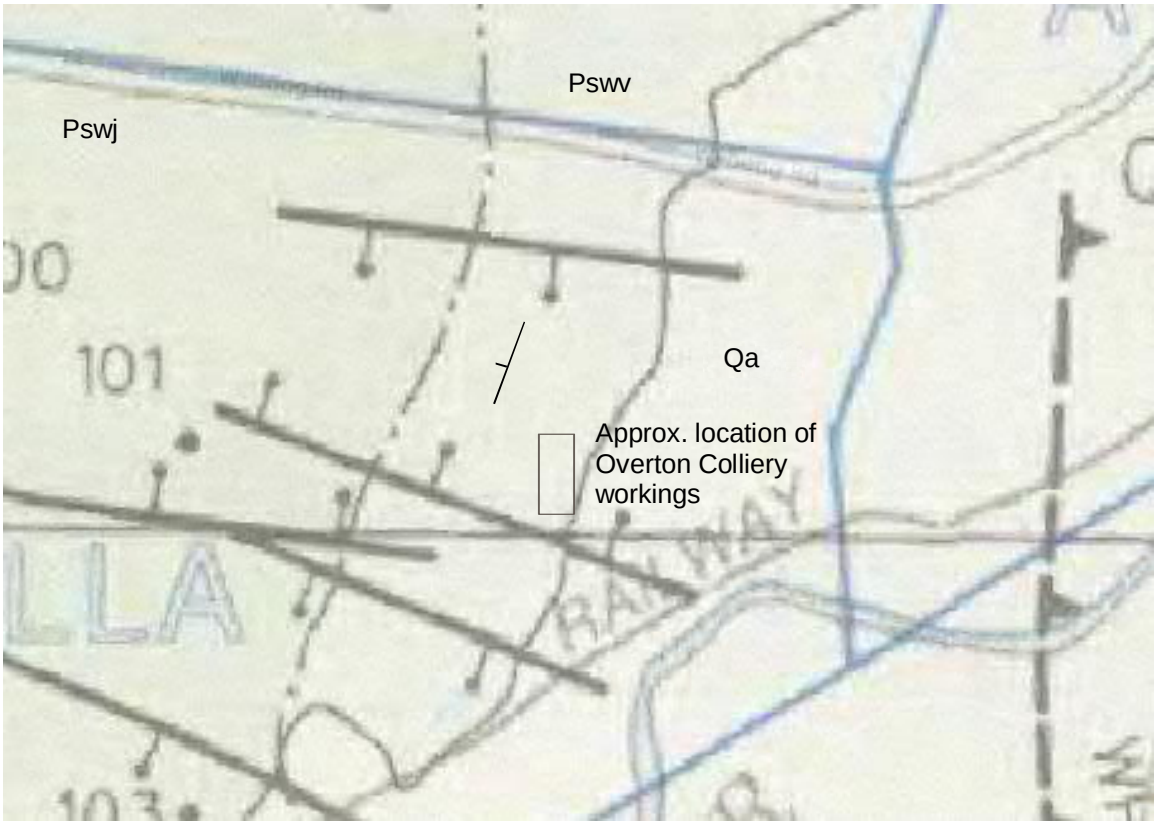


Figure 3 Extract from Hunter Coalfield Regional Geology 1:100,000 Series Sheet. Pswj = Jerrys Plain Sub-Group; Pswv = Vane Sub-Group; Qa = Quaternary Alluvium (Hunter River Floodplain)

Coal members in the Vane Sub-Group include (in stratigraphic order):

- Wynn Coal Member
- Edderton Coal Member
- Clanicard Coal Member
- Bengalla Coal Member
- Edinglassie Coal Member
- Ram Rod Creek Coal Member.

The Saltwater Creek Formation underlies the Ram Rod Creek Coal Member.

Reference to the Muswellbrook 1:25,000 Geological Series Sheet (Figure 4) indicates high level alluvium is mapped approximately 3 kilometres south of the site and forms a terrace well above the existing flood plain. This high-level alluvium is mapped as Tertiary in age and has been heavily weathered and partially cemented with silcrete.

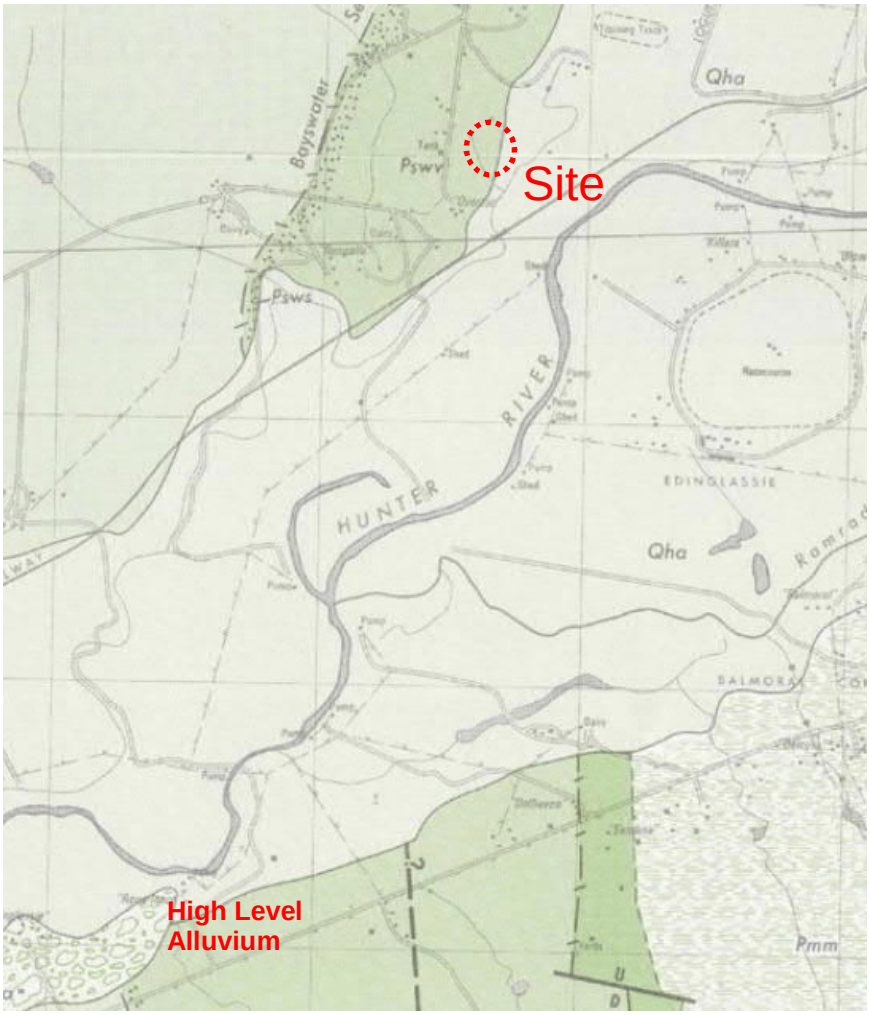


Figure 4 Extract from 1:25,000 Muswellbrook Geological Series Sheet

3.0 Current investigations

3.1 Investigation methodology

Geotechnical investigations within the Bengalla Mine Subsidence District were undertaken in a two-phase process outlined below:

Phase 1:

Preliminary investigations were carried out by WSP in April 2019. The aim was to investigate and confirm the location of the Overton Colliery workings by drilling bores BHCW01 to BHCW06 inclusive. These bores were located within the mapped footprint of the workings. Bores BHRL03, BHRL18, and BHRL17 were also drilled nearby for the alignment of a proposed cutting to the south west of the Overton Colliery workings.

These investigations confirmed the location of the Overton workings but also identified voids along the proposed railway cutting alignment. A second stage of investigations was therefore initiated.

Phase 2:

The Phase 2 investigations (Bores BHCW07 to BHCW12 inclusive) were carried out by Douglas Partners, under the direction of AECOM, in June 2019. This investigation had two aims:

- To further investigate voids encountered in the earlier bores: Bores BHCW07, BHCW09, and BHCW11 were drilled adjacent to bores BHRL17, BHRL18, and BHRL03.
- To test for further voids: Bores BHCW08, BHCW10, and BHCW12 were drilled in the footprint of the proposed cutting and extended 10m below cutting invert level.

The Phase 1 and Phase 2 geotechnical investigations undertaken by WSP and Douglas Partners (on behalf of AECOM) are listed in Table 3.

Bore logs and core photographs from Phase 2 Geotechnical Investigations (undertaken by Douglas Partners) are presented in Appendix B, together with notes defining the terms and acronyms used in the logs.

A plan showing the locations of the above investigations together with the inferred location of the Overton Colliery workings is provided in Appendix C.

The bores were drilled using a combination of non-coring (generally wash boring) and coring methods. Drilling conditions were poor, and this is reflected in the poor core recovery.

Phase 1 Geotechnical Investigations (undertaken by WSP) are presented in Appendix D.

3.2 Logging of the conglomerate/gravel

The bore logs produced by WSP in Phase 1 described the weakly cemented gravel as alluvium. In Phase 2 Douglas Partners were instructed to describe the material as an extremely weathered rock and the logs generally describe the material as conglomerate, although sandstone and fine-grained material was also noted on the logs.

It is now considered that while the weakly cemented gravel does exhibit extremely low strength rock properties, it is most likely alluvium. As such, the Douglas Partners logs should be read in that context, with material logged as conglomerate and sandstone referring to weakly cemented alluvium, so to be consistent with the descriptions of high level alluvium mapped in the 1:25,000 Geological Series Sheet.

Table 3 Investigation summary

ID	Easting	Northing	Collar RL	Depth	Location	By	Downhole Investigations	Comments
BHCW01	297725.683	6427413.423	162.728	47.0m	Cutting	WSP	None	Encountered Unexpected Void 8.3m to 9.9m depth
BHCW02	297746.683	6427384.723	163.010	46.4m	Overton	WSP	None	No Voids encountered
BHCW03	297771.354	6427473.141	148.299	27.18m	Overton	WSP	None	Workings between 24.7m to 27.1m depth
BHCW04	297762.951	6427476.805	149.004	28.5m	Overton	WSP	None	Workings between 26.2m to 28.5m depth
BHCW05	297767.020	6427475.059	148.649	16.7m	Overton	WSP	None	No Workings encountered, third seam not penetrated due to equipment failure
BHCW06	297774.262	6427471.126	147.997	26.3m	Overton	WSP/DP	Camera, Televiewer and laser (by DP in WSP bore)	Two Workings between 13.2m to 15.5m and 25.5m to 26.3m
BHRL03	297695.967	6427265.417	168.885	18.0m	Cutting	WSP	None	Encountered Unexpected Void 13.2m to 14.0m depth (0.8m)
BHRL16	297644.907	6427542.756	165.781	18.1m	Cutting	WSP	None	No Void encountered
BHRL17	297642.194	6427404.119	169.938	45.9m	Cutting	WSP	None	Encountered Unexpected Void 14.5m to 16.0m depth (1.5m)
BHRL18	297662.792	6427324.283	171.271	28.0m	Cutting	WSP	None	Encountered Unexpected Void 26.3m to 27.0m depth (0.7m)
BHRL18A	Not Surveyed. 1.5m SW from BHRL18			50.6m	Cutting	WSP	None	No Void encountered
TPRL25	297666.863	6427322.551	171.345	4.0m	Cutting	WSP	None	Shallow test pits
TPRL24	297644.856	6427494.432	166.509	4.0m	Cutting	WSP	None	
TPRL09	297649.775	6427596.345	164.850	3.0m	Cutting	WSP	None	
TPRL08	297793.918	6427174.546	140.334	3.7m	Cutting	WSP	None	
BHCW07	297641.9	6427403.1	169.9	21.79m	Cutting adj BHRL17	DP	Camera and Televiewer	Encountered a Void 14.92m to 15.85m (0.93m)
BHCW08	297659.9	642736 8.9	170.6	20.0m	Cutting	DP	Camera and Televiewer	No Void encountered

ID	Easting	Northing	Collar RL	Depth	Location	By	Downhole Investigations	Comments
BHCW09	297661.9	6427322.9	171.2	28.5m	Cutting adj BHRL17	DP	Camera and Televiewer	Encountered a Void 19.3m to 20.0m (0.7m)
BHCW10	297693.1	6427305.1	170.8	21.0m	Cutting	DP	Camera and Televiewer	No Void encountered
BHCW11	297696.1	6427263.9	168.7	17.0m	Cutting adj BHRL17	DP	Camera and Televiewer	Did not encounter the void found in adjacent bore BHRL03
BHCW12	297726.9	6427252.2	169.9	17.5m	Cutting	DP	Camera and Televiewer	No Void encountered

4.0 Overton Colliery workings risk assessment

4.1 Discussion and interpretation

4.1.1 Results

Overton Colliery workings were encountered at four locations in three bores as noted in Table 3. A summary typical stratigraphic sequence derived from the borehole information is presented in Figure 5. The roof conditions encountered above the workings are summarised in Table 4.

Table 4 Summary of roof conditions above Overton Colliery Workings

	BHCW03	BHCW04	BHCW06
Second seam	3.4m medium strength sandstone bed & 0.5m low strength siltstone bed.	4.2m medium strength sandstone bed & 0.5m low strength siltstone bed.	1.7m low to medium strength Sandstone bed
Third seam	3.2m medium to high strength siltstone bed	1.9m medium to high strength siltstone bed	1.3m low to medium strength siltstone bed

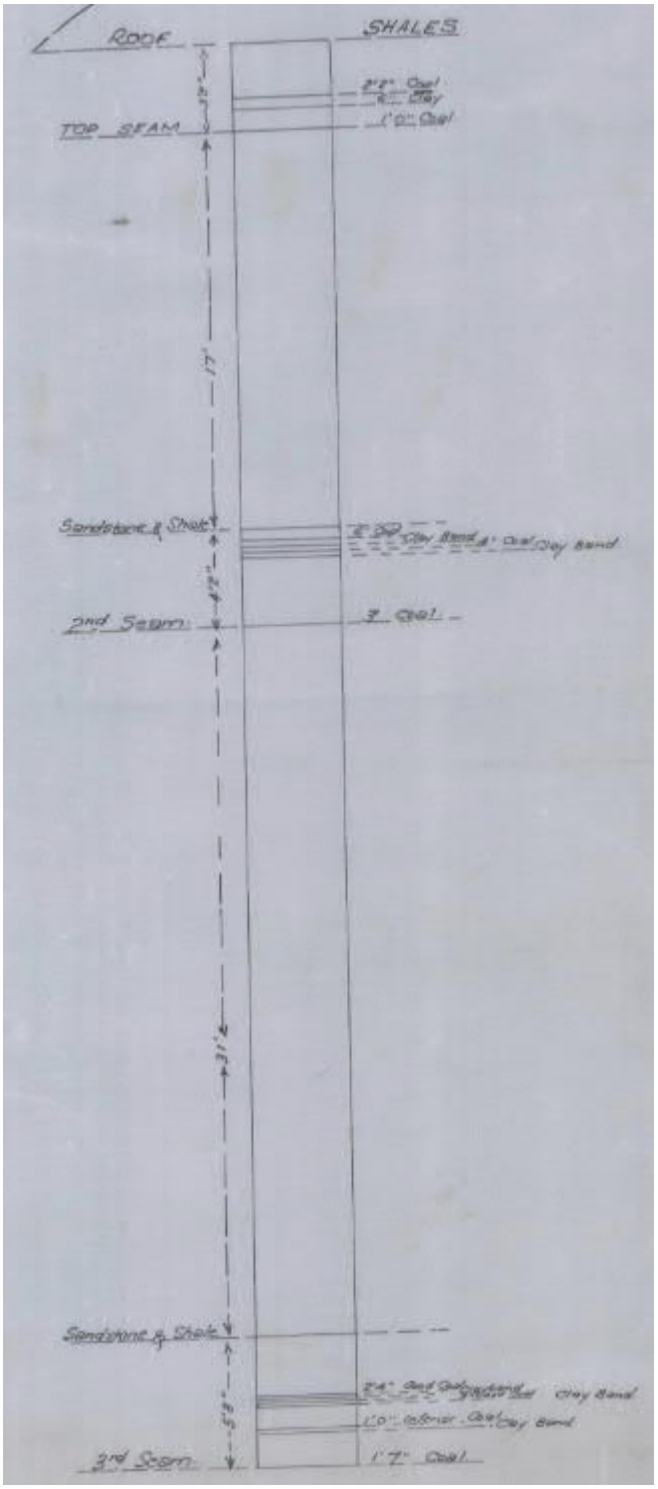


Figure 5 Stratigraphic sequence for Overton Colliery

CCTV imaging of the upper workings (second seam) in BHCW06 showed that the workings are mostly rubble filled with an open void between 13.0m and 13.7m depth. The floor of the workings in the second seam appear to be at 15.6m depth, indicating 1.9m of rubble. A laser survey of the open void in the second seam indicated a roadway approximately 3m wide with uneven walls (suspected to be rubble) and an extent of 10m.

CCTV imaging of the lower workings (third seam) in BHCW06 showed the top of workings/rubble interface at 24.8m depth, with the camera unable to proceed due to rubble.

The optical televiewer identified no defects in the interval above the upper workings. The acoustic televiewer identified a pattern of increased frequency of near horizontal defects as the top of the lower workings were approached.

4.1.2 Geotechnical model

Based on the results of the investigations, the roof of the workings comprise low to medium strength sandstone in the second seam, and generally medium to high strength siltstone in the third seam. Third seam workings were only identified at bore BHCW06, and at this location the siltstone roof was characterised as low to medium strength. Rubble was generally encountered immediately below the voids, and there is an increase in defects immediately above the roof.

It can be inferred from the above that the workings have deteriorated over time, leading to caving or collapse of the roof in places together with delamination of the sandstone and siltstone in the remaining roof. This could have been a progressive phenomenon. Based on the recorded presence of low to medium strength sandstone/siltstone in the roof at all the intercepted workings, it can be inferred that the roof may by now have stabilised.

Based on the above interpretation it is inferred that the workings are filled with rubble, with open voids limited in height and extent.

4.1.3 Location

Based on the laser measurement of the second seam void in BHCW06, the mine abandonment plans appear to be in error by about 3m to the west. This is within the 7m margin of error estimated by the Bengalla Mine surveyor.

Moving the mine plans 3m east results in a good correlation between bores where voids were encountered and the mine plans.

Based on the intersections of the mine workings and the unmined coal seams, the dip and dip direction of the second and third seam are 6° towards 260. This is consistent with the dip of seams in Bengalla Mine.

In view of the above, it can be reasonably assumed that the Phase 1 investigations have intercepted the Overton Colliery workings and that these are located approximately 3m east of the location shown on the mine plan.

4.2 Subsidence risk assessment

4.2.1 Angle of draw

An angle of draw (AoD) of 35 degrees or 0.7 × depth of cover was suggested in the desktop study.

The following is an extract from: Subsidence from Coal Mining Activities, Background Review, Commonwealth of Australia 2014:

> *"The AoD varies with geology and depth of cover and typically ranges from a few degrees, such as the case of a near-vertical step at the panel edge, up to 60 degrees. Most commonly, AoD is in the range of 10 to 35 degrees (MSEC 2007); Ren and Li (2008) report a range of values for AoD varying between 19 and 50 degrees based on limited data from the Newcastle coalfield. A rule of thumb used in NSW is to adopt an AoD of 26.5, if no better information is available (MSEC 2007). This angle describes a subsidence trough extending a distance equivalent to half the mining depth beyond the edge of mining and is close to average in the Sydney Basin.*

An extract from the bore location plan showing the location of the sections drawn through the closest workings is provided in Figure 6. These sections are plotted Figure 7 and show angles of draw of 26.5° and 35°.

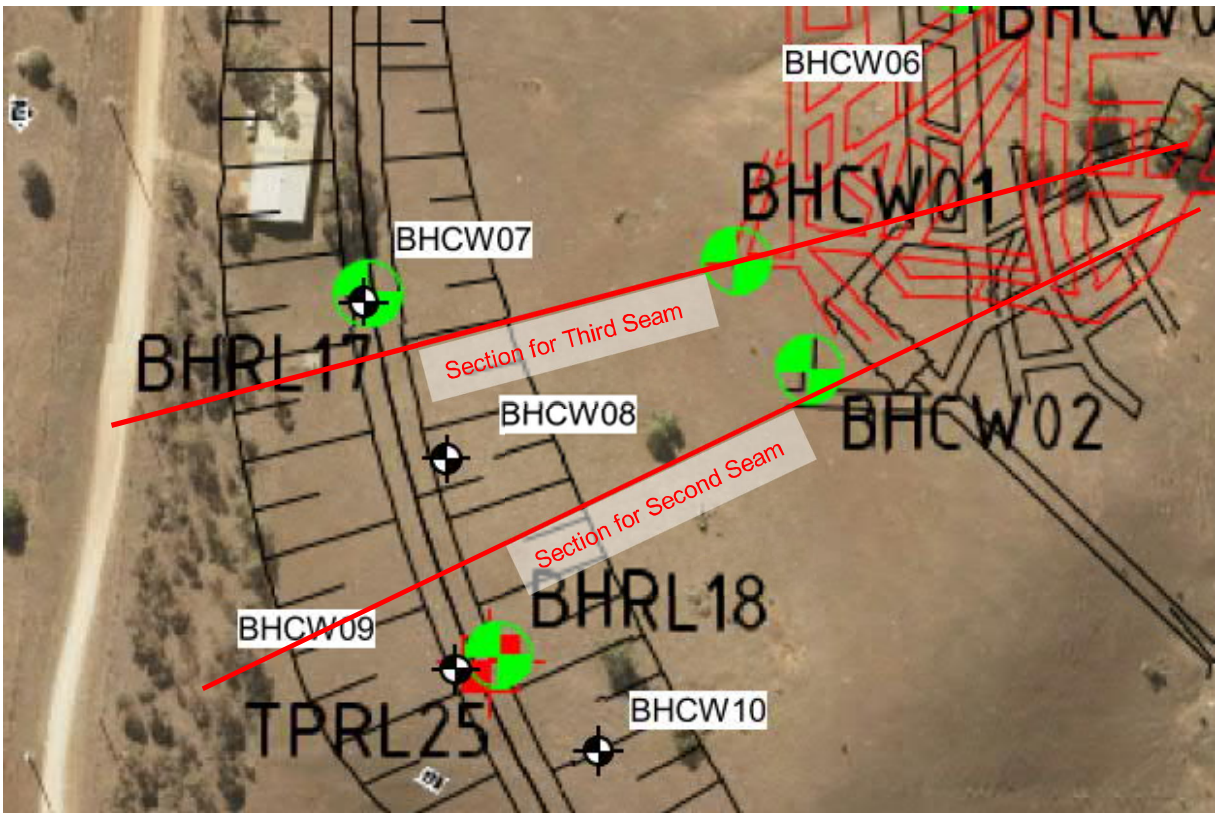


Figure 6 Location of sections for angle of draw

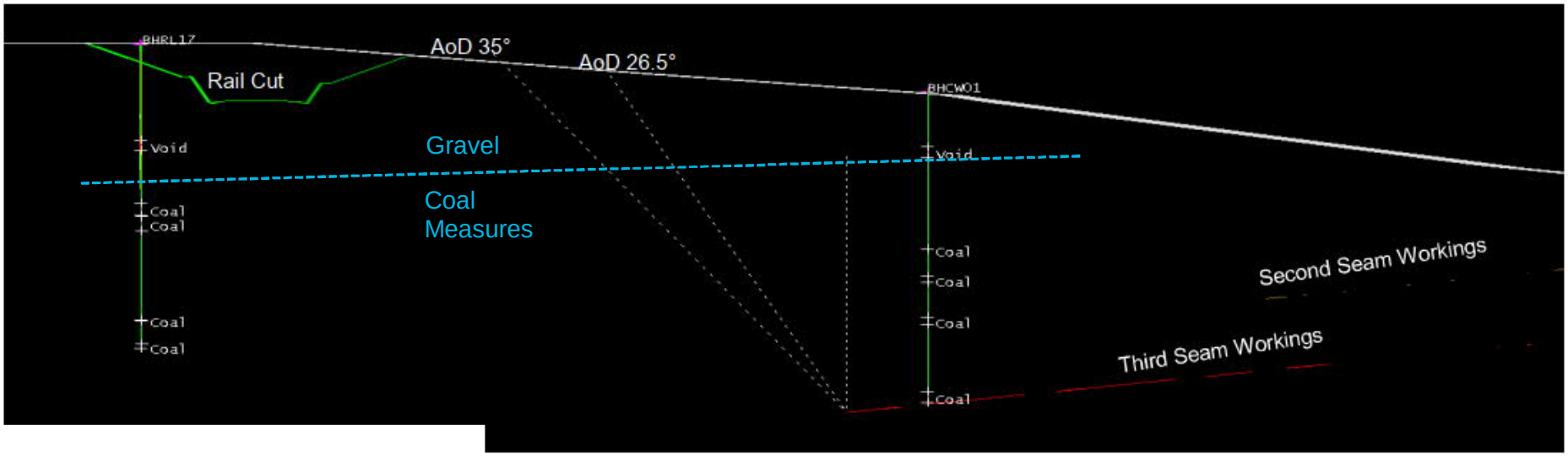


Figure 6 Angles of draw for third seam workings

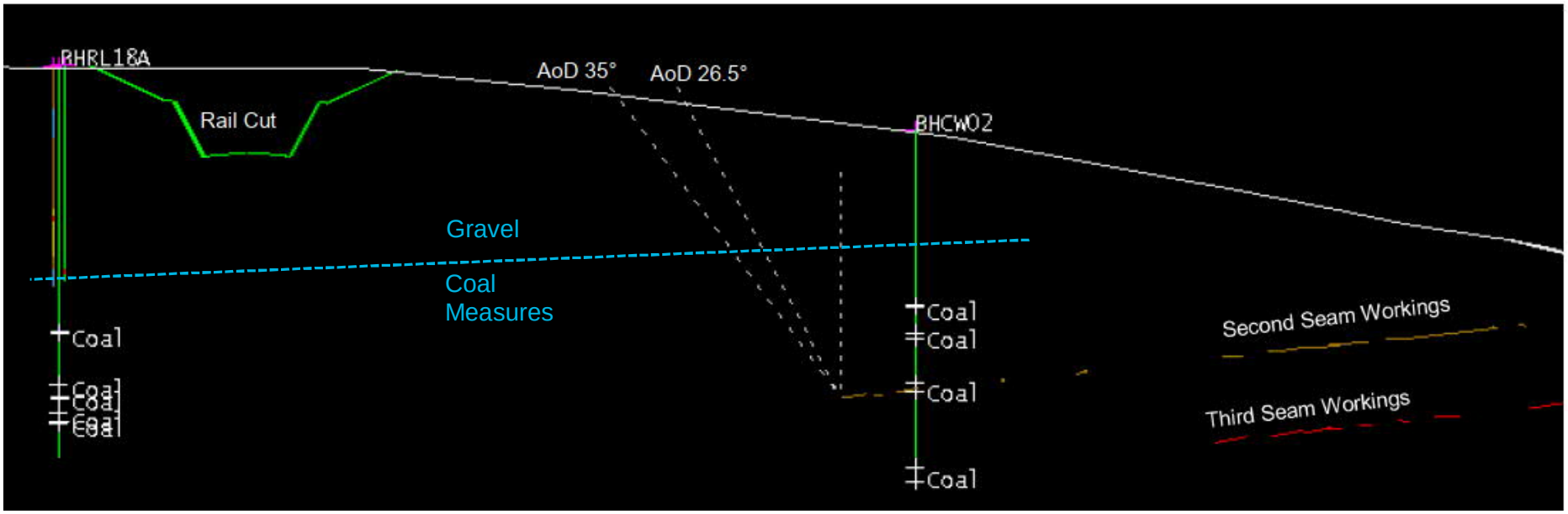


Figure 7 Angles of draw for Overton workings

4.2.2 Assessment

It is clear from Figure 7 that the proposed rail alignment is clear of the zone formed by the 35° angle of draw for both seam workings. The horizontal distance between the floor of the cutting on the proposed design of the rail line and the 35° angle of draw line is listed below:

- second seam workings: 45m
- third seam workings: 25m

As noted in the desktop study (see Section 2.1), there is potential for up to three months of unrecorded mining between the date of abandonment and the date on the mine tracing. It is considered very unlikely that during this period the headings closest to the rail alignment were advanced over 20m in distance. If mining was undertaken, it would be more likely to be towards the north (along strike) where it would be less likely to encounter water. The workings to the west (down dip) were probably left to act as sumps.

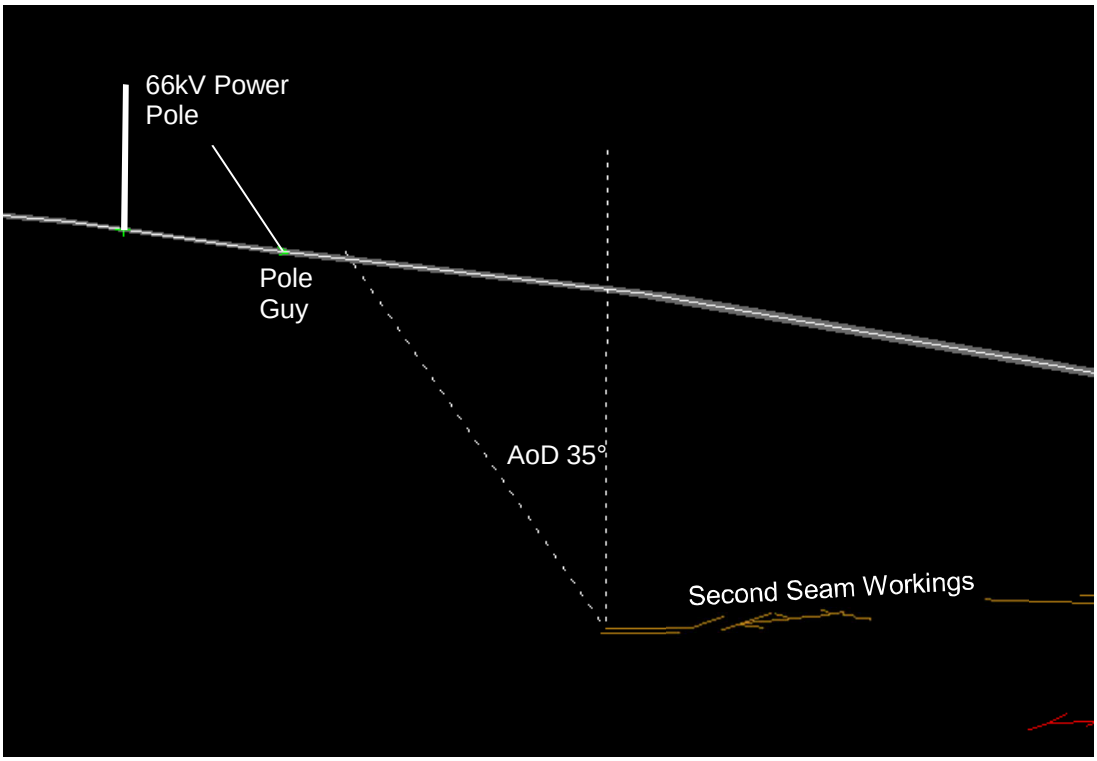
On this basis it is anticipated that it is unlikely that the floor of the proposed rail cut falls within the zone formed by a 35° angle of draw. The risk of mine subsidence due to disturbance associated with subsidence of the Overton Colliery workings is very low outside the zone formed by an appropriate angle of draw.

Based on the above analyses it is considered that when the location of the workings is adjusted 3m eastward, the floor of the cutting is of the order of 20m to 40m outside the angle of draw of the workings. Any additional extraction after closure of the mine is unlikely to be towards the cutting and would be of limited extent (less than 20m).

4.2.3 66kV and 11kV Power Poles

The proposed located of the new 66kV and 11kV power poles in relation to the Overton Mine Workings is shown in Figure 8. The 66kV pole located east of the rail cut is to be guyed and the range of potential guy locations is shown in the figure.

The new 66kV and 11kV power poles are located well clear of the Overton Mine Workings as well as outside the angle of draw from the workings. It is considered that the risk of mine subsidence to the power lines is very low.



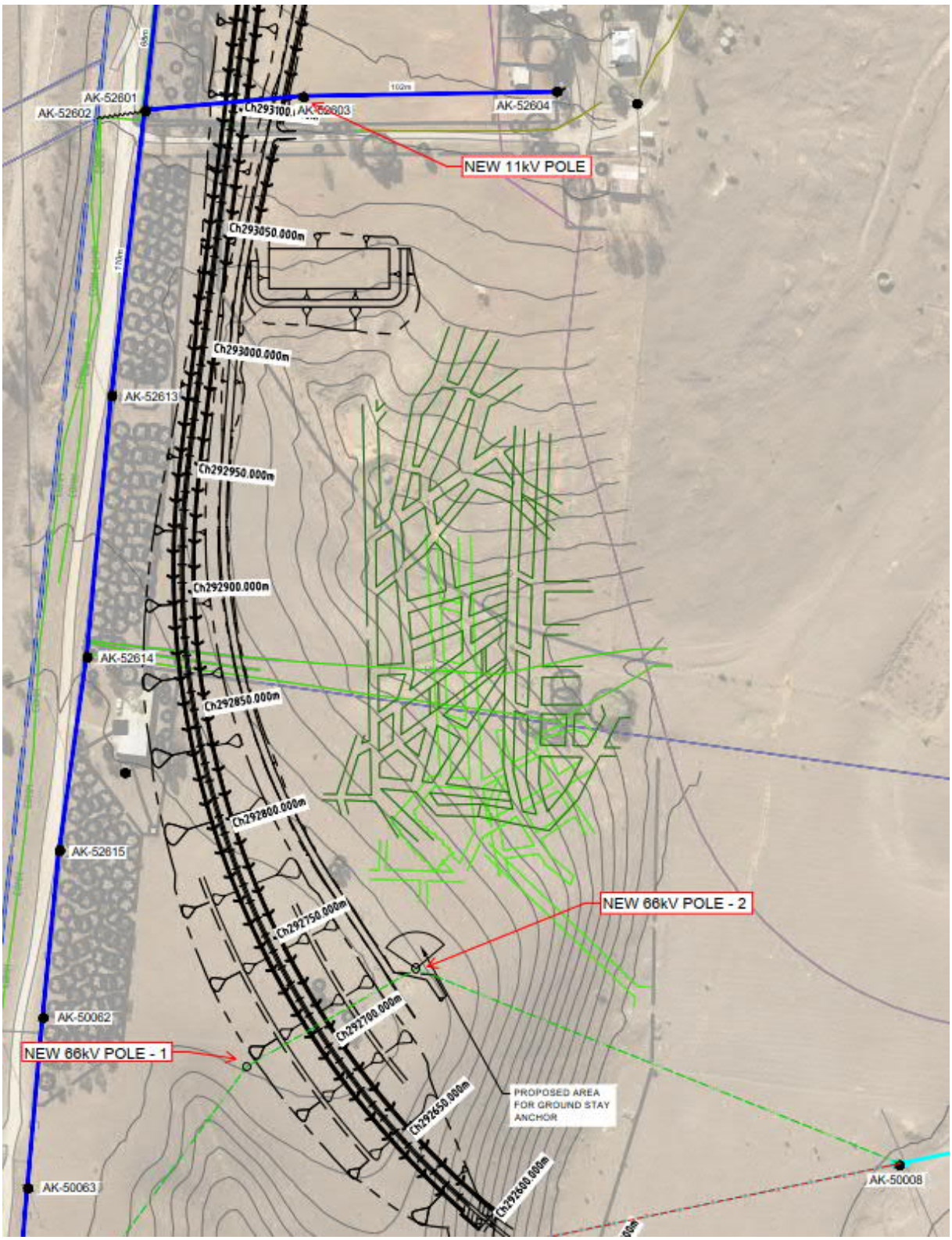


Figure 8 Location of New 66kV and 11kV Power Poles

5.0 Drilling voids risk assessment

5.1 Discussion and interpretation

5.1.1 Results

Intervals logged as voids were encountered in four Phase 1 bores as noted in Table 3. Drilling adjacent to three of these bores produced mixed results. Consistent levels for a void were encountered in BHRL17 and the adjacent BHCW07. However, the voids in the adjacent bores BHRL18 and BHCW09 are 6m to 7m different in level, and the void in BHRL03 was not encountered in the adjacent BHCW11 (see Table 5).

Table 5 Summary of Void Investigations

	BHRL17	BHCW07	BHRL18	BHCW09	BHRL03	BHCW11
Void Depth	14.5m to 16.0m	14.92m to 15.85m	26.3m to 27.0m	19.3m to 20.0m	13.2m to 14.0m	No Void

In all cases, the voids were found in weakly cemented gravel.

CCTV imaging in BHCW07 did not observe a void, and it appeared that the “void” interval is rubble filled. The optical televiewer identified a pattern of increased frequency of defects dipping 15 to 30 degrees from horizontal in the 2m interval above the void.

CCTV imaging in BHCW09 observed the interface between rock and rubble at the top of the “void”, although an open void was not observed. The optical televiewer identified two open defects within the “void”, which probably represent small voids in the rubble. No defects were observed in the 5m interval above the “void”.

CCTV imaging in BHCW011 encountered a collapse at 14.8m depth, with no open void or rubble observed. The optical televiewer did not identify any defects between 8m and 14.5m depth.

5.1.2 Geotechnical model

Voids identified in the investigations and several common characteristics related to these features are listed below:

- The voids occur in poorly cemented gravel that is inferred to be high level alluvium.
- No coal seams were encountered in the bores immediately adjacent to the voids.
- Poorly cemented gravel is reported immediately below the voids in the bore logs.
- They have little lateral or vertical continuity
- The voids are all located well to the west of the Overton Colliery orkings.
- The voids are generally located no closer than 6m to 10m above the upper coal seam.

5.1.3 Drilling void interpretation

Based on the observations above it is very unlikely that the voids in the gravel are former workings.

Given the age and intensive weathering the high-level alluvium has undergone, there are a number of processes that may result in void like features, including:

- Infilling of voids formed by decomposed organic material. The alluvium is likely to have incorporated large pieces of organic material (such as tree trunks) and the loss of the organic material would form voids of limited extent.
- The intensive weathering results in the dissolution of silica in some areas and the precipitation of silica in other areas. Areas where the silica has been removed can be subject to the washing out of fines forming a loose gravel that collapses under its own weight.

- The original deposition of the alluvium may have formed loosely packed zones with a meta-stable framework in the gravel, that loses strength on weathering/wetting and forms a very loose zone that collapses under its own weight.
- Caving of workings in a seam underlying the gravels with a collapse zone extending into the gravels.

Dot points 1, 2 and 3 are geological process that are unrelated to mining. Dot point 4 would be due to un-recorded mine workings not related to the Overton Colliery. However, it is considered that the voids are not collapse zones above former workings as undisturbed weakly cemented alluvium was encountered under each void. In bore BHCW07 (adjacent to BHRL17), cemented sand and gravel was recovered from below the void between 14.92m and 15.85m depth (see Figure 9). Had caving or potholing been a mechanism for the development of the voids it is anticipated that loose rubble would extend down into the coal measures.



Figure 9 Core Photo from BHCW07

5.2 Subsidence risk assessment

Based on the above analysis it is considered that:

- The voids are very unlikely to be collapsed un-recorded workings in conglomerate
- The voids are very unlikely to be due to collapse zones above workings in the coal measures underlying the gravel.

Hence, mine subsidence risk can be considered to be low.

Notwithstanding the above, it is considered that further geotechnical investigations will be required to properly characterise subsurface conditions at the cutting. With the relocation of the cutting relative to the bores, it is possible that the voids will be close to or within the floor of the cutting. It is therefore recommended that a dozer slot (or similar) be excavated in the footprint of the cutting to the cutting floor and the face mapped by a geotechnical engineer prior to bulk earthworks. Alternatively, the face mapping may be undertaken during bulk earthworks. Additional test pits should be excavated in the base of the dozer slot.

The relationship between the drilling voids and the rail cutting is illustrated in Figure 10, Figure 11, and Figure 12.

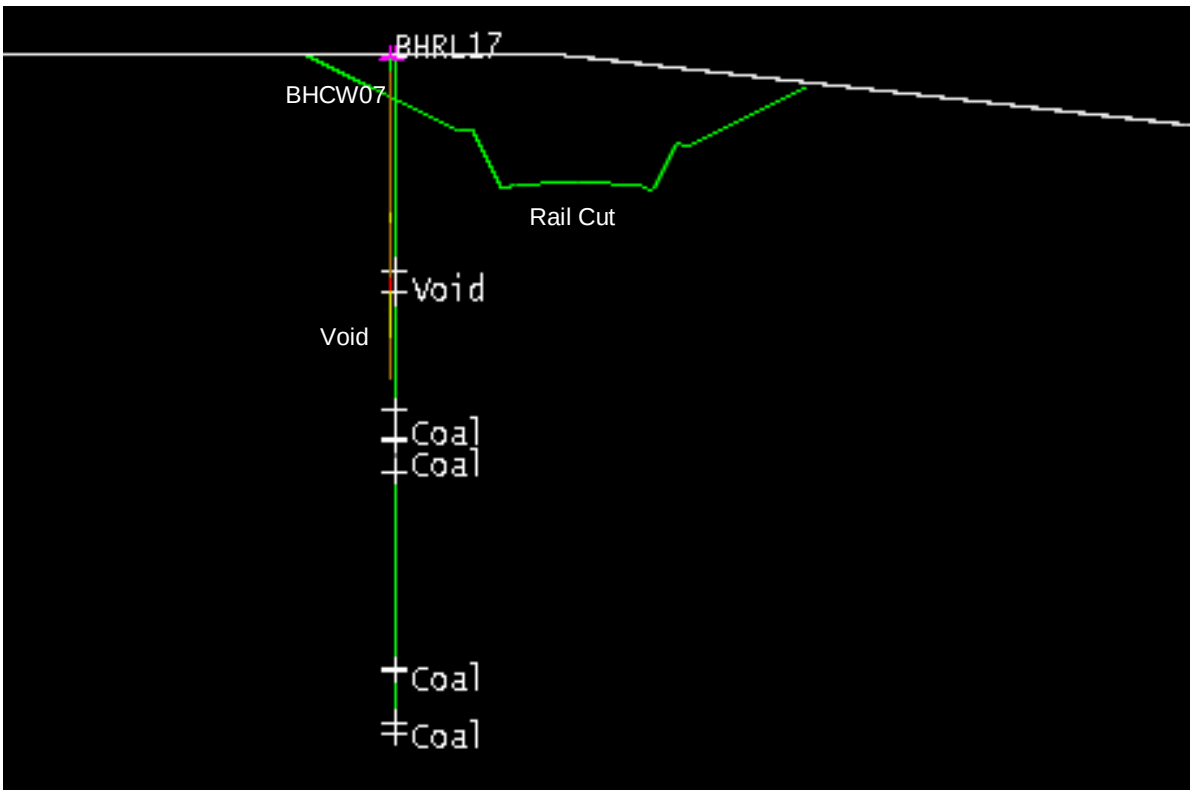


Figure 10 Section through BHRL17and BHCW07

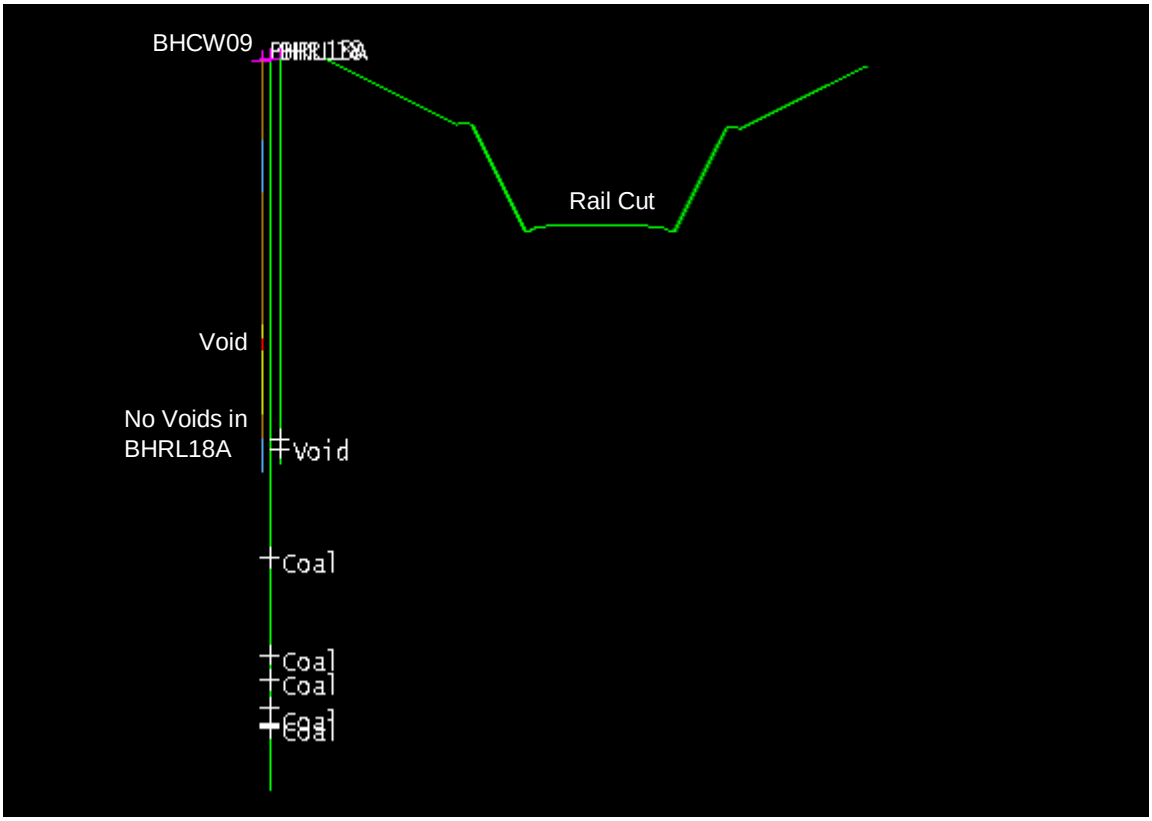


Figure 11 Section through BHRL18, BHRL18A, and BHCW09

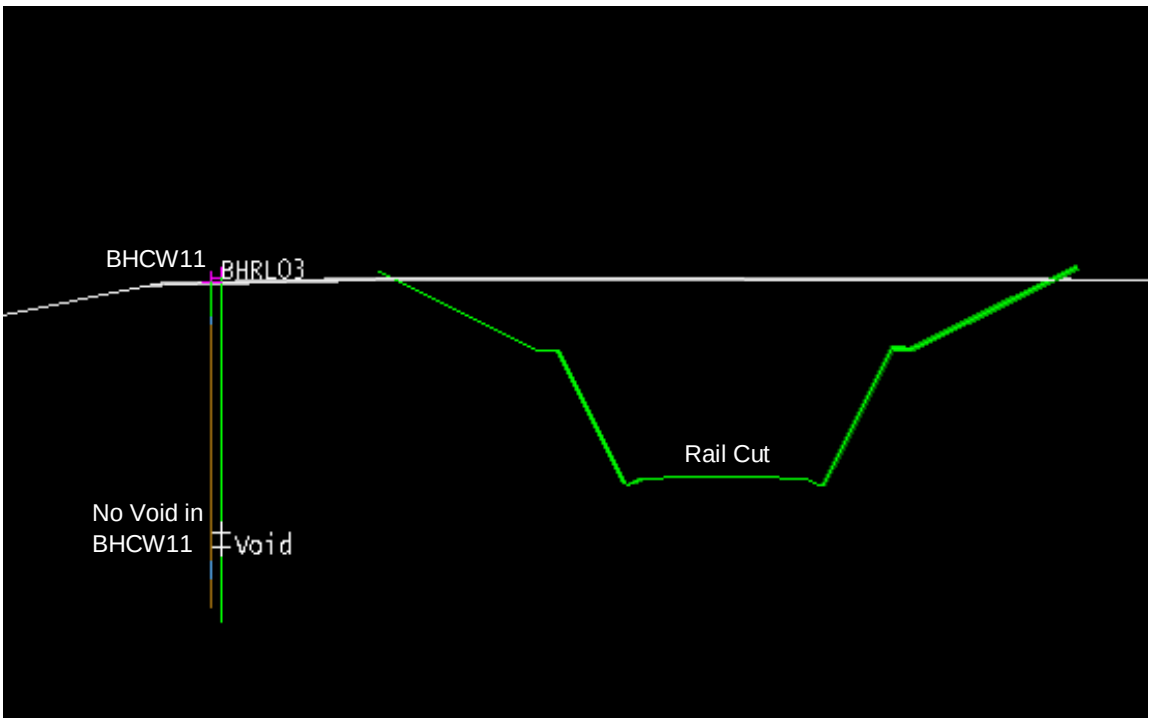


Figure 12 Section through BHRL03 and BHCW11

6.0 Recommendations

6.1 Overton Colliery

The location and extent of the existing Overton Colliery workings were confirmed to be well clear of the proposed works and no further investigations are proposed in the Overton Colliery footprint.

6.2 Drilling Voids

As the drilling voids are very unlikely to be due to former mining, mine subsidence risk from these features can be considered to be low.

The following recommendations are included to ensure the geotechnical stability of the Mt Pleasant Stage 2 rail infrastructure:

- face and batter mapping by an experienced geotechnical engineer or engineering geologist during construction
- excavation and geotechnical logging of test pits or a dozer slot extending below the level of the floor of the cutting before or during bulk earthworks
- where the ground conditions encountered are materially different to anticipated, notification and additional consultation with Subsidence Advisory NSW.

References

Matetic, Rudy J & Chekan, G. J. (Gregory J.) & Galek, James A 1987, *Pillar load transfer associated with multiple-seam mining*, U.S. Dept. of the Interior, Bureau of Mines, Pittsburgh, Pa

Hill, D, *Coal Pillar Design Criteria for Surface Protection*, in Aziz, N (ed), Coal 2005: Coal Operators' Conference, University of Wollongong & the Australasian Institute of Mining and Metallurgy, 2005, 31-38.

MSEC 2007, *Introduction to longwall mining and subsidence*, Unpublished report by Mine Subsidence Engineering Consultants (MSEC), Chatswood New South Wales, August 2007.

Ren, G. and Li, J. 2008, *A study of angle of draw in mining subsidence using numerical modelling techniques*. Electronic Journal of Geotechnical Engineering, Bundle

Geotechnical & Hydro Geological Report Limitations

AECOM Australia Pty Limited (AECOM) has prepared this report in accordance with the usual care and thoroughness of the consulting profession for the use of CPB Contractors and only those third parties who have been authorised in writing by AECOM to rely on the report.

It is based on generally accepted practices and standards at the time it was prepared. No other warranty, expressed or implied, is made as to the professional advice included in this report. It is prepared in accordance with the scope of work and for the purpose outlined in the contract dated 2 April 2019.

The methodology adopted and sources of information used by AECOM are outlined in this the Report.

Where this report indicates that information has been provided to AECOM by third parties, AECOM has made no independent verification of this information unless required as part of the agreed scope of work. AECOM assumes no liability for any inaccuracies in or omissions to that information.

This Report was prepared between 22 July and 23 August 2019. The information in this report is considered to be accurate at the date of issue and is in accordance with conditions at the site at the dates sampled. Opinions and recommendations presented herein apply to the site existing at the time of our investigation and cannot necessarily apply to site changes of which AECOM is not aware and has not had the opportunity to evaluate. This document and the information contained herein should only be regarded as validly representing the site conditions at the time of the investigation unless otherwise explicitly stated in a preceding section of this report. AECOM disclaims responsibility for any changes that may have occurred after this time.

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This report contains information obtained by inspection, sampling, testing or other means of investigation. This information is directly relevant only to the points in the ground where they were obtained at the time of the assessment. The borehole logs indicate the inferred ground conditions only at the specific locations tested. The precision with which conditions are indicated depends largely on the uniformity of conditions and on the frequency and method of sampling as constrained by the project budget limitations. The behaviour of groundwater and some aspects of contaminants in soil and groundwater are complex. Our conclusions are based upon the analytical data presented in this report and our experience. Future advances in regard to the understanding of chemicals and their behaviour, and changes in regulations affecting their management, could impact on our conclusions and recommendations regarding their potential presence on this site.

Where conditions encountered at the site are subsequently found to differ significantly from those anticipated in this report, AECOM must be notified of any such findings and be provided with an opportunity to review the recommendations of this report.

Whilst to the best of our knowledge information contained in this report is accurate at the date of issue, subsurface conditions, including groundwater levels can change in a limited time.

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Appendix A

Previous Desk Studies

Appendix A Previous Desk Studies

MT PLEASANT MOD 4 CONSENT REQUIREMENTS - OVERTON COLLIERY WORKINGS INVESTIGATIONS

UPDATE 2 MARCH 2019

MOD 4 Consent Requirements

44A The Applicant must carry out a detailed geotechnical investigation of former underground workings in the vicinity of the MOD 4 rail infrastructure. This investigation must:

a) be undertaken by suitably qualified and experienced persons;
b) be undertaken in consultation SA NSW;
c) determine the extent of underground mine workings;
d) provide recommendation to ensure the geotechnical stability of MOD 4 infrastructure; and
e) be conducted and reported to the satisfaction of the Secretary.

44B The Applicant must implement the recommendations of the Geotechnical Report to the satisfaction of the Secretary.

Proposed Scope of Investigation for Reporting Relating to Former Underground Workings to Satisfy MOD 4 Consent Conditions

Existing Information

Proximity of Underground Mine Workings to Proposed Infrastructure

Desk Top Study of Mine Workings Information

Survey Validation of Mine Workings and Location in Relation to Proposed Infrastructure

Various studies have been completed relating to the Overton Colliery Workings with the most comprehensive being Formal Mine Survey Plans Project 2A –(6) Archival Research- Christopher Nixon conducted in 2012.

This document has been reviewed and updated as part of this preliminary investigation and will be attached to the final report.

Bengalla surveyors at this time noted “quite confident in the location of the entries and the workings”.
“South Drive located with great confidence and North Drive entrance to the lower third seam has positional evidence.”

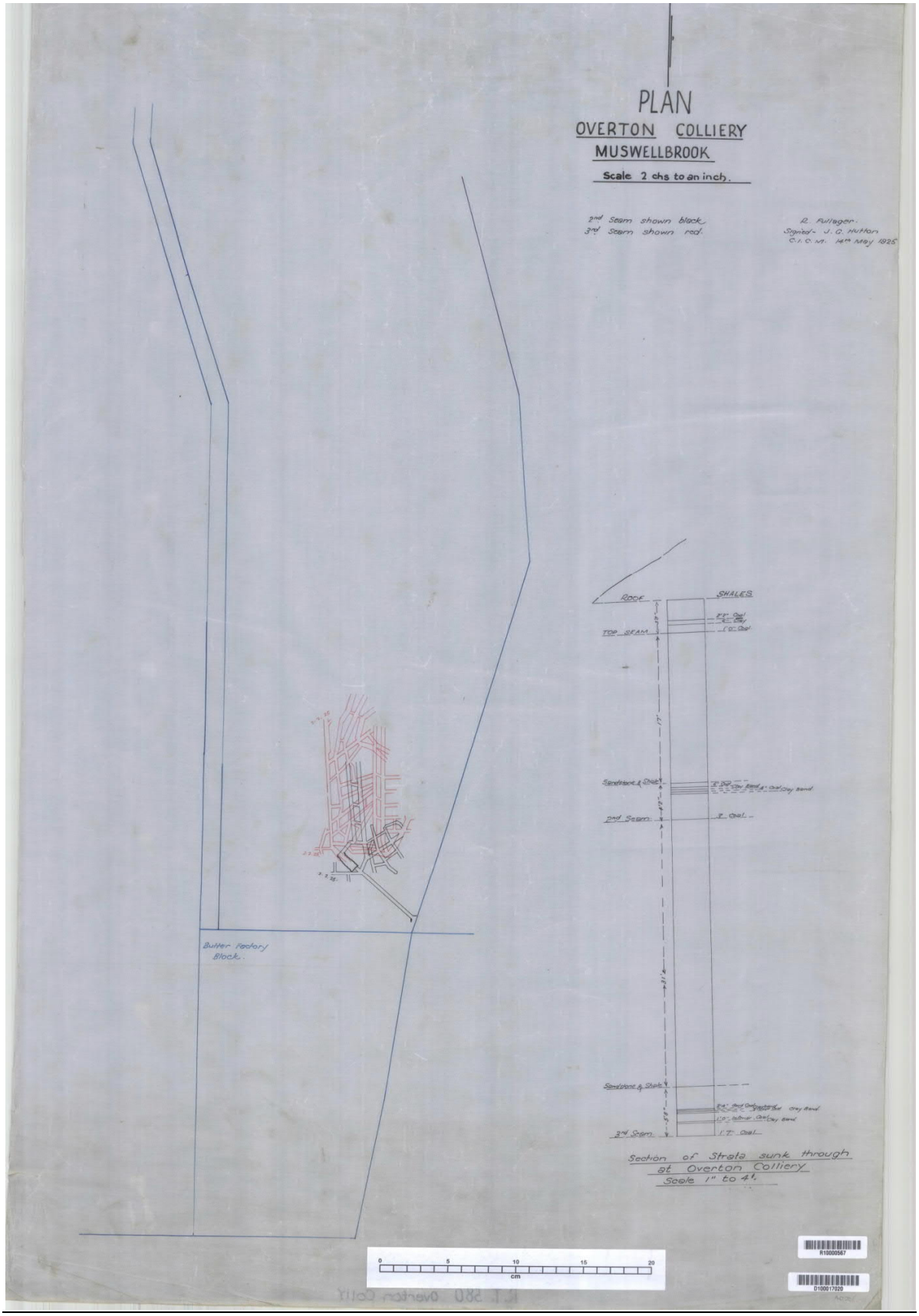
Generally the workings have been georeferenced using the RT580 workings and various surveys relating to property boundaries and possible surface indicators of the Overton Colliery entries.

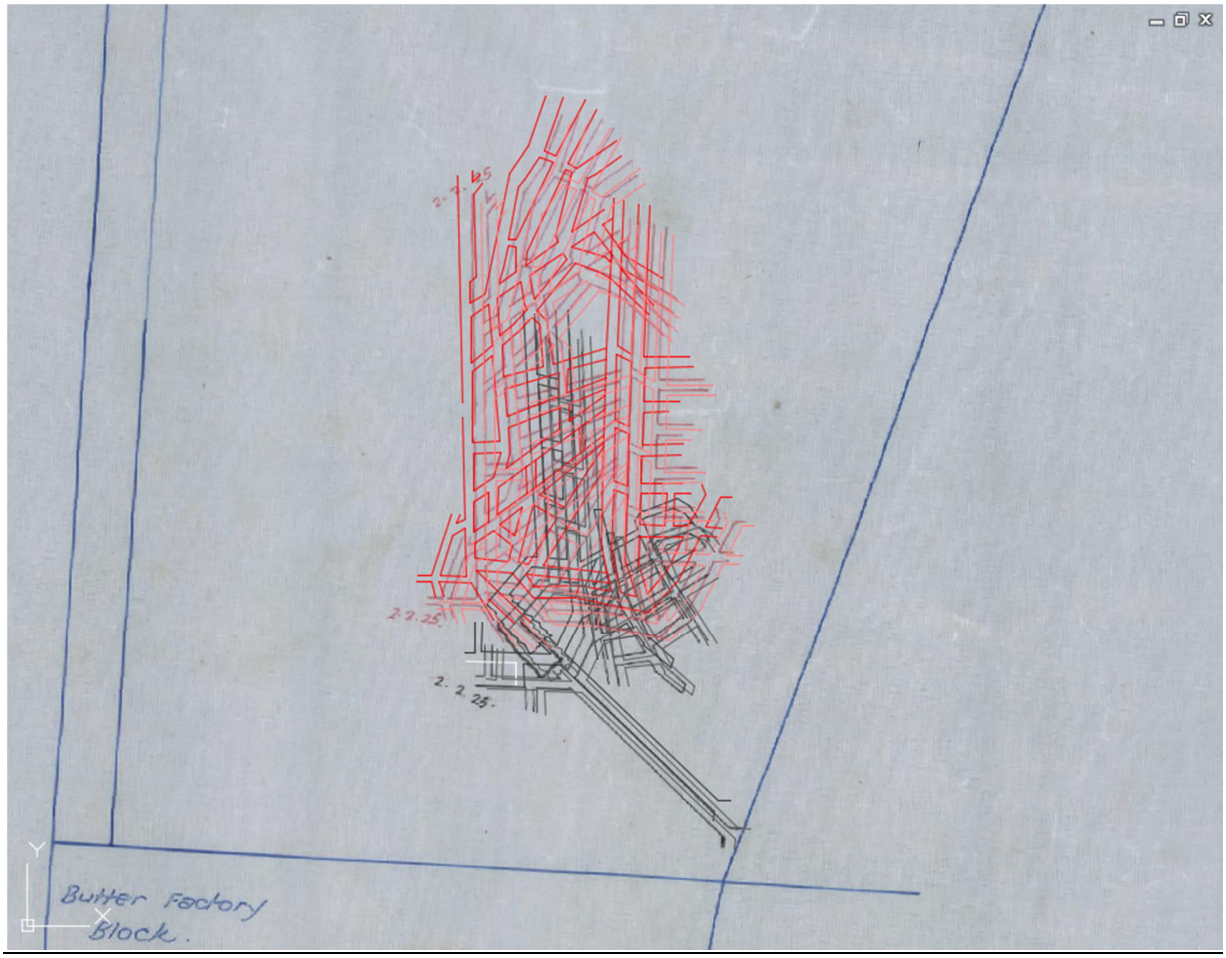
It is considered that the accuracy of the location of these workings is generally in the order of 3.5m to 7.5m.

See plans on following pages for further information.

Reference is made to some potential for previous mining and a newspaper report on 22 March 1922 in the Muswellbrook Chronicle notes "Boiler moved from old shaft to alongside new tunnel 96 yards (87.8m) long. It was intended to connect the tunnel with the old shaft a little further north. Bottom seam 5ft 9in (1.75m) running level. Top seam 4ft 2in (1.27m) at an incline."

This shaft is not shown on the Overton Colliery RT580, however the staggered type section of roadway at the bottom of the new (black) tunnel corresponds with the position of the shaft as noted in the newspaper report. This section of roadway then appears to join with the lower (red) workings.


PLAN
OVERTON COLLIERY
MUSWELLBROOK
Scale 2 chs to an inch.
2nd Seam shown black.
3rd Seam shown red.
R. Fullager.
Signed - J. C. Hutton
C. I. C. M. 14th May 1925
Butter Factory Block.
Rock
SHALES
TOP SEAM
Sandstone & Shale
2nd Seam
Sandstone & Shale
3rd Seam
Section of Strata sunk through at Overton Colliery
Scale 1" to 4½
0
5
10
15
20
cm



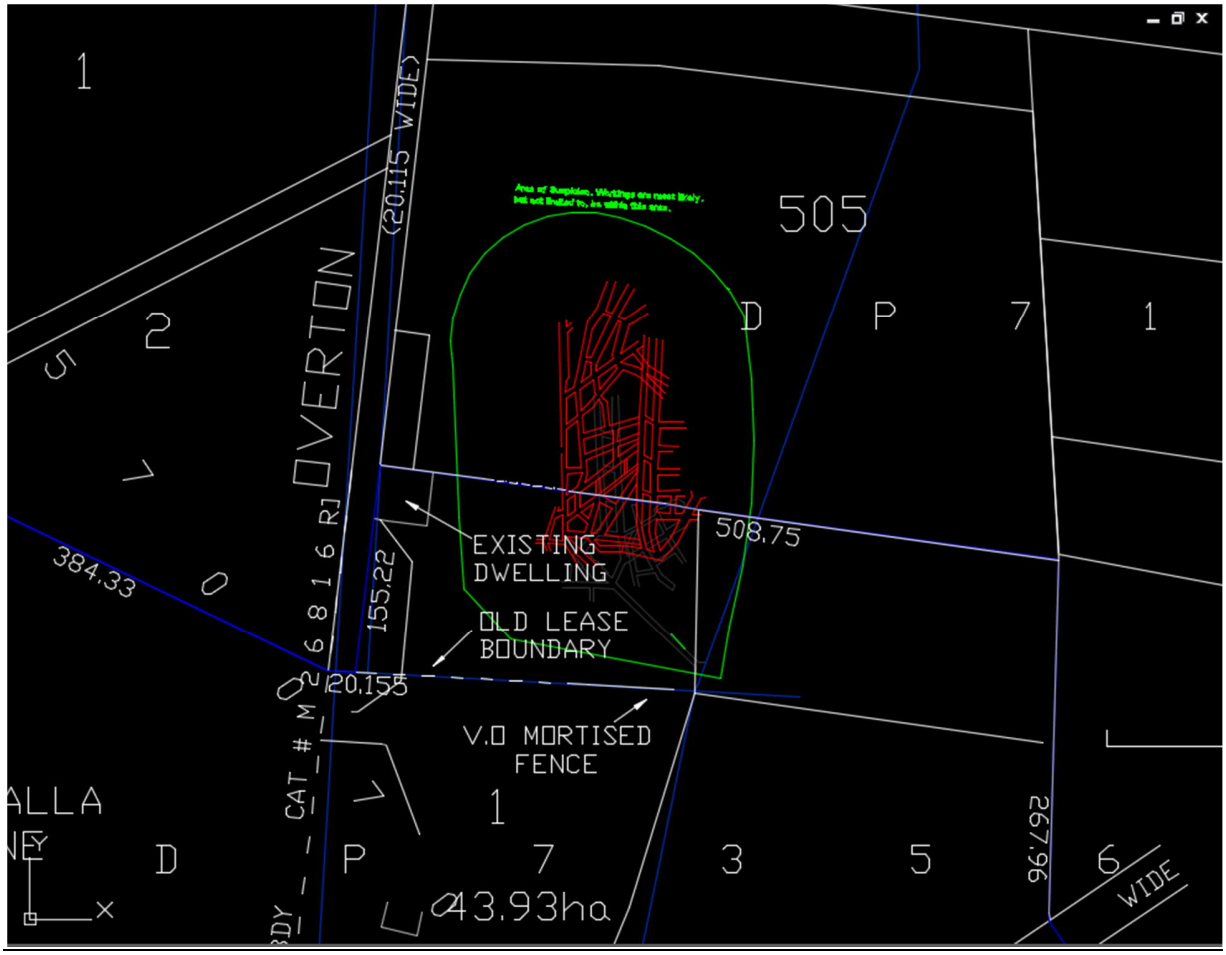
PLAN SHOWING THREE POTENTIAL WORKINGS LOCATION

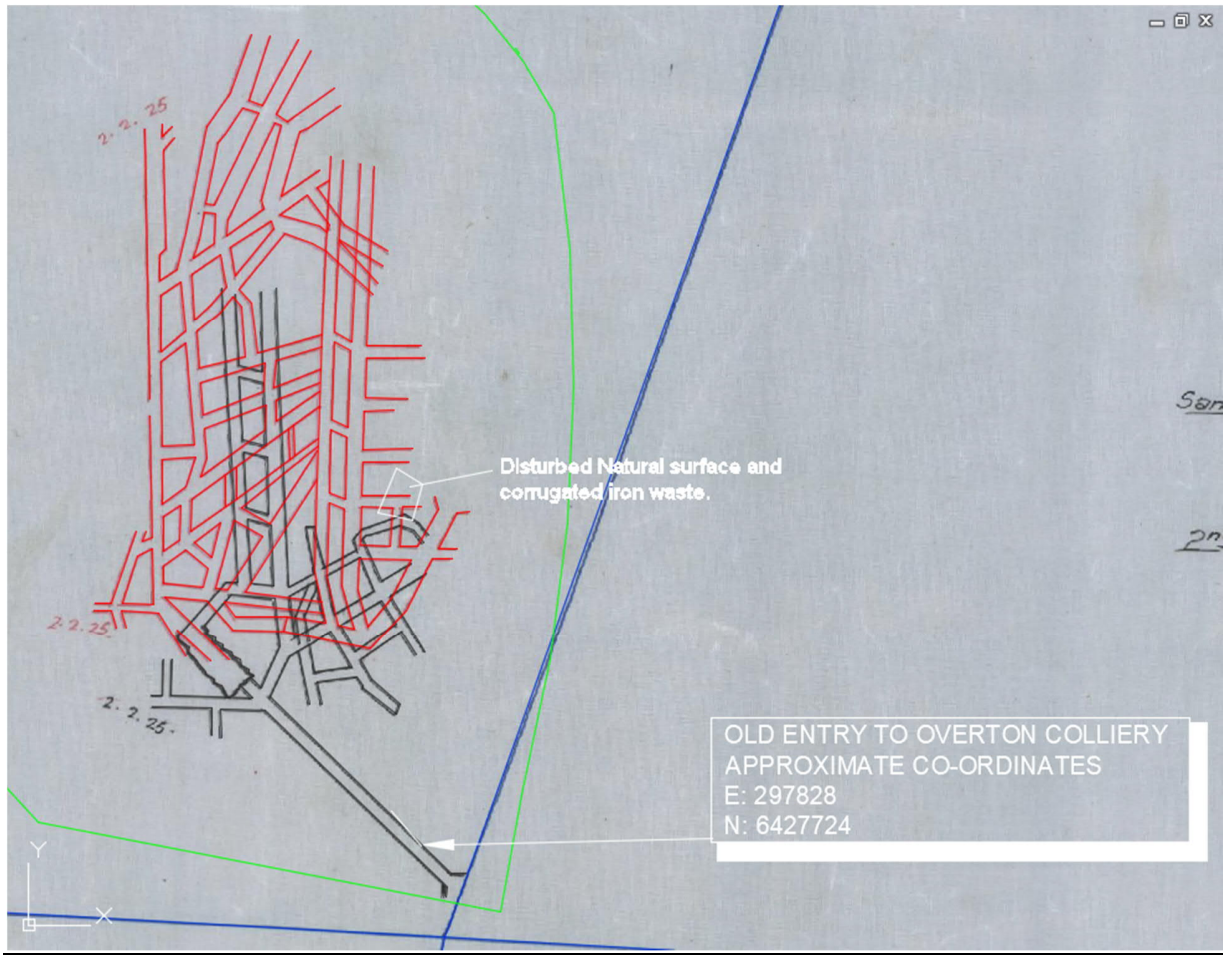
Potential workings location subject of georeferencing from different sources, fence location, RT580, depressions in the field :

a) Boardman Peasley v Overton RT580 – option has RT workings fixed (georeferenced) to old fence;
b) Overton RT580 v field survey - shows where field survey slightly differs if fence line is held fixed.

Generally the lease /property boundary to the south of the Overton mine entries has been adopted as the common alignment for georeferencing.

The various options utilised generate slightly different alignments of the mine workings with the variation being in the order of 3.5m to the north east to 7.0m west.


1
(20.115 WIDE)
OVERTON
505
D P 7 1
S 2 7 0
384.33
155.22
508.75
EXISTING DWELLING
OLD LEASE BOUNDARY
20.155
V.O MORTISED FENCE
1
D P 7 3 5 6
43.93ha
267.96
WIDE


Disturbed Natural surface and corrugated iron waste.
OLD ENTRY TO OVERTON COLLIERY
APPROXIMATE CO-ORDINATES
E: 297828
N: 6427724

Potential for Unrecorded Workings

There is always potential for unrecorded workings unless research uncovers appropriate mine plans, in effect, a complete Plan of Abandonment with date lines and signatures at the extremity of the mine workings.

There is some anecdotal information relating to possible mine workings in the 1870's though no actual records have been located. Reference is made to holing into an existing shaft from former workings such that any workings are likely to be in reasonably close proximity to the tunnels shown on RT580.

The last date shown on the workings on RT 580 is 2 February 1925 with the date of abandonment by the Chief Inspector of Coal Mines on 14 May 1925. A worst case scenario is considered assuming a maximum potential of three months mining. Mine Workings Plans (RTs since 1947) have been required to be updated every 3 months from 1896 until quite recently.

Themine layout shows general development in a northerly direction thus it is considered that any unrecorded workings would be in this northerly direction and away from the proposed infrastructure.

On the basis of a 3 month unrecorded set of workings and bearing in mind that any such workings would be driven using the mining processes available, it could be conservatively calculated that the progress would be in the order of 15 to 45metres, given a working height of 1.75m and bord width of 5.5m dependent on the number of roadways driven.

This may be revised once further information relating to the number of employees and tonnage mined is accessed.

Seam Dip and Strike

Indications are that the third seam strike line is generally north south.

G M Burton's The Coal Resources Of New South Wales (Draft) 1953/11 notes
"At Roxburgh, Overton and Kayuga, which are all within 10 miles of Muswellbrook, collieries have mined seams dipping at 3 to 5 degrees to the west.

This full dip rate and direction has been confirmed by Bengalla geological staff.

Drilling Information Identifying Coal Seam Depth, Cover, Strata Properties

Indicated working seams from borehole information are:
Second seam – Ramrod Creek 2 and Third seam – Ramrod Creek 3.

The closest boreholes to the Overton Colliery workings are:

Mt Pleasant lease	Bore D106ACO1 E297578.65 N6427908.46	RL 177.25	Depth 47.83
Bengalla lease	Bore 1020AD02 E297283.39 N6427624.36	RL 156.45	Depth 76.00

Mapping of Available Information Plans and Cross Sections

Mine workings of Overton Colliery are mapped on both the Mt Pleasant and Bengalla Mine Plans , contained within the mine data base, and also on various surface plans.

All boreholes should be held on the mine database and on the mine plan.

Potential Risk From Mine Subsidence

The workings of Overton Colliery, as shown on RT580, are first workings only thus the risk of subsidence is considered to be generally limited to localised “slumping” or “pot holing”.

Assuming a worst case scenario of total extraction not shown on the plans, the impact of subsidence would be restricted to an angle of draw of 35 degrees or 0.7 x depth of cover.

Proposed Additional Studies / Inspections

Review and Confirmation of Current Underground Mine Workings Information

The majority of the currently available information has been reviewed.

The following inspections / reviews should be carried out to complete the review:

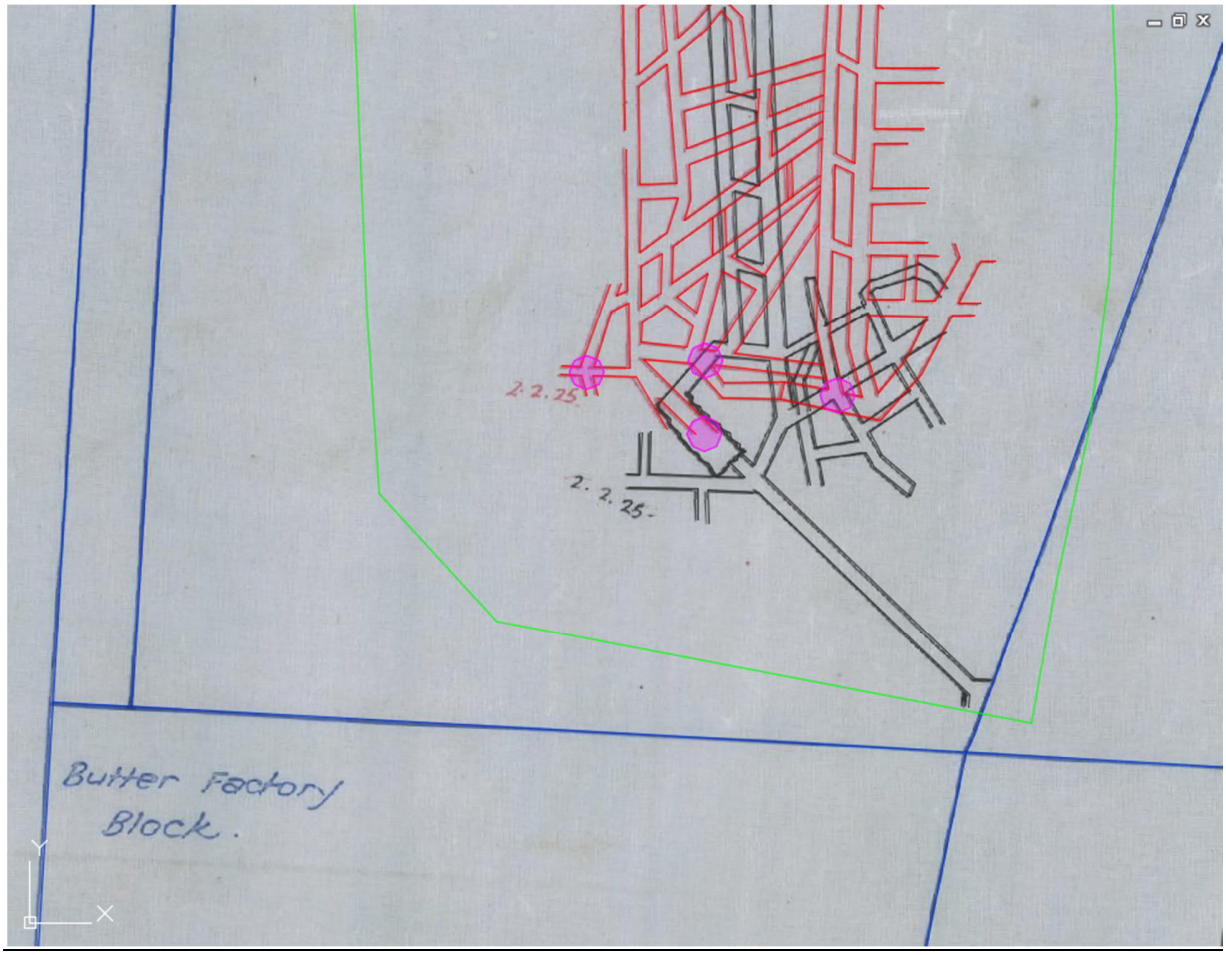
a) Further surface inspections over the Overton mine workings area and surrounds. Any relevant items and locations to be surveyed and plotted.
b) Review to be conducted at Department of Planning and Environment (former Mines Department library) for potential information relating to number of men employed, tonnages mined and possible reference to closing and abandonment.

Proposed Drilling Program to Intercept Workings

A potential preliminary drilling program of four holes is shown on the following plan.

The intention of this program is to intersect the workings void and review the workings location. Consideration should be given to the use of a rotatable camera to inspect any voids intersected to ascertain, if possible, the extent and direction of the workings. This system has previously been used with sound results on the Newcastle section of the Hunter Expressway.

This program is to be reviewed after each holed is drilled dependent on the results obtained from previous holes. It is proposed to drill additional holes to confirm the western extremity of the Overton workings.



Proposed Drilling Program to Identify Strata Properties

To be developed by Geotechnical Engineer.

Site Investigations For Evidence of Subsidence

Conduct site inspection for evidence of mine subsidence within both the footprint of the rail corridor and the overall footprint of the Overton Colliery workings are and surrounding 50 metres.

MT PLEASANT MOD 4 CONSENT REQUIREMENTS - OVERTON COLLIERY WORKINGS INVESTIGATIONS

Information Located in Local Newspapers Relating to Overton Colliery for Period 1870-1930 Via Trove (Internet Search)

Searches conducted for the period 1870 to 1930 (inclusive) as it is noted in Formal Mine Survey Plans Project 2A –(6) Archival Research- Christopher Nixon that a small area was mined possibly in the late 1870's and a further mine in the same area (Overton Colliery) was worked from about 1917 till early 1925.

These searches aim is to validate these dates.

The relevant newspapers and their initial publication dates are:
The Maitland Mercury and Hunter River General Advertiser 1843,
The Newcastle Morning Herald and Miners Advocate 1876,
The Maitland Daily Mercury 1894, and
The Muswellbrook Chronicle 1898.

Date	Newspaper	Relevant Article Content
14-09-1917	The Maitland Daily Mercury	Coal at Overton 4 ft(1.22m) and 8 ft(2.44m) respectively. A syndicate formed to develop a mine and operation for the purpose have already started
22-02-1918	The Maitland Daily Mercury	Coal sample sent to Railways
24-12-1921	The Maitland Daily Mercury	Overton Colliery Co registered
10-01-1922	The Muswellbrook Chronicle	Start on railway loop
28-03-1922	The Muswellbrook Chronicle	30 tpd to Railway Department. Official opening. Boiler moved from old shaft to alongside new tunnel 96 yards (87.8m) long. It was intended to connect the tunnel with the old shaft a little further north. Bottom seam 5ft 9in (1.75m) running level. Top seam 4ft 2in (1.27m) at an incline
28-06-1922	The Muswellbrook Chronicle	First train load of coal
31-10-1922	The Muswellbrook Chronicle	Six feet seam has been reached
09-11-1922	The Muswellbrook Chronicle	Second seam opened 32 ft (9.75m) below the 4ft 6in (1.37m) seam which was worked from March last until a fortnight ago
18-11-1922	The Muswellbrook Chronicle	Railway has doubled order. Double shift commencing next week. 12 men now employed
13-12-1922	The Maitland Daily Mercury	Soon to be fully worked
19-01-1923	The Muswellbrook Chronicle	Top seam 4ft 6in (1.37m), lower seam 5ft 5in (1.65m) to 6 ft (1.83m). 300 yds from Muswellbrook to Merriwarailway
03-10-1923	The Maitland Daily Mercury	Mention of Overton Colliery
13-11-1923	The Muswellbrook Chronicle	Tunnel completed 90 ft(27.4m) grade 1 in 3
14-03-1924	The Muswellbrook Chronicle	Directors have surmounted many obstacles and now 30 men employed
21-03-1924	The Muswellbrook Chronicle	New lease on life

Date	Newspaper	Relevant Article Content
18-01, 11-02, 16-04-1924	The Maitland Daily Mercury	Further mentions of Overton Colliery
24-12-1924	The Maitland Daily Mercury The Muswellbrook Chronicle	Shortage of contracts Shortage of contracts could lead to closure
05-05-1925	The Muswellbrook Chronicle	Employees have taken over colliery. Request for wagons
05-06-1925	The Muswellbrook Chronicle	Boiler for sale
19-08-1925	The Muswellbrook Chronicle	Registration of the voluntary winding up of Overton Colliery

Summary

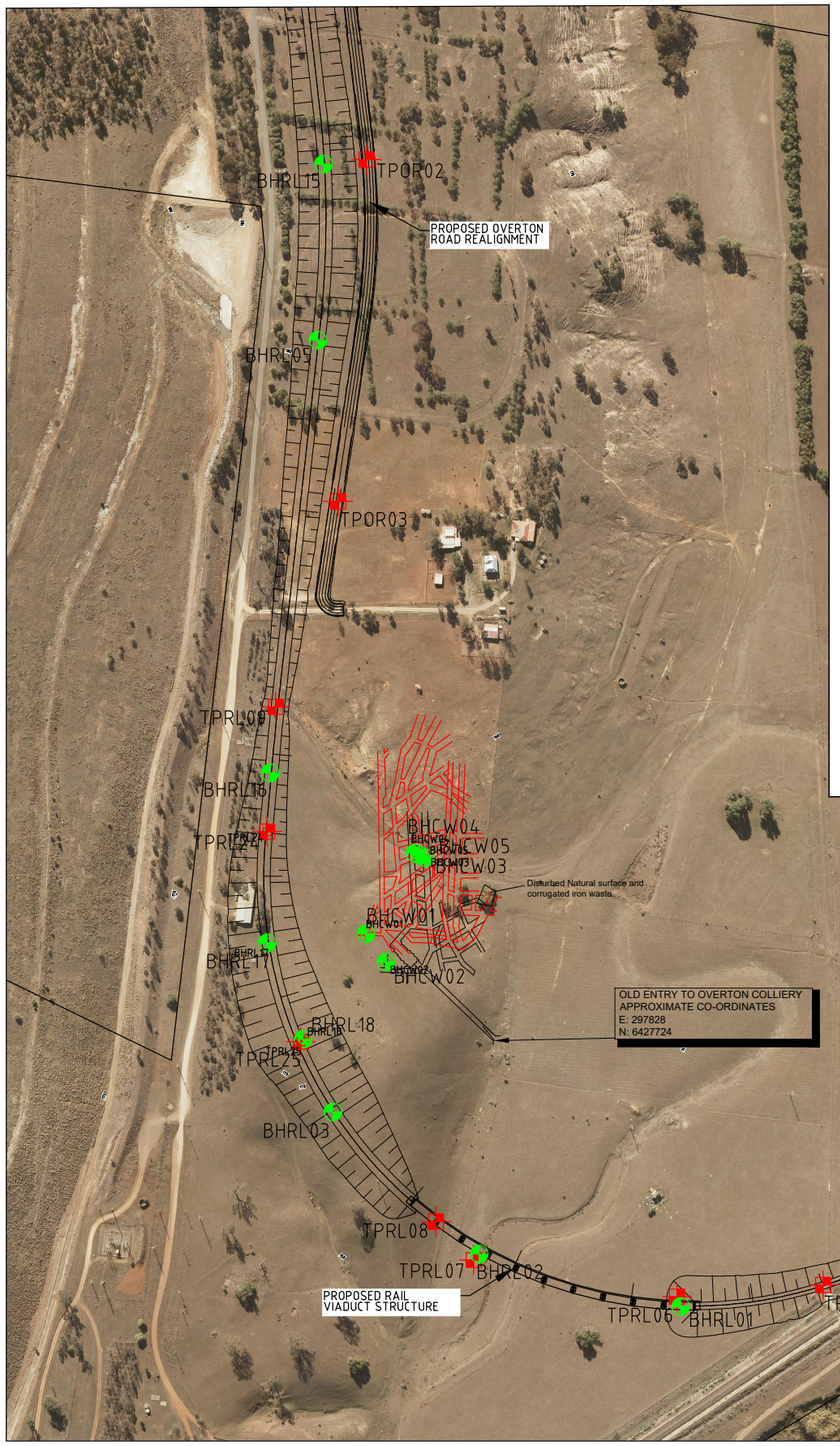
The dates listed in the various newspaper reports confirm the working dates listed in both the Formal Mine Survey Plans Project 2A –(6) Archival Research- Christopher Nixon and the Mines Department Records.

Listing of Seam Thickness and Interburden

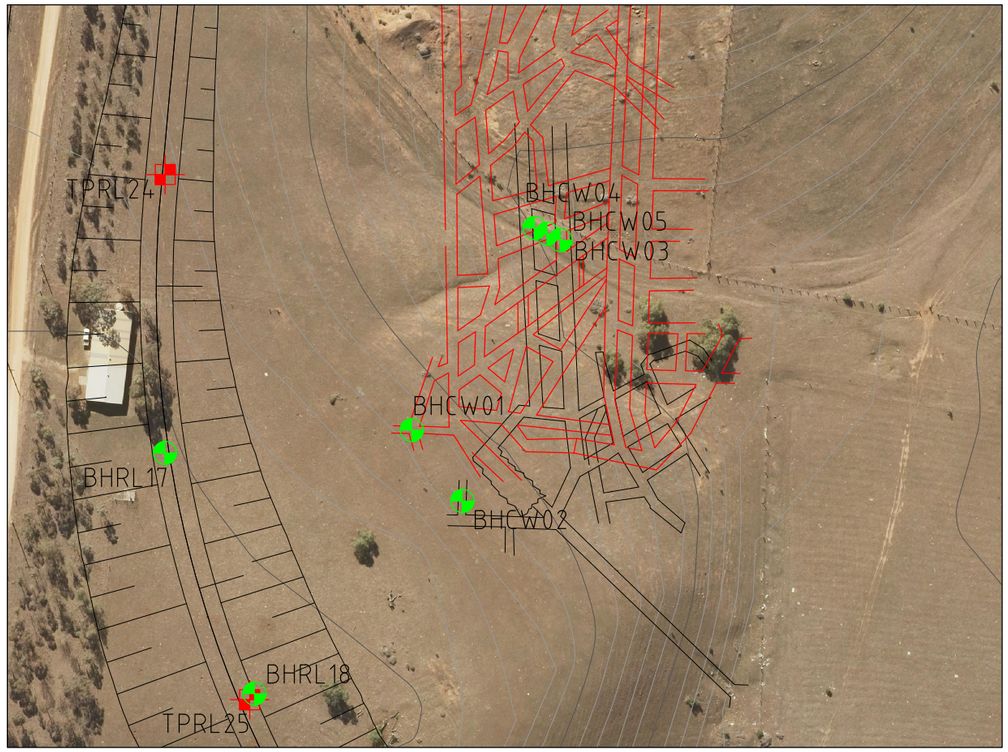
Source	Cover	Top Seam (m)	Interburden	Second Seam	Interburden	Third Seam
RT580		1.12	5.18	1.27	9.50	1.73
Predicted Borehole	58.08	0.86	5.18	1.49	9.45	1.73
14-09-1917 Mait. Merc				1.22		2.44
28-03-1922 Mus. Chron.				1.27		1.75
09-11-1922 Mus. Chron.				1.37	9.75	
19-01-1923 Mus. Chron.				1.37		1.65 to 1.83

Information Contained in Relevant Annual Reports of the Department of Mines

Year	Relevant Information
1875,76,78, 79 & 80	No reports available prior to 1875. List of mines in all years but no reference to either Newman or Overton
1916 & 17	No information listed relating to Newman or Overton
1918	Overton listed. No men employed, one inspection. "The colliery was abandoned during this year." "The Manager gave notice on 9th March of the temporary suspension of operations."
1919	Mention of Newman as ventilated by natural means. Newman 2 men ug, 1 surface, 3 total, 2 inspections. "Restarted after suspension of several months. Under new owner.
1920	Newman 6 men ug, 2 surface, 8 total, 1 inspection.
1921	Overton ventilated by natural means. Overton 6 men ug, 2 surface, 8 total, 3 inspections.
1922	Overton ventilated by natural means. Overton 2 men ug, 1 surface, 3 total, 2 inspections.
1923	Overton 12 men ug, 6 surface, 18 total, 1 inspection.
1924	Overton ventilated by furnace. Overton 13 men ug, 3 surface, 16 total, 2 inspections.
1925	Overton mine abandoned.



GENERAL ARRANGEMENT
SCALE 1:2500



COLLIERY WORKINGS AREA
SCALE NTS

PROPOSED TEST PIT LOCATIONS

ID	EASTING	NORTHING
TPRL01	298999.659	6427410.828
TPRL02	298754.395	6427411.068
TPRL03	298547.694	6427387.488
TPRL04	298271.682	6427223.070
TPRL05	298096.231	6427124.555
TPRL06	297977.000	6427115.000
TPRL07	297811.000	6427145.000
TPRL08	297780.176	6427176.334
TPRL09	297649.455	6427596.273
TPOR02	297723.567	6428042.825
TPOR03	297700.372	6427764.025
TPRL24	297642.449	6427494.427
TPRL25	297670.000	6427323.000

PROPOSED BOREHOLE LOCATIONS

ID	EASTING	NORTHING
BHRL01	297980.000	6427107.000
BHRL02	297815.438	6427149.818
BHRL03	297696.063	6427265.617
~~BHRL04~~	~~297640.391~~	~~6427426.807~~
BHRL05	297683.772	6427895.430
BHRL15	297688.370	6428039.133
BHRL16	297644.796	6427542.293
BHRL17**	297642.369	6427403.519
BHRL18**	297671.597	6427324.978

PROPOSED BOREHOLE LOCATIONS OVERTON COLLIERY WORKINGS**

ID	EASTING	NORTHING
BHCW01	297722.911	6427410.981
BHCW02	297739.428	6427387.827
BHCW03	297771.430	6427473.011
BHCW04	297762.965	6427476.928
BHCW05	297767.020	6427475.059

** BOREHOLE DRILLED TO DETERMINE INDICATIVE EXTENT OF OVERTON COLLIERY WORKINGS. DEPTH OF WORKINGS ARE EXPECTED TO VARY. BOREHOLE TO BE DRILLED TO A DEPTH OF 30M UNLESS DIRECTED OTHERWISE.

* TEST PIT AND BOREHOLE LOCATIONS ARE PRELIMINARY ONLY. FINAL LOCATION TO BE CONFIRMED WITH MACH'S REPRESENTATIVE PRIOR TO THE COMMENCEMENT OF THE WORKS.

LEGEND

- PROPOSED TEST PIT
- PROPOSED BOREHOLE
- INDICATIVE SEAM 2 WORKINGS
- INDICATIVE SEAM 3 WORKINGS

PRELIMINARY

NOT FOR CONSTRUCTION

REV	DESCRIPTION	CHKD	APP	DATE
G	BHCW03 AND 04 LOCATION REVISED. BHCW05 ADDED	WG	WG	01.04.19
F	BHCW02, 03 AND 04 LOCATION REVISED	WG	WG	15.03.19
E	BHRL04 REMOVED, BHRL18, BHCW01, 02 AND 03 LOCATION REVISED	WG	WG	08.03.19
D	BHRL02,04,18 AND OLD WORKINGS LOCATION UPDATED	WG	WG	05.03.19
C	BH LOCATIONS ADDED, TPRL06, TPRL07, TPRL25 AND BHRL01 REVISED	WG	WG	06.02.19
B	TP AND BH LOCATIONS ADDED	WG	WG	23.01.19
A	ISSUE FOR INFORMATION	WG	WG	6.12.18

REVISIONS AND ISSUES

HORIZONTAL DATUM: GDA94
VERTICAL DATUM: AHD
MAP PROJECTION: MGA ZONE 56 SOUTH
SURVEY DATUM

SCALES SHOWN ARE FOR AN A1 SIZE ORIGINAL DRAWING

0 25 50 100 150
Full Size 1:2500 , Half Reduction 1:5000
SCALE (m)

SCALES

DRAWN	JB
DRAFTING CHECK	
DESIGN	
DESIGN CHECK	
APPROVED DATE	

APPROVALS

MACHEnergy

MT PLEASANT COAL MINE
RAIL LOOP - STAGE 2
GEOTECHNICAL INVESTIGATION
GENERAL ARRANGEMENT (1 OF 3)

PROJECT No.
DRAWING No. MP002-0000-GEO-DRG-0001
REVISION G

Plot Date: 01 Apr. 2019 CAD File Name: J:\MACH Energy\CAD\d_Drawings\MP002-0000-GEO-DRG-0001_0003\MP002-0000-GEO-DRG-0001_0003.dwg

Formal Mine Survey Plans Project

2A-(6) Archival Research



Overton Colliery – South Drive

Christopher Nixon
BOSSI Candidate Number 8722

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SCOPE

To satisfy the request to carry out '*A comprehensive written report detailing an archival research undertaken by the candidate. This archival research shall be completed in relation to any abandoned or suspected abandoned mining areas.'*

1. Area of interest

Bengalla mine is located west of Muswellbrook in the Hunter Valley. It is an open cut thermal coal mine and has been in full operation since 1999.

The pit is around 3km long by 200m wide with the current mining leases adding up to be around 1215.36 hectares.

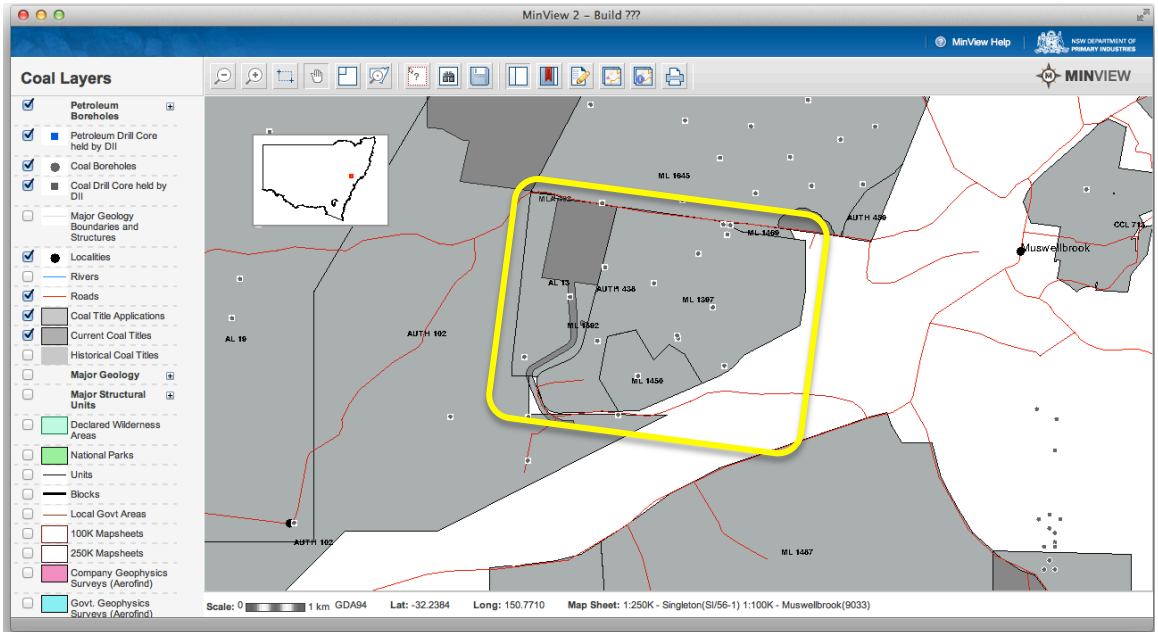


Figure 1 - Minview data of the area of interest in yellow

The mine is looking to extend its operations to the west in the coming years, so this is the area that should be focused on for archival research.

2. Site History, Land Ownership

A majority of the land that BMC holds mining leases over is known as Overdene. Originally named Overton, Overdene was a large property situated on the North East area of the Bengalla Leases and spills down onto the alluvial area.

Table 11
Overdene's Relevance to Historical Themes

National	State/local	Comment
Peopling Australia	Convict	Overdene had assigned convicts working on the property in 1841.
Development of local, regional & national economies	Agriculture	Situated adjacent to the Hunter River floodplain, Overdene was established as an agricultural property, raising sheep and cattle. George Blunt developed very successful irrigation systems on Overdene, pumping water from the Hunter River to grow lucerne on the river flats for fattening stock.
	Mining	Local sources of sandstone, limestone and clay were quarried to provide materials for construction. Skilled workers were employed on the property to extract and process these materials. Coal was mined at Overdene in the early 20th century which was followed by the later larger scale mining that continues today. Exact locations of these activities are not known and may well have been destroyed by recent mining.
	Pastoralism	Stock were raised and fattened on Overdene. The homestead may have been built as the home of the property manager but there no extant remains directly related to this activity.
Building settlements, towns and cities	Land tenure	This property was originally an early land grant and shows expansion as the property developed and reduction as closer settlement took affect.
	Accommodation	Overdene has a good example of mid-19th century housing.
Developing Australia's cultural life	Domestic life	There is some potential for evidence of domestic activities in sub-surface deposits to the west of the house.
	Persons	Overdene is associated with Henry Nowland and George Blunt, both of whom were prominent citizens in the Colony and owners of large tracts of land in the Hunter Valley.

Figure 2 – Overdene's Relevance to Historical themes from pages 44 & 45 of Bengalla's EHMP

George Blunt developed very successful irrigation systems on Overdene, pumping water from the Hunter River to grow lucerne on the river flats for fattening stock. Mining local sources of sandstone, limestone and clay were quarried to provide materials for construction. Skilled workers were employed on the property to extract and process these materials. Coal was mined at Overdene in the early 20th century, which was followed by the later larger scale mining that continues today. Exact locations of these activities are not known and may well have been destroyed by recent mining.

Pastoralism stock were raised and fattened on Overdene. The homestead may have been built as the home of the property manager but there are no remains directly related to this activity. This property was originally an early land grant and shows expansion as the property developed and reduction as closer settlement took affect. Accommodation at Overdene was a good example of mid-19th century housing.

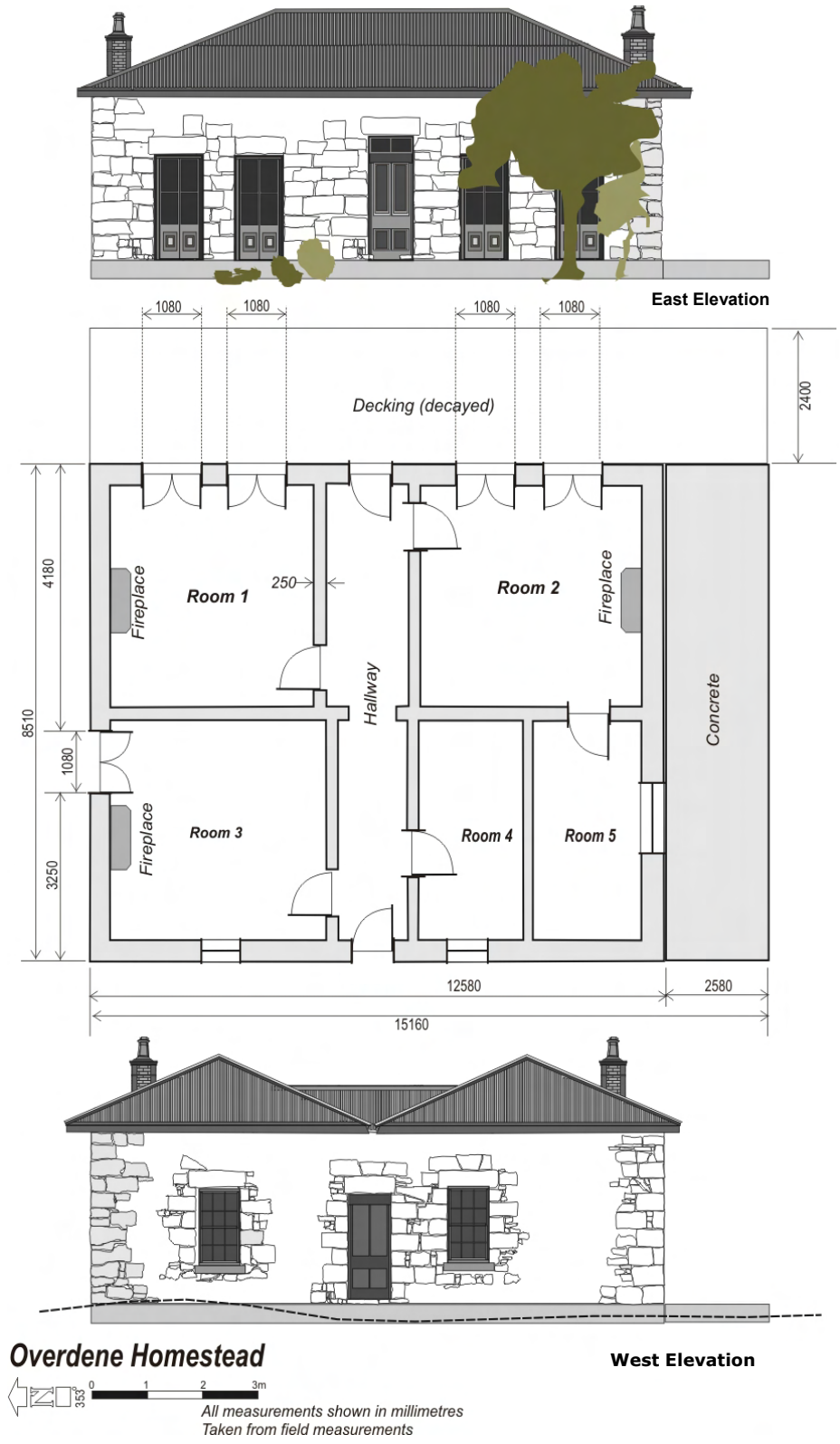


Figure 3 – Overdene Homestead – plan and elevation from Appendix A of Bengalla's EHMP

The Blunt family's railway building experience led to their operation of the Kayuga Colliery on Coal Creek Road before 1894 when it supplied coal to the Muswellbrook Gas Works. This mine also provided coal for the Overton Butter Factory but at an earlier stage the Blunts had opened their own mine on the estate, close to the homestead.



Figure 4 - Above is a photo of the Overdene sandstone structure in 2007. Page 16 Appendix C Bengalla's EHMP

In June 1912 the first sod was turned on the Muswellbrook to Merriwa Railway and in 1915 trains began to run as far as Denman. This facilitated the development of a small coal mine which had probably been opened by George Blunt some years earlier. In 1921 the Overton Colliery Company Ltd. was registered by a syndicate of Muswellbrook businessmen and mine managers associated with the New Greta Colliery.

Work began in the following year when a tunnel driven into the hill near Overton cottage reached the coal seam and the mine was officially opened in March 1922. The plan was to link the tunnel to the shaft of the earlier mine and to transport its produce over the Merriwa line to Muswellbrook and beyond. Mines Department records show that the Overton Colliery employed 11 men in 1922, 18 in 1923 and 13 in 1924 and that it was abandoned in 1925.

It is visible through all of these accounts that George Blunt started a mine on the Overton property in the later stages of the 1870's and then the Overton Colliery mined a similar area in the 1920's, once the Merriwa (or now Ulan) rail line was constructed.

The written history from Bengalla's European Heritage Management Plan above demonstrates a strong case for the existence of an old colliery and workings. This

document however cannot suggest a location other than the general description of ‘close to the homestead’.

3. Previous research by Bengalla Mine Surveyors

BMC has had five Registered Mine Surveyors over the 13 years of its mining operation.

Mr David Lennard (Mine Surveyor 1998 – 2005)

Mr Ross Taylor (Mine Surveyor 2005 – 2007)

Mr Jamie Costello (Mine Surveyor 2007 – 2009)

Mr Andrew Boardman (Mine Surveyor 2009)

Mr Wayne Price (Mine Surveyor 2009 – present)

All five of these surveyors have varying information in regards to previous workings on Bengalla’s land. Nearly all of them were aware of the Overton colliery to the east of the Bengalla site and had deemed the workings to be far enough away from the Bengalla workings not to pursue any further.

Mr Andrew Boardman (who I was lucky enough to work with in his time at Bengalla) took further steps in his time as a surveyor at Bengalla to locate the Overton mine.

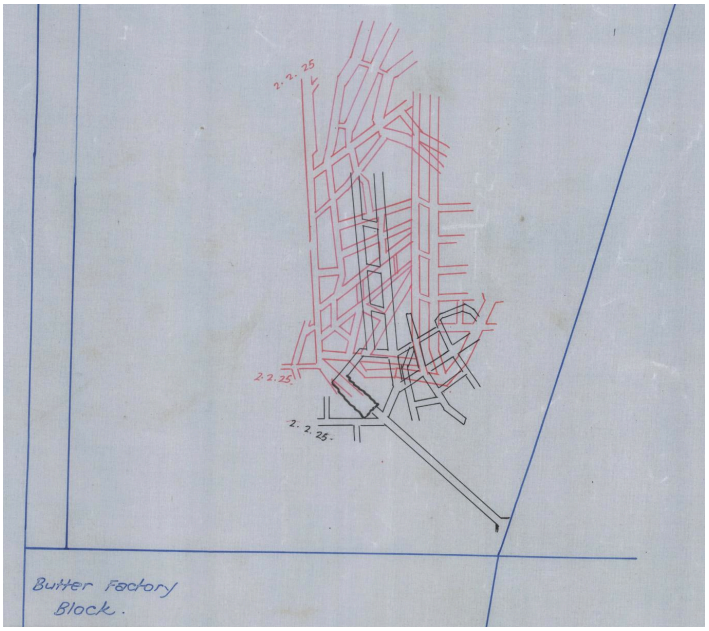


Figure 5 – Overton Colliery from RT580

Whilst working with Andrew, we worked together to pinpoint the location of the Overton mine to the east of Bengalla’s lease. From old RT information from the Department, existing fence lines and old boundaries, along with depressions in the

hillside, we became quite confident in the location of the entrances into the mine and the workings below.

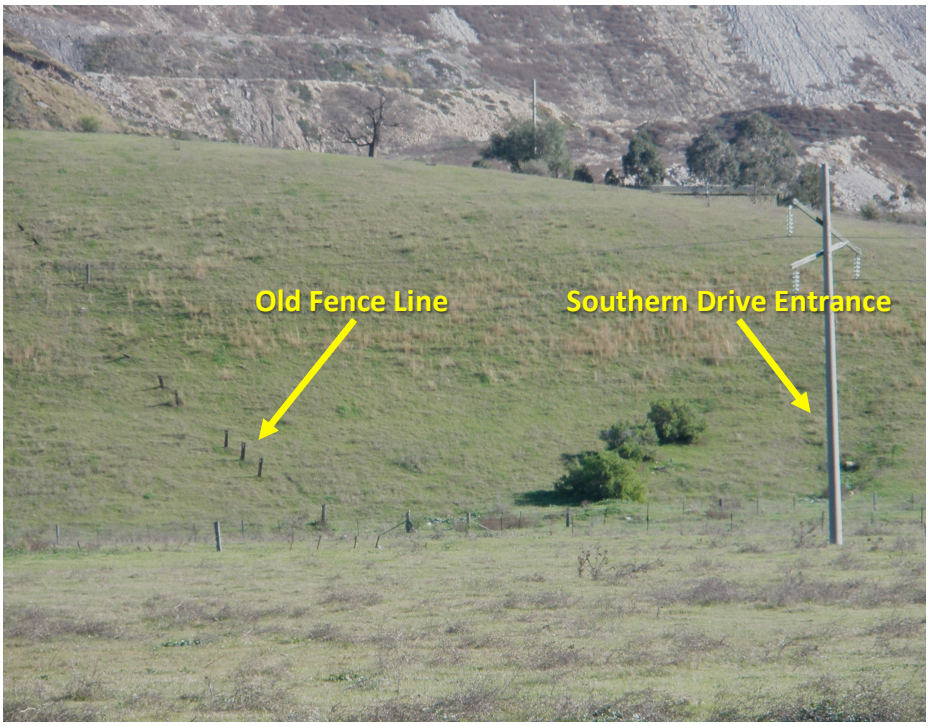


Figure 6 – Photo looking toward the west from the alluvial to the Overton ridge



Figure 7 – Above shows what is most likely the Southern entrance to the Overton Colliery

The borehole cross section overleaf from RT580 shows Overton colliery mining the 2nd and 3rd seams. From borehole data from drilling for the current Bengalla workings, the seams that Overton colliery were working are most likely to be Ramrod Creek 2 and 3. This prediction can be seen in Appendix 4.

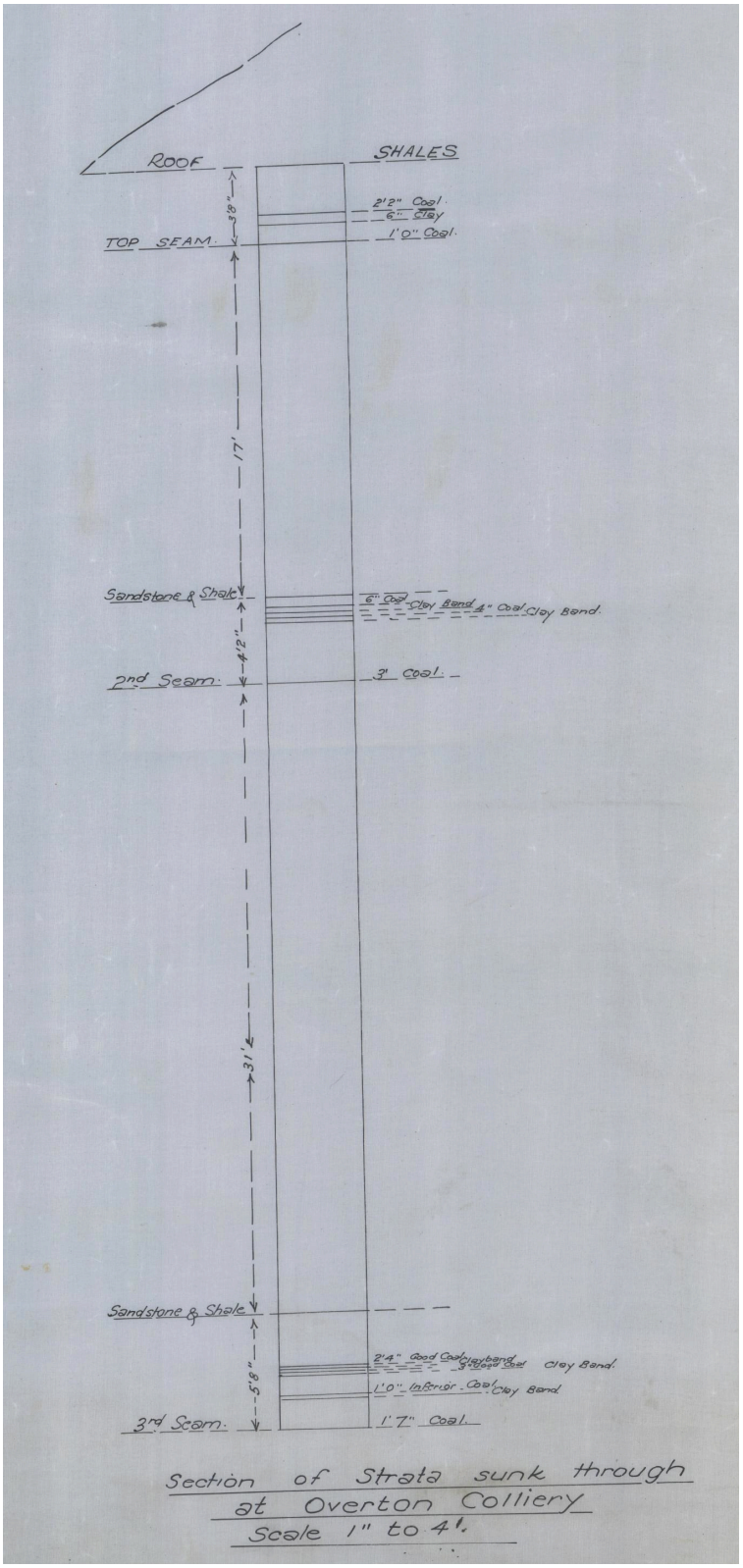


Figure 8 – borehole cross section from RT580

Further processes that could be done to validate the workings position would be to drill into the drives from above to prove their existence and location. This proposal was put to the Mine Manager at the time but he did not see it as a priority since Bengalla was moving away from the Overton colliery in a westerly direction. The letter to the Mine Manager and the response from him can be seen in Appendix 5.

The other thing that Andrew did was to engage Boardman Peasley (registered land surveyors in the area) to undertake an identification survey to show the appropriate property boundaries and reference the old fence remains to the property boundaries. This was done so the boundary positions can be located in the future if the fence posts are ever removed or decay further. This identification survey can be viewed in Appendix 3.

The Overton Colliery was classed as 'abandoned' on 14th May 1925 according to RT580.

4. Visit to the Trade & Investment, Resources & Energy

On the 13th June 2012 I visited Karen Inglis and Kevin Price at the Maitland office of Trade & Investment, Resource & Energy. They showed me through the process of searching for abandoned / suspected abandoned mines in the area. We ran through a checklist of information that is required when searching old mine records. Using the various registers for collieries and projects, the checklist was completed and can be viewed in Appendix 6.

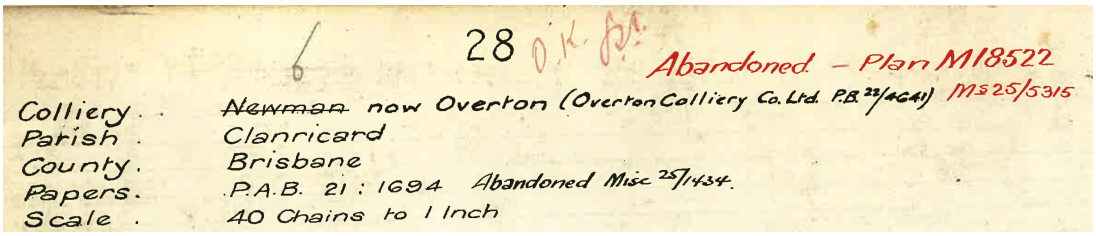
Karen introduced me to Minview and DIGS and the information that is available through both of these digital storage systems. We then moved to the 'documents room' where the original documents and plans could be sighted for the area.

The ~~Newman~~ Overton Lease shown overleaf was found in the register. This sketch shows the lease for the colliery and a scan of the full page can be seen in Appendix 2. By scaling off of this sketch (40 chains to 1 inch) and overlaying the polygon onto current workings, it shows that this was the correct lease for Overton Colliery RT580. This is important to check as other workings could have been carried out in the area and the RT plans may have been lost or never produced.

When transferring this sketch from the register to Bengalla's RT799 plan, scaling techniques were used. After measuring the current western parish boundary it measured 1605m. This is close to 8 chains which equals 1 mile or 1609m. This gave good confidence for this boundary. Holding the western boundary scale fixed makes the southern boundary 2980m. Scaling off the 1938 (109369) portion boundary to the previous Overton western boundary to a fixed line also in the current parish boundary plan, gave 1670m. This fixes the south west corner. The eastern boundary is fixed by an old fence line and the ident survey by Boardman Peasley land surveyors.

After all the scaling was completed there was around 40m east west difference between the register sketch and parish plans. This is acceptable seeing the register sketch is just that – a sketch.

This showed that the lease covers around half of Bengalla's current mining lease – including current workings. This is important since the lease is large and may have other workings on the site. From archival research methods, no other workings have been found on this old lease which gives good confidence for mining further west.



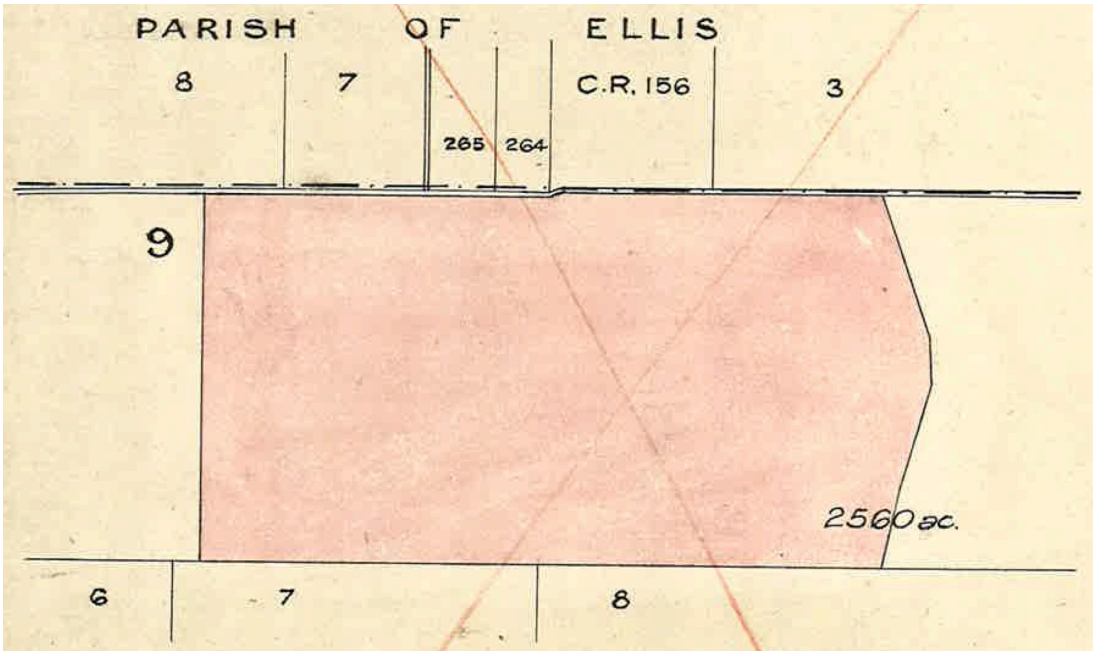


Figure 9 – Overton Colliery lease details and sketch from the Department's register

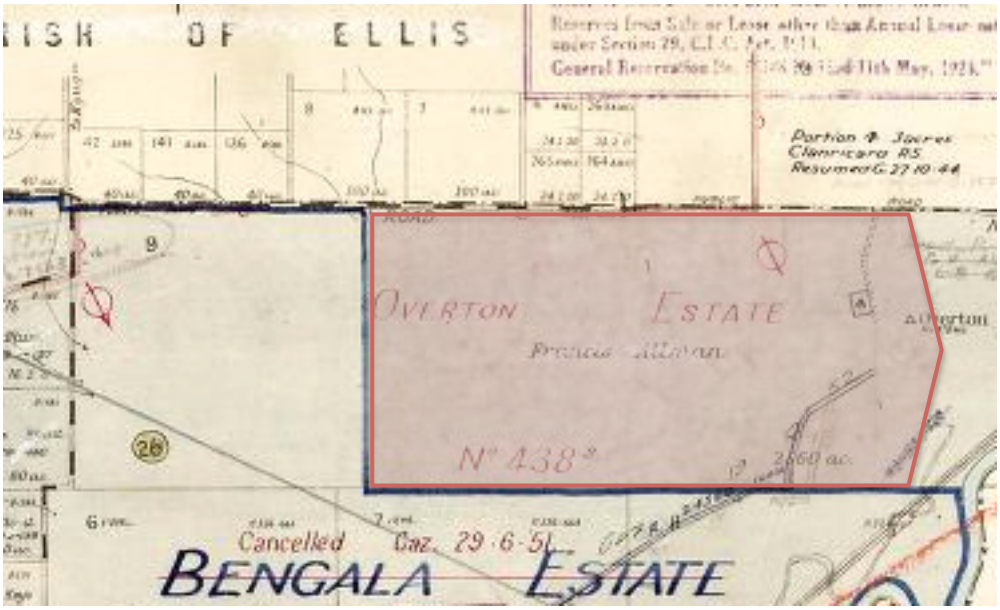


Figure 10 – 1938 Parish Map from LPI website showing approximate lease area overlaid onto the map

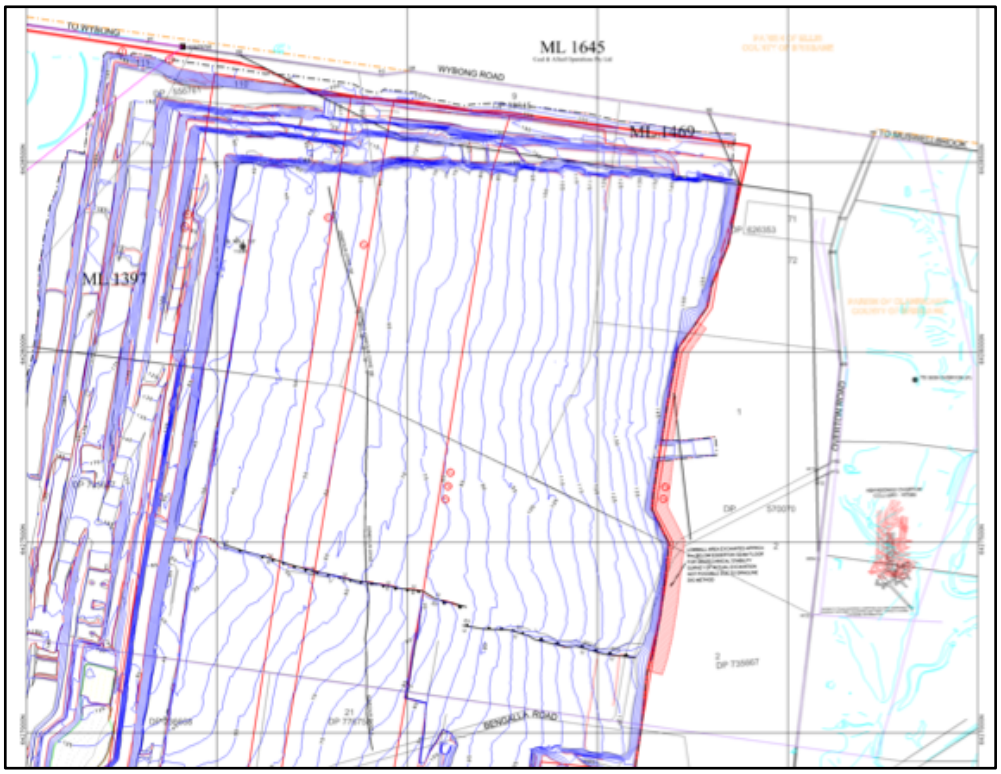


Figure 11 – Above shows how the previous Overton lease sits in comparison to the current lease (purple lines)

Below is the 1:25,000 plan (cancelled on 18/9/2000) that show a good overview of the area of interest as well as some old boreholes that have been drilled 'using public monies' on the lease. Interestingly the Overton Colliery that was known about from other Bengalla Mine Surveyors is not shown on this plan, and that is why it is important not to rely on just one plan and search all facets of various plans.

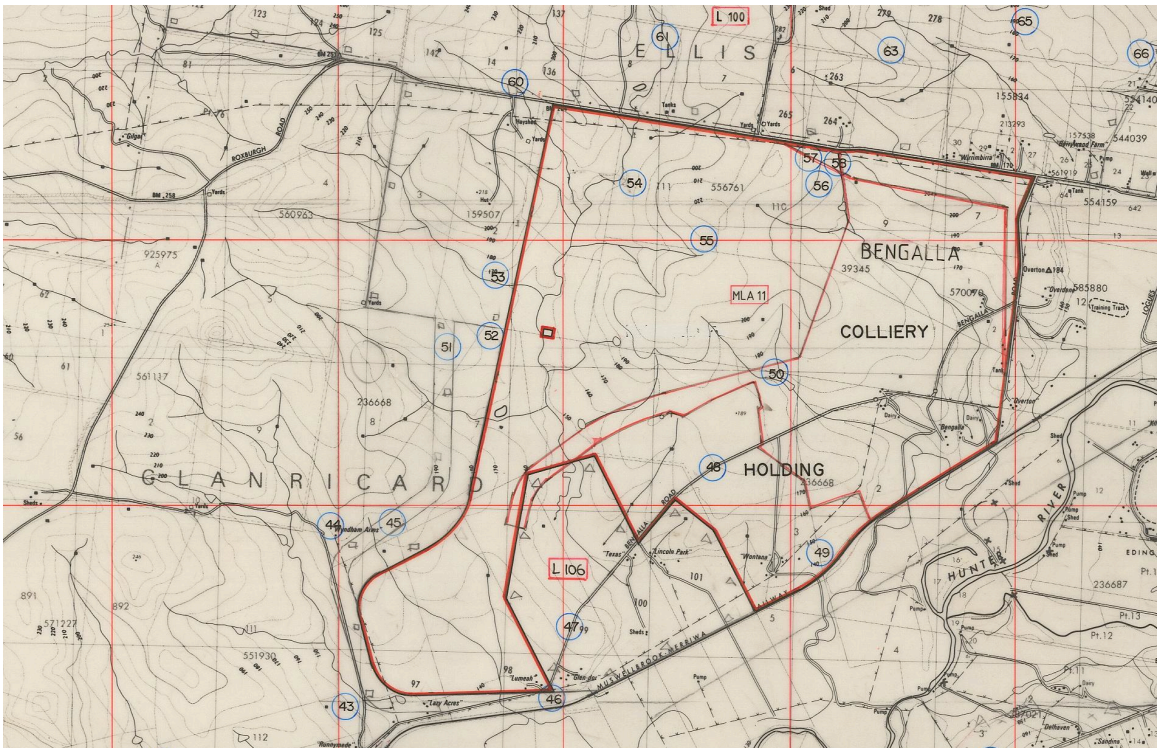


Figure 12 – some old borehole information in the area of interest from 1:25,000 plan (Muswellbrook 9033_2_N_sh1)

The boreholes in the area of interest from the 1:25,000 can be seen on the following screen grab. The plan numbers for each of the boreholes were sourced to make sure that these boreholes had been converted from ISG to MGA correctly and were shown on Bengalla's current Record Tracing borehole plans.

Further boreholes were also found when searching 'Clanricard' as a location through DIGS. The eleven boreholes in the area of interest were also checked to make sure they were accurately shown on current Record Tracing plans along with being endorsed appropriately. The details for the 1:25,000 boreholes as well as the extra boreholes found through DIGS can be found in Appendix 4.

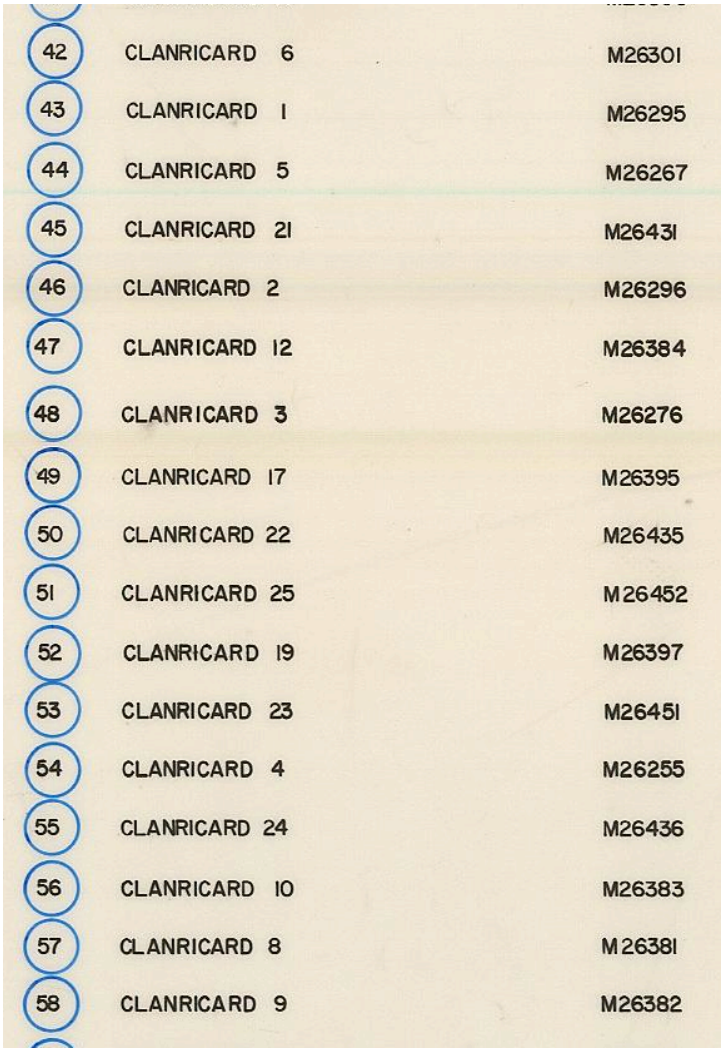


Figure 13 – Borehole information from 1:25,000 plan (Muswellbrook 9033_2_N_sh2) relating to description of borehole and plan number

Information from DIGS also gave details about the Muswellbrook Brick Works mining lease from the mid to late 1970's. This area is outside of the area of interest as shown in the following image, and any workings within the lease are unknown. Further research would be carried out if the lease was within the area of interest. The lease was withdrawn on 22/2/1980. Details of the lease can be seen in Appendix 1.

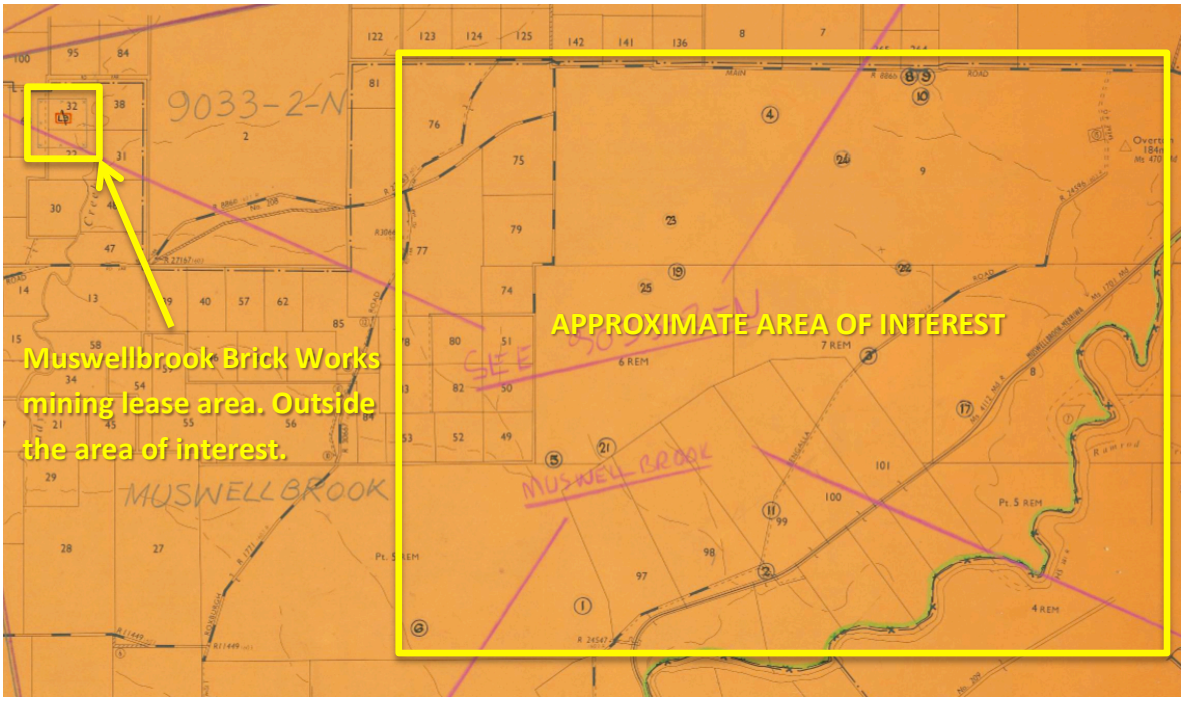


Figure 14 – Muswellbrook Brick Works lease. Well west of the area of interest.

From the research through the avenues of Minview, DIGS and at the Department, I feel that I have thoroughly looked into the possibility of any abandoned or suspected abandoned mines in the area of interest. Also from a visual look around the area and talking with previous surveyors, there is no extra evidence to suggest any unknown workings in the area.

It should be noted that any information from the Department is not certified by them. The Department only compiles and stores records from Mine Surveyors. The Mine Surveyor producing the plan is responsible for the accuracy of workings and all that is shown on the plan.

NSW GOVERNMENT | Trade & Investment

Record Tracing Images

"Information contained in this CD-ROM is derived from mine record tracings and other historical data produced by third parties. The Department of Trade and Investment and the Government of NSW have no role in preparing the information contained in this CD-ROM and do not warrant or represent that such information is complete, current or accurate in the depiction of the mine or in any other respect.
Users should make and rely upon their own separate enquiries when checking or verifying historical material.
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5. Relevant Legislation

The following extracts for legislation relevant to Archival Research is from the Survey and Drafting Directions for Mine Surveyors 2007 NSW Coal.

SURVEY AND DRAFTING DIRECTIONS FOR MINE SURVEYORS 2007 (NSW - COAL)

1.3 Compilation

1.3.3 Where old workings exist it shall be assumed, for the purpose of marking the Mine Workings Plan, that they constitute a danger until the contrary is proven. In this situation, all plans should be regarded with suspicion until their accuracy has been verified. Reasonable effort should be made to obtain all existing information about old workings and, once obtained, to ensure that they are recorded on the Mine Workings Plan in accordance with these Directions.

Note. Clause 28 of the Regulation prescribes for the purposes of section 32 of the Act hazards arising from inrush into underground parts of a coal operation as a major hazard to which subdivision 2 of Division 2 of Part 5 of the Act applies. Clause 33 of the Regulation prescribes for the purposes of section 36 of the Act contents of an inrush management plan. Clause 49 of the Regulation prescribes working within an inrush control zone as a high risk activity to which Subdivision 6 of Division 2 of Part 5 of the Act applies.

2. DEFINITIONS
Abandoned

A Mine or a Seam shall be deemed to be Abandoned where the workings of the Mine or Seam, as the case may be, have been Discontinued and there is no Care and Maintenance in place.

Note. Clause 64 and paragraph 2 of Schedule 1 of the Regulation provide further information regarding abandonment.

4.4 Preparation of Mine Workings Plan

4.4.1 Mine Workings Spatial Information.

For the preparation of the Mine Workings Spatial Information the following, unless otherwise required by these Directions, shall be compiled, as a minimum information in the form of digital themes, for each Seam Workings Plan or Void Plan.

4.4.1.1 Themes – General (NB: polygons are preferred see Table 9.2) 16

. (a) **Adjacent Mine Workings** - an outline of all workings in any seam in any direction within 100 metres of the current seam being worked.

. (b) **Adjacent Seam Workings** - all Mine workings (including other mines) in the seam being mined within 100 metres of the current workings.

Throughout section 4 of the Survey and Drafting Directions for Mine Surveyors there is a clear requirement to display data within 100m of current workings whether it be old or abandoned workings from the mine of your statutory position or that of another mining company.

In the case of the abandoned Overton Colliery, these workings can be placed outside the 100m of the proximity of the Bengalla workings. At this stage there is no long term plans for Bengalla to mine east of Oveton road. If there was, exploration drilling would be necessary to locate these workings more accurately and to then mark them on future mine operations plans and Mine Working Plans.

The importance of Archival Research and determining adjoining workings positions was brought to the front of Mine Surveyors minds during the tragic events of the Gretley disaster in 1996. The Department only compiles data supplied by the Mine Surveyor. The accuracy of plans is the responsibility of the Mine Surveyor.

So in the case of the Overton Colliery workings, their position cannot be satisfactorily determined, in this case you would refer to;

Coal Mine Health and Safety Regulation 2006

143 Duties of a Mining Surveyor

A mining surveyor must ensure that:

> (a) any variation of the coal operation workings from a mine workings plan of which the surveyor becomes aware, or
>
> (b) any interference with or obstruction to the performance of his or her functions, or
>
> (c) any doubt about the accuracy of any plans, is brought to the attention of the relevant operator.

In it's present position the abandoned workings of the Overton Colliery do not pose a threat of a possible inrush source. If workings to the east of Bengalla were planned, an inrush management plan may also have to be looked at.

Coal Mine Health and Safety Regulation 2006

33 Contents of major hazard management plan: inrush management plan

For the purposes of section 36 of the Act, a major hazard management plan in relation to a major hazard comprising hazards arising from any inrush into the underground

parts of the coal operation of water or other fluid materials, or any materials that become fluid when wet, or flammable or noxious gases, must make provision for the following matters:

(a) in assessing the risk of inrush, the consideration of the originals of any relevant plans and any relevant files or other material held by, or accessible by, the Department,

(b) the identification of each potential source of inrush (for example, current or disused mine workings (in the same seam or another seam), surface waters or aquifers), which must include the following:

. (i) the consideration of all available relevant information concerning the risk of inrush to the operation,

. (ii) an assessment of the nature and magnitude of all potential sources of inrush,

. (iii) a record of assumptions made in the development of the inrush management plan,

. (iv) for each potential source of inrush, an assessment of the worst case position of the potential source of inrush having regard to such things as the accuracy of plans of the mine, future mining operations and geological changes,

(c) the forming by the manager of mining engineering of an opinion as to whether or not it is practicable to remove or render harmless each identified potential source of inrush,

(d) if the manager of mining engineering is of the opinion that it is not practicable to remove or render harmless a potential source of inrush−—the documenting by the manager of the reasons for being of that opinion and the retention of that document at the coal operation,

(e) an objective summary of the nature and magnitude of the identified risks of inrush,

(f) the measures to be taken to prevent inrushes,

(g) the identification and maintenance of inrush control zones between the mine workings and each identified potential source of inrush,

(h) any special systems of working developed for mining and working in inrush control zones,

(i) any assumptions made in the development of measures to prevent inrushes,

(j) maintenance of the major hazard management plan so that at all times it implements the best available knowledge of risk of inrush at the mine,

(k) the reviewing and updating of the major hazard management plan before the mine is extended into any new area,

(l) ensuring that an inrush control zone identified in the major hazard management plan:

(i) is of sufficient thickness to safely separate the mine workings from the relevant potential source of inrush, or

(ii) in the case of a potential source of inrush that is not an accessible place in the same mine——is sufficient to provide a separation of 50 metres of solid rock between the mine workings and the assessed worst case position of the potential source of inrush.

Note. Clause 49 prescribes working within an inrush control zone as a high risk activity to which Subdivision 6 of Division 2 of Part 5 of the Act applies.

It is the surveyors responsibility to alert the relevant operator if there is a threat of inrush by coming in contact with abandoned or old workings. In the case of Bengalla, the Registered Surveyor would notify the Mine Manager position and any workings shown on the Mine Workings Plans endorsed to alert others of the inaccuracy of such workings.

In 2009 the Mine Manager was notified about Overton Colliery and the potential inaccuracies of the position of the workings by Mr Surveyor Andrew Boardman. A copy of this letter can be seen in Appendix 5.

The Mine Surveyor cannot be prosecuted for not determining the accuracy of old workings, but neglecting to pass on or research such information can lead to prosecution or more importantly endanger the health and safety of others.

An element that was acknowledged in the Judges report for the Gretley disaster was the exclusion of the Mine Surveyor in the management and planning process. This can mean that the Mine Surveyor is presented with near completed Mine Operations Plans requiring the Mine Surveyors signature. With time pressures and constraints putting a thorough investigation of all aspects in jeopardy. As shown through the court findings, this does not reduce the Mine Surveyors responsibility or liability.

References

Mines Health & Safety Regulation 2007

Surveying and Drafting Directions for Mine Surveyors (Coal) 2007

Gretley - Report of Formal Investigation CMRA 1982 Recommendations

Department Records – RT580
Old borehole information
Various archived plans

Archival Research – guidelines from the Department

Bengalla European Heritage Management Plan

Acknowledgements

Mr Andrew Boardman – Previous Bengalla Mine Registered Mine Surveyor

Mrs Karen Inglis – Trade & Investment, Resources & Energy

Mr Kevin Price – Registered Mine Surveyor

Mr Jamie Costello – Previous Bengalla Mine Registered Mine Surveyor

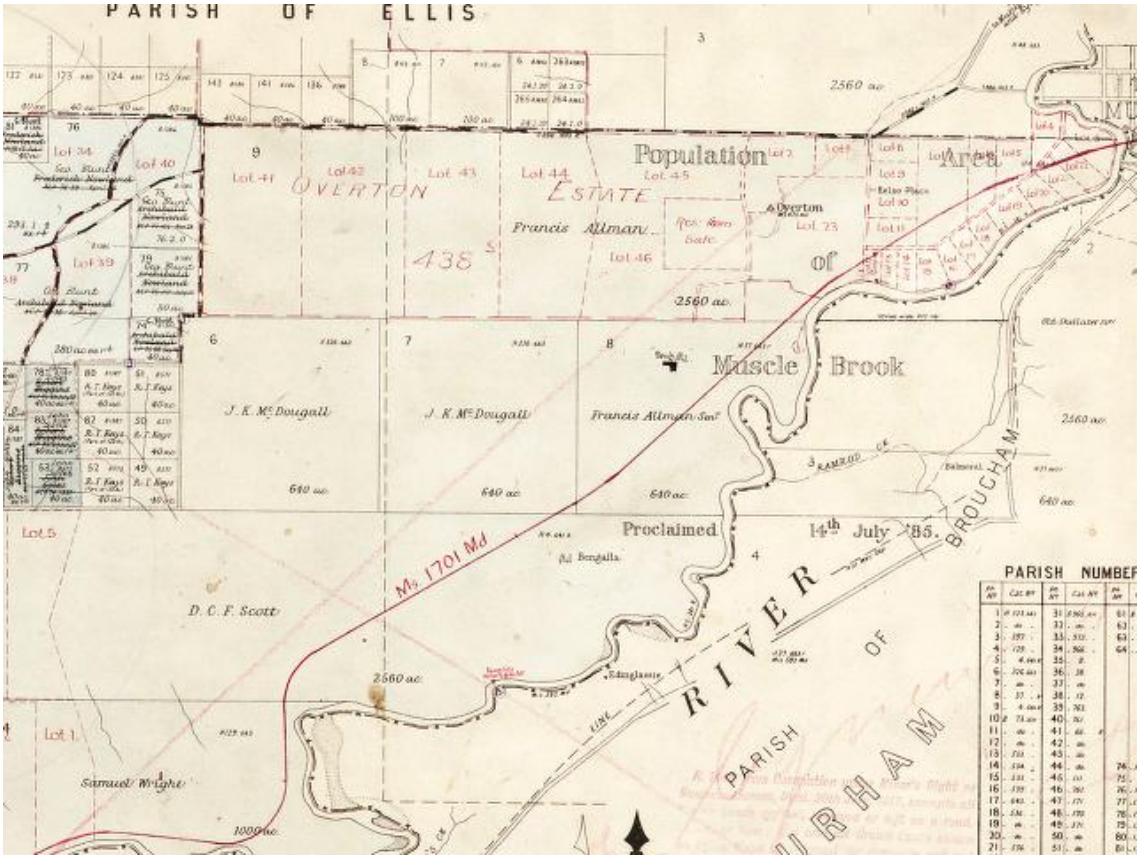
Mr Ross Peasley – Registered Land Surveyor, Boardman Peasley Pty Ltd

APPENDIX 1

Relevant Archived Plans and Information

Parish plans from the Land & Property Information

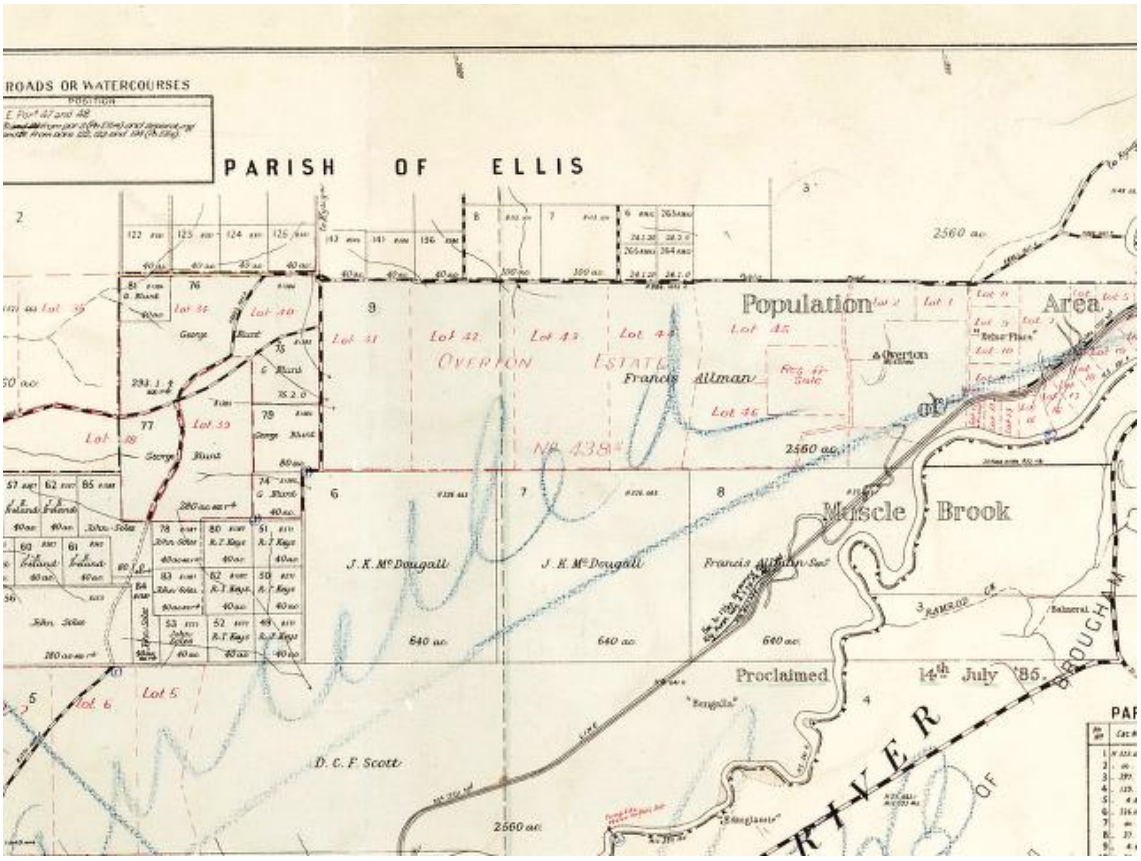
(http://www.lpi.nsw.gov.au/mapping_and_imagery/parish_maps - search = Clanricard)



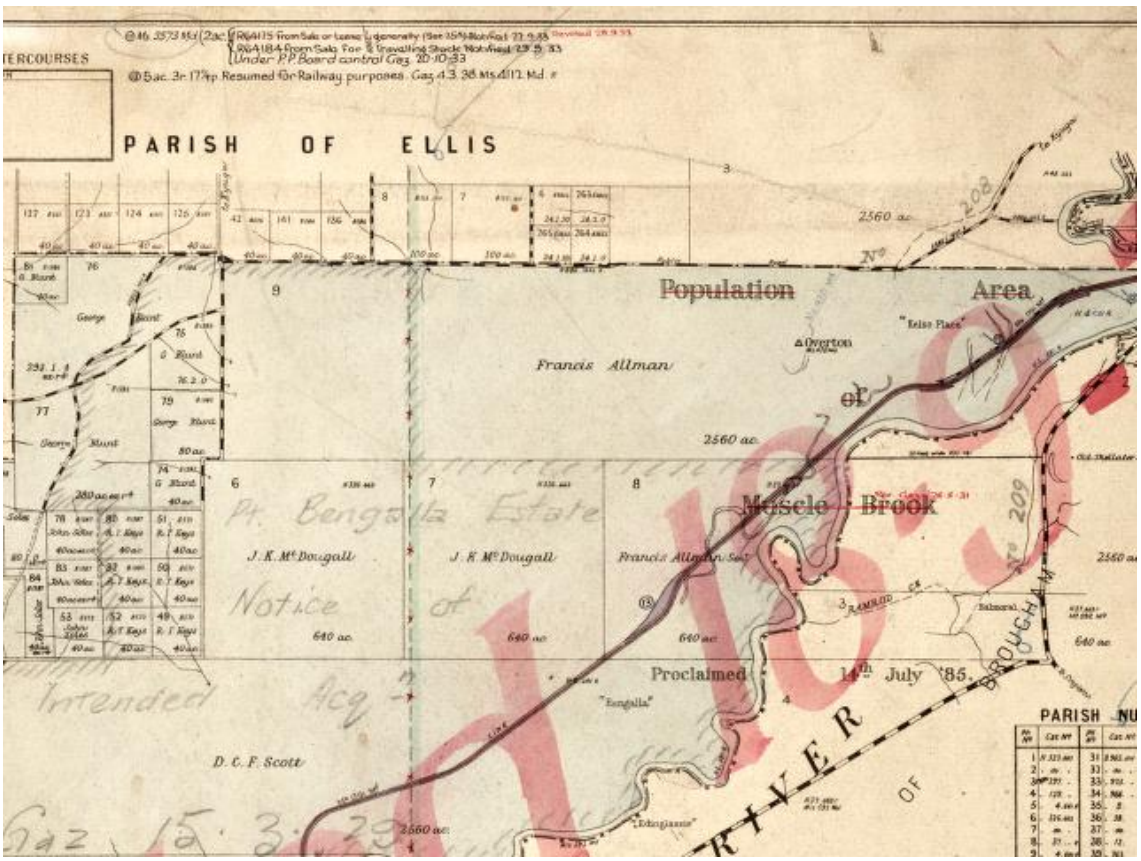
1897 Parish Map – Clanricard - 10937



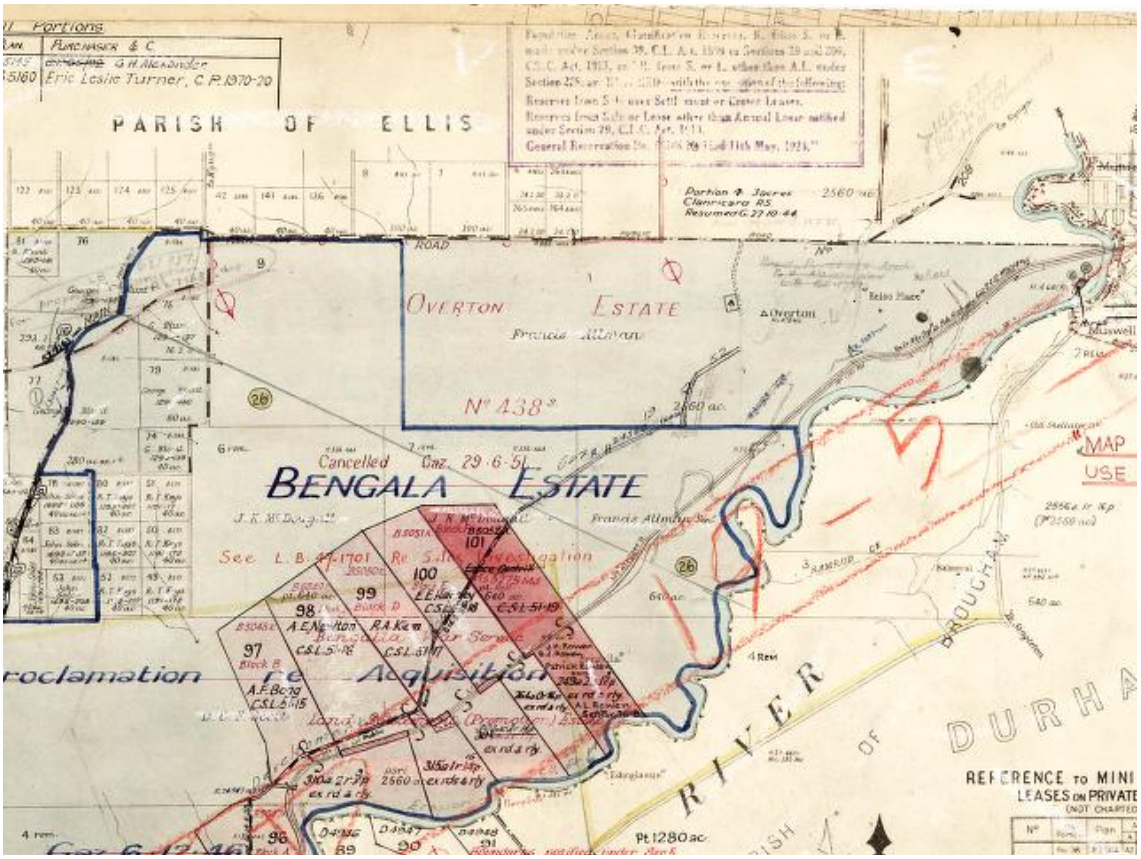
1897 Parish Map – Clanricard - 139034



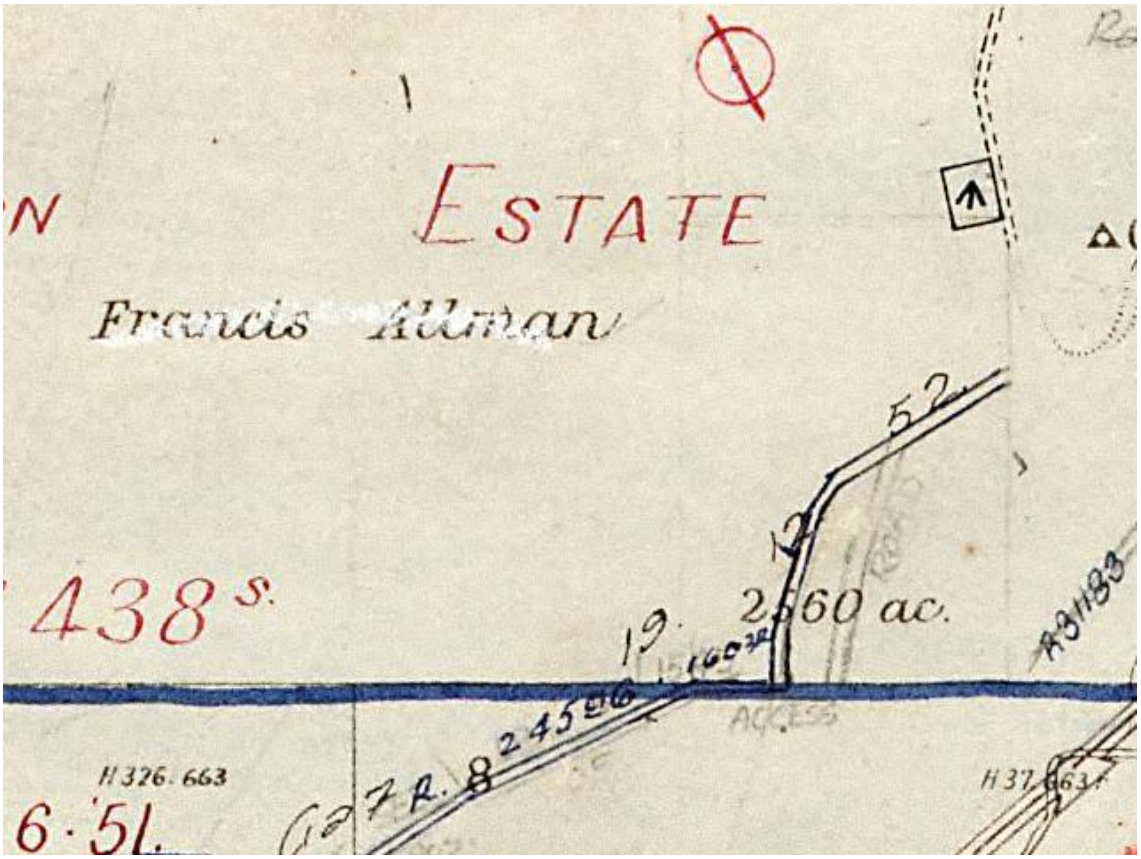
1921 Parish Map – Clanricard - 109370



1921 Parish Map – Clanricard - 139035



1938 Parish Map – Clanricard - 109369



1938 Parish Map – Clanricard – 109369 – zoomed in on south east corner

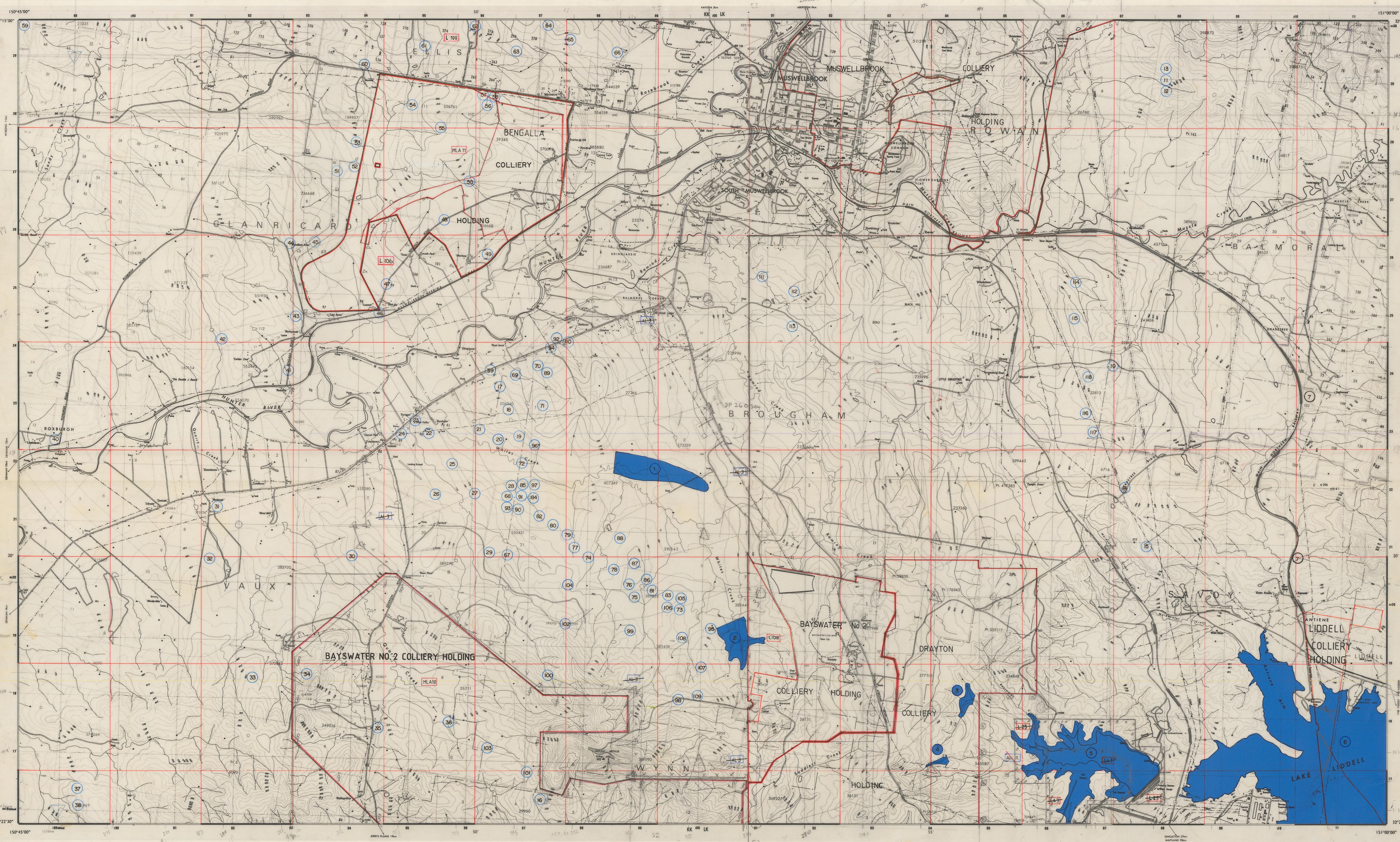
PRODUCED BY CENTRAL DRAFTING BRANCH
DEPARTMENT OF MINERAL RESOURCES, SYDNEY
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Mining Division of : SINGLETON ~~NEWCASTLE~~
Charted by :
Examined by : S Rogers 19-10-88
Approved by : I. House 21·10·88

FOR EXPLORATION LICENCES AND APPLICATIONS SEE SEPERATE MAP. FOR DETAILS OF INDIVIDUAL TITLES WITHIN COLLIERY HOLDINGS USE COLLIERY REGISTER.

MUSWELLBROOK

MUSWELLBROOK 9033-2-N 1:25,000 SERIES



MINING LEASES 1973 MINING ACT

For precise details of the area to which any Authority or application for Authority relates, reference must be made to the survey plan or diagram.

Appn No. - M.D.	Applicant - Lessee	Plan - Diagram No.	Area (ha)	Mineral - Purpose	Appn. Date	Date of Grant	Lease No.	Term Until	Renewed Until	State
108 Ne	Bayswater Colliery Company Pty. Ltd.	~~D6390~~ 6139	abt.122·1		11·9·84	17·10·90	MPL 263	17·10·2011		x x x
215	Muswellbrook Coal Co. Pty. Ltd.	D 6953	abt.108	Coal	7·12·90					
Mining Leases and Mineral Claims 1992 Act.										
215 HO	MUSWELLBROOK COAL COMPANY LIMITED	D 6953	ABT. 108	COAL	7.12.90	12.01.93	ML 1304	12.01.2014		
MLA 11 SI	BENGALLA MINING COMPANY PTY. LIMITED	M 26816 R	abt. ~~1225~~ 1047	COAL	12.11.93	27·06·96	ML.1397'92	27·6·2017		
MLA 10 SI	CALTEX OIL (AUSTRALIA) PTY. LIMITED & ORS.	D7313	abt. 3393	COAL	23.7.93	21.09.94	ML1358('92)	21.09.2015		
MLA 25 SI	SN & RG MARTIN		abt 357	MAGNETITE, TITANIUM	18·11·94					R 14·6·95
MLA 43 (SI)	SN & RG MARTIN		abt 151	OXIDE OF IRON	11·8·95					R 26·10·95
L 100	COAL & ALLIED OPERATIONS PTY LTD		2957	COAL	19.9.97					
L 106 SI	BENGALLA MINING CO P/L		177·2	COAL	10·2·98	10.6.99	ML1450(92)	9.6.2020		△ △ △

PROSPECTING LICENCES 1973 MINING ACT

For precise details of the area to which any Authority or application for Authority relates, reference must be made to the survey plan or diagram.

Appn No. - M.D.	Applicant - Licencee	Plan - Diagram No.	Area (ha)	Mineral	Appn. Date	Date of Grant	Licence No.	Term Until	Renewed Until	State
ASSESSMENT LEASES		**1992**	**ACT**							
AL 2 SI	DRAYTON COAL PTY. LIMITED		316.0		27.08.93					W25·10·93
AL 3 SI	ELECTRICITY COMMISSION OF NSW		ABT. 3530		11.11.94					W 3·2·97

REFERENCE NOTES

State Coal Mine Reserves Proclaimed Under Section 2(1) and Reserves Notified Under Section 10(1) of the State Coal Mines Act, 1912 have not been shown on this map.

1. MOUNT ARTHUR NORTH No.2 DAM, PRESCRIBED UNDER THE DAM SAFETY ACT, 1978. G.G. 7·11·86
2. MOUNT ARTHUR NORTH No.1 DAM, " " " " " " G.G 22·7·83
3. DRAYTON WATER SUPPLY DAM, (1891) " " " " " " G.G 17·10·80
4. DRAYTON MINE DAM, (1789) G.G 12·11·82
5. LIDDELL ASH DISPOSAL DAM & LIDDELL ASH DAM (STAGE 2) PRESCRIBED UNDER THE DAM SAFETY, ACT 1978.
6. LIDDELL COOLING WATER DAM PRESCRIBED UNDER THE DAM SAFETY, ACT 1978
7. RAILWAY TRANSMISSION LINE ALONG DED ROAD. RLY. DEPTS INTERESTS TO BE SAFEGUARDED PKS 50 8533

— NOTE —
INFORMATION SHOWN ON THIS MAP HAS BEEN ENTERED INTO MRLIS IF A CHANGE IS MADE TO ANY SHAPE (INCLUDING NEW APPNS AND DELETIONS) PLEASE BRING TO ATTENTION OF JOHN DUNNELL.

GRID CONVERGENCE
GRID MAGNETIC ANGLE
TN MN
TRUE NORTH, GRID NORTH AND MAGNETIC NORTH ARE SHOWN DIAGRAMMATICALLY FOR THE CENTRE OF THIS MAP. MAGNETIC NORTH IS CORRECT FOR AND MOVES EASTERLY BY IN ABOUT THREE YEARS.

SCALE - 1:25000

0 250 500 750 1000 1250 1500 1750 2000 2250 2500 2750

LEGEND

Public Road
Parish Boundary
County Boundary
Mining Division Boundary
Telephone Line
Tracks, Foot or Bridle
Trigonometrical Station
Single Track Railway
Tanks
Buildings
Power Transmission Line

ACCURACY:
This map has been compiled by the 'let-in' process and may incorporate minor errors present in source materials.
There is no warranty that Blocks and Units are correctly shown in relation to other features on the map. Boundaries are to be ascertained by reference to the Australian Geodetic Datum.

KEY TO ADJOINING MAPS

MANOBALAI 9033-4-S	ABERDEEN 9033-1-S	ROUCHEL BROOK 9133-4-S
SANDY HOLLOW 9033-3-N	**MUSWELLBROOK 9033-2-N**	DAWSONS HILL 9133-3-N
DENMAN 9033-3-S	JERRYS PLAINS 9033-2-S	CAMBERWELL 9133-3-S

9033-2-N SH1.

MAP CANCELLED AS AT 18-09-00
9033-2-N

PRODUCED BY CENTRAL DRAFTING BRANCH
DEPARTMENT OF MINERAL RESOURCES, SYDNEY.
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Mining Division of : SINGLETON NEWCASTLE
Charted by :
Examined by : S. Cyler 19-10-88
Approved by : D. Howe 21-10-88

FOR EXPLORATION LICENCES AND APPLICATIONS SEE SEPARATE MAP. FOR DETAILS OF INDIVIDUAL TITLES WITHIN COLLIERY HOLDINGS USE COLLIERY REGISTER.

MUSWELLBROOK

MUSWELLBROOK 9033-2-N 1:25 000 SERIES

MINING LEASES 1973 MINING ACT

For precise details of the area to which any Authority or application for Authority relates, reference must be made to the survey plan or diagram.

Appn Nº - M.D.	Applicant - Lessee	Plan - Diagram Nº	Area (ha)	Mineral - Purpose	Appn. Date	Date of Grant	Lease Nº	Term Until	Renewed Until	State

PROSPECTING LICENCES 1973 MINING ACT

For precise details of the area to which any Authority or application for Authority relates, reference must be made to the survey plan or diagram.

Appn Nº - M.D.	Applicant - Licencee	Plan - Diagram Nº	Area (ha)	Mineral	Appn. Date	Date of Grant	Licence Nº	Term Until	Renewed Until	State

REFERENCE NOTES

	DESCRIPTION OF BOREHOLE	PLAN No.
10	BALMORAL 1	M26501
11	LUPTON PARK 1	M26291
12	LUPTON PARK 2	M26292
13	LUPTON PARK 3	M26293
14	SAVOY 1	M26499
15	SAVOY 2	M26500
16	MOUNT ARTHUR DDH 36	X
17	MOUNT ARTHUR DDH 57	X
18	MOUNT ARTHUR DDH 61	X
19	MOUNT ARTHUR DDH 65	X
20	MOUNT ARTHUR DDH 75	
21	MOUNT ARTHUR DDH 23	X
22	MOUNT ARTHUR DDH 71	X
23	MOUNT ARTHUR DDH 73	X
24	MOUNT ARTHUR DDH 1	X
25	MOUNT ARTHUR DDH69	X
26	MOUNT ARTHUR DDH 20	
27	MOUNT ARTHUR DDH 68	X
28	MOUNT ARTHUR DDH 52	X
29	MOUNT ARTHUR DDH 6	X
30	MOUNT ARTHUR DDH 26	X
31	MOUNT ARTHUR DDH 21 & 21A	X
32	MOUNT ARTHUR DDH 5	X
33	MOUNT ARTHUR DDH 31	X
34	MOUNT ARTHUR DDH 27	X
35	MOUNT ARTHUR DDH 28	X
36	MOUNT ARTHUR DDH 19	X
37	MOUNT ARTHUR DDH 9	X
38	JERRYS PLAINS No. 6	X
39	MOUNT ARTHUR DDH 7	X
40	CLANRICARD 7	M26269
41	CLANRICARD 18	M26396
42	CLANRICARD 6	M26301
43	CLANRICARD 1	M26295
44	CLANRICARD 5	M26267
45	CLANRICARD 21	M26431
46	CLANRICARD 2	M26296
47	CLANRICARD 12	M26384
48	CLANRICARD 3	M26276
49	CLANRICARD 17	M26395
50	CLANRICARD 22	M26435
51	CLANRICARD 25	M26452
52	CLANRICARD 19	M26397
53	CLANRICARD 23	M26451
54	CLANRICARD 4	M26255
55	CLANRICARD 24	M26436
56	CLANRICARD 10	M26383
57	CLANRICARD 8	M26381
58	CLANRICARD 9	M26382
59	CLANRICARD 20	M26430
60	ELLIS 20	
61	ELLIS 42	
62	ELLIS 45	
63	ELLIS 44	
64	ELLIS 8	
65	ELLIS 41	
66	ELLIS 12	M26256
67	MOUNT ARTHUR DDH 3	O
68	MOUNT ARTHUR DDH 7	O
69	MOUNT ARTHUR DDH 11	O
70	MOUNT ARTHUR DDH 13	O X
71	MOUNT ARTHUR DDH 15	O
72	MOUNT ARTHUR DDH 17	O
73	MOUNT ARTHUR DDH 30	
74	MOUNT ARTHUR DDH 38	
75	MOUNT ARTHUR DDH 39	
76	MOUNT ARTHUR DDH 40	
77	MOUNT ARTHUR DDH 41	
78	MOUNT ARTHUR DDH 42	
79	MOUNT ARTHUR DDH 43	
80	MOUNT ARTHUR DDH 44	
81	MOUNT ARTHUR DDH 45	
82	MOUNT ARTHUR DDH 46	
83	MOUNT ARTHUR DDH 47	
84	MOUNT ARTHUR DDH 48	
85	MOUNT ARTHUR DDH 50	
86	MOUNT ARTHUR DDH 51	
87	MOUNT ARTHUR DDH 53	
88	MOUNT ARTHUR DDH 54	
89	MOUNT ARTHUR DDH 55	
90	MOUNT ARTHUR DDH 56	
91	MOUNT ARTHUR DDH 58	
92	MOUNT ARTHUR DDH 59	
93	MOUNT ARTHUR DDH 60	
94	MOUNT ARTHUR DDH 63	
95	MOUNT ARTHUR DDH 64	
96	MOUNT ARTHUR DDH 67	
97	MOUNT ARTHUR DDH 70	
98	MOUNT ARTHUR DDH 22	O
99	MOUNT ARTHUR DDH 24 & 24A	O
100	MOUNT ARTHUR DDH 25	O
101	MOUNT ARTHUR DDH 29	O
102	MOUNT ARTHUR DDH 32	O
103	MOUNT ARTHUR DDH 34	O
104	MOUNT ARTHUR DDH 37	O
105	MOUNT ARTHUR DDH 49	O
106	MOUNT ARTHUR DDH 62	O
107	MOUNT ARTHUR DDH 66	O
108	MOUNT ARTHUR DDH 72	
109	MOUNT ARTHUR DDH 74	O
110	MOUNT ARTHUR DDH 76	
111	BLACKHILL 1	M26289
112	BLACKHILL 2	M26290
113	BLACKHILL 3	M26288
114	BROUGHAM 1	M26502
115	BROUGHAM 2	M26503
116	BROUGHAM 3	M26504
117	BROUGHAM 4	M26505
118	BROUGHAM 5	M26506

X ISG Co-ords available from Coal Geology
O T.M Co-ords shown on Parish of Brougham Map Nº 81

MAP CANCELLED AS AT 18-09-00
9033-2-N

9033-2-N SH2.

3056

PARISH OF CLANRICARD

COUNTY OF BRISBANE

LAND DISTRICT – MUSWELLBROOK
SHIRE – MUSWELLBROOK
PASTURES PROTECTION DISTRICT – SINGLETON

EDITION – SIXTH
DATE OF MAP – 4TH APRIL 1979
AIR PHOTOS AVAILABLE

SCALE
1:25 000

Approx. 11° 30' 30"E Reduce Change + 1·1'

Copies of this map may be purchased from the Department of Lands, Sydney and Regional Offices at Newcastle, Queanbeyan, Lands Office in Row Street, Wagga Wagga and Lands Office in Rous Way, Grafton, who have Department of Lands Maps.

Widths of surveyed roads and public roads are shown to the nearest metre. If widths are not shown they are 20 metres or 20·115 metres wide. Where widths other than these apply the required reference will be necessary to plans of survey.

No land included within, or within 20m of the bed or banks of any river or lake or watercourse or any prescribed river notified since Gazette 9th April, 1948, 30th May, 1952 and 17th June, 1960, shall be transferred, but shall, limited or conditional Crown Grant, be granted, except as provided by Section 22 Water Act 1912, as amended.

R.56/46 Soils or Lands Generally, 11th May, 1923. All beds of rivers, tributaries, and, the boundary of the E., R. C. Divisions and all shingle, gravel, sand beds and alluvium thereon or adjacent thereto, i.e., Lower lands between the banks or such rivers &c. and the boundary of the E., R. C. Divisions are reserved. However, all beds of rivers, tributaries and lagoons 20·5m reservations not already reserved from sale by Act of Parliament, or by Proclamation, and all islands or parts of islands in the Division, quoted not alienated, held under Special Lease, or reserved from sale for a Public Purpose other than under the reservation held sure under general notice of 11th April, 1862, revoked 12th May, 1922.

Areas of alienated portions quoted on this map are those at the date of issue of Crown Grant.

WITHIN

Division – Eastern, N.S.W.

Conservation Trust District – Hunter Valley, Act No.19, 1962.
R.2297 (W) from the vesting provisions of the Mining Act 1906, as amended. Notified 6th December, 1963 (Crown land).
R.2298 (W) from the provisions of Part VII of the Mining Act 1906, as amended. Notified 6th December, 1963 (Freehold land).

Standard topographic maps are available covering this parish.
Relevant maps are Muswellbrook 9033-I-N, Sandy Hollow 9033-II-N, Wollombi 9033-III-S & Aberdeen 9033-I-S.

Integrated Survey Grid (ISG) Zone 56 (1 millimetre in metres is only an approximate representation due to insufficient horizontal control).

Place names are as approved under the provisions of the Geographical Names Act, 1966.

Valuations of Land Act 1916, as amended. Parts V & VI, operates in Muswellbrook Shire

LEGEND

State
Territorial Division
County
Parish
Land District
Shire, Municipality or City (L.G. Act)
Urban Area
City, Town or Village
Town or Village (L.G. Act)
Suburban
Planning Scheme
Registration of Buildings Area
National Park, Wildlife Site, Nature Reserve
Wildlife Refuge or Game Reserve
Aboriginal Areas or Places, Archaeological Areas
Area of Erosion Hazard
Fisheries Protection District
Reserves or land vested in Council
State Forest
National Forest
State Coal Mine
Catchment Area
Irrigation Area
Dominion & State Water Supply & Irrigt. Dist.
Water Trust District
Survey Area
State Recreation Area
Grain, Licence and Pest, Occn. License
Reserves from Sale or Lease or License
Lands under Heritage Act
Reserves from Occupation Use Mining Act
Reserves from Mining Lease
Public road - Public Roads Act, 1902 as amended
Private Subdivision Roads
Restricted Control Point - Landmark (with height)
Horizontal Control Point - Other (with height)
Observing Station
Adjoining Parish Names

HARTLEY

IN GENERAL USE FOR CHARTING
Mining Division of NEWCASTLE
Charted by Sue French 8-10-79
Examined by
Approved by 9-11-79

FOR EXPLORATION LICENCES AND APPLICATIONS SEE COUNTY MAPS.

FOR AREAS SET ASIDE & AUTHORISATIONS GRANTED UNDER SECTION 20, COAL MINING ACT, 1973, IN THIS PARISH OR COUNTY SEE SEPARATE COUNTY MAP KEPT IN COAL TITLES BRANCH.

FOR COLLIERY HOLDINGS IN THIS PARISH SEE PARISH MAP KEPT IN COAL TITLES BRANCH.

REFERENCE TO PORTIONS

Areas in hectares unless otherwise shown
Small number 2196 – unless otherwise shown

Por.	Plan	Loc.	Vol.	Fol.	Area	Purchaser etc.
1	P 323 (sht.)	A3			29.0	Samuel Wright
2	323 (sht.)	A4			29.0	Samuel Wright
3	282 (sht.)	A5			Pt. 328.4	John Pike
4	175 (sht.)	A6			Pt. 29.0	Samuel Wright
5	326 (sht.) R	C1,C2			Pt. 1066	S.C. Scott
6	326 (sht.)	C3			Pt. 29.0	J.K. McDougall
7	326 (sht.)	C3			Pt. 29.0	J.K. McDougall
8	37 (sht.) R	C3			29.0	Francis Aloysius Sav.
9	4 (sht.) R	C4			1036	Francis Aloysius
10	D 73 (sht.)	A2			160.2	J.H. Keys
11	73 (sht.)	A1			259.0	J.H. Keys
12	73 (sht.)	B1			240.4	J.H. Keys
13	538 (sht.)	B2	935	181	16.19	J.E. Ireland
14	538 (sht.)	B2	968	68	35.36 acres	J.E. Ireland
15	535 (sht.)	B3	896	188	16.19	J.E. Ireland
16	535 (sht.)	B3	896	189	16.19	John Soles
17	443 (sht.)	B3	951	96	16.19	John Soles
18	536 (sht.)	B3	70	203	44.92	J.H. Keys
19	536 (sht.)	A3	70	139	44.92	J.H. Keys
20	536 (sht.)	B3	70	141	44.92	J.H. Keys
21	536 (sht.)	B4	2037	42	16.19	John Soles
22	536 (sht.)	B4	2037	43	16.19	George Clark
23	885 (sht.)	B3	123	229	129.5 acres	J.H. Keys
24	888 (sht.)	B3	189	141	129.5 acres	J.H. Keys
25	888 (sht.) R	B3	121	204	118.8	J.H. Keys
26	888 (sht.) R	B3	309	49	118.5	J.H. Keys
27	888 (sht.) R	B3	121	225	109.5	J.H. Keys
28	888 (sht.) R	B3	123	206	89.74	J.H. Keys
29	888 (sht.) R	B3	121	205	89.74	J.H. Keys
30	888 (sht.) R	B4	2098	134	20.23	J.H. Soles
31	965 (sht.) R	B4	2037	43	16.19	George Clark
32	965 (sht.) R	B4	2127	43	16.19	George Clark
33	893 (sht.) R	A3	1851	123	16.19 acres	John Soles
34	966 (sht.) R	B4	2037	50	16.19	John Soles
35	8	A3	367	21	21.04	J.H. Keys
36	36	B4	3883	177	57.09 acres	John Soles
37	38	B4	2084	194	32.37	George Clark
38	363	B4	975	206	16.19	J.E. Ireland
39	363	B4	975	207	16.19	J.E. Ireland
40	767	B4	975	47	16.19	J.E. Ireland
41	68 R	A3	367	68	139.8	J.H. Keys
42	68 R	A3	562	114	36.82	J.H. Keys
43	68 R	A3	367	115	34.83	J.H. Keys
44	68 R	A2	367	116	29.82	J.H. Keys
45	511	B3	1196	151	16.19	R.T. Keys
46	511	B3	1196	152	16.19	J.E. Ireland
47	511	B4	2135	111	16.19	George Clark
48	508	B4	2037	36	21.04	George Clark
49	511	C3	1196	172	16.19	R.T. Keys
50	511	C3	1196	173	16.19	R.T. Keys
51	511	C3	1196	177	16.19	R.T. Keys
52	511	C3	1196	201	16.19	R.T. Keys
53	513	B3	1692	205	16.19	John Soles
54	513	B3	1692	206	16.19	John Soles
55	513	B3	1790	169	38.28	John Soles
56	513	B3	1443	36	17.84 acres	John Soles
57	514	B4	975	39	16.19	J.E. Ireland
58	649	B3	645	102	16.19	J.H. Keys
59	649	B3	1443	70	16.19	John Soles
60	507	B3	979	25	16.19	J.E. Ireland
61	507	B4	975	38	16.19	J.E. Ireland
62	507	B4	975	71	16.19	J.E. Ireland
63	514	B4	2137	43	16.19 acres	George Clark
64	514	B4	3564	83	17.42 acres	George Clark
65	1345	F4	10606	195	1.080	C.M. Alexander
66	1386	C4	1790	136	16.19	George Brunt
67	1386	C4	1790	138	20.90	George Brunt
68	1386	C4	1790	139	118.7 acres	George Brunt
69	1385	C4	1790	135	132.3 acres	George Brunt
70	1387	C3	1196	238	16.19 acres	R.T. Keys
71	1383	C2	1790	140	22.25	George Brunt
72	1387	C3	1196	202	16.19	R.T. Keys
73	1386	C4	1790	141	16.19	George Brunt
74	1387	C3	1196	203	16.19	R.T. Keys
75	1387	C3	1692	203	16.19 acres	John Soles
76	1383	C2	1692	208	16.19 acres	John Soles
77	1383	C2	1949	44	16.19	R.T. Keys
78	1760	B2	1196	44	21.04	R.T. Keys
79	1760	B2	1196	45	21.04	R.T. Keys
80	1760	B2	1196	46	21.04	R.T. Keys
81	1760	B2	1196	47	21.04	R.T. Keys
82	1760	B2	1196	48	19.83	R.T. Keys
83	1762	C2	1196	49	20.23	R.T. Keys
84	5049 R	D3			177.2 acres	K.R. Broadbent C.S.L. 51-14
85	5048 R	D3			179.7 acres	A.F. Bugg C.S.L. 52-15
86	5049 R	D3			177.8 acres	A.F. Bugg C.S.L. 51-16
87	5050 R	D3			123.5 acres	K.A. Kent C.S.L. 52-17
88	5051 R	D3			156.9 acres	E.F. Hayley C.S.L. 51-18
89	5052 R	D3			197.2 acres	Patrick Rowen and others S.P. 76-8
90	5160	C2			5.165	L.L. Turner C.P. 70-20

REFERENCE TO LOTS

Areas in hectares unless otherwise shown

Lot	Plan	Loc.	Vol.	Fol.	Area	Purchaser etc.

REFERENCE NOTES

Numbers shown on roads are map

No.	Loc.	Details
1	A2	Closed road, J.B. Brown. 1.821 ha. Vol. 3605. Fol. 194
2	B1,B2	Closed road, W.T. Bruxton. 2.380 ha. Vol. 3411. Fol. 181
3	B2	Closed road, John Timmins. 3698 m². Vol. 2183. Fol. 221
4	A1,B2	Closed road, Jowers Lowes. 2.229 ha. Vol. 4276. Fol. 254
5	B2	Closed road, J.H. Keys. 4047 m². Vol. 2500. Fol. 18
6	B2	Closed road, J.H. Keys. 4026 m². Vol. 2500. Fol. 19
7	E3	Reserve No. 1 for Hunter River Improvement Trust. 20th May, 1911. 3.644 ha. Lot 11 D.P. 726608
8	B2	Severed land, Coal Adv. July, 1963. 4254 m². R.31375 (sht.)
9	B2,C2	Closed road, J.R. Keys. 2.225 ha. Vol. 2539. Fol. 219
10	C2	Closed road, Gaz. 5th September, 1968. J.K. Fitzgerald. 1.215 ha. Vol. 11064. Fol. 183
11	B3	C.R.47960. Notified 31st July, 1912. R.R. 120. Notified 9th February, 1880. Lower P.P. closed comm. Gaz. 31st October, 1930
12	C3	Closed road, Gaz. 5th September, 1968. A.C. Clarke 4047 m²
13	A3	Closed road, R.G. Bray. 1012 m². Vol. 2441. Fol. 29
14	A3,A4	Closed road, Gaz. 3rd December, 1965. Vested in owner of adjoining land.
15	E4	Reserved for Public School site Gaz. 27th October, 1944. 2.214 ha. M.4634 Mid. New sold.

MINING SURVEYS

LEASES ON PRIVATE LANDS

No.	Portion	Plan	Area	Purpose
	38	P 3544	16.19 ha	Water Conservation

CLASSIFIED AREAS

Por.	Set apart for	Gazette
96,97,98,99,100,101	Bregalla Promotion Estate	

REFERENCE NOTES

Numbers shown on roads are map

No.	Loc.	Details
1	A2	Closed road, J.B. Brown. 1.821 ha. Vol. 3605. Fol. 194
2	B1,B2	Closed road, W.T. Bruxton. 2.380 ha. Vol. 3411. Fol. 181
3	B2	Closed road, John Timmins. 3698 m². Vol. 2183. Fol. 221
4	A1,B2	Closed road, Jowers Lowes. 2.229 ha. Vol. 4276. Fol. 254
5	B2	Closed road, J.H. Keys. 4047 m². Vol. 2500. Fol. 18
6	B2	Closed road, J.H. Keys. 4026 m². Vol. 2500. Fol. 19
7	E3	Reserve No. 1 for Hunter River Improvement Trust. 20th May, 1911. 3.644 ha. Lot 11 D.P. 726608
8	B2	Severed land, Coal Adv. July, 1963. 4254 m². R.31375 (sht.)
9	B2,C2	Closed road, J.R. Keys. 2.225 ha. Vol. 2539. Fol. 219
10	C2	Closed road, Gaz. 5th September, 1968. J.K. Fitzgerald. 1.215 ha. Vol. 11064. Fol. 183
11	B3	C.R.47960. Notified 31st July, 1912. R.R. 120. Notified 9th February, 1880. Lower P.P. closed comm. Gaz. 31st October, 1930
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14	A3,A4	Closed road, Gaz. 3rd December, 1965. Vested in owner of adjoining land.
15	E4	Reserved for Public School site Gaz. 27th October, 1944. 2.214 ha. M.4634 Mid. New sold.

1 Reserve No 2897 Gazetted 6-12-68 being a Reserve within which Mining Leases, Coal Leases and Mining Purposes Leases will not be granted.
Reserve No 2898 Gazetted 6-12-68 being a Reserve within which Prospecting Licences, Mining Leases, Coal Leases or Mining Purposes Leases shall not be granted.

SCHEDULE OF BOREHOLES WHICH HAVE BEEN DRILLED USING PUBLIC MONIES

NAME	PORTION	PLAN
(1) Clanricard 1	Por 5 Rem	M 26295
(2) Clanricard 2	Por 98	M 26296
(3) Clanricard 3	Rd (Por 7)	M 26276
(4) Clanricard 4	Por 9	M 26255
(5) Clanricard 5	Por 5 Rem	M 26267
(6) Clanricard 6	Por 5 Rem	M 26301
(7) Clanricard 7	Rd (Por 90)	M 26269
(8) Clanricard 8	Por 9	M 26381
(9) Clanricard 9	Por 9	M 26382
(10) Clanricard 10	Por 9	M 26383
(11) Clanricard 11	Rd (Por 99)	M 26384
(12) Denman 3	Por 11	M 26039
(13) Clanricard 13	Por 1	M 26392
(14) Clanricard 14	Por 1	M 26393
(15) Clanricard 15	Por 41	M 26394
(16) Clanricard 16	Por 2	M 26429
(17) Clanricard 17	Por 8	M 26395
(18) Clanricard 18	Rd Por 98	M 26396
(19) Clanricard 19	Por 6 Rem	M 26397
(20) Clanricard 20	Por 2	M 26430
(21) Clanricard 21	Por 6	M 26431
(22) Clanricard 22	Por 7 REM	M 26435
(23) Clanricard 23	Por 8	M 26451
(24) Clanricard 24	Por 8	M 26436
(25) Clanricard 25	Por 6 REM	M 26452

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MINING LEASES 1973 MINING ACT

For precise details of the area to which any Authority or Application for Authority relates, reference must be made to the survey plan or diagram

Appn.No.	Min. Div.	Pors.	Cat.No.	Applicant/Lessee.	Area.	Appn.Date.	Mineral-Purpose	Lease No.	Date of Grant	Term.	Renewed.	State.
9	Newcastle	22,32 & 63	D 2185	Muswellbrook Brick Works Pty Ltd	Abt 14·4ha	27·8·76						W 22·280

PROSPECTING LICENCES 1973 MINING ACT

For precise details of the area to which any Authority or application for Authority relates, reference must be made to the survey plan or diagram

Appn.No.	Min. Div.	Pors.	Cat. No.	Applicant/Licencee	Area	Appn. Date	Mineral	Licence No.	Date of Grant	Term	Renewed	State

PLAN

OVERTON COLLIERY

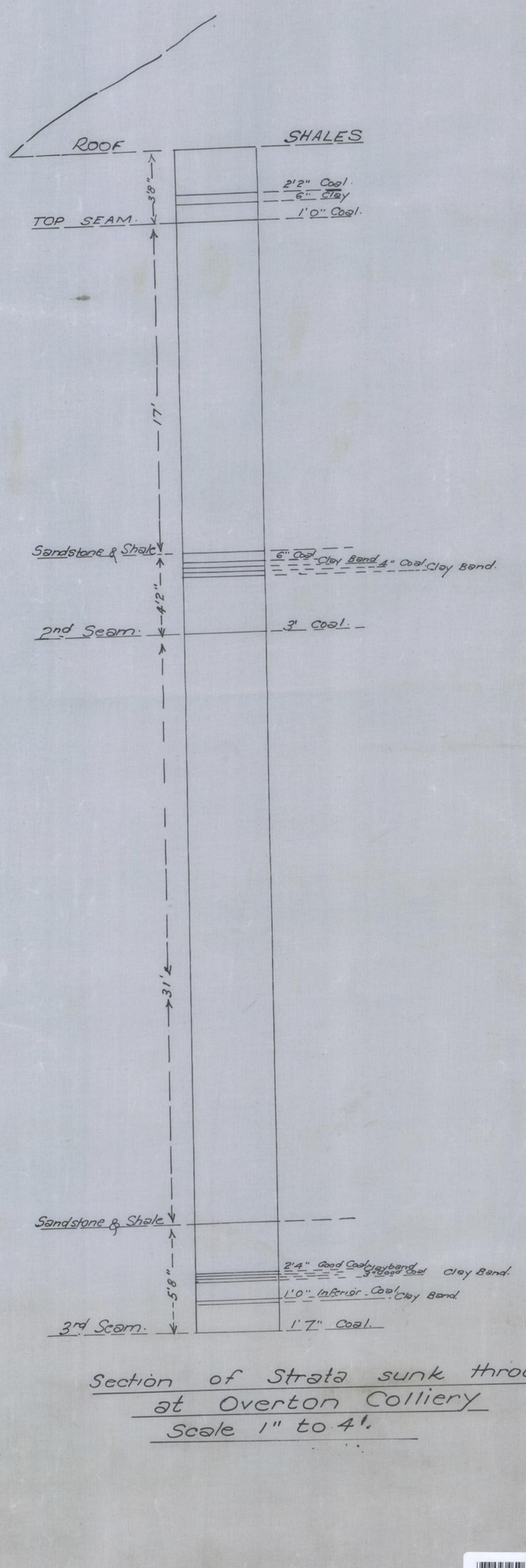
MUSWELLBROOK

Scale 2 chs to an inch.

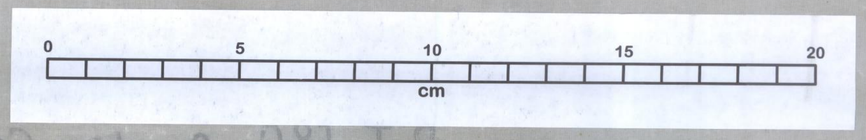
2nd Seam shown black
3rd Seam shown red.

R. Fullager.
Signed- J. G. Hutton
C.I.C.M. 14th May 1925





Section of Strata sunk through at Overton Colliery
Scale 1" to 4'.



R10000567
D100017020
A0091

COLLIERY : BENGALLA PROJECT

Update of the Titles Details for BENGALLA C.H.

First Owner : BENGALLA MINING COMPANY PTY LIMITED

Other Owners : NONE

Operator : NONE

Colliery Address: P.O. BOX 294
MUSWELLBROOK NSW 2333

File Number : C96-0436

Colliery Status : ~~ABANDONED~~ CURRENT

CPAB Region : NORTHERN

Parishes : CLANRICARD

Counties : BRISBANE

NO FREEHOLD TITLES INCLUDED

1 HISTORIC LEASEHOLD TITLE INCLUDED

Lease Identifier	Lease Sub	Whole Part	Id Num	Area & Units	Surf Affect
ML 1397 1992	LEASE	WHOLE	001	1047.0000 HA	YES

NO DEALING TYPES AFFECT THIS COLLIERY

CURRENT LEASEHOLD TITLES INCLUDED (approvals 24.7.98 & 26.8.98)

Lease Identifier	Lease Sub	Whole Part	Id Num	Area & Units	Surf Affected
ML 1397 1992	Lease	Part			YES

FREEHOLD WITHIN COLLIERY (approvals 26.8.98 and 24.7.98)

Lot 9 DP 39345 ✓	PART	Approval 26.8.98	consequence of P/C of ML 1397 (21.8.1998
Lot 72 DP 626353 ✓	PART	Approval 26-8-98	
Lot 71 DP 626353 ✓	PART	Approval 26-8-98	
Lot 1 DP 570070 ✓	PART	Approval 26.8.98	
Lot 2 DP 570070 ✓	PART	Approval 26.8.98	
Lot 105 DP 43390	PART	Approval 24.7.98	
Lot 103 DP 43389	PART	Approval 24.7.98.	

18.9.98

** End of Report **

BENGALLA

SCALE 1 : 25000

MAP SHEET NO. 9033-2-N

PARISH : CLANRICARD

COUNTY : BRISBANE

RT 799

NOTE: FOR TITLE DETAILS SEE C.A.S.

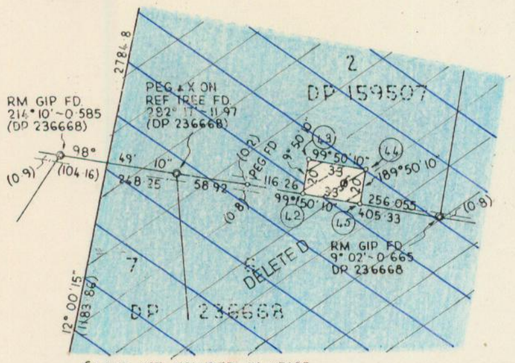


DIAGRAM A

NOT TO SCALE

Colliery: BENGALLA

Parishes: CLANRICARD

County: BRISBANE

Owner: BENGALLA MINING COMPANY PTY. LIMITED

RT 799

BENGALLA

93-91 2.65 V. C. N. Blight, Government Printer

PILLAR EXTRACTIONS			
REF.	PAPERS	APPROVAL	REMARKS

PILLAR EXTRACTIONS			
REF.	PAPERS	APPROVAL	REMARKS

BARRIERS		
REF.	PAPERS	REMARKS

BARRIERS		
REF.	PAPERS	REMARKS

BENGALLA

SCALE 1 : 25000

MAP SHEET NO. 9033-2-N

PARISH : CLANRICARD

COUNTY : BRISBANE

BARRIERS

N

NOTE: FOR TITLE DETAILS SEE C.A.S.

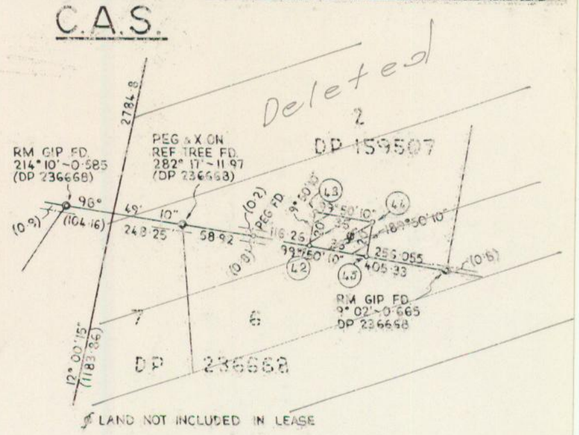


DIAGRAM A

NOT TO SCALE

BENGALLA

SCALE 1:25000

MAP SHEET NO. 9033-2-N

PARISH : CLANRICARD

COUNTY : BRISBANE

PILLAR EXTRACTIONS

N

NOTE: FOR TITLE DETAILS SEE C.A.S.

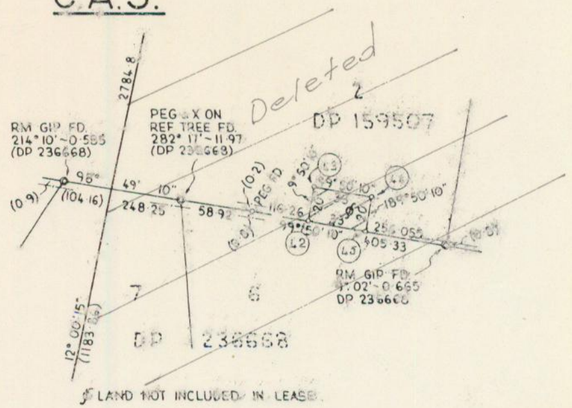


DIAGRAM A

NOT TO SCALE

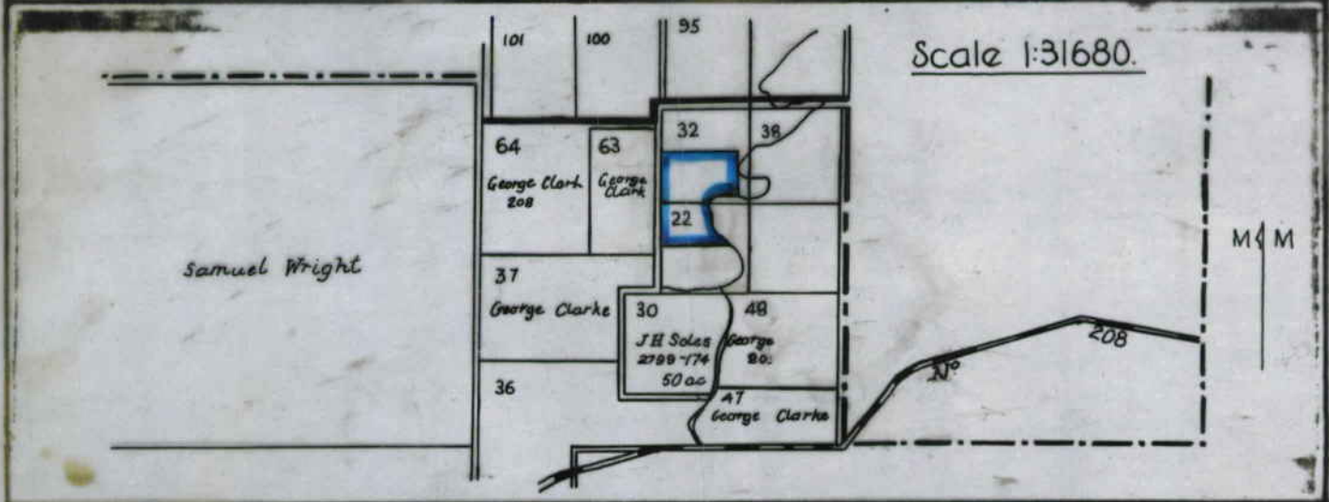
D2185

ML Appn No 9 Mining Division Newcastle ('73 Act)

Applicant Muswellbrook Brick Works Pty Ltd

Parish of Glanricard County of Brisbane

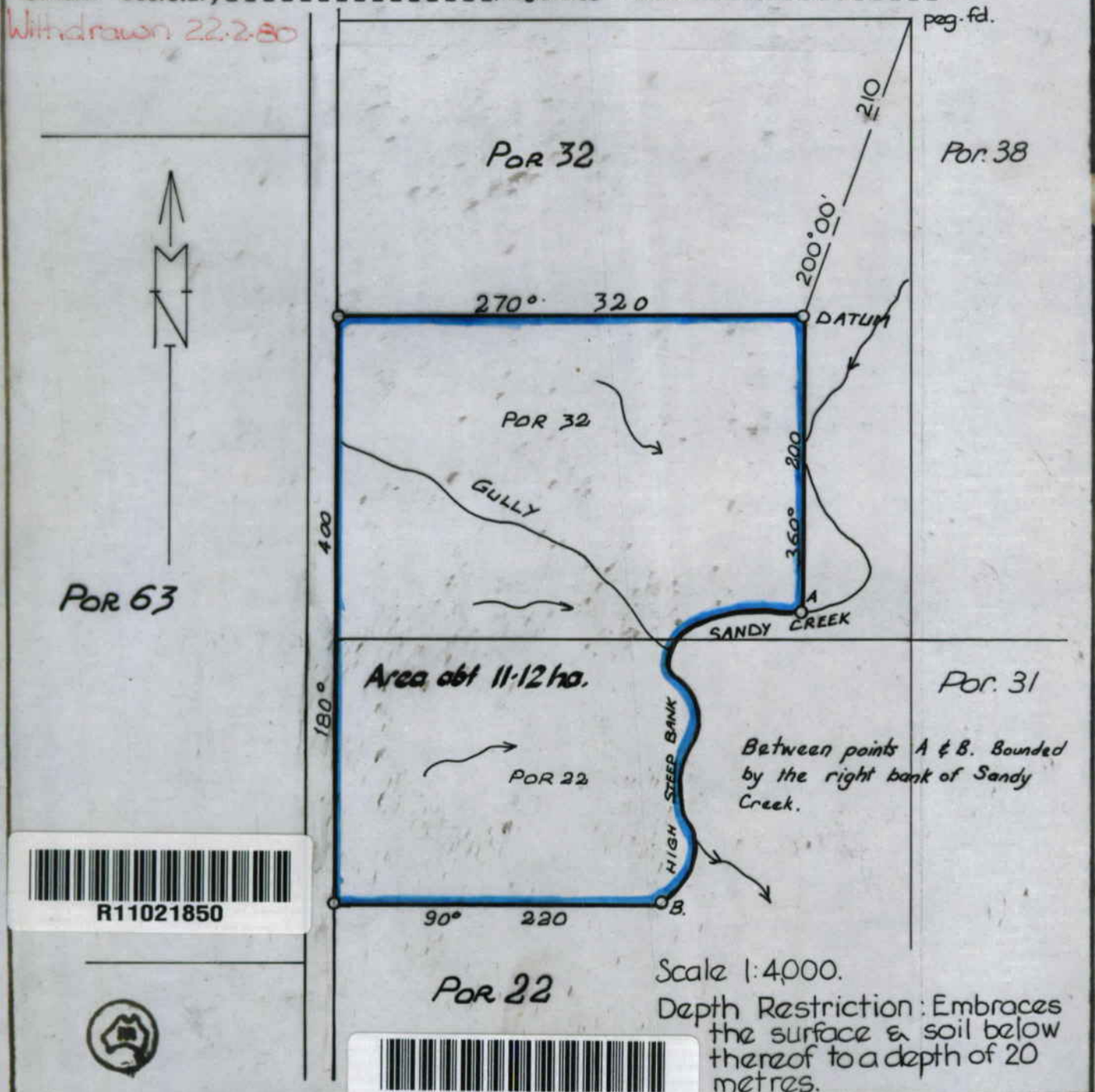
Area Abt 11·12 ha Date of Appn 27-8-76 Papers I 76/1574



This is the plan referred to in Mining Lease under the Mining Act, 1973, granted to the day of 19.

Official Secretary Registered Holder

Withdrawn 22.2.80



Scale 1:4000.

Depth Restriction: Embraces the surface & soil below thereof to a depth of 20 metres.

R11021850

D101021850

TRACER

~~DRAFTSMAN~~ Sue Lynch

EXAMINER S. P. Seng 2-6-77

GUAN GUA
TYRONE
HALSCOT
MANOBALAI
BROGHEDA
STRATHEARN
MACQUEEN
RUSSELL
VILLAGE OF ABERDEEN
ELLIS
ROWAN
WYBONG
CLANRICARD
SEE INSET
BALMORAL
YARRAMAN
VAUX
BROUGHAM
SAVOY
DENMAN
ALTHORPE
WYNN
HOWICK
RAVENSWORTH
PIRIBIL
WAMBO
LEMINGTON

INSET

MUSWELLBROOK

SCALE RATIO 1:20000

Metres 0 100 200 400 600 800 1000 Metres

AREA SHOWN BY BLACK HATCH REVOKED GG 23-7-82

PLAN OF THE

MUSWELLBROOK

MINE SUBSIDENCE DISTRICT

PROCLAIMED 23.9.81 NOTIFIED 2.10.81

UNDER SECTION 15(1) MINE SUBSIDENCE COMPENSATION ACT 1961

PARISHES OF WYBONG, DENMAN, BROGHEDA, STRATHEARN , ELLIS, CLANRICARD, RUSSELL, ROWAN, BALMORAL, VAUX , BROUGHAM, SAVOY, LIDDELL, WYNN & ALTHORPE

COUNTIES OF BRISBANE & DURHAM

SCALE 1:55,000

Kilometres 0 1 2 3 4 5 6 7 8 9 Kilometres

The lands contained within the District are tinted thus :

R13264500
D103264500

Compiled by the Department of Mineral Resources, Sydney, 1981

Crown copyright reserved

APPENDIX 2

Registers

6

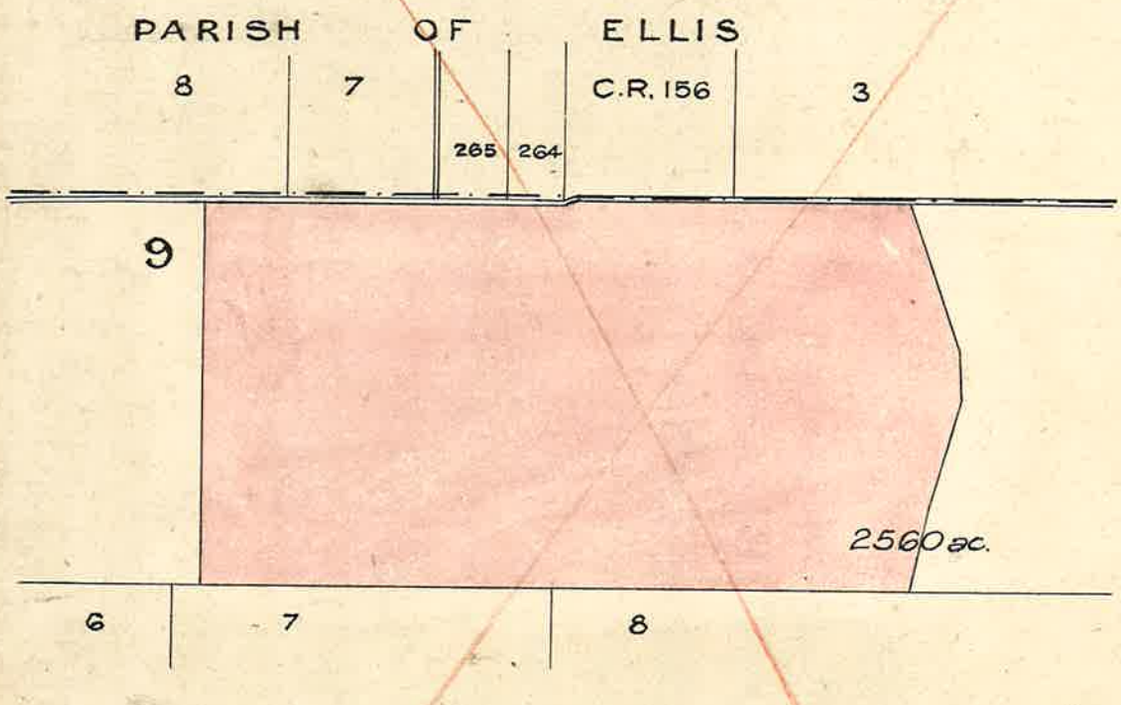
28 D.K. P.A.

Abandoned. – Plan M18522

MS 25/5315

Colliery . . ~~Newman~~ now Overton (Overton Colliery Co. Ltd. P.B. 22/4641)
Parish . Clanricard
County. Brisbane
Papers. P.A.B. 21 : 1694 Abandoned Misc 25/1434.
Scale . 40 Chains to 1 Inch

Newman Colliery


PARISH OF ELLIS
8
7
265
264
C.R. 156
3
9
2560 ac.
6
7
8

Name	Region	Location	Start	Close	Proprietor	Proprietor	Plan No.	Comments
Bengalla Open Cut		County of Brisbane; Parish of Clanricard						
	Hunter	near Muswellbrook					RT.799 - various seams	
			1990		Bengalla Joint Venture (1990-91)			22.12.1990 - Minister announced successful proposal of Joint Vent.
								14. 2.1991 - authorisation granted for two years
					Bengalla Mining Co. P/L. (1993)			. .1993 - sought Development Consent
								. 8.1994 - Commission of Inquiry recommended consent
			1996					. 6.1996 - mining lease granted - expects to produce coal in 1999
								. 4.1999 - first shipment of coal sent away after the dragline uncovered coal
			1999					30. 7.1999 - officially opened by Minister - created more than 200 jobs
								30. 7.1999 - managed by Peabody Resources
Newman		County of Brisbane; Parish of Clanrichard						Now Overton
Overton	Hunter	Muswellbrook				Overton Colliery Co.Ltd.		
			1919					. .1919 - restarted
Overton		County of Brisbane; Parish of Clanricard - portion 9						
	Hunter	Muswellbrook					RT.580	
								. .1925 - abandoned

Grey Text are Project Names
Brown Text are List of the Plans of Abandoned Mines or Seams Sent to the Mininster for Mines Under Coal Mines Regulation Act 1896.
Orange text are Colliery Holdings not listed from Old registers
Green Text are plans located on shelf above Vertiplan Cabinets
Black Text are Colliery Index

NSW Department of Primary Industries
Coal Resources Administration Branch

Colliery	Projects	Mine Name	Colliery Approval Date	Officer	County	Parish	Portion	RT	Mplans	Associated Files	Status	Abandoned	Plan Reviewed	Minerals worked & in the case of the name of seam	Seam	Remarks	History	Comments from Cards
Bengalla Open Cut		Bengalla Open Cut			Brisbane	Clanricard		**799**			W				Edderton Wynn Broonie-Bayswater			
Overton Overton Newman					Brisbane Brisbane	Clanricard Clanricard	9	**580**	~~M18522~~ M18522	21.5587 PB	A	2.2.25	2.5.25	Coal 2nd & 3rd	2nd & 3rd Seam		Plan of Overton Colliery - Muswellbrook Formerly Newman, Abandoned 1925 Now Overton	

APPENDIX 3

Current Plans

(Overton Mine also seen on current A0 Record Tracing Plans)

Overton identification survey (land survey)

LEASE BOUNDARY I.S.G. COORDINATES

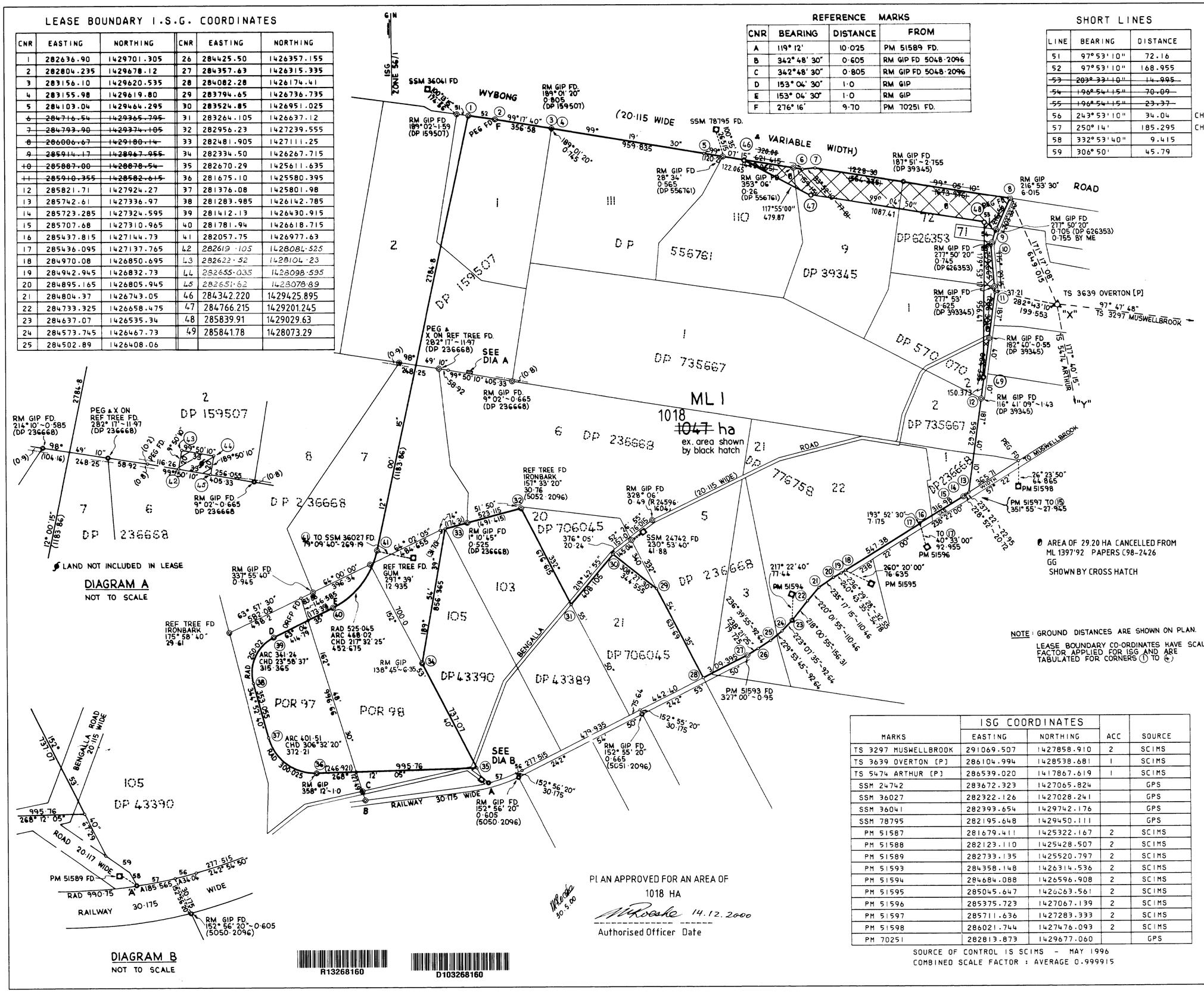
CNR	EASTING	NORTHING	CNR	EASTING	NORTHING
1	282636.90	1429701.305	26	284425.50	1426357.155
2	282804.235	1429678.12	27	284357.63	1426315.335
3	283156.10	1429620.535	28	284082.28	1426174.41
4	283155.98	1429619.80	29	283794.65	1426736.735
5	284103.04	1429464.295	30	283524.85	1426951.025
~~6~~	~~284716.54~~	~~1429365.795~~	31	283264.105	1426637.12
~~7~~	~~284793.90~~	~~1429374.105~~	32	282956.23	1427239.555
~~8~~	~~286006.67~~	~~1429180.14~~	33	282481.905	1427111.25
~~9~~	~~285914.17~~	~~1428967.955~~	34	282334.50	1426267.715
~~10~~	~~285887.00~~	~~1428878.54~~	35	282670.29	1425611.635
~~11~~	~~285910.355~~	~~1428582.615~~	36	281675.10	1425580.395
12	285821.71	1427924.27	37	281376.08	1425801.98
13	285742.61	1427336.97	38	281283.985	1426142.785
14	285723.285	1427324.595	39	281412.13	1426430.915
15	285707.68	1427310.965	40	281781.94	1426618.715
16	285437.815	1427144.73	41	282057.75	1426977.63
17	285436.095	1427137.765	42	282619·105	1428084·525
18	284970.08	1426850.695	43	282622·52	1428104·23
19	284942.945	1426832.73	44	282655·035	1428098·595
20	284895.165	1426805.945	45	282651·62	1428078·89
21	284804.37	1426743.05	46	284342.220	1429425.895
22	284733.325	1426658.475	47	284766.215	1429201.245
23	284637.07	1426535.34	48	285839.91	1429029.63
24	284573.745	1426467.73	49	28584178	1428073.29
25	284502.89	1426408.06			

REFERENCE MARKS

CNR	BEARING	DISTANCE	FROM
A	119° 12'	10·025	PM 51589 FD.
B	342° 48' 30"	0·605	RM GIP FD 5048·2096
C	342° 48' 30"	0·805	RM GIP FD 5048·2096
D	153° 04' 30"	1·0	RM GIP
E	153° 04' 30"	1·0	RM GIP
F	276° 16'	9·70	PM 70251 FD.

SHORT LINES

LINE	BEARING	DISTANCE	
51	97°53'10"	72.16	
52	97°53'10"	168.955	
~~53~~	~~203°33'10"~~	~~14.995~~	
~~54~~	~~196°54'15"~~	~~70.09~~	
~~55~~	~~196°54'15"~~	~~23.37~~	
56	243°53'10"	34.04	CHD
57	250°14'	185.295	CHD
58	332°53'40"	9.415	
59	306°50'	45.79	



AREA OF 29.20 HA CANCELLED FROM ML 1397/92 PAPERS C98-2426 GG SHOWN BY CROSS HATCH

NOTE: GROUND DISTANCES ARE SHOWN ON PLAN.
LEASE BOUNDARY CO-ORDINATES HAVE SCALE FACTOR APPLIED FOR ISG AND ARE TABULATED FOR CORNERS (1) TO (4)

MARKS	ISG COORDINATES EASTING	ISG COORDINATES NORTHING	ACC	SOURCE
TS 3297 MUSWELLBROOK	291069.507	1427858.910	2	SCIMS
TS 3639 OVERTON [P]	286104.994	1428538.681	1	SCIMS
TS 5474 ARTHUR [P]	286539.020	1417867.619	1	SCIMS
SSM 24742	283672.323	1427065.824		GPS
SSM 36027	282322.126	1427028.241		GPS
SSM 36041	282393.654	1429742.176		GPS
SSM 78795	282195.648	1429450.111		GPS
PM 51587	281679.411	1425322.167	2	SCIMS
PM 51588	282123.110	1425428.507	2	SCIMS
PM 51589	282733.135	1425520.797	2	SCIMS
PM 51593	284358.148	1426314.536	2	SCIMS
PM 51594	284684.088	1426596.908	2	SCIMS
PM 51595	285045.647	1426863.561	2	SCIMS
PM 51596	285375.723	1427067.139	2	SCIMS
PM 51597	285711.636	1427283.333	2	SCIMS
PM 51598	286021.744	1427476.093	2	SCIMS
PM 70251	282813.873	1429677.060		GPS

SOURCE OF CONTROL IS SCIMS - MAY 1996
COMBINED SCALE FACTOR : AVERAGE 0.999915

PLAN APPROVED FOR AN AREA OF 1018 HA

14.12.2000
Authorised Officer Date

R13268160 D103268160

PLAN OF PORTION ML 1

PARISH: CLANRICARD

COUNTY: BRISBANE

MAP SHEET NO.: 9033-2-N "MUSWELLBROOK"

REDUCTION RATIO: 1:12,500

LENGTHS ARE IN METRES

MINING LEASE APPLICATION NO. 11

MINING DIVISION: SINGLETON

APPLICANT: BENGALLA MINING CO. P./L.

APPLICATION DATE: 12·11·1993

MINING LEASE NO.: ML 1397 (Act 1992)

STATUS:

METHOD: OPEN CUT

SURFACE EXCEPTION/ DEPTH RESTRICTION: NIL.

NOTES:

AZIMUTH: "X-Y" (TS OVERTON TO TS ARTHUR)

PLANS USED IN THE COURSE OF THIS SURVEY

DP 776758	DP 585880	DP 159507	5052·2096
DP 735667	DP 556761	DP 236668	5051·2096
DP 711996	DP 190096	DP 43390	5050·2096
DP 706045	DP 189134	DP 43389	5049·2096
DP 634412	DP 168367	DP 39345	5048·2096
DP 626353			

SURVEY DECLARED ON THIS PLAN FOR LINES

I, GORDON VICTOR BOARDMAN
OF G.BOARDMAN & ASSOCIATES P/L
PO BOX 404 MUSWELLBROOK 2333
A SURVEYOR REGISTERED UNDER THE SURVEYORS ACT, 1929,
HEREBY CERTIFY THAT THE SURVEY REPRESENTED IN THIS PLAN
IS ACCURATE AND HAS BEEN COMPLETED IN ACCORDANCE WITH
THE SURVEY PRACTICE REGULATIONS, 1990 AND THE
DIRECTIONS FOR THE GUIDANCE OF MINING SURVEYORS
AND WAS COMPLETED ON 26TH JUNE 1996

SIGNATURE: G.V.Boardman

SURVEYOR'S REFERENCE: S3690LEASE

SURVEY CALCS: J Elsholz 26-6-96
PLAN INVESTIGATED: J Elsholz 27-6-96
PLAN APPROVED: 27.6.96
PAPER NO.: C92 / 2008

PLAN CATALOGUE NUMBER M26816R

SURVEY PRACTICE REGULATIONS : CLAUSE 32(2)

MARK	ISG CO-ORDINATES		ZONE	ACC
	EASTING	NORTHING		
TS 10699 GLENDOR [P]	282 982·455	1425 893·034	56/1	2
TS 5474 ARTHUR [P]	286 539·020	1417 867·619	56/1	1
PM 51592	283 880·315	1426 070·128	56/1	2
PM 51593	284 358·148	1426 314·536	56/1	2
COMBINED SCALE FACTOR 0·99992				
SOURCE OF INFORMATION IS SCIMS 1/5/98				

REFERENCE MARKS

MARK	BEARING	DIST.	FROM
⑨	332° 54' 30"	29·51	RM G.I. PIPE
⑩	355° 46'	1·0	RM G.I. PIPE

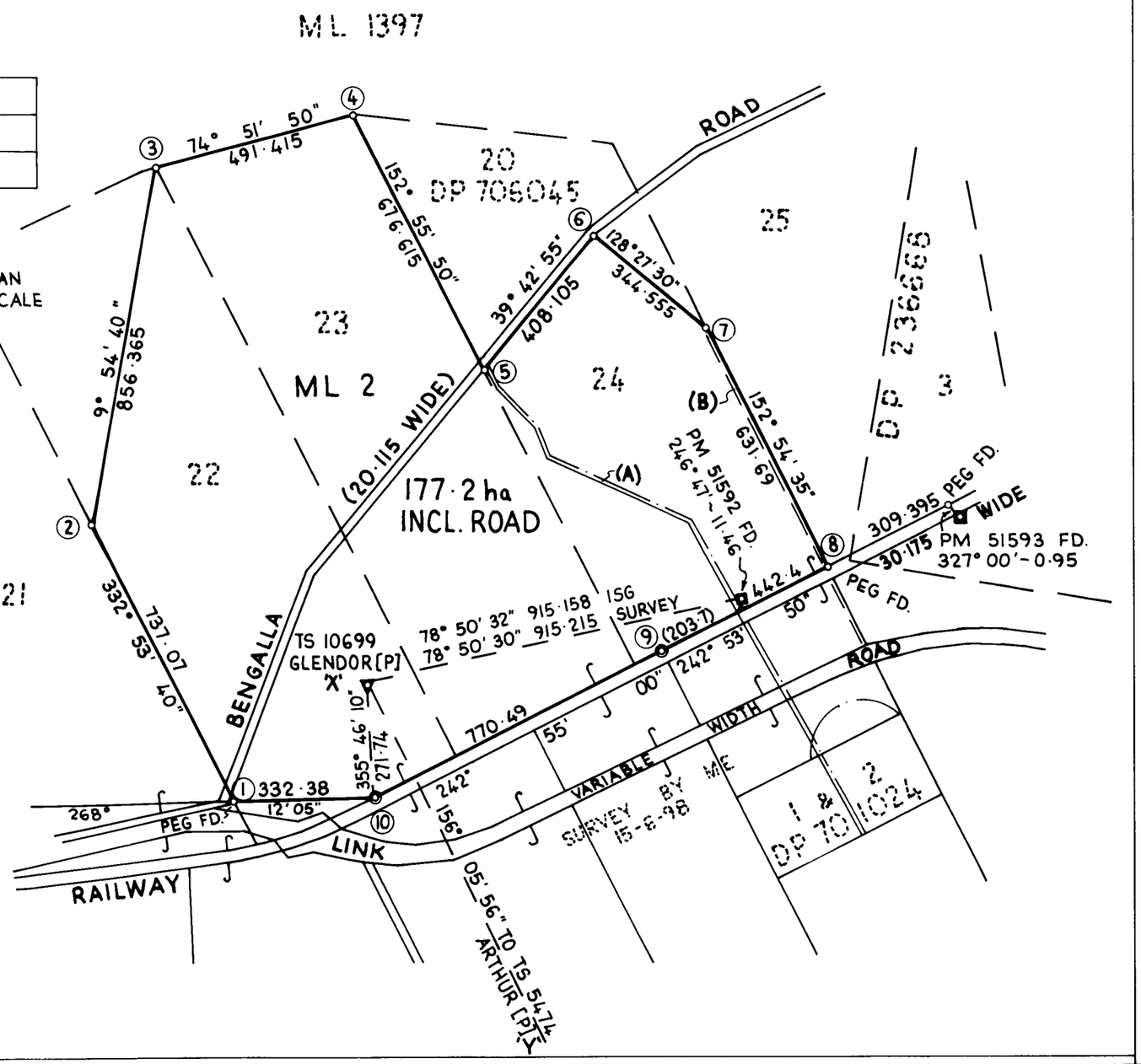
NOTE:
GROUND DISTANCES ARE SHOWN ON PLAN
LEASE BOUNDARY CO-ORDINATES HAVE SCALE FACTOR APPLIED FOR ISG AND ARE TABULATED FOR CORNERS ① TO ⑩

ISG CO-ORDINATES

CNR	EASTING	NORTHING
①	282 670·29	1425 611·635
②	282 334·50	1426 267·715
③	282 481·905	1427 111·25
④	282 956·23	1427 239·555
⑤	283 264·105	1426 637·12
⑥	283 524·85	1426 951·025
⑦	283 794·65	1426 736·735
⑧	284 082·28	1426 174·41
⑨	283 688·49	1425 972·875
⑩	283 002·50	1425 622·035

(A) EASEMENT FOR RIGHT OF CARRIAGEWAY 10 WIDE (DP 634412)
(B) EASEMENT FOR SERVICES 2 WIDE (DP 636149)

G N



PLAN OF PORTION ML 2

PARISH(S) CLANRICARD

COUNTY(S) BRISBANE

MAP SHEET NO(S) 9033-11-N

REDUCTION RATIO 1:12 500

MINING LEASE APPLICATION NO. 106

MINING DIVISION SINGLETON

APPLICANT BENGALLA MINING CO. PTY LTD

APPLICATION DATE. 10.02.1998

MINING LEASE NO.

STATUS

METHOD OPEN CUT

SURFACE EXCEPTION/DEPTH RESTRICTION
NIL

R13268650

NOTES

D103268650

Azimuth (X-Y)
(TS GLENDOR TO TS ARTHUR)

Plans used in the course of this survey / compilation
DP 634412 DP 636149 DP 201024
ROAD SURVEY BY ME 15-6-98
M26816R

Survey declared on this plan for lines
8 9 10 AND 1

I, GORDON VICTOR BOARDMAN
of G BOARDMAN & ASSOCIATES P/L
P.O. BOX 404 MUSWELLBROOK 2333
a surveyor registered under the Surveyors Act, 1929,
hereby certify that the survey represented in this plan is accurate and has been completed in accordance with the Survey Practices Regulations, 1996 and the Directions for the Guidance of Mining Surveyors and was completed on 15th JUNE 1998

Signature : G.V.Boardman

Surveyor's Reference : S3690 LEASE 2

Survey Calcs : M.Roeska 17.9.98
Plan Investigated : M.Roeska 17.9.98
Plan Approved :
Paper No :

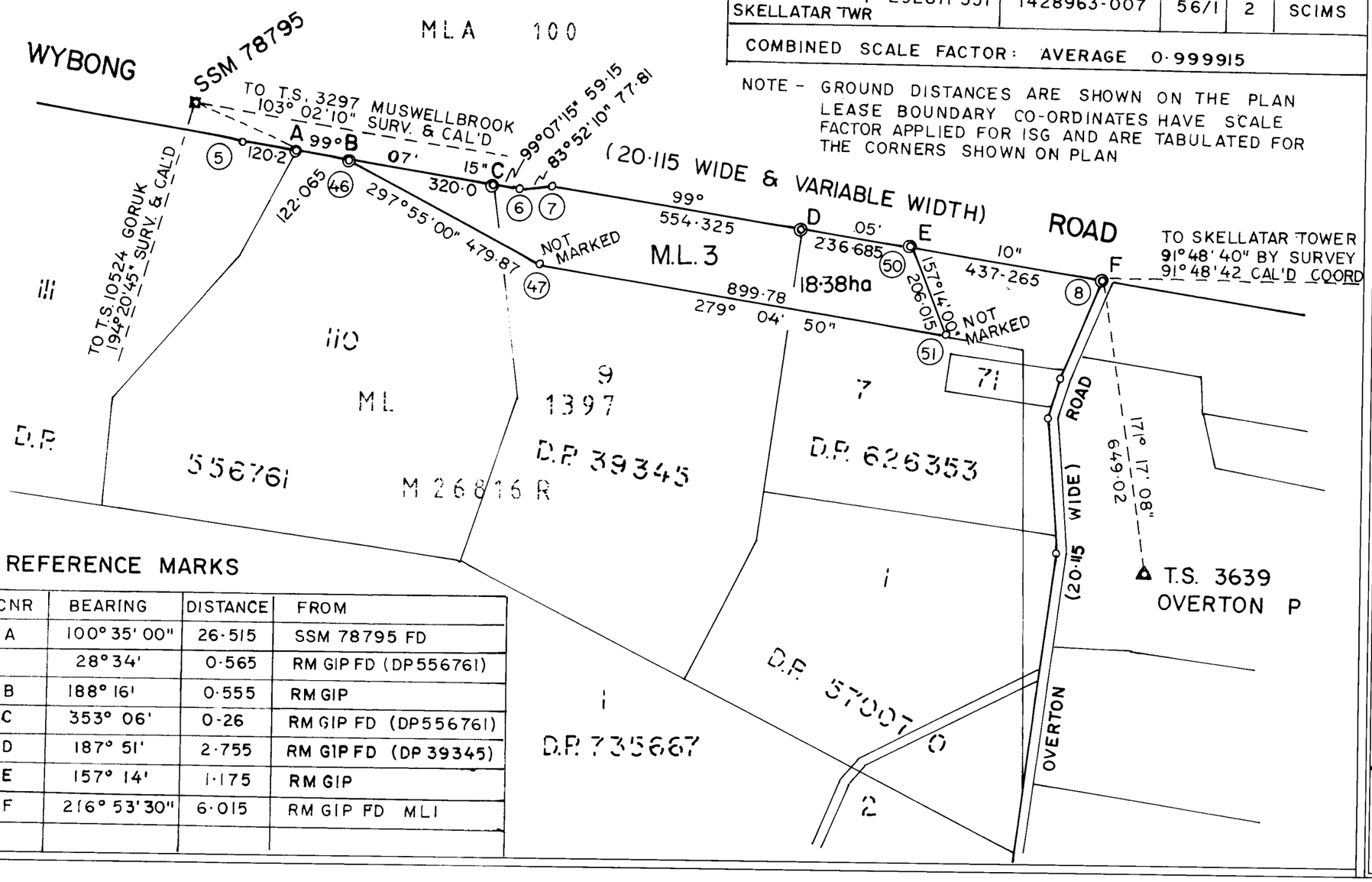
M 26865 R

CNR	EASTING	NORTHING
5	284103·04	1429464·295
6	284716·545	1429365·795
7	284793·905	1429374·105
8	286006·665	1429180·155
46	284342·220	1429425·895
47	284766·215	1429201·245
50	285574·925	1429249·200
51	285654·640	1429059·250

G N

I.S.G.

MLA 100



REFERENCE MARKS

CNR	BEARING	DISTANCE	FROM
A	100° 35' 00"	26·515	SSM 78795 FD
	28° 34'	0·565	RM GIP FD (DP556761)
B	188° 16'	0·555	RM GIP
C	353° 06'	0·26	RM GIP FD (DP556761)
D	187° 51'	2·755	RM GIP FD (DP 39345)
E	157° 14'	1·175	RM GIP
F	216° 53' 30"	6·015	RM GIP FD MLI

SURVEY PRACTICE REGULATIONS 1990 CLAUSE 32(2)

MARK	ISG CO-ORDINATES EASTING	ISG CO-ORDINATES NORTHING	ZONE	ACC	SOURCE
TS 3297 MUSWELLBROOK	291069·507	1427858·910	56/1	2	SCIMS
TS 10524 GORUK	281567·346	1419172·948	56/1	2	SCIMS
SSM 78795	284195·648	1429450·111			GPS
TS 3639 OVERTON	286104·994	1428538·681	56/1	1	SCIMS
TS 10179 SKELLATAR TWR	292871·351	1428963·007	56/1	2	SCIMS

COMBINED SCALE FACTOR: AVERAGE 0·999915

NOTE - GROUND DISTANCES ARE SHOWN ON THE PLAN
LEASE BOUNDARY CO-ORDINATES HAVE SCALE FACTOR APPLIED FOR ISG AND ARE TABULATED FOR THE CORNERS SHOWN ON PLAN

PLAN OF PORTION ML 3

PARISH(S) CLANRICARD

COUNTY(S) BRISBANE

MAP SHEET NO(s) 9033-11-N

REDUCTION RATIO 1: 10,000

MINING LEASE APPLICATION NO. 136

MINING DIVISION SINGLETON

APPLICANT BENGALLA MINING CO P/L

APPLICATION DATE. 22.11.1999

MINING LEASE NO.

STATUS

METHOD

SURFACE EXCEPTION/DEPTH RESTRICTION

NIL

R13268950

NOTES

D103268950

Azimuth
SSM 78795 TO TS MUSWELLBROOK

Plans used in the course of this survey / compilation
ML 1 - M 26816 R

Survey declared on this plan for lines
5, 46, 6, 7, 50, AND 8

I, GORDON VICTOR BOARDMAN
of G. BOARDMAN & ASSOCIATES P/L
PO BOX 404 MUSWELLBROOK 2333
a surveyor registered under the Surveyors Act, 1929,
hereby certify that the survey represented in this plan is accurate and has been completed in accordance with the Survey Practices Regulations, 1990 and the Directions for the Guidance of Mining Surveyors
and was completed on 18-2-2000

Signature : G.V. Boardman

Surveyor's Reference : S3690 LEASE 3

Survey Calcs : MKoetko 13.4.2000

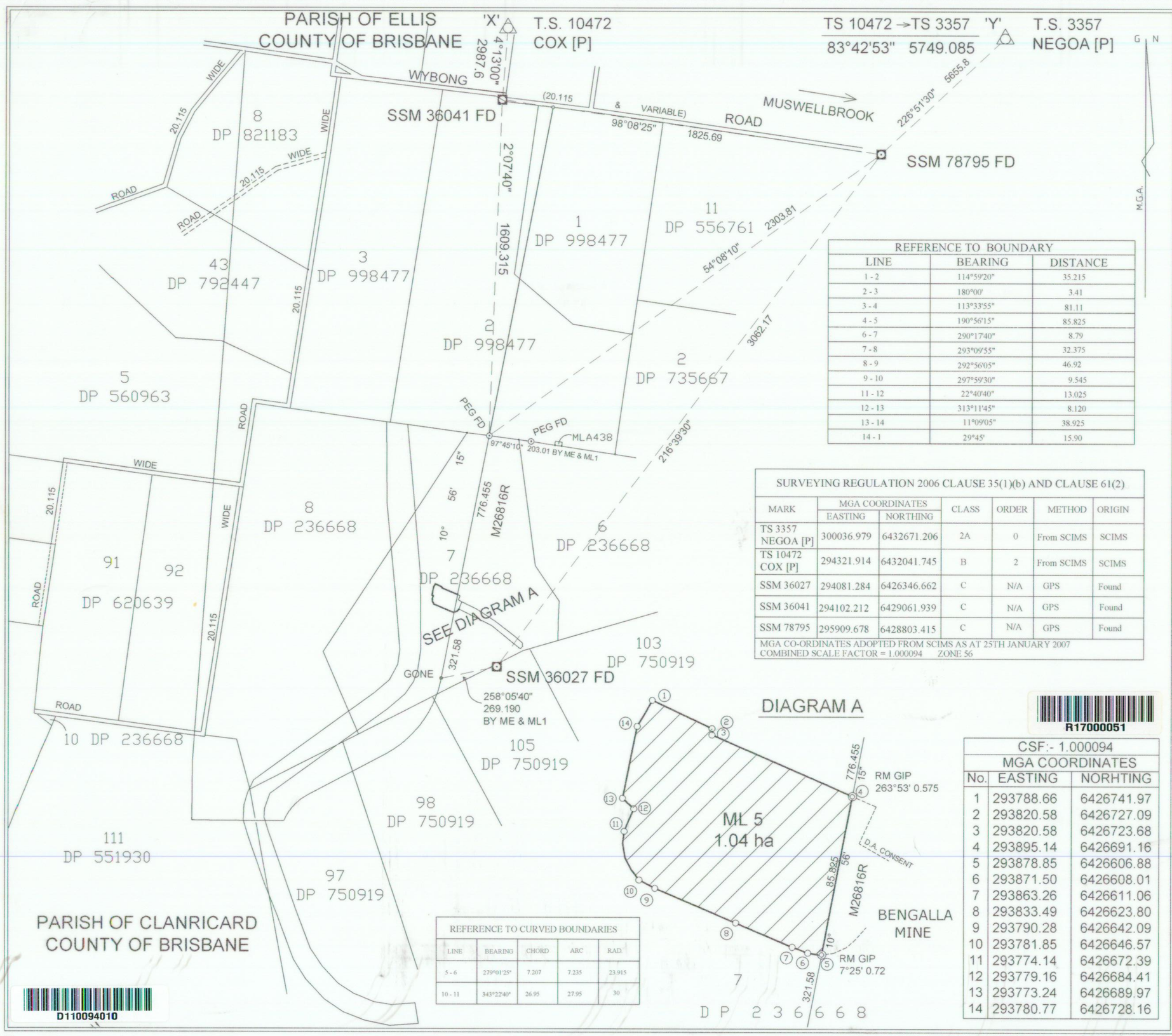
Plan Investigated : MKoetko 13.4.2000

Plan Approved : MKoetko 13.4.2000

Paper No : C99-0759

M 26895 R

M26895P



REFERENCE TO BOUNDARY		
LINE	BEARING	DISTANCE
1 - 2	114°59'20"	35.215
2 - 3	180°00'	3.41
3 - 4	113°33'55"	81.11
4 - 5	190°56'15"	85.825
6 - 7	290°17'40"	8.79
7 - 8	293°09'55"	32.375
8 - 9	292°56'05"	46.92
9 - 10	297°59'30"	9.545
11 - 12	22°40'40"	13.025
12 - 13	313°11'45"	8.120
13 - 14	11°09'05"	38.925
14 - 1	29°45'	15.90

SURVEYING REGULATION 2006 CLAUSE 35(1)(b) AND CLAUSE 61(2)

MARK	MGA COORDINATES EASTING	MGA COORDINATES NORTHING	CLASS	ORDER	METHOD	ORIGIN
TS 3357 NEGOA [P]	300036.979	6432671.206	2A	0	From SCIMS	SCIMS
TS 10472 COX [P]	294321.914	6432041.745	B	2	From SCIMS	SCIMS
SSM 36027	294081.284	6426346.662	C	N/A	GPS	Found
SSM 36041	294102.212	6429061.939	C	N/A	GPS	Found
SSM 78795	295909.678	6428803.415	C	N/A	GPS	Found

MGA CO-ORDINATES ADOPTED FROM SCIMS AS AT 25TH JANUARY 2007
COMBINED SCALE FACTOR = 1.000094 ZONE 56

REFERENCE TO CURVED BOUNDARIES				
LINE	BEARING	CHORD	ARC	RAD
5 - 6	279°01'25"	7.207	7.235	23.915
10 - 11	343°22'40"	26.95	27.95	30

DIAGRAM A

CSF:- 1.000094 MGA COORDINATES		
No.	EASTING	NORHTING
1	293788.66	6426741.97
2	293820.58	6426727.09
3	293820.58	6426723.68
4	293895.14	6426691.16
5	293878.85	6426606.88
6	293871.50	6426608.01
7	293863.26	6426611.06
8	293833.49	6426623.80
9	293790.28	6426642.09
10	293781.85	6426646.57
11	293774.14	6426672.39
12	293779.16	6426684.41
13	293773.24	6426689.97
14	293780.77	6426728.16

R17000051

D110094010

PLAN OF PORTION ML 5

PARISH: CLANRICARD

COUNTY: BRISBANE

MAP SHEET No. 9033-2-N MUSWELLBROOK

REDUCTION RATIO 1:12500

MINING LEASE APPLICATION No.293

MINING DIVISION: SINGLETON

APPLICANT: BENGALLA MINING COMPANY PTY LIMITED

APPLICATION DATE: 07-12-2006

MINING LEASE No. 1592 (act 1992)

STATUS:

METHOD: BUILDING/MAGAZINE/MINING PLANT

DEPTH RESTRICTION/SURFACE EXCEPTION

EMBRACES THE SURFACE AND SOIL BELOW THEREOF TO A DEPTH OF 10 METRES

NOTES: THIS SURVEY WAS MADE IN RELATIONSHIP TO THE FOLLOWING MINE PLANS:-
M 26816R

Azimuth: "X - Y" [TS10472 - TS3357]

Plans used in the course of this survey/~~compilation~~
DP 776758 DP 585880 DP 159507 5052-2096
DP 735667 DP 556761 DP 236668 5051-2096
DP 711996 DP 190096 DP 43390 5051-2096

Survey declared on this plan for lines
LINES 1 - 14

I, ROSS ANDREW PEASLEY
of BOARDMAN PEASLEY PTY LIMITED SURVEYORS
44 MARKET STREET MUSWELLBROOK 2333
a surveyor registered under the Surveying Act 2002,
hereby certify that the survey/~~compilation~~ represented in this plan is accurate and has been completed in accordance with the Surveying Regulation 2006 and the Surveyor General's Direction for Mining Surveys and was completed on 25th JANUARY 2007

Signature : Ross Peasley

Surveyors Reference : S3690-30

Survey Calcs : 27/02/07

Plan Investigated : 27/02/07

Plan Approved : 27/02/07

Paper No : 06-0033

M27093

M27093

PLAN No. A438-01

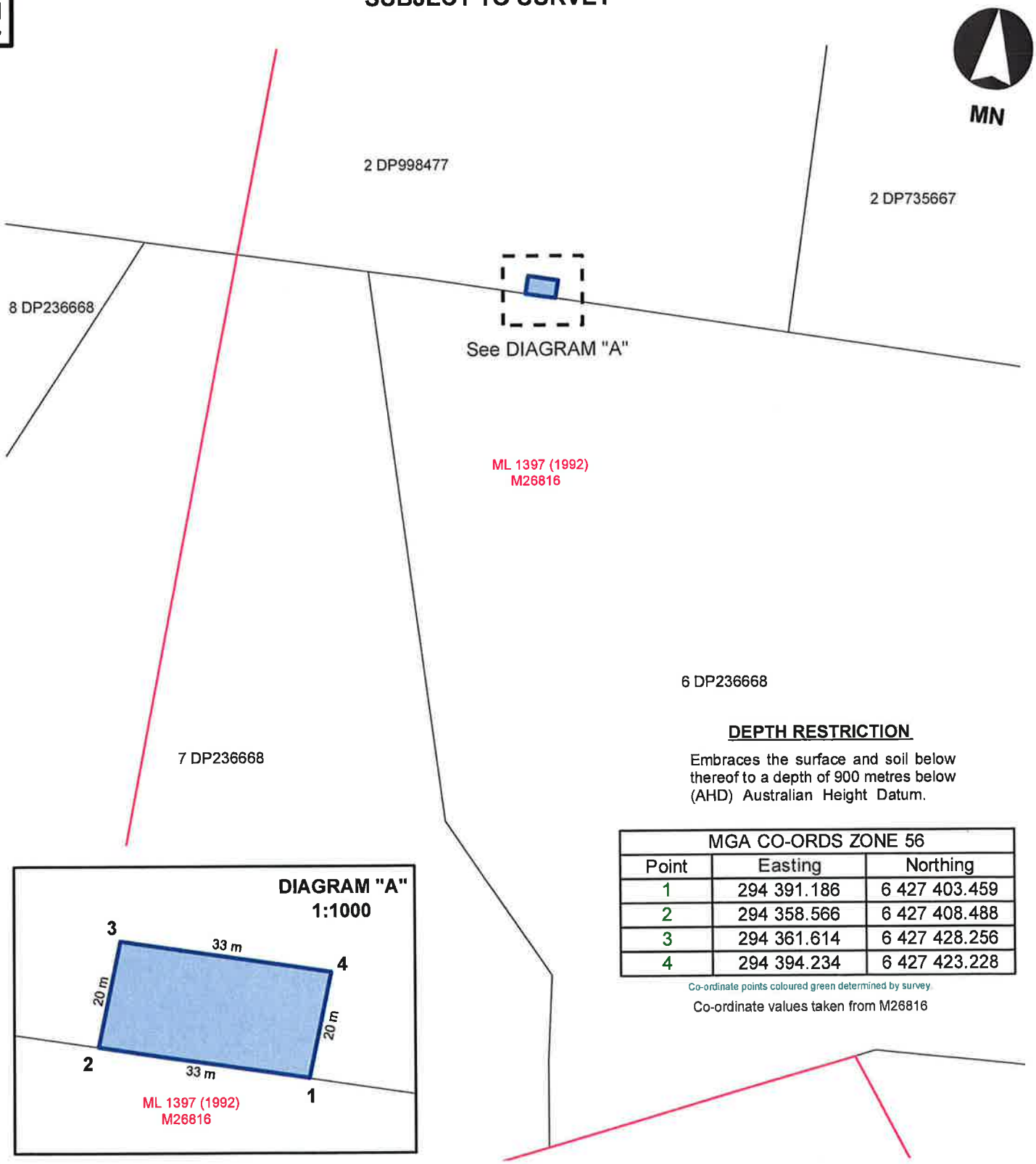
DEPARTMENT OF PRIMARY INDUSTRIES

File: C91-0015

DIAGRAM OF AUTHORISATION No. 438
HOLDER: BENGALLA MINING COMPANY PTY LIMITED
PARISH: CLANRICARD
SCALE 1: 6000

COUNTY: BRISBANE
REF MAP: 9033-2-N

SUBJECT TO SURVEY



DEPTH RESTRICTION

Embraces the surface and soil below thereof to a depth of 900 metres below (AHD) Australian Height Datum.

MGA CO-ORDS ZONE 56		
Point	Easting	Northing
1	294 391.186	6 427 403.459
2	294 358.566	6 427 408.488
3	294 361.614	6 427 428.256
4	294 394.234	6 427 423.228

Co-ordinate points coloured green determined by survey.

Co-ordinate values taken from M26816

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
HORIZONTAL DATUM: GDA94

NSW DEPARTMENT OF PRIMARY INDUSTRIES
MINERAL RESOURCES

0 50 100 200 300 400 Metres

AREA: abt. 660 m²

Prepared by: P. Gorrel
Date: 22-04-2009
Approved by: P.Hord
Date: 29-04-2009
Maitland Regional Office

DISCLAIMER: The compilation of information shown on this diagram is derived from plans and data, some of which has been produced and provided by third parties. Title boundaries have been adjusted to maintain their relationship with the digital cadastral database in some circumstances, thereby creating certain inaccuracies in the data. This information does not constitute part of the record required under Section 159 of the Mining Act 1992 or Section 95 of the Petroleum (Onshore) Act 1991. The Department of Primary Industries and the State of New South Wales make no statement, representation or warranty that the titles information shown on this diagram is complete, accurate or free from error. Users rely on the titles information supplied on this diagram at their own risk. The Department of Primary Industries and the State of New South Wales accepts no responsibility for any person, acting on, or relying on, or upon any of the titles information shown on this diagram, and disclaim all liability for any loss, damage, cost, expense or injury (including death) incurred or arising by reason of any person using or relying on the titles information contained on this diagram by reason or by any error, omission, defect or misstatement (whether such error, omission or misstatement is caused by or arises from negligence, lack of care or otherwise). Users should always verify historical material by making and relying upon their own separate inquiries prior to making any important decisions or taking any action on the basis of titles information.

MINING ACT 1992

INSTRUMENT OF RENEWAL OF AUTHORISATION 438
HELD BY BENGALLA MINING COMPANY PTY LIMITED

I, **IAN MACDONALD, MLC, MINISTER FOR MINERAL RESOURCES** for the State of New South Wales **HEREBY RENEW THE LICENCE** subject to the terms and conditions set out below:

1. The licence is renewed for a further term until **7 May 2014.**

2. The conditions of the licence are amended by deleting all the conditions contained in the licence prior to this renewal and by including the attached **Exploration Licence Conditions 2009** numbered:

   1-3 (inclusive), 10-24 (inclusive), 26-29 (inclusive), 32-34 (inclusive), 36, 38, 41, 42 and 44-48 (inclusive).

3. The licence is renewed over the land described hereunder and shown on the **Exploration Area** attached hereto.

4. Mineral Group covered by this licence: Group 9 (Coal & Oil Shale).

We, **Bengalla Mining Company Pty Limited, ACN 053 909 470**, hereby accept the renewal of this Exploration Licence and agree to be bound by the conditions specified.

.....
BENGALLA MINING COMPANY PTY LIMITED
ACN 053 909 470

Renewed this 18th day of August 2009

.....
TEAM LEADER COAL & PETROLEUM TITLES
UNDER DELEGATION FROM THE MINISTER

MGA NORTH

297250 297500 297750 298000

6428250 6428000 6427750 6427500 6427250 6427000

71 DP 626353 72 1 2 DP 735667 DP 700070

124 DP700578 13 DP 700578 PT 641 DP 554159 123 DP700578 506 DP711996 505 DP711996

OVERTON ROAD

Ramp Dam

(Y)

(X)

Original BMC ROM Hopper

465m

122m

Area of Suspicion. Workings are most likely, but not limited to, be within this area.

Disturbed Natural surface and corrigated iron waste.

Escarpment location & Direction. Drive Entry to 2nd seam workings.

Old Fence Remains (Post & Rail, Posts only)

Overdene

Butter Factory Block

Overton

Ulan Railway

Hunter River

DP 236669

LEGEND

- Cadastre Boundary Information
- Bengalla Mining Company ML 1397 Eastern Boundary
- Overlay of RT 580 Overton Colliery Reference Boundary/Fencing line work.
- Eastern Limit of Current BMC Workings
- GPS Survey (of existing monuments
- Overlay of RT 580 Overton Colliery 1925 Workings - 2nd Seam
- Overlay of RT 580 Overton Colliery 1925 Workings - 3rd Seam
- Topographical Information
- Most likely extents of Overton Colliery Workings. (see endorsement D)

Schedule of Endorsements

REF.	Description/References
A	Cadastre information shown is approximate only, information originated from cadastral Information compiled BMC Survey and should be used as a guide only.
B	MGA positioning of Overton Workings were esablished by initial map overlay then a minor then a minor adjustment to agree with old fence line and evidence of old openings.
C	Topographical information displayed originates from aerial photography suppied by AAM Hatch.
D	Area of Suspicion. Workings are most likely, but not limited to, be within this area.

PLAN No.: AO-059
FILE No.: SU-SP-045

SHEET 1 OF SHEETS 1

DRAWING : Overton Colliery.dwg

DATA : Compiled

DATUM : AHD / MGA

SCALE : 1 : 2000 (A1)

DATE : 31-5-2009

DRAFTED : AJB

RIO TINTO COAL AUSTRALIA

BENGALLA MINING COMPANY

PLAN SHOWNING OVERTON COLLIERY WORKINGS OVERLAY WITH BMC CADASTRE AND TOPO.

BENGALLA MINING COMPANY

IDENTIFICATION SURVEY OF LOT 1 IN DP 735667

NORTH
West
East
South

1
D P 5 7 0 0 7 0
2

OVERTON ROAD
(20.115 WIDE)

123
DP 700578

506

505
D P 7 1 1 9 9 6

2
DP 735667

30.215
384.33
276.66
174.07
291.53
160.71
129.37
RAILWAY (163.87)
RAILWAY 35.205 WIDE
358.08
BK BANK IS HUNTER RIVER
80.47
TO MUSWELLBROOK BOUNDARY

EXISTING DWELLING
OLD LEASE BOUNDARY
155.22
20.158
508.75
267.96

OLD ENTRY TO OVERTON COLLIERY
APPROXIMATE CO-ORDINATES
E: 297828
N: 6427724

V.O MORTISED FENCE

BENGALLA MINE
D P 7 3 5 6 6 7
1
43.93ha

[ML BDY CAT #M26816 R]

22
DP 776758

1
DP 236668

REV	DESCRIPTION	DATE	BY	CHECKED
A	IDENTIFICATION SURVER OF LOT 1 IN DP 735667	10/5/10	JG	RP

Liability Limited a Scheme Approved under Professional Standards Legislation

COVER OF EXCELLENCE

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DIAL 1100 BEFORE YOU DIG

BOARDMAN PEASLEY Pty Ltd.
Registered Land Surveyors &
Civil Engineering
44 Market Street
Muswellbrook NSW 2333
P.O. Box 404
(Ph) 02 6541 1366 00
(Fax) 02 6541 2997
www.boardmanpeasley.net.au

BENGALLA MINING COMPANY
IDENTIFICATION SURVEY OF
LOT 1 IN DP 735667

DRAWING FILE:
SURVEY FILE: S3690-42
SURVEY: DM
DESIGNED: N/A
DRAWN: JG
CHECKED: RP
DATUM:
DATUM SOURCE: MGA (T.S OVERTON)
DATE: 10TH MAY 2010

Sheet No. 1 of 1 Sheets
Job No. S
Plan No.
SCALES:
1 : 5,000 (A3)
Revision No. A

PLAN No. A102-08

INDUSTRY & INVESTMENT

File: 05-764

DIAGRAM OF AUTHORISATION No. 102
HOLDER: NSW DEPT OF INDUSTRY & INVESTMENT
PARISHES: YARRAMAN(B), DENMAN(B), WYBONG(B), ELLIS(B), CLANRICARD(B), VAUX(D) & ARNDELL(H)
COUNTIES: BRISBANE, DURHAM & HUNTER
SCALE 1:120000

REF MAPS: 9033-1-S, 9033-2-N & 9033-3-N

SUBJECT TO SURVEY

MGA CO-ORDINATES ZONE 56		
Pt	Easting	Northing
1	294 585.75	6 433 330.25
2	293 774.20	6 431 396.08
3	292 874.57	6 429 292.00
4	292 630.53	6 425 891.00
5	292 629.25	6 425 611.00
6	292 950.50	6 424 824.10
7	291 428.59	6 422 481.68
8	289 859.26	6 422 449.08
9	286 798.79	6 418 686.97
10	286 837.93	6 416 838.86
11	282 916.67	6 416 755.00
12	283 416.31	6 417 844.35
13	286 749.89	6 420 997.08
14	286 724.87	6 422 179.65
15	289 334.25	6 422 228.37
16	289 240.96	6 427 228.49
17	292 610.61	6 434 293.82
18	292 629.23	6 433 293.82
19	278 344.67	6 422 212.09
20	278 398.99	6 420 000.00
21	278 438.13	6 418 220.71
22	275 858.30	6 416 600.21
23	275 734.85	6 422 144.71

SURFACE EXCEPTION

Excludes the surface and soil below thereof to a depth of 900 metres below Australian Height Datum (AHD).

Excludes the surface and soil below thereof to a depth of 40 metres.

MN

ELLIS

YARRAMAN

WYBONG

CLANRICARD

VAUX

DENMAN

ARNDELL

ALTHORPE

DENMAN ROAD

Wybong Road

HUNTER RIVER

ML1645
(Plan No. M27095)

SEE INSET B

SEE INSET A

INSET B

Scale 1:25000

Scale 1:10000

ML1626
(Plan No. M27137)

INSET A

UNIVERSAL TRANSVERSE MERCATOR PROJECTION
HORIZONTAL DATUM: GDA94

NSW GOVERNMENT Industry & Investment - MINERAL RESOURCES

0 0.5 1 2 3 4 5 Kms

AREA: abt. 6044 ha

Prepared by: G Walker
Date: 29-03-2011
Approved by: P.Hord
Date: 27-04-2011
Maitland Regional Office

DISCLAIMER: The compilation of information shown on this diagram is derived from plans and data, some of which has been produced and provided by third parties.Title boundaries have been adjusted to maintain their relationship with the digital cadastral database in some circumstances, thereby creating certain inaccuracies in the data. This information does not constitute part of the record required under Section 159 of the Mining Act 1992 or Section 95 of the Petroleum (Onshore) Act 1991. Industry & Investment NSW and the State of New South Wales make no statement, representation or warranty that the titles information shown on this diagram is complete, accurate or free from error. Users rely on the titles information supplied on this diagram at their own risk. Industry & Investment NSW and the State of New South Wales accepts no responsibility for any person, acting on, or relying on, or upon any of the titles information shown on this diagram, and disclaim all liability for any loss, damage, cost, expense or injury (including death) incurred or arising by reason of any person using or relying on the titles information contained on this diagram by reason or by any error, omission, defect or misstatement (whether such error, omission or misstatement is caused by or arises from negligence, lack of care or otherwise). Users should always verify historical material by making and relying upon their own separate inquiries prior to making any important decisions or taking any action on the basis of titles information.

MINING ACT 1992

**INSTRUMENT OF RENEWAL OF AUTHORISATION NO. 102
HELD BY DIRECTOR-GENERAL NSW DEPT OF INDUSTRY AND INVESTMENT
ON BEHALF OF THE CROWN**

I, STEVE WHAN, MP, MINISTER FOR PRIMARY INDUSTRIES for the State of New South Wales **HEREBY RENEW THE LICENCE** subject to the terms and conditions set out below:

1. The licence is renewed for a further term until **16 September 2015.**

2. The conditions of the licence are amended by deleting all the conditions contained in the licence prior to this renewal and by including the attached **Exploration Licence Conditions 2010** numbered:

   1-3 (inclusive), 10-24 (inclusive), 29, 31-34 (inclusive).

3. The licence is renewed over the land described hereunder and shown on the **Exploration Area** attached hereto.

4. Mineral Group covered by this licence: Group 9. (Coal & Oil Shale).

I, Director-General, NSW Dept of Industry and Investment, on behalf of the Crown hereby accept the renewal of this Exploration Licence and agree to be bound by the conditions specified.

.....

Director-General, NSW Dept of Industry
and Investment, on behalf of the Crown

Renewed this 2nd day of March 2011

.....

STEVE WHAN MP
MINISTER FOR PRIMARY INDUSTRIES

SCHEDULE OF MGA CO-ORDINATES
SCALE FACTOR: 1.000062 ZONE:- 56

POINT	EASTING	NORTHING	POINT	EASTING	NORTHING
1	299109.53	6434415.09	91	293341.350	6429217.945
2	299110.40	6434394.95	92	293302.650	6429235.650
3	299121.505	6433857.085	93	293270.735	6429246.865
4	299115.355	6433709.13	94	293249.645	6429252.095
5	299115.83	6433688.77	95	293227.130	6429256.290
6	299126.46	6433230.105	96	293026.790	6429283.185
7	299134.18	6432931.345	97	292988.560	6429286.845
8	299136.44	6432598.705	98	292965.815	6429287.290
9	299136.675	6432578.305	99	292933.015	6429285.665
10	299144.295	6432469.59	100	292922.305	6429284.365
11	299156.715	6431987.475	101	292883.580	6429277.225
12	299156.765	6431985.485	102	292897.07	6429309.32
13	299398.725	6431602.92	103	291683.765	6429480.540
14	299560.275	6431185.98	104	291794.075	6430239.195
15	299178.98	6429998.0	105	291693.515	6430254.535
16	299177.415	6429995.83	106	291340.380	6430521.025
17	299164.07	6429977.36	107	291089.850	6430544.635
18	299030.43	6429792.38	108	291062.430	6432016.390
19	298564.68	6429425.98	109	293861.895	6432874.170
20	298484.83	6429292.19	110	294014.110	6433981.270
21	298327.96	6429029.34	111	294194.935	6434054.00
22	298211.48	6428759.280	112	294250.485	6434072.040
23	298179.77	6428523.82	113	294299.450	6434087.940
24	298176.295	6428497.980	114	294325.650	6434106.125
25	298122.66	6428511.525	115	294366.965	6434134.795
26	297972.545	6428532.59	116	294395.575	6434157.095
27	297725.68	6428567.24	117	294435.31	6434188.07
28	297103.065	6428654.88	118	294466.76	6434216.64
29	296509.31	6428738.455	119	294514.52	6434262.55
30	296432.11	6428728.70	120	294580.075	6434338.175
31	296373.54	6428736.995	121	294613.14	6434376.80
32	295816.80	6428815.88	122	294645.475	6434414.57
33	295796.90	6428818.765	123	294679.64	6434450.03
34	294866.84	6428953.74	124	294723.435	6434493.86
35	294866.945	6428954.48	125	294760.685	6434526.10
36	294533.71	6429002.67	126	294810.08	6434557.44
37	294513.995	6429005.52	127	294851.465	6434583.70
38	294346.25	6429025.61	128	294890.485	6434598.715
39	294042.48	6427453.60	129	294935.865	6434616.185
40	293939.27	6427467.66	130	294992.135	6434621.405
41	293893.80	6427473.86	131	295040.795	6434625.925
42	293653.13	6427506.61	132	295103.435	6434617.475
43	293684.97	6427154.77	133	295107.405	6434616.940
44	293716.51	6426779.95	134	295108.295	6434573.400
45	293718.185	6426427.145	135	295322.525	6434577.695
46	293704.03	6426328.14	136	296419.010	6434599.690
47	293684.85	6426275.32	137	297606.22	6434623.52
48	293644.675	6426216.75	138	297698.94	6434613.75
49	293560.785	6426144.665	139	298042.48	6434565.83
50	293000.975	6425740.110			
51	292974.795	6425668.27			
52	292973.085	6425625.57			
53	292991.97	6425563.795			
54	293070.140	6425342.955			
55	293123.21	6425192.16			
56	293194.99	6425001.32			
57	293252.365	6424915.53			
58	293327.510	6424834.345			
59	293400.095	6424785.33			
60	293497.830	6424745.585			
61	293581.145	6424731.505			
62	293694.375	6424739.75			
63	293710.09	6424640.97			
64	293572.92	6424631.46			
65	293452.47	6424657.205			
66	293352.765	6424696.610			
67	293261.955	6424757.925			
68	293172.440	6424854.645			
69	293114.470	6424948.080			
70	293036.230	6425157.465			
71	292976.485	6425307.785			
72	292896.960	6425532.470			
73	292872.465	6425612.585			
74	292875.385	6425685.485			
75	292894.205	6425745.700			
76	292921.990	6425804.600			
77	293499.445	6426223.735			
78	293569.255	6426283.620			
79	293608.295	6426357.530			
80	293618.120	6426428.845			
81	293596.665	6426693.570			
82	293556.195	6427131.655			
83	293553.070	6427520.380			
84	293094.835	6427583.555			
85	293284.330	6428805.525			
86	293333.785	6429167.265			
87	293455.435	6429152.670			
88	293444.020	6429169.805			
89	293434.020	6429173.380			
90	293407.640	6429184.165			

PLANS USED IN THIS SURVEY

DP 2770	DP 659924	B512-1511	B1222-2096
DP 39345	DP 706645	B671-1511	B1228-2096
DP 45621	DP 731706	B670-1511	B1216-2096
DP 93329	DP 738597	B673-1511	B1219-2096
DP 104563	DP 742324	B788-1511	B1223-2096
DP 112742	DP 744333	B782-1511	B2072-2096
DP 114090	DP 745897	B783-1511	B2073-2096
DP 137297	DP 749716	B784-1511	B3678-2096
DP 159507	DP 791576	B785-1511	B3660-2096
DP 164190	DP 792447	B957-1511	B4462-2096
DP 174071	DP 801249	B963-1511	B4461-2096
DP 192121	DP 821183	B11-2096	B4457-2096
DP 194043	DP 838259	B16-2096	B4463-2096
DP 254339	DP 870608	B56-2096	B4464-2096
DP 236666	DP 905281	B351-2096	B4822-2096
DP 236668	DP 906668	B352-2096	B4823-2096
DP 255048	DP 911212	B2071-2096	R23347-1603
DP 312392	DP 915913	B588-2096	R12321-1603
DP 432713	DP 916748	B589-2096	R24313-1603
DP 544039	DP 944231	B564-2096	R27933-1603
DP 551930	DP 944232	B563-2096	R5417-1603
DP 554140	DP 998239	B2185-2096	R8860-1603
DP 554159	DP 998477	B1667-2096	R30209-1603
DP 556761	DP 1053537	B2113-2096	R2180-1603
DP 558246	DP 1072668	B1217-2096	R30980-1603
DP 560963	DP 1108421	B1220-2096	R1577-1603
DP 561919	DP 1112792	B1220-2096	R5417-1603
DP 584603	B3852-2096	B1215-2096	
DP 626353	B345-1511		
DP 629491	B426-1511		
DP 635272	B349-1511		
DP 648797	B350-1511		
DP 648841	B352-1511		

SURVEYING REGULATIONS 2006 CLAUSE 35(1)(b) and CLAUSE 61(2)

MARK	MGA CO-ORDINATES EASTING	MGA CO-ORDINATES NORTHING	ZONE	CLASS	ORDER	METHOD	ORIGIN
TS 10526 BRAY [P]	287230.730	6426402.173	56	B	2	FROM SCIMS	SCIMS
TS 10695 CLANRICARD [P]	293180.866	6423893.081	56	B	2	FROM SCIMS	SCIMS
TS 10472 COX [P]	294321.914	6432041.745	56	B	2	FROM SCIMS	SCIMS
TS 10699 GLENDOR [P]	294762.788	6425223.784	56	B	2	FROM SCIMS	SCIMS
TS 10465 MARYVALE [P]	295261.003	6435124.627	56	B	2	FROM SCIMS	SCIMS
TS 3357 NEGOA [P]	300036.979	6432671.206	56	2A	0	FROM SCIMS	SCIMS
TS 3639 OVERTON [P]	297835.972	6427927.650	56	2A	0	FROM SCIMS	SCIMS
PM 51587	293470.386	6424628.602	56	B	2	FROM SCIMS	SCIMS
PM 51588	293912.104	6424743.222	56	B	2	FROM SCIMS	SCIMS
PM 51601	298788.649	6427389.556	56	B	2	FROM SCIMS	SCIMS
PM 70250	292873.223	6429295.323	56	C	N/A	RTK GPS	FOUND
SSM 36027	294081.284	6426346.662	56	C	N/A	RTK GPS	FOUND
SSM 36041	294102.245	6429061.944	56	C	N/A	RTK GPS	FOUND
SSM 78795	295909.678	6428803.415	56	C	N/A	RTK GPS	FOUND
SSM 119700	299399.120	6428673.565	56	C	N/A	RTK GPS	FOUND
SSM 119701	298766.068	6428419.080	56	C	N/A	RTK GPS	FOUND
SSM 73390	300430.681	6429614.130	56	C	3	FROM SCIMS	SCIMS

COMBINED SCALE FACTOR:- 1.000062
SOURCE- MGA COORDINATES TAKEN FROM SCIMS
DATE- 8th JUNE 2010

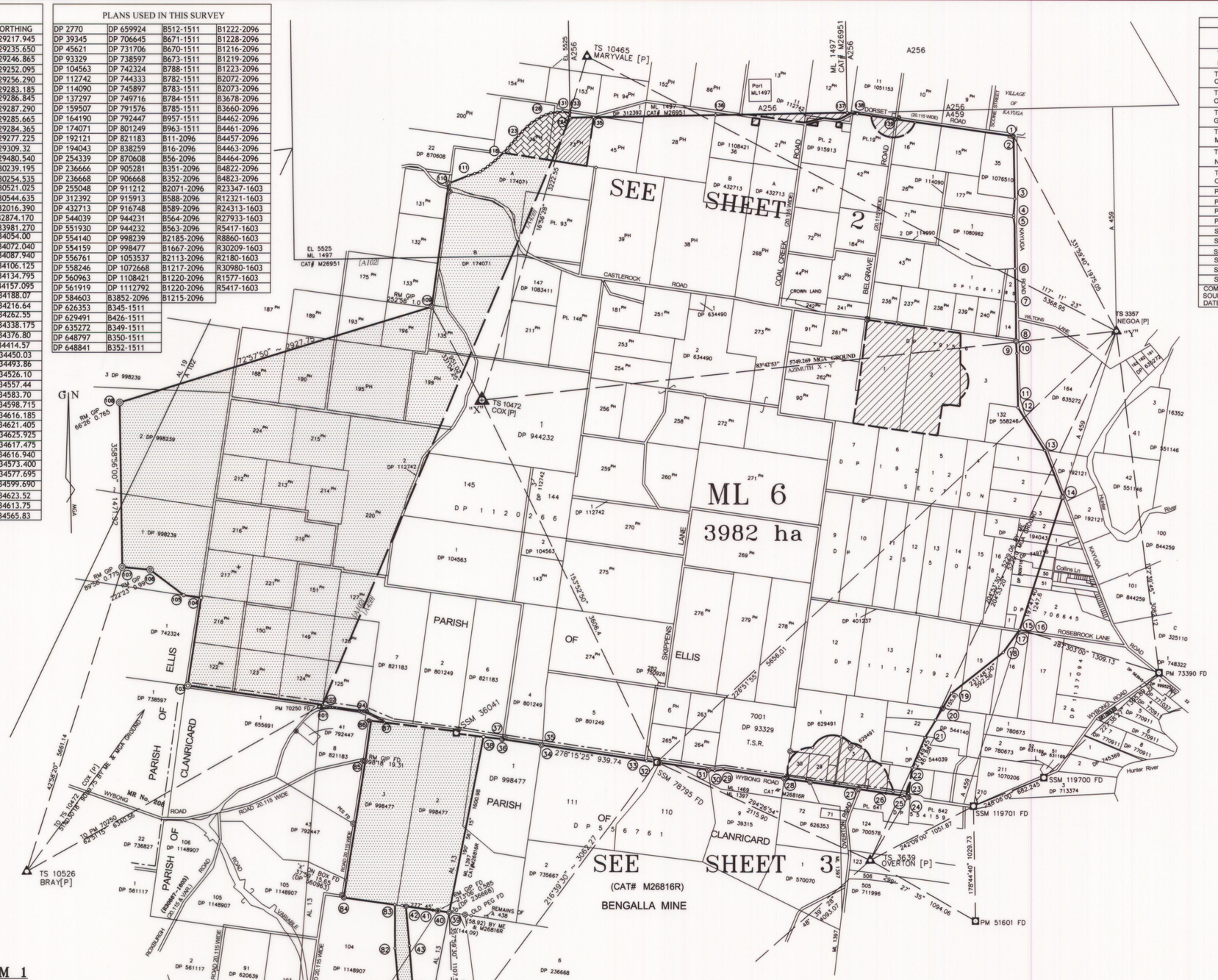
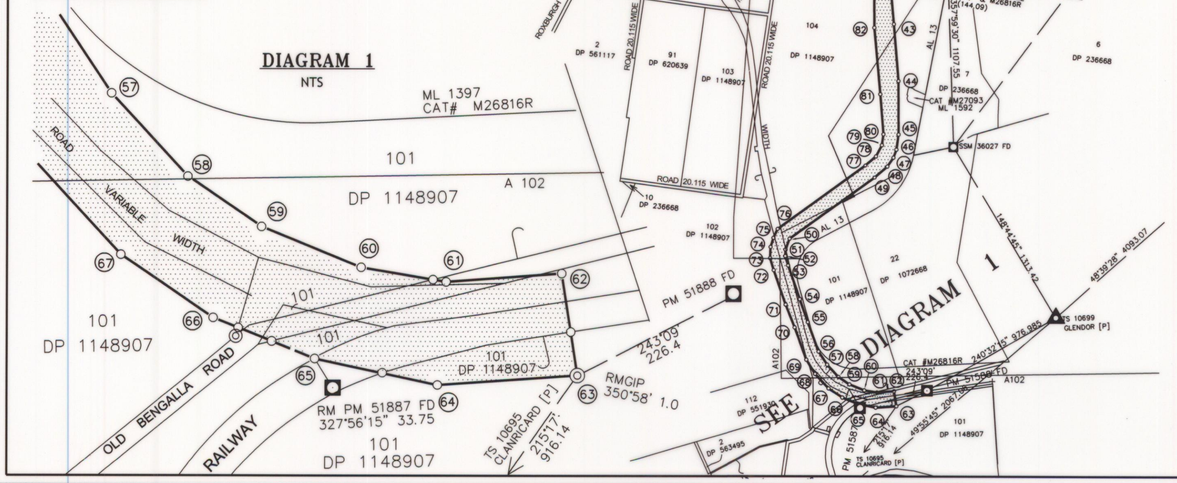


DIAGRAM 1
NTS



REFERENCE TO BOUNDARIES

LINE	BEARING	DISTANCE	LINE	BEARING	DISTANCE	LINE	BEARING	DISTANCE	LINE	BEARING	DISTANCE	LINE	BEARING	DISTANCE
1–2	177°33'00"	20.155	32–33	278°15'25"	20.11	63–64	266°01'55"	137.49	92–93	289°21'20"	33.825	121–122	40°33'55"	49.715
2–3	178°49'00"	537.95	34–35	7°57'20"	0.745	64–65	282°03'55"	123.16	93–94	283°56'25"	21.725	122–123	43°56'00"	49.245
3–4	182°22'50"	148.075	35–36	278°13'40"	336.68	65–66	291°33'50"	107.205	94–95	280°32'40"	22.905	123–124	44°58'30"	61.955
4–5	178°40'00"	20.365	36–37	278°13'40"	19.925	66–67	304°01'45"	109.565	95–96	277°38'45"	202.125	124–125	49°07'40"	49.265
5–6	178°40'20"	458.76	37–38	276°49'25"	168.945	67–68	317°12'50"	131.775	96–97	275°28'15"	38.40	125–126	57°36'15"	58.495
6–7	178°31'10"	298.84	39–40	277°45'30"	104.16	68–69	328°11'00"	109.950	97–98	271°07'35"	22.75	126–127	57°36'15"	49.015
7–8	179°36'40"	332.625	40–41	277°45'30"	45.885	69–70	339°30'40"	223.515	98–99	267°09'35"	32.84	127–128	68°57'05"	41.805
8–9	179°20'00"	20.40	41–42	277°45'00"	242.875	70–71	338°19'30"	161.745	99–100	263°05'05"	10.79	128–129	68°57'00"	48.625
9–10	175°59'25"	108.975	42–43	174°49'45"	353.26	71–72	340°30'35"	238.330	100–101	259°33'15"	39.375	129–130	84°41'50"	56.51
10–11	178°31'25"	482.245	43–44	175°11'25"	376.12	72–73	342°59'50"	83.770	101–102	22°47'55"	34.81	130–131	84°41'50"	48.865
11–12	178°31'25"	1.99	44–45	179°43'40"	352.785	73–74	2°17'45"	72.955	102–103	278°01'55"	1225.25	131–132	97°40'50"	63.20
12–13	147°41'15"	452.63	45–46	188°08'15"	100.005	74–75	17°21'10"	63.080	103–104	8°16'25"	766.585	132–133	97°40'50"	4.005
13–14	158°49'15"	447.11	46–47	199°57'15"	56.19	75–76	25°15'15"	65.125	104–105	278°40'20"	101.715	133–134	178°49'50"	43.545
15–16	215°50'50"	2.675	47–48	214°26'55"	71.025	76–77	54°01'35"	713.490	105–106	307°02'25"	442.38	134–135	88°51'05"	214.26
16–17	215°50'50"	22.785	48–49	229°19'40"	110.60	77–78	49°22'40"	91.970	106–107	275°23'00"	251.625	135–136	88°51'05"	1096.64
17–18	215°50'50"	228.19	49–50	234°08'50"	690.64	78–79	27°50'30"	83.580	107–108	358°56'00"	1471.92	136–137	88°51'05"	1187.37
19–20	210°49'45"	155.8	50–51	200°01'15"	76.460	79–80	7°50'40"	71.985	108–109	72°57'50"	2927.75	137–138	95°59'55"	93.235
20–21	210°49'45"	306.09	51–52	182°17'45"	42.73	80–81	355°22'00"	265.575	109–110	7°49'45"	1117.44	138–139	97°56'30"	346.845
21–22	203°19'50"	294.09	52–53	162°59'50"	64.59	81–82	354°43'20"	439.920	110–111	68°05'25"	194.89	139–1	98°02'25"	1077.58
22–23	187°40'05"	237.565	53–54	160°30'20"	234.25	82–83	359°32'20"	388.715	111–112	72°00'20"	58.40			
23–24	187°40'05"	26.07	54–55	160°36'40"	159.845	83–84	277°51'00"	462.535	112–113	72°00'20"	51.48			
24–25	284°10'20"	55.315	55–56	159°23'10"	203.885	84–85	8°48'55"	1236.5	113–114	55°14'35"	31.89			
25–26	277°59'20"	151.575	56–57	146°13'35"	103.20	85–86	7°47'05"	365.08	114–115	55°14'35"	50.285			
26–27	277°59'20"	249.27	57–58	137°12'50"	110.615	86–87	96°50'30"	122.515	115–116	52°03'45"	36.27			
27–28	278°00'45"	673.97	58–59	124°01'45"	87.580	87–88	326°19'35"	20.59	116–117	52°03'50"	50.38			
28–29	278°00'45"	554.315	59–60	112°07'50"	105.500	88–89	289°40'30"	10.620	117–118	47°44'45"	42.485			
29–30	262°47'45"	77.815	60–61	99°35'30"	84.495	89–90	292°14'05"	28.50	118–119	46°07'50"	66.25			
30–31	278°03'50"	59.155	61–62	85°50'10"	113.52	90–91	297°00'15"	74.395	119–120	40°55'10"	100.075			
31–32	278°03'50"	562.27	62–63	170°57'40"	100.01	91–92	294°35'10"	42.555	120–121	40°34'05"	50.845			

NOTE: (1) ALL DISTANCES SHOWN HEREIN ARE GROUND DISTANCES
(2) GPS OBSERVATIONS HAVE BEEN USED FOR PART OF THE SURVEY SHOWN HEREON

R17009105
D110094940

PLAN OF PORTION ML 6

PARISH: ELLIS & CLANRICARD

COUNTY: BRISBANE

MAP SHEET No. 9132-2-N

REDUCTION RATIO 1: 20 000

MINING LEASE APPLICATION No. 100

MINING DIVISION: SINGLETON

APPLICANT: COAL & ALLIED OPERATIONS PTY LIMITED

APPLICATION DATE: 21-10-1997

MINING LEASE No.1645 (Act 1992)

STATUS:

METHOD: OPEN CUT

DEPTH RESTRICTION/SURFACE EXCEPTION

- Embraces the strata between a depth of 15 metres below the surface to a depth of 900 metres below Australian Height Datum (AHD).
- Embraces the surface and soil below thereof to a depth of 40 metres.
- Embraces the surface and soil below thereof to a depth of 900 metres below AHD.
- Embraces the strata between a depth of 15 metres below the surface to a depth of 40 metres below the surface.

NOTES: SHEET 1 OF 3

Azimuth: TS 10472 to TS 3357
"X" Cox [P] "Y" Negoa [P]

Plans used in the course of this survey/~~compilation~~
SEE TABLE ON SHEET 1

Survey declared on this plan for lines
THE WHOLE

I, ROSS ANDREW PEASLEY
of BOARDMAN PEASLEY PTY LIMITED
a Surveyor registered under the Surveying & Spatial Information Act 2002, as amended hereby certify that the survey represented in this plan is accurate and has been completed in accordance with the Surveying & Spatial Information Regulation 2006 and the Surveyor General's Direction for Mining Surveys and was completed on 18th AUGUST 2010

Signature : Ross Peasley
Surveyors Reference : S4153ML

Survey Calcs : 20/9/2010
Plan Investigated : 20/9/2010
Plan Approved : 21-09-2010
Paper No : 07/529

M 27095

SURVEYING REGULATION 2006 CLAUSE 35(1)(b) and CLAUSE 61(2)							
MARK	MGA CO-ORDINATES EASTING	MGA CO-ORDINATES NORTHING	ZONE	CLASS	ORDER	METHOD	ORIGIN
TS 10472 COX [P]	294321.914	6432041.745	56	B	2	FROM SCIMS	SCIMS
TS 3357 NEGOA [P]	300036.979	6432671.206	56	2A	0	FROM SCIMS	SCIMS
TS 3639 OVERTON [P]	297835.972	6427927.650	56	2A	0	FROM SCIMS	SCIMS
PM 36049	297928.070	6433626.755	56	C	N/A	RTK GPS	FOUND
PM 46794	297540.78	6431225.58	56	C	N/A	RTK GPS	FOUND
PM 73390	300430.681	6429614.130	56	C	3	FROM SCIMS	SCIMS
PM 127942	297835.972	6427927.650	56	2A	0	FROM SCIMS	SCIMS
PM 142749	297835.972	6427927.650	56	2A	0	FROM SCIMS	FOUND
SSM 24720	298103.84	6432727.70	56	C	N/A	RTK GPS	FOUND
SSM 36038	297187.55	6434147.12	56	2A	0	FROM SCIMS	SCIMS
SSM 36048	297835.972	6427927.650	56	C	N/A	RTK GPS	FOUND
SSM 36055	298449.834	6431880.603	56	C	N/A	RTK GPS	FOUND
SSM 36058	298449.835	6431880.605	56	C	N/A	RTK GPS	FOUND
SSM 78795	295909.678	6428803.415	56	C	N/A	RTK GPS	FOUND
SSM 79798	297702.13	6432114.55	56	C	N/A	RTK GPS	FOUND

COMBINED SCALE FACTOR: 1.000062
SOURCE- MGA COORDINATES TAKEN FROM SCIMS
DATE- 29th APRIL 2009

NOTE: ALL DISTANCES SHOWN HEREIN ARE GROUND DISTANCES

PLAN OF PORTION ML 6

PARISH: ELLIS & CLANRICARD

COUNTY: BRISBANE

MAP SHEET No. 9132-2-N

REDUCTION RATIO 1: 10 000

MINING LEASE APPLICATION No. 100

MINING DIVISION: SINGLETON

APPLICANT: COAL & ALLIED OPERATIONS PTY LIMITED

APPLICATION DATE: 21-10-1997

MINING LEASE No. 1645 (Act 1992)

STATUS:

METHOD: OPEN CUT

DEPTH RESTRICTION/SURFACE EXCEPTION

- Embraces the strata between a depth of 15 metres below the surface to a depth of 900 metres below Australian Height Datum (AHD).
- Embraces the surface and soil below thereof to a depth of 40 metres.
- Embraces the surface and soil below thereof to a depth of 900 metres below AHD.
- Embraces the strata between a depth of 15 metres below the surface to a depth of 40 metres below the surface.

NOTES:

SHEET 2 OF 3

Azimuth:

Plans used in the course of this survey/~~compilation~~
SEE TABLE ON SHEET 1

Survey declared on this plan for lines
THE WHOLE

I, ROSS ANDREW PEASLEY
of BOARDMAN PEASLEY PTY LIMITED
a Surveyor registered under the Surveying & Spatial Information Act 2002, as amended hereby certify that the survey/compilation represented in this plan is accurate and has been completed in accordance with the Surveying & Spatial Information Regulation 2006 and the Surveyor General's Direction for Mining Surveys and was completed on 18th AUGUST 2010

Signature : Ross Peasley

Surveyors Reference : S4453ML

Survey Calcs : G Schmo 20/9/2010
Plan Investigated : G Schmo 20/9/2010
Plan Approved : Mark 21-09-2010
Paper No : 07/529

M 27095

REFERENCE TO BOUNDARIES					
LINE	BEARING	DISTANCE	LINE	BEARING	DISTANCE
110-111	68° 05' 25"	194.89	139-140	277° 53' 40"	102.345
111-112	72° 00' 20"	58.40	140-143	256° 31' 40"	161.26
112-113	72° 00' 20"	51.48	143-144	256° 31' 40"	21.605 P.O
113-114	55° 14' 35"	31.89	160-151	187° 55'	39.610
114-115	55° 14' 35"	50.285	151-152	278° 01' 45"	100.615
115-116	52° 03' 45"	36.27	152-141	76° 31' 40"	108.057
116-117	52° 03' 50"	50.38	147-148	97° 47' 20"	46.12 P.O
117-118	47° 44' 45"	42.485	148-149	187° 47' 20"	43.905 P.O
118-119	46° 07' 50"	66.25	149-150	277° 47' 20"	46.12 P.O
119-120	40° 55' 10"	100.075	150-147	7° 47' 20"	43.905 P.O
120-121	40° 34' 05"	50.845	153-154	187° 50' 15"	63.570 P.O
121-122	40° 33' 55"	49.715	154-155	277° 50' 15"	63.770 P.O
122-123	43° 56' 00"	49.245	155-156	7° 50' 15"	63.570 P.O
123-124	44° 58' 30"	61.955	156-153	97° 50' 15"	63.770 P.O
124-125	49° 07' 40"	49.265	157-158	241° 54' 00"	102.68
125-126	57° 36' 15"	58.495	158-159	259° 53' 55"	46.995
126-127	57° 36' 15"	49.015			
127-128	68° 57' 05"	41.805			
128-129	68° 57' 00"	48.625			
129-130	84° 41' 50"	56.51			
130-131	84° 41' 50"	48.865			
138-139	187° 55'	39.610			

MGA CO-ORDINATES SCALE FACTOR:								
POINT	EASTING	NORTHING	125	294760.685	6434526.10	160	297348.355	6434543.465
			126	294810.08	6434557.44	161	298221.250	6434540.580
1	299109.53	6434415.09	127	294851.465	6434583.70	162	298000.050	6434404.570
2	299110.40	6434394.95	128	294890.485	6434598.715	163	297824.920	6434596.180
3	299121.505	6433857.085	129	294935.865	6434616.185	170	297794.69	6432768.345
4	299115.355	6433709.13	130	294992.135	6434621.405	171	298042.145	6432734.155
5	299115.83	6433688.77	131	295040.795	6434625.925	172	298135.75	6432720.955
6	299126.46	6433230.105	132	295103.435	6434617.475	173	298222.05	6432708.735
7	299134.18	6432931.345	133	295107.405	6434616.940	174	298637.30	6432649.935
8	299136.44	6432598.705	134	295108.295	6434573.400	175	298636.13	6432375.155
9	299136.675	6432578.305	135	295322.525	6434577.695	176	298648.86	6432077.30
10	299144.295	6432469.59	136	296419.010	6434599.690	177	298634.795	6432061.985
11	299156.715	6431987.475	137	297606.22	6434623.52	178	298634.52	6431998.215
12	299156.765	6431985.485	138	297698.94	6434613.75	179	298542.02	6432010.45
13	299398.725	6431602.92	139	298042.48	6434565.83	180	298473.665	6432005.905
14	299560.275	6431185.98	140	297403.08	6434577.25	181	298437.695	6431738.30
109	293861.895	6432874.170	141	297348.357	6434543.465	182	298089.55	6431785.22
110	294014.110	6433981.270	144	297225.230	6434534.650	183	297928.155	6431806.97
111	294194.935	6434054.00	145	296710.230	6434605.530	184	297666.99	6431846.615
112	294250.485	6434072.040	146	296581.495	6434602.945	185	297707.280	6432134.055
113	294299.450	6434087.940	147	297514.405	6434541.535	187	295263.27	6434149.60
114	294325.650	6434106.125	148	297560.100	6434535.285	188	294948.84	6434194.05
115	294366.965	6434134.795	149	297554.150	6434491.785	189	294508.08	6434256.36
116	294395.575	6434157.095	150	297508.450	6434498.035			
117	294435.31	6434188.07	151	297342.900	6434504.230			
118	294466.76	6434216.64	152	297243.270	6434518.285			
119	294514.52	6434262.55	153	296820.100	6434570.110			
120	294580.075	6434338.175	154	296811.435	6434507.130			
121	294613.14	6434376.80	155	296748.255	6434515.825			
122	294645.475	6434414.57	156	296756.925	6434578.805			
123	294679.64	6434450.03	157	297641.310	6434619.810			
124	294723.435	6434493.86	158	297550.730	6434571.440			
			159	297504.460	6434563.200			

D110094930

DIAGRAM A

NOTE: (1) ALL DISTANCES SHOWN HEREIN ARE GROUND DISTANCES
(2) GPS OBSERVATIONS HAVE BEEN USED FOR PART OF THE SURVEY SHOWN HEREON

GN

ML 6
3982 ha

SEE SHEET 2

REFERENCE MARKS			
CNR	BEARING	DISTANCE	FROM
(AA)	215°50'	6.015	RM GIP FD (℄ M26816R)
(BB)	186°47'	2.755	RM GIP FD (DP 39345)
(DD)	187°58'	0.805	RM GIP FD (DP159507)

SURVEYING REGULATIONS 2006 CLAUSE 35(1)(b) and CLAUSE 61(2)							
MARK	MGA CO-ORDINATES EASTING	NORTHING	ZONE	CLASS	ORDER	METHOD	ORIGIN
TS 10472 COX [P]	294321.914	6432041.745	56	B	2	From SCIMS	SCIMS
TS 10699 GLENDOR [P]	294762.788	6425223.784	56	B	2	From SCIMS	SCIMS
TS 3357 NEGOA [P]	300036.979	6432671.206	56	2A	0	From SCIMS	SCIMS
TS 3639 OVERTON [P]	297835.972	6427927.656	56	2A	0	From SCIMS	SCIMS
PM 51601	298788.649	6427389.550	56	B	2	From SCIMS	SCIMS
PM 73390	300430.681	6429614.130	56	C	3	From SCIMS	SCIMS
PM 70250	292873.223	6429295.323	56	C	N/A	RTK GPS	FOUND
SSM 36041	294102.245	6429061.944	56	C	N/A	RTK GPS	FOUND
SSM 78795	295909.678	6428803.415	56	C	N/A	RTK GPS	FOUND
SSM 119700	299399.120	6428673.565	56	C	N/A	RTK GPS	FOUND
SSM 119701	298766.068	6428419.080	56	C	N/A	RTK GPS	FOUND

COMBINED SCALE FACTOR 1.00062 (AVERAGE ADOPTED OVERSITE)
SOURCE- MGA COORDINATES TAKEN FROM SCIMS
DATE- 29th APRIL 2009

MGA CO-ORDINATES SCALE FACTOR: 1.000062					
POINT	EASTING	NORTHING	POINT	EASTING	NORTHING
14	299560.275	6431185.98	96	293026.790	6429283.185
15	299178.98	6429998.0	97	292988.560	6429286.845
16	299177.415	6429995.83	98	291340.380	6430521.025
17	299164.07	6429977.36	99	292933.015	6429285.665
18	299030.43	6429792.38	100	292922.305	6429284.365
19	298564.68	6429425.98	101	292883.580	6429277.225
20	298484.83	6429292.19	102	292897.07	6429309.32
21	298327.96	6429029.34	103	291683.765	6429480.540
22	298211.48	6428759.280	104	291794.075	6430239.195
23	298179.77	6428523.82	105	291693.515	6430254.535
24	298176.295	6428497.980	106	291340.380	6430521.025
25	298122.66	6428511.525	249	294274.580	6429034.165
26	297972.545	6428532.59	250	294115.015	6429053.260
27	297725.68	6428567.24	251	294069.700	6429078.975
28	297103.065	6428654.88	252	293818.415	6429109.125
29	296509.31	6428738.455	253	297568.97	6429034.39
30	296432.11	6428728.70	254	297645.67	6428978.73
31	296373.54	6428736.995	255	297839.86	6428827.37
32	295816.80	6428815.88	256	297998.20	6428646.87
33	295796.90	6428818.765	257	298042.08	6428522.83
34	294866.84	6428953.74	258	297103.06	6428654.88
35	294866.945	6428954.48	259	297176.47	6428899.24
36	294533.71	6429002.67	262	298193.745	6428627.59
37	294513.995	6429005.52	263	298163.845	6428501.125
38	294346.25	6429025.61	275	297310.795	6428931.370
39	294042.48	6427453.60			
40	293939.27	6427467.66			
41	293893.80	6427473.86			
42	293653.13	6427506.61			
43	293684.97	6427154.77			
82	293556.195	6427131.655			
83	293553.070	6427520.380			
84	293094.835	6427583.555			
85	293284.330	6428805.525			
86	293333.785	6429167.265			
87	293455.435	6429152.670			
88	293444.020	6429169.805			
89	293434.020	6429173.380			
90	293407.640	6429184.165			
91	293341.350	6429217.945			
92	293302.650	6429235.650			
93	293270.735	6429246.865			
94	293249.645	6429252.095			
95	293227.130	6429256.290			

SCHEDULE OF CURVED BOUNDARIES				
ARC	CHORD BEARING	CHORD DISTANCE	ARC	RADIUS
253-254	125°58'	94.755	95.665	200
254-255	127°56'05"	246.205	265.21	200
255-256	138°44'30"	240.09	257.515	200
256-257	160°31'	131.56	134.055	200
258-259	16°43'15"	255.13	276.67	200
259-275	76°32'55"	138.105	141.005	200
275-253	68°14'45"	277.955	307.305	200
262-263	193°18'15"	129.945	132.345	200

REFERENCE TO BOUNDARIES								
LINE	BEARING	DISTANCE	LINE	BEARING	DISTANCE	LINE	BEARING	DISTANCE
15-16	215°50'50"	2.675	84-85	8°48'55"	1236.5	101-102	22°47'55"	34.81
16-17	215°50'50"	22.785	85-86	7°03'50"	365.08	102-103	278°01'55"	1225.25
17-18	215°50'50"	228.19	86-87	96°50'30"	122.515	103-104	8°16'25"	766.585
22-23	187°40'05"	237.565	87-88	326°19'35"	20.59	104-105	278°40'20"	101.715
23-24	187°40'05"	26.075	88-89	289°40'30"	10.620	105-106	307°02'25"	442.38
29-30	262°47'45"	77.815	89-90	292°14'05"	28.50	38-249	276°49'25"	72.16
30-31	278°03'50"	59.155	90-91	297°00'15"	74.395	249-250	276°49'25"	160.69
34-35	7°57'20"	0.745	91-92	294°35'10"	42.555	250-251	299°34'30"	52.10
35-36	278°13'40"	336.685	92-93	289°21'20"	33.825	251-252	276°50'30"	253.075
36-37	278°13'40"	19.935	93-94	283°56'25"	21.725	252-86	276°50'30"	488.075
37-38	276°49'25"	168.96	94-95	280°32'40"	22.905			
39-40	277°45'30"	104.16	95-96	277°38'45"	202.125			
40-41	277°45'30"	45.885	96-97	275°28'15"	38.40			
41-42	277°45'00"	242.875	97-98	271°07'35"	22.75			
42-43	174°49'45"	353.26	98-99	267°09'35"	32.84			
82-83	359°32'20"	388.715	99-100	263°05'05"	10.79			
83-84	277°51'00"	462.535	100-101	259°33'15"	39.375			

NOTE: (1) ALL DISTANCES SHOWN HEREIN ARE GROUND DISTANCES
(2) GPS OBSERVATIONS HAVE BEEN USED FOR PART OF THE SURVEY SHOWN HEREON

DIAGRAM A
N.T.S

DIAGRAM B
N.T.S

PLAN OF PORTION ML 6

PARISH: ELLIS & CLANRICARD

COUNTY: BRISBANE

MAP SHEET No. 9132-2-N

REDUCTION RATIO 1: 12 500

MINING LEASE APPLICATION No. 100

MINING DIVISION: SINGLETON

APPLICANT: COAL & ALLIED OPERATIONS PTY LIMITED

APPLICATION DATE: 21-10-1997

MINING LEASE No.1645 (Act1992)

STATUS:

METHOD: OPEN CUT

DEPTH RESTRICTION/SURFACE EXCEPTION

- Embraces the strata between a depth of 15 metres below the surface to a depth of 900 metres below Australian Height Datum (AHD).
- Embraces the surface and soil below thereof to a depth of 40 metres.
- Embraces the surface and soil below thereof to a depth of 900 metres below AHD.
- Embraces the strata between a depth of 15 metres below the surface to a depth of 40 metres below the surface.

NOTES:

SHEET 3 OF 3

Azimuth:

Plans used in the course of this survey/~~compilation~~
SEE TABLE ON SHEET 1

Survey declared on this plan for lines

I ROSS ANDREW PEASLEY
of BOARDMAN PEASLEY PTY LIMITED
a Surveyor registered under the Surveying & Spatial Information Act 2002, as amended hereby certify that the survey/compilation represented in this plan is accurate and has been completed in accordance with the Surveying & Spatial Information Regulation 2006 and the Surveyor General's Direction for Mining Surveys and was completed on 18th AUGUST 2010

Signature : Ross Peasley
Surveyors Reference : S4153ML

Survey Calcs : 20/9/2010
Plan Investigated : 20/9/2010
Plan Approved : 21-09-2010
Paper No : 07/529

M 27095

D110094920

APPENDIX 4

Various borehole data

(Archived boreholes also seen on current A0 Record Tracing Plans)

****** Predicted Borehole :Borehole1 : ******

Collar Coordinate - Easting : 297777
Northing : 6427496
Elevation : 149.92

Seam/Layer	From_Depth	To_Depth	Thickness
WN1E	-55.40	-55.20	0.20
WN1D	-55.20	-55.00	0.20
WN1C	-55.00	-54.67	0.33
WN1A	-54.51	-54.01	0.50
ED1E	-49.77	-49.24	0.53
ED1C	-48.82	-48.12	0.71
ED1A	-47.98	-46.64	1.34
CL1	-35.31	-33.56	1.75
BG1C	-22.10	-21.81	0.29
BG1A	-21.21	-20.67	0.54
BG2	-10.37	-9.27	1.10
BG3	-8.90	-7.86	1.04
EG1	9.25	9.89	0.64
EG2E	23.11	23.68	0.57
EG2C	23.71	24.59	0.88
EG2A	24.62	26.82	2.20
RC1	38.08	38.94	0.86
RC2	43.57	45.06	1.49
RC3	58.68	60.41	1.73

EDENGLASIE SEAM TOO THICK.

← MORE LIKELY

RC = RAMROD CREEK.

38.08
38.94 — 0.86m — RC 1

4.63m

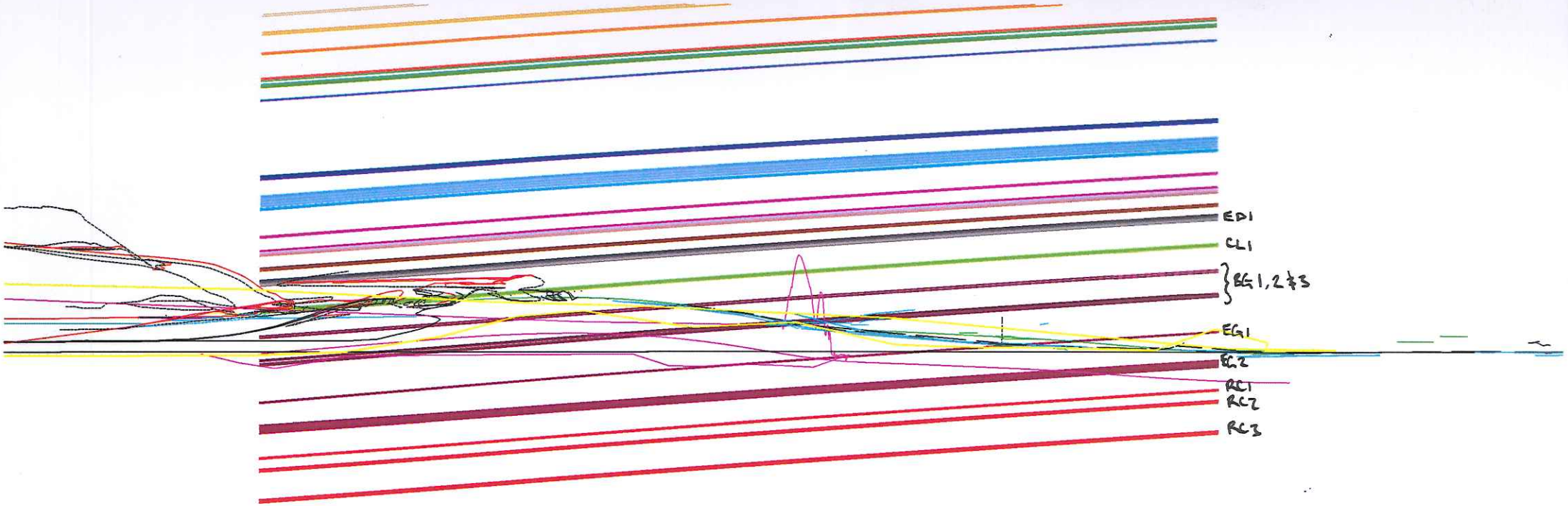
17' = 5.18m ✓

43.57
45.06 — 1.49m — RC 2

-13.620m

31' = 9.45m

58.68
60.41 — 1.73m — RC 3


ED1
CL1
EG1,2 & 3
EG1
EG2
RC1
RC2
RC3

'Clanricard 8' Borehole

SSM 35989

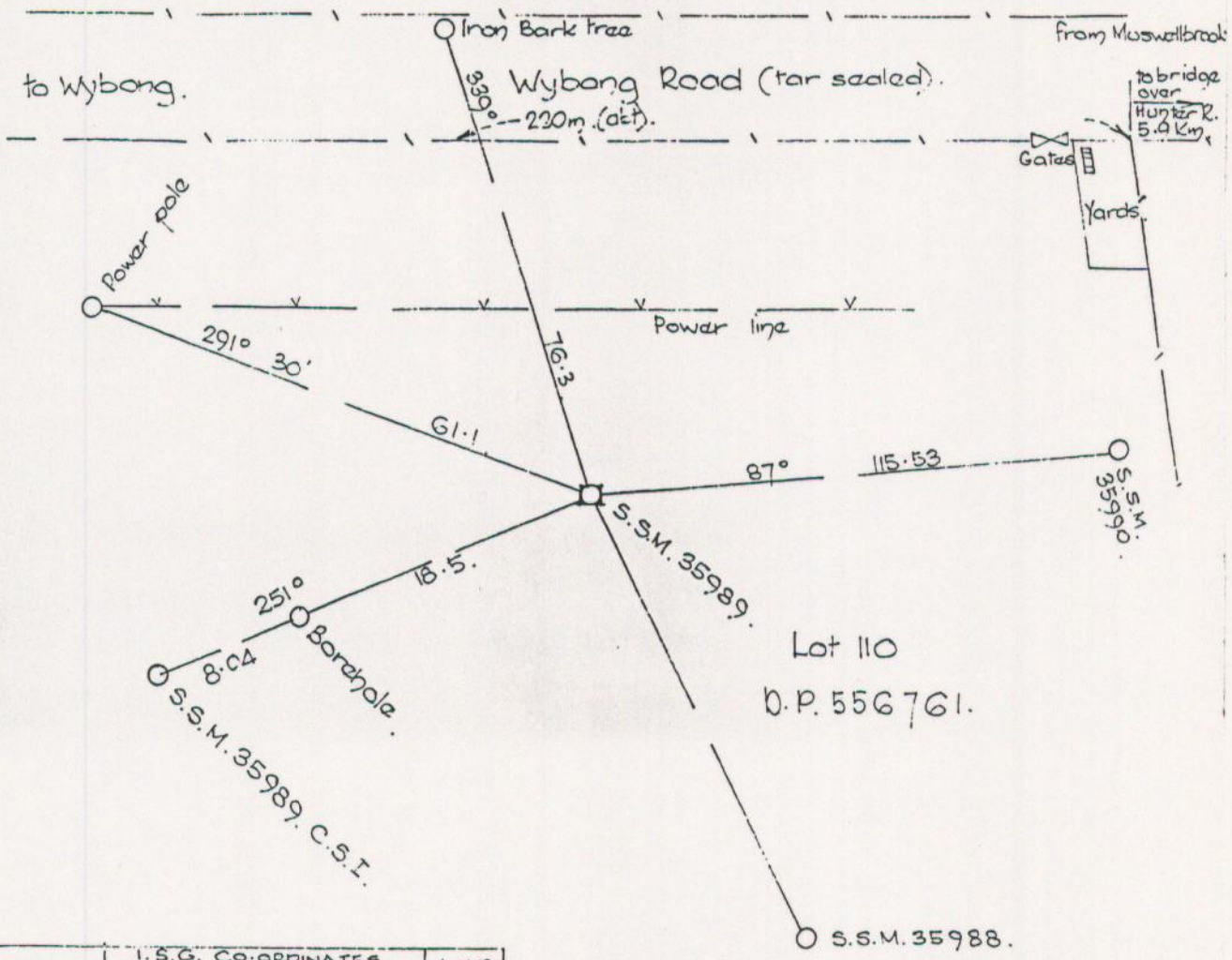
MsM

LOCALITY SKETCH PLAN

Parish Clanricard County Brisbane City or Town

~~Municipality or~~ Shire Denman Control Survey Plan

Not to Scale Measurements are in metres I.S.G. Zone 56/1



	I.S.G. CO-ORDINATES. East	North.	A.H.D.
Borehole	284 440·47	1429 349·07	206.33
S.S.M. 35989	284 458·01	1429 354·92	205·90

Field Book 954/25.

Accepted for Departmental Use

J. Howe 10.8.79

Authorised Officer.

Organization placing Marks

.....

Aerial photo No. ..... Run .....

Plan registered / / 19

Mark last inspected / / 19

SSM 35989

M26381

I certify that the Mark or Marks have been placed and numbered as detailed hereon.

.....

Designation

36391 8.77 D. West, Government Printer

R13263810

D103263810

'CLANRICARD 10' BOREHOLE

SSM 35988

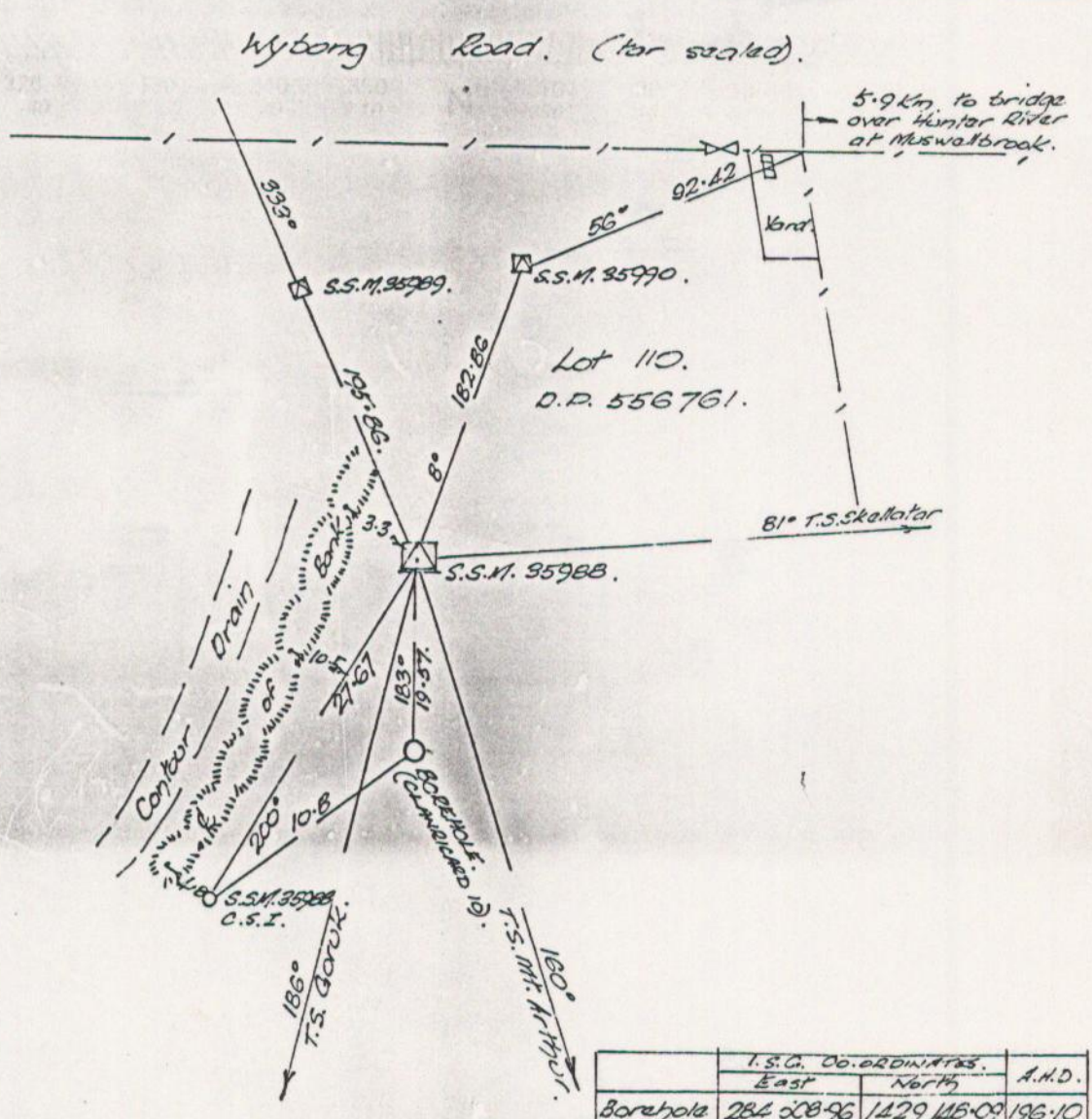
M S M

LOCALITY SKETCH PLAN

Parish Clanricard County Brisbane City or Town

~~Municipality or~~ Shire Denman Control Survey Plan

Not to Scale. Measurements are in metres I.S.G. Zone 56 / /



	I.S.G. 06. ORDINATES. East	North	A.H.D.
Borehole	284 208·96	1429 126·09	196·10
S.S.M. 35988	284 513·51	1429 167·12	196·66

Accepted for Departmental Use.
J. House 10:8:79
Authorised Officer.

Field Book 954/23.

Organization placing Marks

I certify that the Mark or Marks have been placed and numbered as detailed hereon.

Aerial photo No. ..... Run .....

Plan registered / /19

Mark last inspected / /19

SSM 35988

M26383

Designation

36391 8.77 D. West, Government Printer

R13263830

D103263830

'Clanricard 17' Borehole

SSM 36034

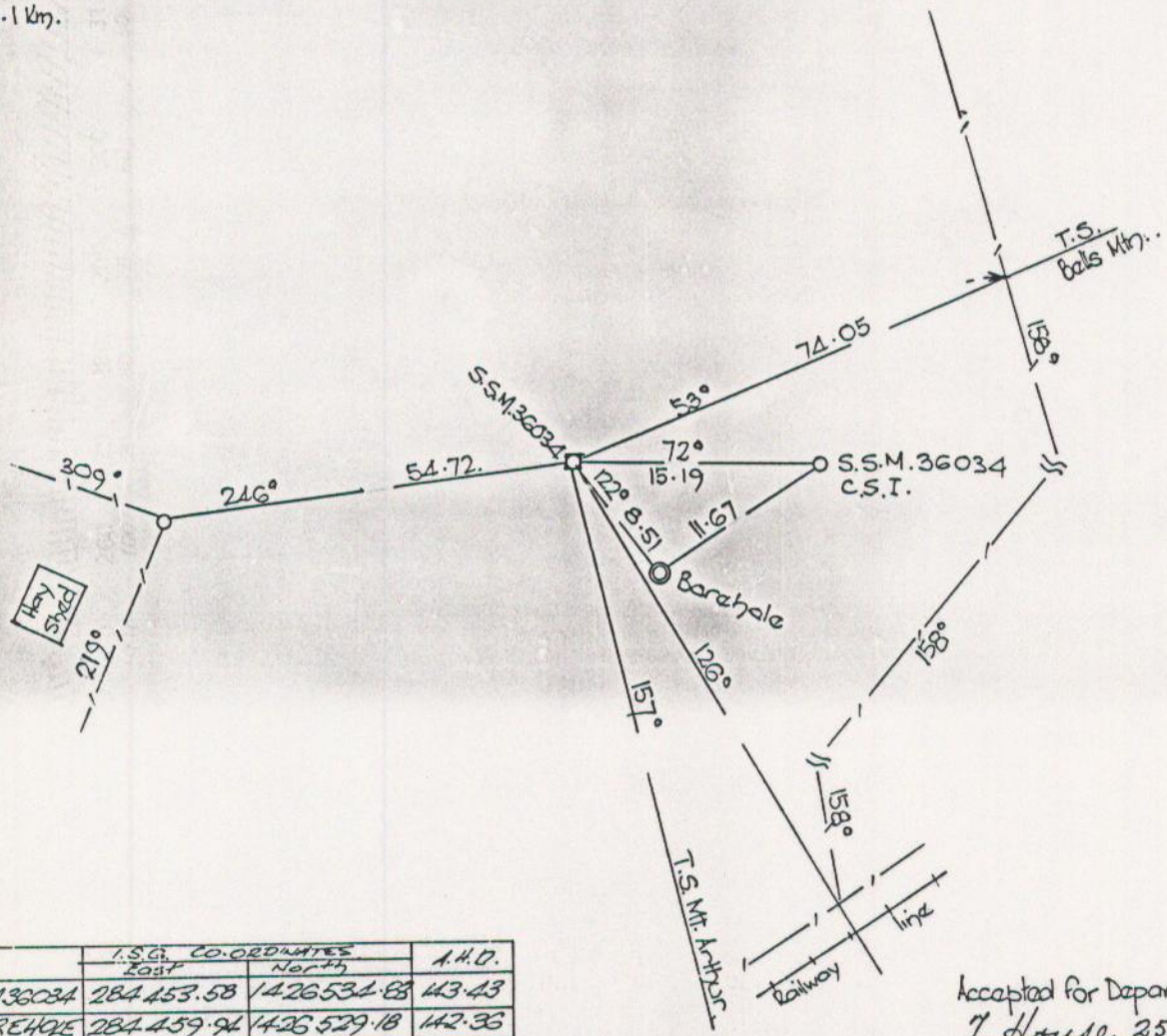
LOCALITY SKETCH PLAN

Parish Clanricard County Brisbane City or Town

~~Municipality or~~ Shire Muswellbrook Control Survey Plan

Not to Scale. Measurements are in metres I.S.G. Zone 56

From bridge over Hunter River at Muswellbrook (0.0 Km). Go westerly along Kayuga Rd. - turn left into Wybong Rd. at (0.8 Km) - turn left into Bengalla Rd (at 3.8 Km) - turn left into 'Wontana' Gate (at 7.7 Km) Follow dirt road to old dairy (at 8.8 Km) - turn left down hill and around hill to left - Find S.S.M. 36034 at 9.1 Km.



	I.S.G. CO-ORDINATES East	North	A.H.D.
S.S.M. 36034	284 453.58	1426 534.68	143.43
BOREHOLE	284 459.94	1426 529.18	142.36

Field Book 1360/39.

Accepted for Departmental Use
I House 25.10.79
Authorised Officer

Organization placing Marks

.....

Aerial photo No. ..... Run .....

Plan registered / / 19

Mark last inspected / / 19

SSM 36034

M26395

I certify that the Mark or Marks have been placed and numbered as detailed hereon.

DEPARTMENT OF MINERAL RESOURCES AND DEVELOPMENT

.....

Designation

36391 8.77 D. West, Government Printer

R13263950

D103263950

"Clanricard 20" Borehole

SSM 36016

MsM

LOCALITY SKETCH PLAN

Parish Clanricard County Brisbane City or Town

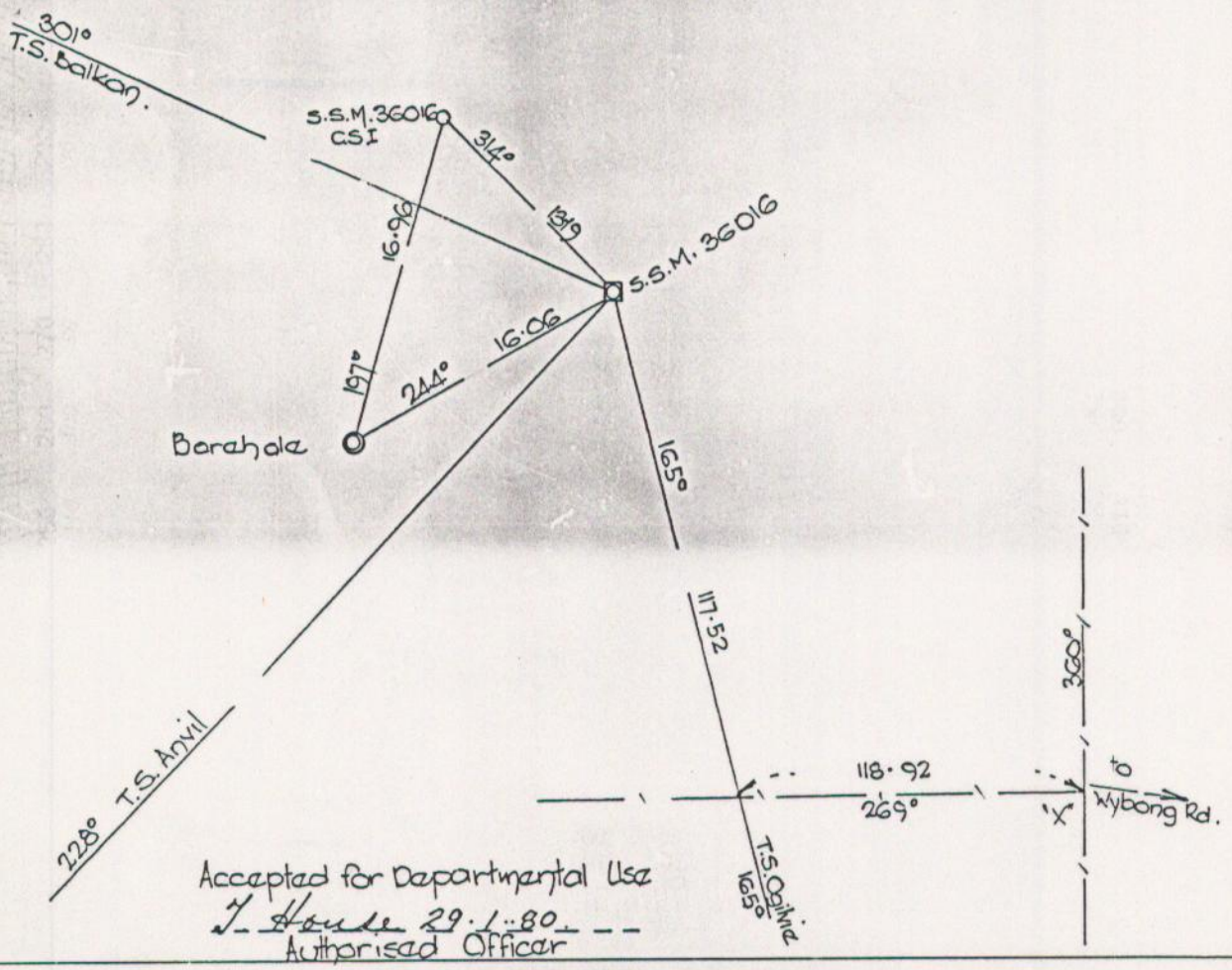
~~Municipality or~~ Shire Muswellbrook Control Survey Plan

Not to Scale. Measurements are in metres I.S.G. Zone 56 / 1

	I.S.G. CO-ORDINATES. East	North	A.H.D.
S.S.M.36016	276 523·55	1 430 277·75	245·28
Borehole	276 508·13	1 430 273·23	243·35

Field Book 1361/26.

From bridge over Hunter River at Muswellbrook (00 Km) go westerly on Kayuga Road – at 0·9 Km turn left onto Wybong Road – at 15·4 Km. turn right off road through gate – go N.E. along fence – pass below dam and go through gate at 15·8 Km. – go north & through gate to north-south fence at 16·4 Km. – go up ridge westerly to fence ("X" below).



Accepted for Departmental Use

J. Houde 29.1.80

Authorised Officer

Organization placing Marks

.....

Aerial photo No. ..... Run .....

Plan registered / / 19

Mark last inspected / / 19

PM

SSM 36016

M26430

I certify that the Mark or Marks have been placed and numbered as detailed hereon.

.....

Designation

36391 8.77 D. West, Government Printer

DEPARTMENT OF MINERAL RESOURCES AND DEVELOPMENT

R13264300

D103264300

PM 'Clanricard 22' Borehole
SSM 36026
M.M

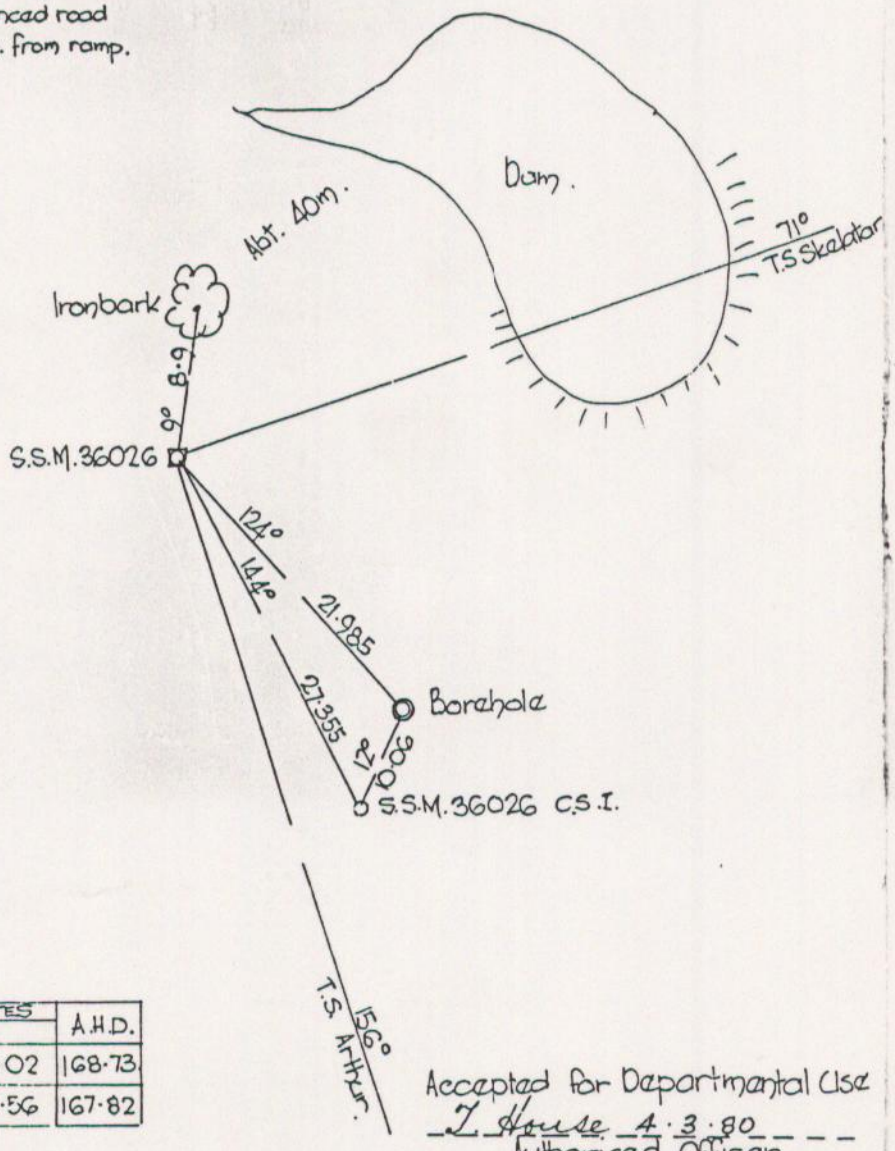
LOCALITY SKETCH PLAN

Parish Clanricard County Brisbane City or Town

Shire Muswellbrook Control Survey Plan

Not to Scale. Measurements are in metres I.S.G. Zone 56/1

From bridge over Hunter River at Muswellbrook (00 Km) - go westerly along Koyuga Rd. — at 0·9 Km. turn left onto Wybong Rd. — At 4·4 Km. turn left onto Bengala Rd. — at 7·6 Km. stop before crossing ramp into fenced road reserve - S.S.M. 36026 is 328° distant 350m. from ramp.



	I.S.G. CO-ORDINATES		A.H.D.
	East	North	
S.S.M. 36026	284 247·53	1427 711·02	168·73
(Clanricard 22) Borehole	284 263·16	1427 695·56	167·82

Field Book 1363/37.

Clanricard 22(A) 284 263·89 1427 698·14 167·77
Organization placing Marks

Accepted for Departmental Use
I House 4·3·80
Authorised Officer

I certify that the Mark or Marks have been placed and numbered as detailed hereon.

.....

Aerial photo No. ..... Run .....
Plan registered / / 19
Mark last inspected / / 19

SSM 36026
M.M M26435

.....
Designation

36391 8.77 D. West, Government Printer

R13264350
D103264350

"Clanricard 24" Borehole

SSM 36042

MsM

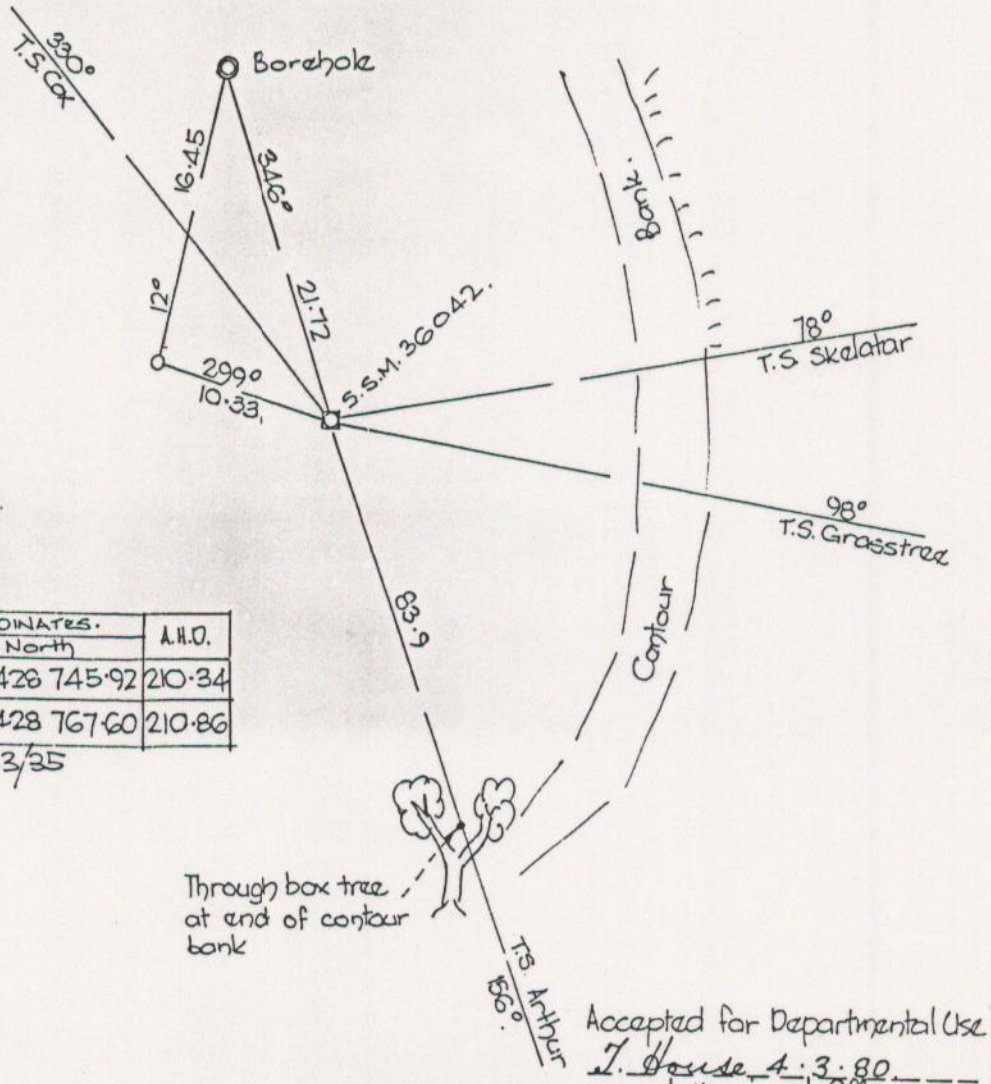
LOCALITY SKETCH PLAN

Parish Clanricard County Brisbane City or Town

Shire Muswellbrook Control Survey Plan

Not to Scale Measurements are in metres I.S.G. Zone 56/1

From bridge over Hunter River at Muswellbrook (00Km) go westerly along Kayuga Rd. - at 0·9 Km. turn left into Whybong Rd. - at 5·9 Km. leave road through gate on left - go west to top of hill & fence at 6·4 Km. - follow fence southerly - at 6·9 Km. leave fence and head towards Mt. Arthur - at 7·3 Km. find S.S.M. 36042.



	I.S.G. CO-ORDINATES. East	North	A.H.D.
S.S.M. 36042	284 014·04	1 428 745·92	210·34
Borehole	284 012·81	1 428 767·60	210·86

Field Book 1363/35

Accepted for Departmental Use
I. House 4·3·80
Authorised Officer

Organization placing Marks

.....

Aerial photo No. ..... Run .....

Plan registered / /19

Mark last inspected / /19

I certify that the Mark or Marks have been placed and numbered as detailed hereon.

SSM 36042

M26436

.....
Designation

36391 8.77 D. West, Government Printer

R13264360

D103264360

CLANRICARD DDH 3

SSM 24742

LOCALITY SKETCH PLAN

Parish Clanricard County Brisbane City or Town .....

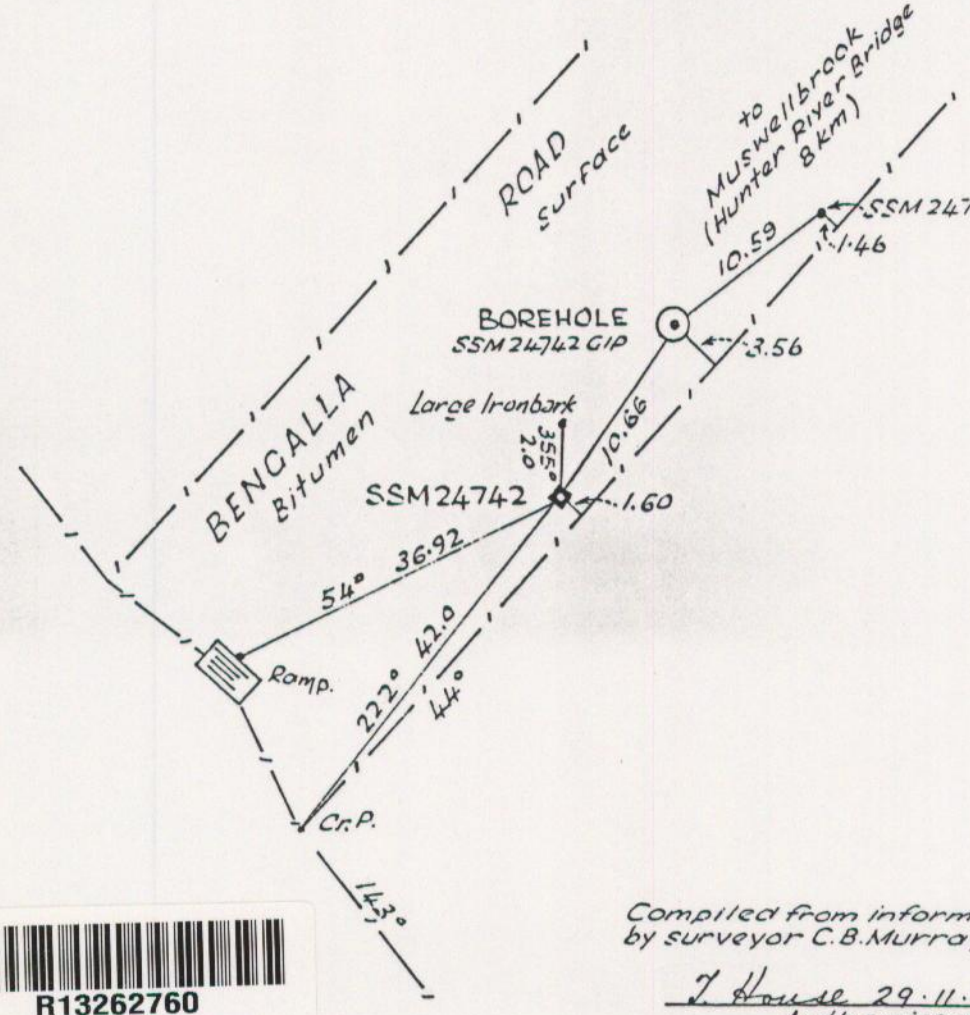
Municipality or Shire Denman Control Survey Plan .....

Not to scale
Measurements are in metres

ISG Zone 56/1

	ISG COORDINATES		AHD
	East.	North.	
SSM 24742	283 672.22	1427 065.83	173.78
Borehole	283 679.28	1427 073.82	174.42

Coordinates obtained by computer.



Compiled from information supplied by surveyor C.B. Murray FB. LD. 678/25.

J House 29.11.78
Authorised Officer.

R13262760

Organization placing Marks

.....

Aerial photo No. ..... Run .....

Plan registered / / 19

Mark last inspected / / 19

SSM 24742

M 26276

I certify that the Mark or Marks have been placed and numbered as detailed hereon.

.....
Designation

36391 8.77 D. West, Government Printer

D103262760

GEOLOGICAL SURVEY OF NEW SOUTH WALES
DEPARTMENT OF MINES

Geological Survey Report
No.: GS 1978/279
Dated: August, 1978

WEST MUSWELLBROOK COAL DRILLING PROGRAMME

- Basic Data Report

by

J Rogis

The information contained in this report has been obtained by the Department of Mines as part of the policy of the State Government to assist in the development of mineral resources and furtherance of geological knowledge. It may not be published in any form or used in a company prospectus, document or statement without the permission in writing of the Under Secretary,
Department of Mines, Sydney

Accompanying plans

Department File No.

Map reference Singleton SI 56 - 1
Muswellbrook 9033

18328
R00013151
D002113580

BORE NAME	BORE LOCALITY (I.S.G.)	COLLAR LEVEL (metres)	TOTAL DEPTH (metres)	DATE COMMENCED	DATE COMPLETED
DM Ellis DDH 7	284293.46 E 1436570.29 N	248.10	503.65	12-7-77	25-8-77
DM Ellis DDH 8	285571.23 E 1430699.25 N	212.60	248.85	17-10-77	9-11-77
DM Ellis DDH 9	286465.18 E 1433333.89 N	229.00	250.60	9-11-77	2-12-77
DM Clanricard DDH 1	281139.77 E 1425501.46 N	155.73	317.95	30-8-77	21-9-77
DM Clanricard DDH 2	282661.65 E 1425543.08 N	136.70	263.50	21-9-77	15-10-77
DM Strathearn DDH 1	285715.90 E 1440425.66 N	175.02	502.40	30-8-77	27-10-77

b) Bore Status - All bores were plugged and abandoned.

c) Drilling Contractor

Paterick and Zieja
8 Spring Avenue
Springfield
GOSFORD NSW 2250

d) Drilling Plant

Boyles 35 A

Boyles

Longyear 38

e) Coring Equipment - split inner tube core barrels.

f) Coring Method - wireline.

g) Blowout Prevention Gear - Nil.

h) Hole Sizes - 100 mm until casing set, then 76 mm (NQ).

i) Casing Details - NX (89 mm) casing used as noted on individual bore drilling records (appendices 1 to 16)

j) Casing Cementation - Nil.

k) Drilling Fluid - water.

l) Water Supply - surface water from nearby creeks and dams.

m) Plugging Back - all bores were fully cemented to surface on completion.

n) Fishing Operations - Nil.

o) Side Tracked Hole - Nil.

2. Logging

a) Lithological logging of interseam strata and coal seams, as well as sampling of seams for subsequent analysis, was carried out by officers of the Coal Section, Geological Survey of N.S.W.

Bore cores and coal seam residues are stored at the Department of Mines, Core Library, Londonderry.

D002113630

GEOLOGICAL SURVEY OF NEW SOUTH WALES
DEPARTMENT OF MINERAL RESOURCES

DENMAN-SCONE COAL DRILLING PROGRAMME

STAGE 3D

BASIC DATA REPORT

by

I. McDonald

Geological Survey Report N^{O}: 1981/039 **Dated:** 1981

Departmental File N^{O}: M79/2082

Map Reference:
SINGLETON SI 56-I
SCONE 9033 I
MUSWELLBROOK 9033 II
DENMAN 9033 III
BUNNAN 9033 IV

Accompanying Plans: 12488, 12489

NOT CONFIDENTIAL

R00012746

D002074930

GS1981/039(1)

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GS 1981 039

TABLE 2

	ISG COORDINATES E	N	YEAR DRILLED	COLLAR HEIGHT metres	TOTAL DEPTH metres	MICROFILM NUMBERS	GRAPHIC LOG PLAN NO.
DM Clanricard 13	274 929.06	1 427 990.30	1979	189.03	110.70		10 821
DM Clanricard 14	276 241.21	1 428 245.72	1979	166.73	39.00		10 822
DM Clanricard 15	276 107.22	1 427 463.62	1979	211.30	74.65		10 823
DM Clanricard 16	276 546.27	1 429 342.49	1979	202.39	78.50		10 824
DM Clanricard 20	276 508.13	1 430 273.23	1979	243.35	125.40		10 811
DM Denman 1 *	274 448	1 429 061	1971	185.4	266.1		10 704
Goldfields Roxburgh 4 *	275 766	1 429 936	1971	218.2	149.3	10844, 10845	10 675
Armco H.V. 5 & 5R *	279 219	1 435 191	1971	223.7	210.6, 323.51	11535-11538	10 754
Armco H.V. 9*	277 703	1 431 192	1971	194.8	596.1	11612-11617	10 761
Armco H.V. 10 *	277 496	1 433 381	1971	274.0	493.7	11628-11633	10 763
DM Ellis 13*	280 716.87	1 436 553.11	1979	301.98	517.75		10 793

* Bores previous to Stage 3D

GEOLOGICAL SURVEY OF NEW SOUTH WALES
DEPARTMENT OF MINERAL RESOURCES

DENMAN-SCONE COAL DRILLING PROGRAMME

STAGE 3E

BASIC DATA REPORT

by

I. McDonald

Geological Survey Report N^{o}: 1981/037 **Dated:** 1981

Departmental File N^{o}: M79/2082

Map Reference: SINGLETON SI 56-I
SCONE 9033I
MUSWELLBROOK 9033II

Accompanying Plans: 12490, 12491

R00012744

D002074760

GS1981/037 (A)

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GS 1981 037

TABLE 2

BOREHOLE LOCATIONS AND DEPTHS

	ISG COORDINATES E	N	YEAR DRILLED	COLLAR HEIGHT	TOTAL DEPTH	MICROFILM NUMBERS	GRAPHIC LOG PLAN NO.
DM Ellis 3 *	287 014	1 431 309	1977	197.5	149.6		10 729
DM Ellis 4 *	285 871	1 431 838	1977	220.0	279.7		10 730
DM Ellis 6 *	287 750	1 431 999	1977	153.9	87.7		10 732
DM Ellis 8 *	285 571	1 430 699	1977	212.6	248.5		10 735
DM Ellis 38	288 423.83	1 433 895.63	1979	167.36	93.0		10 845
DM Ellis 39	286 797.04	1 432 450.97	1979	177.96	142.20		10 859
DM Ellis 40	286 428.99	1 431 048.61	1979	170.06	113.50		10 847
DM Ellis 41	285 936.31	1 430 123.04	1979	178.50	108.50		10 840
Armco H.V. 13 *	287 500	1 433 300	1972	195.1	147.7	12756-12758	10 767
Armco H.V. 14 *	288 200	1 433 000	1972	181.4	126.3	12759-12760	10 768
DM Clanricard 11	283 660	1 427 130	1979	175	25.30		10 828

* Bores previous to Stage 3E

APPENDIX 5

Correspondence with peers

BENGALLA

MANAGED BY
COAL & ALLIED
A Rio Tinto Group Company

Mr Tony Davis
Mine Manager
Bengalla Mining Company
L.M.B. 5 Bengalla Road
Muswellbrook NSW 2333

Dear Tony,

RE : OVERTON COLLIERY WORKINGS

As a result of an Archival research project for the Mine Surveyors Registration Process, it has come to my / our attention the existence of old underground mine workings known to the Department of Primary industry as 'Overton Colliery'.

A reasonable search has been conducted and the workings can be placed between the Overton and Overdene homesteads as shown on the attached compiled plan.

Physical monuments have been used to identify the position of the workings. The South drive entrance has been located with great confidence and the North drive entrance to the lower 3rd seam has positional evidence.

The underground workings shown on the compiled plan have been scaled and overlayed, the line work for the scaled workings should be regarded with suspicion until their accuracy can be verified.

The vertical position of the workings cannot be confirmed other than the most likely seams mined are Ramrod Creek 2nd & 3rd based on seam thickness, interburden spacing and current BMC seam data.

For a more comprehensive explanation of this research it would be of benefit to view the Project report compiled for the Mine Surveyors Registration Process. This report can be made available at your request.

Yours truly,

Andrew Boardman
Mine Surveyor

Jamie Costello
Registered Mine Surveyor

Boardman, Andrew (CNA BM)

From: Davis, Tony (CNA BM)
Sent: Friday, 12 June 2009 2:07 PM
To: Boardman, Andrew (CNA BM)
Subject: RE: RE : Overton Colliery

Drew,

Thanks for this. As per our discussions please treat this email as an acknowledgement of the existence of the Overton Colliery.

Regards,

Tony Davis
Mine Manager
Bengalla Mining Company
Telephone: (02) 6542 9530
Mobile: 0428 429 530
Email: tony.davis@rtca.riotinto.com.au
Post: Bengalla Road (Locked Mailbag 5) Muswellbrook NSW 2333
-----Original Message-----
From: Boardman, Andrew (CNA BM)
Sent: Friday, 12 June 2009 2:05 PM
To: Davis, Tony (CNA BM)
Subject: RE : Overton Colliery

Attached is a .pdf of the hard copy letter regarding the Overton Colliery.

> Regards,
>
> Drew Boardman
> Mine Surveyor
> Bengalla Mining Company Pty Ltd
> Ph: (02) 6542 9568
> Fax: (02) 6542 9599
> Mob: 0428 429568
> Email: andrew.boardman@rtca.riotinto.com.au
> Postal Address: Locked Mail Bag 5, Muswellbrook, NSW 2333
>

Nixon, Chris (CNA BM)

From: Payne, Ian J (NSWEC) <Ian.J.Payne@BHPBilliton.com>
Sent: Monday, 18 June 2012 6:58 AM
To: Nixon, Chris (CNA BM)
Subject: RE: Archival Research - Bengalla

Chris,

To my knowledge Bengalla has been the only mine on your current site.

We are busy, growing as you can see.

How are your studies going? Aaron Clack is about to start his projects.

Regards

Ian

From: Nixon, Chris (CNA BM) [mailto:chris.nixon@riotinto.com]
Sent: Friday, 15 June 2012 7:28 AM
To: Payne, Ian J (NSWEC)
Subject: Archival Research - Bengalla

Hi Ian,

Do you have any knowledge of any old workings that may be present on Bengalla's lease?

I visited Karen Inglis and Kevin Price on Wednesday and could not find any extra workings to the west of us (just a few boreholes) but thought I would just ask you the question in case you knew of anything in the area. We know of the old 'Overton Colliery' to the east of us, but that should not concern us for future workings.

Hope all is well over there.

Regards,
Chris

Christopher Nixon
Mine Surveyor
Bengalla Mining Company
Rio Tinto Coal Australia

Phone: 02 6542 9597
Mobile: 0438 388 717
E-mail: chris.nixon@riotinto.com

This message and any attached files may contain information that is confidential and/or subject of legal privilege intended only for use by the intended recipient. If you are not the intended recipient or the person responsible for delivering the message to the intended recipient, be advised that you have received this message in error and that any dissemination, copying or use of this message or attachment is strictly forbidden, as is the disclosure of the information therein. If you have received this message in error please notify the sender immediately and delete the message.

APPENDIX 6

Archival Research department checklist

NSW GOVERNMENT | Trade & Investment

CHECK SHEET FOR MINE PLAN RESEARCH ATTENDANCE RECORD COAL

Candidate Name: CHRISTOPHER NIXON

Mine/Company: BENGALLA MINE / RIO TINTO

Date: 13/6/12

Mine Name/s: OVERTON COLLIERY

RT Number/s: RT580 (MI8522)

Register for Collieries and Projects: ☑

History: FORMERLY KNOWN AS NEWMAN

Associated files: 21.5587PB

Colliery Card Index: ☑

Comments: No cards found.

Mine Mapping - Titles Section, 516 High Street Maitland NSW 2320
PO Box 344 Hunter Region Mail Centre NSW 2310
Email tasinfo@industry.nsw.gov.au Fax: 02 4931 6776
ABN 72 189 919 072 www.industry.nsw.gov.au

Colliery Workings, Holding and Title Maps:

District/Parish Working Maps: PARISH CLANRICARD / COUNTY BRISBANE.
Check Outline of workings generally agrees with RT: ☑

Shown Reference Number:

Parish Title Maps: CLANRICARD 3056 ☑

Colliery Holding Plan Register: Page 28 ☑

Mine Record Tracing:

Seam/s: 2nd & 3rd Seams ☑

No of Sheets: 1 ONE ☑

Scale: 2 chains to an inch ☑

Plan of Abandonment/Discontinuance: RT580 ☑

Date of Abandonment/Discontinuance: 14th May 1925 ☑

Notations: PLAN ☑

Datelines 2/2/1925 ☑

Surveyors Signature NIL. ONLY J.G. HUTTON C.I.C.M ☑

Mine Mapping - Titles Section, 516 High Street Maitland NSW 2320
PO Box 344 Hunter Region Mail Centre NSW 2310
Email tasinfo@industry.nsw.gov.au Fax: 02 4931 6776
ABN 72 189 919 072 www.industry.nsw.gov.au

Survey Information NIL ☑

Drift/Shaft NIL ☑

Connection to Boundary: ☑
SCALED PLAN TO PORTION PLAN (checked)

Name of Last Surveyor: NIL ☑

Notes: DIGITAL: R10000567
D10001702O

Additional Information:

Field Notes/Books: NONE FOUND ☑

Survey Plans: NIL ☑

Miscellaneous Plans 1:25,000 MUSWELLBROOK 9033_2_N ☑
1:25,000 BENGALLA RT799

Baseline Plan NONE FOUND ☑

Signature of Attendee: Christopher Nixon 13/6/12

Signature of Departmental Officer: 13/6/12.

Mine Mapping - Titles Section, 516 High Street Maitland NSW 2320
PO Box 344 Hunter Region Mail Centre NSW 2310
Email tasinfo@industry.nsw.gov.au Fax: 02 4931 6776
ABN 72 189 919 072 www.industry.nsw.gov.au

Appendix B

Investigation Report
(Douglas Partners)

Appendix B Investigation Report (Douglas Partners)

Douglas Partners
Geotechnics / Environment / Groundwater

Integrated Practical Solutions

Report on
Geotechnical Investigation

Proposed Stage 2 Rail Loop
Mt Pleasant Coal Mine, Muswellbrook

Prepared for
AECOM

Project 91570.00
July 2019



Douglas Partners
Geotechnics / Environment / Groundwater

Document History

Document details

Project No.	91570.00	Document No.	R.001.Rev0
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Site address	Mt Pleasant Coal Mine, Muswellbrook		
Report prepared for	AECOM		
File name	91570.00.R.001.Rev0		

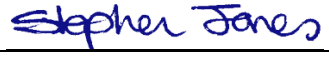
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Revision 0	Chase Benson / Michael Semmler	Stephen Jones	11 July 2019

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Status	Electronic	Paper	Issued to
Revision 0	1	0	Jason Lawer, AECOM

The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

	Signature	Date
Author		11 July 2019
Reviewer		11 July 2019

bsi. ISO 9001 Quality Management
FS 604853

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Fax (02) 4960 9601

Douglas Partners
Geotechnics / Environment / Groundwater

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Appendix A: About this Report

Sampling Methods

Soil Descriptions

Rock Descriptions

Symbols and Abbreviations

Borehole Logs (Bores BHCW07, BHCW08, BHCW09, BHCW10, BHCW11 and BHCW12-V2)

Point Load Test Report (Bore BHCW07)

Core Photoplates (Bore BHCW07)

Sample Photoplates (Bores BHCW08, BHCW09, BHCW10, BHCW11 and BHCW12-V2)

CCTV Camera Record Sheets (Bores BHCW06, BHCW07, BHCW08, BHCW09, BHCW10, BHCW11 and BHCW12-V2)

Laser Survey Results (BHCW06)

Appendix B: Acoustic Televiewer Reports (Bores BHCW06, BHCW07, BHCW09 and BHCW11)

Optical Televiewer Reports (Bores BHCW06, BHCW07, BHCW08, BHCW09, BHCW10, BHCW11 and BHCW12-V2)

Appendix C: Drawing 1 – Site Location

Report on Geotechnical Investigation
Proposed Stage 2 Rail Loop
Mt Pleasant Coal Mine, Muswellbrook

1. Introduction

This report presents the field work results of a geotechnical investigation undertaken for the proposed Stage 2 rail loop at Mt Pleasant Coal Mine, Muswellbrook. The investigation was undertaken with reference to Douglas Partners' Pty Ltd (DP) proposal NCL190220.P.001.Rev3 dated 10 May 2019.

It is understood that unanticipated cavities and voids were encountered in three bores undertaken during a previous investigation, undertaken by others, for the proposed Stage 2 rail loop. The rail loop alignment has since been re-aligned further towards the east since the previous investigation was completed. At the time of the investigation the cavities and voids were thought to be associated with former mining activities.

A geotechnical investigation was undertaken to provide information on the subsurface conditions, including the depth, the condition and composition of the roof and floor of the mine workings (or cavities).

The investigation included the drilling of one cored borehole and five non-cored boreholes supplemented by down-hole CCTV, sonar / laser inspections and geophysical logging. The details of the investigation are presented in this report.

For the purposes of this investigation the client provided the borehole logs drilled along the alignment which encountered voids during the previous investigation (Bores BHRL03, BHRL17 and BHRL18).

The previous investigation undertaken by others, also identified known historical workings to the north-east of the area of this investigation. One of the boreholes (Bore BHCW06) drilled during the previous investigation was inspected using DP's CCTV camera and laser equipment. Geophysical logging of this borehole was also undertaken by a specialist contractor.

2. Site Description

The site is located near the end of Overton Road, about 1.2 km from its intersection with Wybong Road. The site is immediately east of Bengalla Coal Mine and to south east of Mt Pleasant Coal Mine, Muswellbrook. It is understood that the proposed development is to extend from the existing rail alignment about 500 m south of the site into Mt Pleasant Coal Mine. The site herein refers to the location shown in hatching on Drawing 1. The site is bound to the west by Overton Road and by rural grazing land to the north, east and south.

The site is located on top of a hill which falls steeply towards the north, east and south. The crest of the hill sits at approximately RL172 AHD with the toe of the slope at approximately RL 145. Photographs showing the site are shown below in Figure 1 and 2 below.



Figure 1: View looking north from BHCW09 towards BHCW07



Figure 2: View looking south east towards BHCW10 and BHCW12-V2

Reference to the NSW Hunter Coalfield 1:100,000 Geology sheet indicates the site is underlain by rocks of the Singleton Supergroup of the Wittingham Coal Measures which typically comprise sandstone, coal seams, siltstone, shale and conglomerate. The conditions encountered in the bores are commensurate with the regional geological mapping.

3. Background Data

A previous investigation identified cavities or voids at three bore locations along the proposed alignment. Bores BHRL03, BHRL17 and BHRL18 noted voids or cavities at depths of 13.2 m, 14.5 m and 26.3 m, respectively, and were between about 0.7 m and 1.5 m in height. 'Possible gas' was noted on two of the logs at the depth at which the void was encountered.

It is also known that the previous investigation included bores drilled to intersect the workings of the Overton Colliery located about 80 m east / north east of the current investigation area. Details of these bores were not available at the time of this investigation.

4. Field Work Methods

The field work for the investigation included the following:

- The field work was undertaken in the period 3 June 2019 to 24 June 2019;
- Drilling of one cored borehole (BHCW07) to a depth of 21.79 m. The bore was drilled using a truck-mounted drill rig with PQ and HQ coring equipment;
- Drilling of five non-cored boreholes (Bores BHCW08, BHCW09, BHCW10, BHCW11 and BHCW12-V2) to depths of between 17.0 m and 28.5 m. The bores were drilled using a truck-mounted drill rig using solid flight auger and mud rotary drilling methods;
- The bores were drilled at the pegged locations set out by the client;
- Bore BHCW07 was drilled adjacent BHRL17, Bore BHCW09 was drilled adjacent BHRL18 and Bore BHCW11 was drilled adjacent BHRL03. These bores were understood to have been pegged at about 1 m offset from the respective previous investigation borehole location;
- The bores were logged by a geotechnical engineer. The non-cored bores were logged using chip samples returned to the surface during the drilling process. Accordingly, the depth of different layers in the strata noted on the non-cored bores should be considered as approximate only;
- A gas monitor (methane, carbon monoxide, oxygen and hydrogen sulphide sensors) was used throughout the drilling program to monitor gas levels emanating from the bores;
- Point load strength index testing was undertaken on retrieved intact core samples;
- Following the completion of the drilling, the boreholes were flushed with water and a downhole CCTV camera was used to inspect the condition of the void (where present) in each of the bores;

- Acoustic televiewer tool was deployed in the majority of the bores. It is noted the tool only works in water filled bores and hence was only undertaken below the standing water level in each bore. Water was not added to the bores during deployment of the geophysical tools due to the risk to equipment from borehole collapse which was observed during drilling in the conglomerate layer,
- Downhole sonar survey was undertaken below the standing water level in Bore BHCW09 to provide information on the lateral dimensions and orientation of the encountered voids (where present);
- Downhole laser survey was undertaken in Bore BHCW06 to provide information on the lateral dimensions and orientation of the encountered void;
- The bores were cased with PVC pipe within the soil profile and then sealed with tape following completion of drilling; and
- A differential GPS unit was used to measure the position and surface elevation of the bores. The differential GPS has a typical accuracy of about ±0.1 m, depending on satellite coverage.

The locations of the bores drilled during this investigation and the nearby bores of the previous investigation are shown on the attached Drawing 1 in Appendix C.

5. Field Work Results

5.1 Drilling

The subsurface conditions encountered are presented in the attached Borehole Logs. These should be read in conjunction with the accompanying notes (in Appendix A), which explain the classification methods and define descriptive terms used in this report.

The bores are summarised below in Table 1.

Table 1: Summary of Subsurface Conditions of the Investigation Bores.

Borehole		BHCW07	BHCW08	BHCW09	BHCW10	BHCW11	BHCW12-V2
Reduced Level of Surface (AHD)		169.9	170.6	171.2	170.8	168.7	167.9
Depths (m)	Groundwater	NFGWO	NFGWO	NFGWO	NFGWO	NFGWO	NFGWO
	Void	14.92 - 15.85	NE	19.3 - 20.0	NE	NE	NE
	Rubble	15.85 - 15.90	NE	NE	NE	N/E	NE
Total Void and Rubble Thickness (m)		0.98	NE	0.70	NE	N/E	NE
End of Bore (m)[LOI]		21.79	20.0	28.5	21.0	17.0	17.5

Notes to Table 1: Groundwater observations obscured below mud rotary drilling depths (refer to Borehole Logs)
LOI – Limit of Investigation
NE – Not encountered
NFGWO – No free groundwater observed

It is noted that groundwater observations during drilling were prevented due to the drilling methods used. The standing water levels were observed in some bores during CCTV Camera inspection. It is noted that groundwater levels vary and are dependent on climatic conditions and soil and rock permeabilities. The noted standing water levels observed in the bores may be remnant drill water and not representative of the local groundwater levels.

The drilling observations are further summarised as follows:

- Full water and cutting returns were observed in bores BHCW08, BHCW10, BHCW11 and BHCW12-V2 during drilling. No voids were encountered;
- No gas (methane, carbon monoxide or hydrogen sulphide) was detected emanating from the bores during drilling;
- Depth of cover to a void was measured at its shallowest in Bore BHCW07 at 14.92 m depth;
- Thickness of the void, including rubble, varied from 0.70 m to 0.98 m;
- Tuffaceous claystone with coal lenses was encountered in BHCW09 only from 26.2 m to 27.3 m depth. No other bores drilled during this investigation observed coal lenses or seams;
- PQ coring of the bedrock indicated that the conglomerate bedrock is deeply weathered and generally extremely low in strength which resulted in the matrix often been washed away during coring; and
- Point load testing undertaken on the few recovered intact rock core lengths indicated inferred low or high rock strengths.

Drilling fluid return and hence drill cutting returns were lost during the drilling of Bores BHCW07 and BHCW09 at varying depths, but typically near depths relating to the top of the void. The drilling fluid loss observations are noted on the attached borehole logs. For the non-cored bores, rock and soil descriptions have been interpreted, where shown, based on either drill cuttings or CCTV camera footage (where observed).

5.2 CCTV camera inspections

CCTV camera inspections were undertaken in all investigation bores and in the previously drilled (by others) Bore BHCW06.

Notable CCTV observations were as follows:

- No voids were observed within the Bores BHCW08, BHCW10, BHCW11 and BHCW12-V2. It is noted that borehole collapse was observed at shallow depths at some borehole locations which prevented further assessment;
- Drilling indicated a void in Bore BHCW07 from 14.92 m to 15.85 m depth, which following CCTV inspection, the 'void' was not observed with bore walls observed to 15.7 m (limit of inspection). The material in the bore wall could not be positively distinguished between gravel / rubble / drill cuttings or conglomerate bedrock. No open voids were observed to limit of inspection (camera refusal) at 15.7 m. The standing water level in the bore was at 14.1 m depth;

- Drilling indicated a void in Bore BHCW09 from 19.3 m to 20 m depth, which following CCTV inspection, the 'void' was observed to be filled with material. The material in the 'void' appeared granular. Conglomerate was observed in the roof to 19.5 m. The source of the material observed in the void could not be determined (i.e. weak in-situ layer or gravel / drill cuttings from drilling processes). The standing water level in the bore was at 19.9 m depth and was turbid, preventing further observations. No open voids were observed to limit of inspection to 19.9 m; and
- Open void encountered in BHCW06 (previous investigation) from 13.1 m to 13.8 m, and, possible top of void or rubble at 24.8 m depth where sediment prevented further assessment.

The camera inspections were typically discontinued due to loose debris and / or sediment within the bore obstructing further camera advancement. The CCTV camera observations for each bore are summarised in Table 2 below and in CCTV camera record sheets attached in Appendix A

Table 2: Summary of CCTV Camera Inspections

		BHCW06	BHCW07	BHCW08	BHCW09	BHCW10	BHCW11	BHCW12-V2
Reduced Surface Level (AHD)		148.0	169.9	170.6	171.2	170.8	168.7	167.9
Depths (m)	Standing Water	16.4	14.1	NO	19.9*	18.4	12.1*	NO
	Void	13.0-13.7^{U} NO^{L}	NO	NO	NO	NO	NO	NO
	Rubble	13.7-15.6?^{U} 24.8?^{L}	ND	NO	19.5 – 19.9*	NO	NO	NO
Total Void and Rubble Thickness (m)		2.6^{U}	-	NO	0.4*	NO	NO	NO
Camera Inspection End Depth (m)		24.8	15.7	11.7	21.2	20.5	14.8	6

Notes to Table 2:
NO – Not observed
ND – Not distinguishable
U – Upper Seam Level
L – Lower Seam Level
* – Further observations prevented due to poor water clarity
? – Possible – as noted on attached CCTV camera record sheets

It is noted that the accuracy of depths shown on the CCTV camera footage and hence those recorded above are considered to be ±1% i.e at 20 m depth typically within ±0.2 m.

Figures 3 to 10 below show CCTV camera footage snapshots from within selected bores.



Figure 3: CCTV image at approximate depth of top of void observed during drilling Bore BHCW07.



Figure 4: CCTV image within approximate depth of void observed during drilling Bore BHCW07.

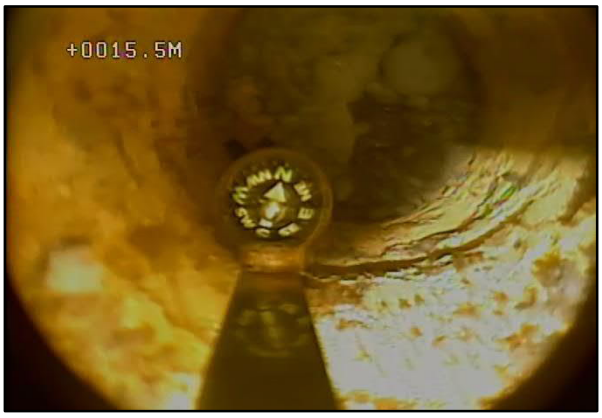


Figure 5: CCTV image within approximate depth of void observed during drilling Bore BHCW07 (sediment in base of bore).

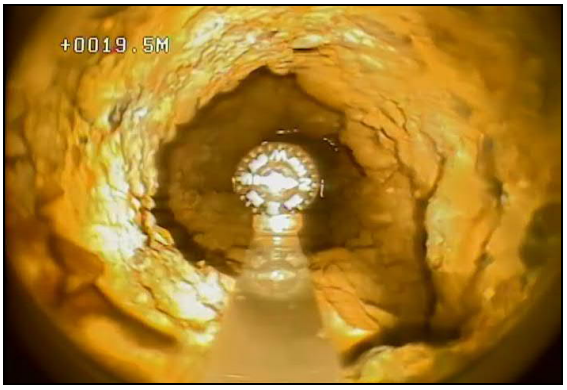


Figure 6: CCTV image at top 'rubble/sediment' in void in Bore BHCW09.



Figure 7: CCTV image of 'rubble/sediment' in void in Bore BHCW09.



Figure 6: CCTV image of open void (upper seam level) in Bore BHCW06.



Figure 7: CCTV image of open void and rubble on the floor (upper seam level) in Bore BHCW06.



Figure 8: CCTV image of open void and block of rubble (upper seam level) in Bore BHCW06.



Figure 9: CCTV image of rubble in base of open void (upper seam level) in Bore BHCW06.



Figure 10: CCTV image of possible top of void or rubble (lower seam level) in Bore BHCW06. Sediment in base of bore prevented further assessment (24.8 m depth).

5.3 Downhole Sonar Survey

Drilling indicated a void in Bore BHCW09 from 19.3 m to 20 m depth. Subsequent CCTV camera inspection revealed that no open void was present to 19.9 m depth at which depth observations were obscured due to the turbidity of the groundwater. Sonar survey was undertaken in Bore BHCW09 on 20 June 2019 to confirm that no open void was present below the groundwater level at depth of between 19.9 m and 20.5 m. It is noted that the minimal detectable range of the sonar is 0.15 m i.e. if no open void is detected then an open void is not present or the void is quite small at less than 0.15 m distance from the sonar.

Figure 11 shows a typical sonar plot of Bore BHCW09.

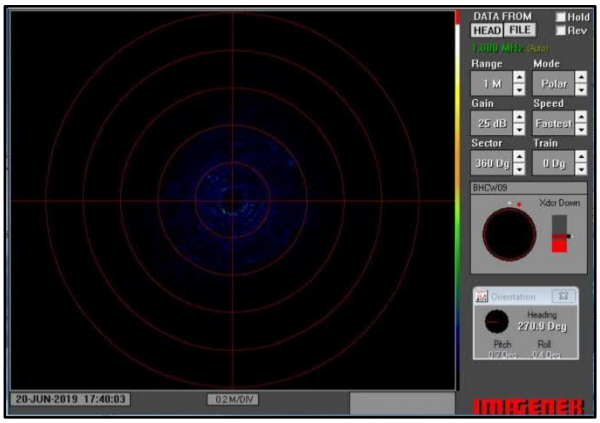


Figure 11: Sonar plot at 20.0 m depth showed no open void within detectable range.

5.4 Downhole Laser Measurements

Laser measurement of the open void observed in Bore BHCW06 was undertaken on 20 June 2019. The measurement device uses a laser to measure the distance between an object and the device which is centred in the borehole. The laser device is set to a known orientation and rotated 360° with measurements recorded in 32 equal increments providing a radial plot of the void. This radial plot is undertaken at different depth intervals within the void.

The results have been orientated and superimposed on the plan, see Figure 12 below, provided by the client and indicate a void trending in an approximate north-south alignment. The measurement outline showed unevenness of the walls indicating that rubble is likely present in the void influencing the results. The results show a void of about 3 m in width and 10 m in length at its maximum extents.

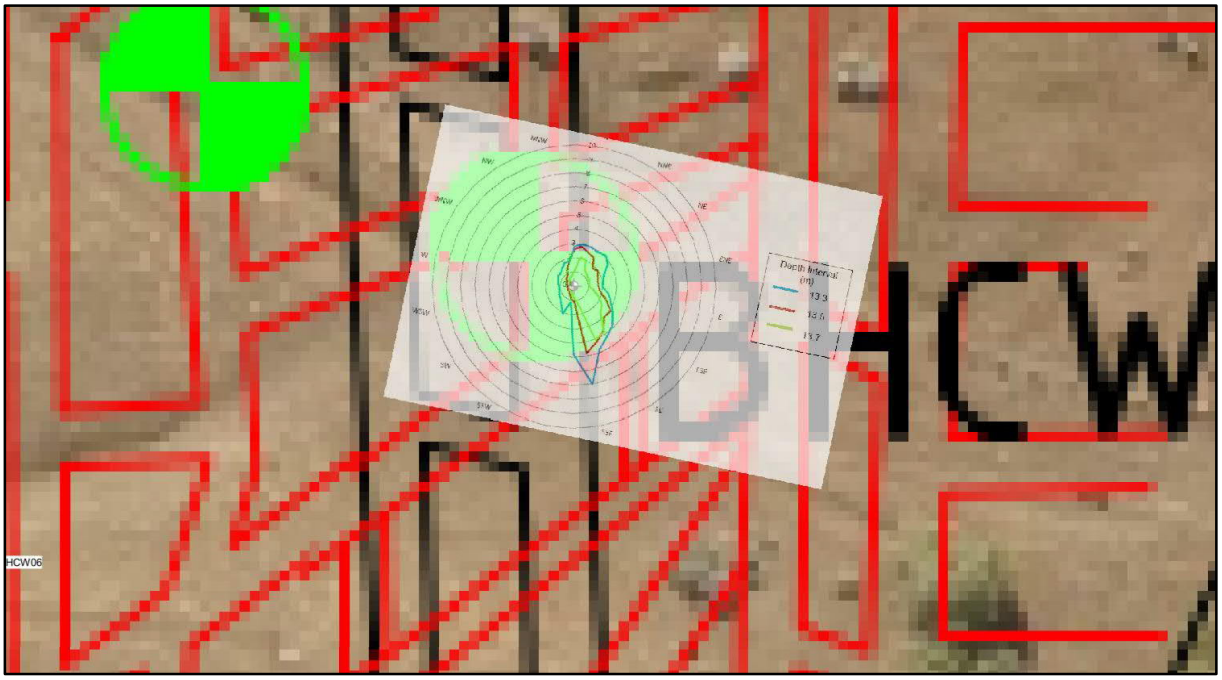


Figure 12: Results of laser radial plots superimposed over traced workings.

The results of the laser measurement survey are attached in Appendix A.

5.5 Geophysical Logging

A specialist geophysical logging contractor completed the geophysical logging which included acoustic televiewer and optical televiewer tools. Table 3 below summaries the depths of which each tool was used. The interpreted results are attached in Appendix B.

Table 3: Summary of Geophysical Logging

Bore	Optical Televiewer (m)	Acoustic Televiewer (m)
BHCW06	7.19 – 16.91	16.0 – 25.31
BHCW07	7.68 – 16.56	13.41 – 21.59
BHCW08	0.76 – 11.67	–
BHCW09	9.96 – 21.08	20.5 – 21.09
BHCW10	0.42 – 20.86	–
BHCW11	4.83 – 14.64	7.5 – 14.23
BHCW12-V2	1.74 – 6.12	–

6. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at Mt Pleasant Coal Mine, Muswellbrook with reference to DP's proposal dated NCL190220.P.001.Rev2 dated 10 May. The work was carried out under AECOM Letter of Engagement dated 25 May 2019. This report is provided for the exclusive use of AECOM for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP's field testing has been completed.

DP's advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The scope for work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of filling of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such filling may contain contaminants and hazardous building materials.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the (geotechnical / environmental / groundwater) components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Douglas Partners Pty Ltd

Appendix A

About This Report

Sampling Methods

Soil Descriptions

Rock Descriptions

Symbols and Abbreviations

Borehole Logs (Bores BHCW07, BHCW08, BHCW09, BHCW10, BHCW11 and BHCW12-V2)

Point Load Test Report (Bore BHCW07)

Core Photoplates (Bore BHCW07)

Sample Photoplates (Bores BHCW08, BHCW09, BHCW10, BHCW11 and BHCW12-V2)

CCTV Camera Record Sheets (Bores BHCW06, BHCW07, BHCW08, BHCW09, BHCW10, BHCW11 and BHCW12-V2)

Laser Survey Results (BHCW06)

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Sampling Methods

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Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Soil Descriptions

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Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are generally based on Australian Standard AS1726:2017, Geotechnical Site Investigations. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	19 - 63
Medium gravel	6.7 - 19
Fine gravel	2.36 – 6.7
Coarse sand	0.6 - 2.36
Medium sand	0.21 - 0.6
Fine sand	0.075 - 0.21

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

The proportions of secondary constituents of soils are described as follows:

In fine grained soils (>35% fines)

Term	Proportion of sand or gravel	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	>30%	Sandy Clay
With	15 – 30%	Clay with sand
Trace	0 - 15%	Clay with trace sand

In coarse grained soils (>65% coarse)
- with clays or silts

Term	Proportion of fines	Example
And	Specify	Sand (70%) and Clay (30%)
Adjective	>12%	Clayey Sand
With	5 - 12%	Sand with clay
Trace	0 - 5%	Sand with trace clay

In coarse grained soils (>65% coarse)
- with coarser fraction

Term	Proportion of coarser fraction	Example
And	Specify	Sand (60%) and Gravel (40%)
Adjective	>30%	Gravelly Sand
With	15 - 30%	Sand with gravel
Trace	0 - 15%	Sand with trace gravel

The presence of cobbles and boulders shall be specifically noted by beginning the description with 'Mix of Soil and Cobbles/Boulders' with the word order indicating the dominant first and the proportion of cobbles and boulders described together.

Soil Descriptions

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	VS	<12
Soft	S	12 - 25
Firm	F	25 - 50
Stiff	St	50 - 100
Very stiff	VSt	100 - 200
Hard	H	>200
Friable	Fr	-

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	Density Index (%)
Very loose	VL	<15
Loose	L	15-35
Medium dense	MD	35-65
Dense	D	65-85
Very dense	VD	>85

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Extremely weathered material – formed from in-situ weathering of geological formations. Has soil strength but retains the structure or fabric of the parent rock;
- Alluvial soil – deposited by streams and rivers;
- Estuarine soil – deposited in coastal estuaries;
- Marine soil – deposited in a marine environment;
- Lacustrine soil – deposited in freshwater lakes;
- Aeolian soil – carried and deposited by wind;
- Colluvial soil – soil and rock debris transported down slopes by gravity;
- Topsoil – mantle of surface soil, often with high levels of organic material.
- Fill – any material which has been moved by man.

Moisture Condition – Coarse Grained Soils

For coarse grained soils the moisture condition should be described by appearance and feel using the following terms:

- Dry (D) — Non-cohesive and free-running.
- Moist (M) — Soil feels cool, darkened in colour.
  Soil tends to stick together.
  Sand forms weak ball but breaks easily.
- Wet (W) — Soil feels cool, darkened in colour.
  Soil tends to stick together, free water forms when handling.

Moisture Condition – Fine Grained Soils

For fine grained soils the assessment of moisture content is relative to their plastic limit or liquid limit, as follows:

- 'Moist, dry of plastic limit' or 'w <PL' (i.e. hard and friable or powdery).
- 'Moist, near plastic limit' or 'w ≈ PL (i.e. soil can be moulded at moisture content approximately equal to the plastic limit).
- 'Moist, wet of plastic limit' or 'w >PL' (i.e. soils usually weakened and free water forms on the hands when handling).
- 'Wet' or 'w ≈LL' (i.e. near the liquid limit).
- 'Wet' or 'w >LL' (i.e. wet of the liquid limit).

Rock Strength

Rock strength is defined by the Unconfined Compressive Strength and it refers to the strength of the rock substance and not the strength of the overall rock mass, which may be considerably weaker due to defects.

The Point Load Strength Index $Is_{(50)}$ is commonly used to provide an estimate of the rock strength and site specific correlations should be developed to allow UCS values to be determined. The point load strength test procedure is described by Australian Standard AS4133.4.1-2007. The terms used to describe rock strength are as follows:

Strength Term	Abbreviation	Unconfined Compressive Strength MPa	Point Load Index * $Is_{(50)}$ MPa
Very low	VL	0.6 - 2	0.03 - 0.1
Low	L	2 - 6	0.1 - 0.3
Medium	M	6 - 20	0.3 - 1.0
High	H	20 - 60	1 - 3
Very high	VH	60 - 200	3 - 10
Extremely high	EH	>200	>10

* Assumes a ratio of 20:1 for UCS to $Is_{(50)}$. It should be noted that the UCS to $Is_{(50)}$ ratio varies significantly for different rock types and specific ratios should be determined for each site.

Degree of Weathering

The degree of weathering of rock is classified as follows:

Term	Abbreviation	Description
Residual Soil	RS	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely weathered	XW	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible
Highly weathered	HW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately weathered	MW	The whole of the rock material is discoloured , usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly weathered	SW	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	FR	No signs of decomposition or staining.
Note: If HW and MW cannot be differentiated use DW (see below)		
Distinctly weathered	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching or may be decreased due to deposition of weathered products in pores.

Rock Descriptions

Degree of Fracturing

The following classification applies to the spacing of natural fractures in diamond drill cores. It includes bedding plane partings, joints and other defects, but excludes drilling breaks.

Term	Description
Fragmented	Fragments of <20 mm
Highly Fractured	Core lengths of 20-40 mm with occasional fragments
Fractured	Core lengths of 30-100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths of 300 mm or longer with occasional sections of 100-300 mm
Unbroken	Core contains very few fractures

Rock Quality Designation

The quality of the cored rock can be measured using the Rock Quality Designation (RQD) index, defined as:

$$\text{RQD \%} = \frac{\text{cumulative length of 'sound' core sections} \geq \text{100 mm long}}{\text{total drilled length of section being assessed}}$$

where 'sound' rock is assessed to be rock of low strength or stronger. The RQD applies only to natural fractures. If the core is broken by drilling or handling (i.e. drilling breaks) then the broken pieces are fitted back together and are not included in the calculation of RQD.

Stratification Spacing

For sedimentary rocks the following terms may be used to describe the spacing of bedding partings:

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

Symbols & Abbreviations

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Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

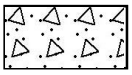
Symbols & Abbreviations

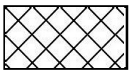
Graphic Symbols for Soil and Rock

General

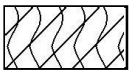

Asphalt

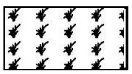

Road base

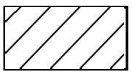

Concrete

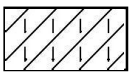

Filling

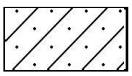
Soils


Topsoil

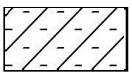

Peat


Clay

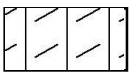

Silty clay

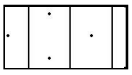

Sandy clay

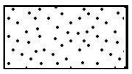

Gravelly clay

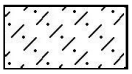

Shaly clay

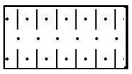

Silt

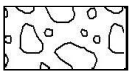

Clayey silt


Sandy silt

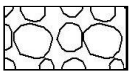

Sand

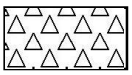

Clayey sand


Silty sand

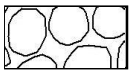

Gravel

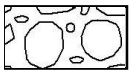

Sandy gravel


Cobbles, boulders

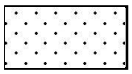

Talus

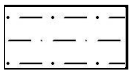
Sedimentary Rocks

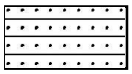

Boulder conglomerate

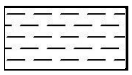

Conglomerate


Conglomeratic sandstone

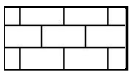

Sandstone


Siltstone

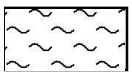

Laminite

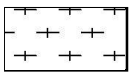

Mudstone, claystone, shale

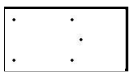

Coal


Limestone

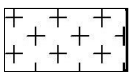
Metamorphic Rocks

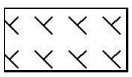

Slate, phyllite, schist

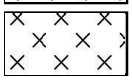

Gneiss

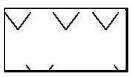

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 169.9 m AHD
EASTING: 297641.9
NORTHING: 6427403.1
DIP/AZIMUTH: 90°/--

BORE No: BHCW07
PROJECT NO: 91570.00
DATE: 3/6 - 11/6/2019
SHEET: 1 of 6

DRILLING: PROGRESS: DRILLING & CASING	DRILLING: PROGRESS: WATER	DRILLING: GROUND WATER LEVELS	DRILLING: SAMPLING: GEO	DRILLING: SAMPLING: ENV	DRILLING: SAMPLING: IDs and REMARKS	DRILLING: RL	DRILLING: DEPTH (m)	MATERIAL: GRAPHIC LOG	MATERIAL: DESCRIPTION OF STRATA	MATERIAL: MOISTURE CONDITION	MATERIAL: CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
HA							0.0		0.10m SANDY SILT: brown; sand is fine to coarse grained; with gravel; trace clay; with cobbles up to 70 mm	M<Wp	VST	
									CLAY: Red brown; with fine to medium grained sand	M<Wp	H	
							0.5		0.60m			
						169			SANDY CLAY: Brown; sand is fine to medium grained; trace subangular / subrounded up to 60 mm in size gravel; (extremely weathered, fine to medium grained sandstone)	M<Wp	H	
									1.00m			
			SPT				1.0		SANDY GRAVEL: brown; sand is fine to coarse grained; with clay; gravel is subangular / sub rounded up to 60 mm in size (extremely weathered conglomerate)			pp: >600 kPa 1.00m SPT: 7,9,8 N=17
						168	1.5					
							2.0				MD	
			SPT				2.5			dry		2.50m SPT: 8,11,16 N=27
PVC150		No free groundwater observed				167						
SFA							3.0					
							3.5					
						166						
			SPT				4.0				D	4.00m SPT: 13,17,20 N=37
PWT												
							4.5		4.50m			
									CONTINUED ON SHEET 2			
						165	5.0					

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS: PWT casing advanced during drilling to allow water return. **GRID DATUM:** MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

DPDGD_1.05.01.GLB Log DP_301.00.02_SOIL_WGATE 91570.00.GPJ <<DrawingFile>> 09/07/2019 18:26 10.0.000 Datgel Lab and In Situ Tool - DGD | Lib: dpdgd 1.04.02.Prj: dpdgd 1.03.04

CORED BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 169.9 m AHD
EASTING: 297641.9
NORTHING: 6427403.1
DIP/AZIMUTH: 90°/--

BORE No: BHCW07
PROJECT NO: 91570.00
DATE: 3/6 - 11/6/2019
SHEET: 2 of 6

DRILLING						MATERIAL	ROCK MASS						
PROGRESS		SAMPLING			RL / DEPTH (m)	GRAPHIC LOG / DESCRIPTION OF STRATA	Weathering	Rock Strength (Very Low, Low, Medium, High, Very High, Ex High)	Fracture Spacing (m) (0.005, 0.01, 0.05, 0.10, 0.50, 1.00, 5.00)	Core Rec %	RQD %	TEST RESULTS DISCONTINUITIES & COMMENTS
DRILLING & CASING	WATER	GEO	ENV	IDs and REMARKS									
					0.0								
					0.5								
					169								
					1.0								
					1.5								
					168								
					2.0								
					2.5								
					167								
					3.0								
					3.5								
					166								
					4.0								
					4.5	4.50m CONTINUED FROM SHEET 1							
PQ3	PWT					CONGLOMERATE: brown grey; Subrounded gravel up to 63 mm in size with cobbles	EW			100	0	4.50-4.90m: fg
					165					100	0	
					5.0								

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS: PWT casing advanced during drilling to allow water return. **GRID DATUM:** MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U,	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

Douglas Partners
Geotechnics | Environment | Groundwater

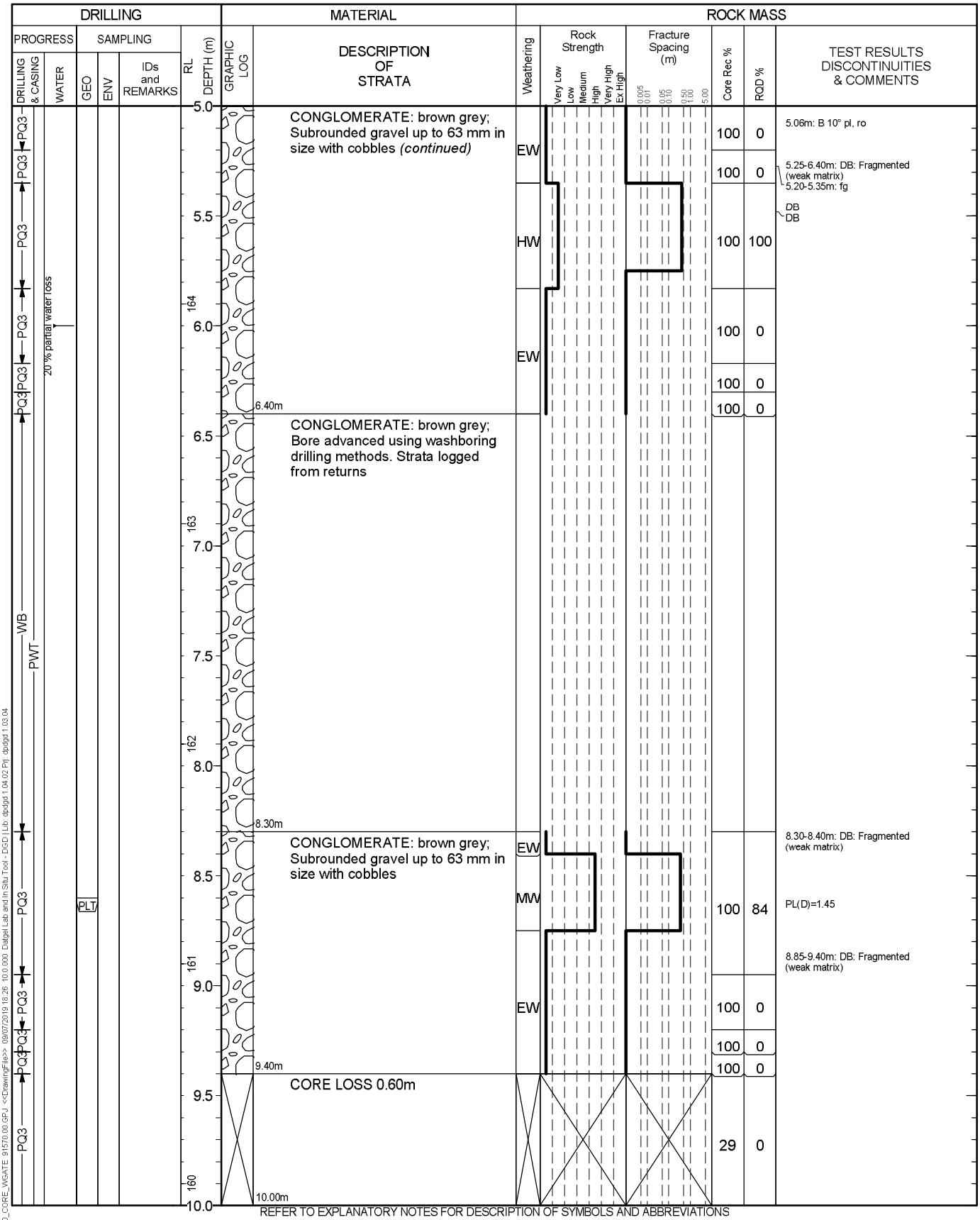
DPDGD 1.05.01 GLB Log DP_302.00.00_CORE_WCATE 91570.00.GPJ <<DrawingFile>> 09/07/2019 18:26 10.0.000 Datgel Lab and In Situ Tool - DGD | Lib: dpdgd 1.04.02 Prj: dpdgd 1.03.04

CORED BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 169.9 m AHD
EASTING: 297641.9
NORTHING: 6427403.1
DIP/AZIMUTH: 90°/--

BORE No: BHCW07
PROJECT NO: 91570.00
DATE: 3/6 - 11/6/2019
SHEET: 3 of 6



REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS: PWT casing advanced during drilling to allow water return. **GRID DATUM:** MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U,	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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DPDGD 1.05.01 GLB Log DP_302.00.00_CORE_WCATE 91570.00.GPJ <<DrawingFile>> 09/07/2019 18:26 10.0.000 Datgel Lab and In Situ Tool - DGD | Lib: dpdgd 1.04.02 Prj: dpdgd 1.03.04

CORED BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 169.9 m AHD
EASTING: 297641.9
NORTHING: 6427403.1
DIP/AZIMUTH: 90°/--

BORE No: BHCW07
PROJECT NO: 91570.00
DATE: 3/6 - 11/6/2019
SHEET: 4 of 6

DRILLING: PROGRESS (DRILLING & CASING)	DRILLING: PROGRESS (WATER)	DRILLING: SAMPLING (GEO)	DRILLING: SAMPLING (ENV)	DRILLING: SAMPLING (IDs and REMARKS)	RL	DEPTH (m)	GRAPHIC LOG	MATERIAL: DESCRIPTION OF STRATA	ROCK MASS: Weathering	ROCK MASS: Rock Strength	ROCK MASS: Fracture Spacing (m)	ROCK MASS: Core Rec %	ROCK MASS: RQD %	TEST RESULTS DISCONTINUITIES & COMMENTS
PQ3 PWT	90 % partial water loss; 30% partial water loss					10.0		CONGLOMERATE: brown grey; Subrounded gravel up to 63 mm in size with cobbles	EW	Very Low / Low / Medium / High / Very High / Ex High	0.005 / 0.01 / 0.05 / 0.10 / 0.50 / 1.00 / 5.00	29	0	10.00-10.25m: DB: Fragmented (weak matrix)
						10.25m		CORE LOSS 0.22m						
						10.47m								
						10.52m		CONGLOMERATE: brown grey; Subrounded gravel up to 63 mm in size with cobbles						pp: 250 kPa
PQ3	total water loss; 80% partial water loss; 60% partial water loss				159	10.5		SANDSTONE: brown 10.72-11.78m: Pebbly band						DB
						11.0			MW			85	8	DB; pp: 150 kPa; DB
						11.20m		11.15m: Fine to coarse grained						
								CONGLOMERATE: brown grey; Subrounded gravel up to 63 mm in size with cobbles						
					158	11.5								
PQ3						12.0			HW			100	0	11.70-14.52m: DB: Fragmented (weak matrix)
PQ3						12.5						100	0	
PQ3 HWT												100	0	
PQ3					157	13.0			EW			100	0	
PQ3	total water loss; 40% partial water loss	UCS		GT- 001					MW			100	0	
PQ3						13.5						100	0	
PQ3					156	14.0						100	0	
PQ3												100	0	
PQ3	total water loss					14.5								
						14.52m		CORE LOSS 0.40m				0	0	
					155	14.92m								
						15.0		*(description next page)*						

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS: PWT casing advanced during drilling to allow water return. **GRID DATUM:** MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U,	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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DPDGD 1.05.01 GLB Log DP_302.00.00_CORE_WCATE 91570.00.GPJ <<DrawingFile>> 09/07/2019 18:26 10.0.000 Datgel Lab and In Situ Tool - DGD | Lib: dpdgd 1.04.02.Prj: dpdgd 1.03.04

CORED BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 169.9 m AHD
EASTING: 297641.9
NORTHING: 6427403.1
DIP/AZIMUTH: 90°/--

BORE No: BHCW07
PROJECT NO: 91570.00
DATE: 3/6 - 11/6/2019
SHEET: 5 of 6

DRILLING					MATERIAL	ROCK MASS					
PROGRESS		SAMPLING									
DRILLING & CASING	WATER	GEO	ENV	IDs and REMARKS	RL / DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	Weathering	Rock Strength (Very Low, Low, Medium, High, Very High, Ex High)	Fracture Spacing (m) (0.005, 0.01, 0.05, 0.10, 0.50, 1.00, 5.00)	Core Rec %	RQD %	TEST RESULTS DISCONTINUITIES & COMMENTS
PQ3					15.0		VOID: 0.93 m, Drill rods lowered with no rotation, drill head open to 15.85 m depth *(continued)*				5	0	
					15.5						5	0	
HWT					15.85m / 15.90m / 154		RUBBLE: 0.05 M						15.90-16.70m: HWT casing advanced to 16.7 m.
WB					16.0		SANDSTONE: fine strata logged from returns on end of advancer						
					16.5								
HQ3	no water loss encounted after HWT casing was installed				16.88m / 153		16.7-16.88m: Structure observed within core	EW					16.70-16.88m: DB: Fragmented (weak matrix)
					17.0		CORE LOSS 0.62m				34	0	
					17.50m								
					17.5		SANDSTONE: fine iron staining; some structure observed, from 17.95 m likely structure destroyed during drilling methods						17.50-17.64m: DB: Fragmented (weak matrix)
HQ3					152 / 18.0			EW			100	0	17.88-18.00m: DB: Fragmented (weak matrix) 17.95m: Fine to coarse grained
					18.32m								
HQ3					18.5		CORE LOSS 0.68m				22	0	
					19.00m / 151								
HQ3					19.0		CONGLOMERATE: Subrounded gravel up to 63 mm in size with cobbles	EW			100	0	19.00-19.49m: DB: Fragmented (weak matrix)
HQ3					19.5			SW			100	50	19.66m: B 10° ir, ro, fe DB
					150 / 20.0						80	75	

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS: PWT casing advanced during drilling to allow water return. **GRID DATUM:** MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U,	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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CORED BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 169.9 m AHD
EASTING: 297641.9
NORTHING: 6427403.1
DIP/AZIMUTH: 90°/--

BORE No: BHCW07
PROJECT NO: 91570.00
DATE: 3/6 - 11/6/2019
SHEET: 6 of 6

DRILLING: PROGRESS	DRILLING: SAMPLING			RL / DEPTH (m)	MATERIAL	ROCK MASS				
DRILLING & CASING	WATER	GEO	ENV	IDs and REMARKS	GRAPHIC LOG	DESCRIPTION OF STRATA	Weathering	Rock Strength	Fracture Spacing (m)	Core Rec %	RQD %	TEST RESULTS DISCONTINUITIES & COMMENTS
HQ3		PLT				CONGLOMERATE: Subrounded gravel up to 63 mm in size with cobbles *(continued)*	SW	Very Low / Low / Medium / High / Very High / Ex High	0.005 / 0.01 / 0.05 / 0.10 / 0.50 / 1.00 / 5.00	80	75	PL(D)=0.22 20.20-20.30m: DB: Fragmented (weak matrix)
HQ3		UCS		GT - 002						85	85	PL(D)=0.13
		PLT					HW					
				20.0								
				20.5								
				149								
				21.0								
				21.5		21.58m						
						CORE LOSS 0.21m						
						21.79 Bore discontinued at 21.79m depth (as directed by client) Limit of Investigation						
				148								
				22.0								
				22.5								
				147								
				23.0								
				23.5								
				146								
				24.0								
				24.5								
				145								
				25.0								

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS: PWT casing advanced during drilling to allow water return. **GRID DATUM:** MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U,	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 170.6 m AHD
EASTING: 297659.9
NORTHING: 6427368.9
DIP/AZIMUTH: 90°/--

BORE No: BHCW08
PROJECT NO: 91570.00
DATE: 12/6/2019
SHEET: 1 of 3

DRILLING							MATERIAL				
PROGRESS			SAMPLING								
DRILLING & CASING	WATER	GROUND WATER LEVELS	GEO	ENV	IDs and REMARKS	RL / DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
HA PVC150 SFA	WB (No water loss)	No free groundwater observed				170 / 0 169 / 1 168 / 2 167 / 3 166 / 4 165 / 5 164 / 6 163 / 7 8		0.20m SANDY SILTY GRAVEL: brown red; sand is fine to coarse grained GRAVELLY CLAY: brown; gravel is fine to coarse in size, subrounded; with silt; with cobbles 0.70m SANDY GRAVEL: brown; sand is fine to coarse grained; with clay; with cobbles (extremely weathered conglomerate) 1.00m CONGLOMERATE: brown grey	dry M<Wp dry		

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 170.6 m AHD
EASTING: 297659.9
NORTHING: 6427368.9
DIP/AZIMUTH: 90°/--

BORE No: BHCW08
PROJECT NO: 91570.00
DATE: 12/6/2019
SHEET: 2 of 3

DRILLING								MATERIAL			
PROGRESS			GROUND WATER LEVELS	SAMPLING			RL / DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
DRILLING & CASING	WATER			GEO	ENV	IDs and REMARKS						
WB	(No water loss)						8 / 162		CONGLOMERATE: brown grey *(continued)*			
							9 / 161					
							10 / 160					
							11 / 159					
							12 / 158					
							13 / 157					
							14 / 156					14.20-15.10m: moderate to high drilling resistance
							15 / 155		15.1-15.8m: Increased fines content possibly fine grained sandstone / siltstone band			
							16					

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 170.6 m AHD
EASTING: 297659.9
NORTHING: 6427368.9
DIP/AZIMUTH: 90°/--

BORE No: BHCW08
PROJECT NO: 91570.00
DATE: 12/6/2019
SHEET: 3 of 3

DRILLING							MATERIAL			
PROGRESS			SAMPLING							
DRILLING & CASING	WATER	GROUND WATER LEVELS	GEO	ENV	IDs and REMARKS	RL / DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
WB	(No water loss)					16 / 154		CONGLOMERATE: brown grey *(continued)*			
						17 / 153					
						18 / 152					
						19 / 151					
						20 / 150		20.00m Bore discontinued at 20.00m depth Limit of investigation			
						21 / 149					
						22 / 148					
						23 / 147					
						24					

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 171.2 m AHD
EASTING: 297661.9
NORTHING: 6427322.9
DIP/AZIMUTH: 90°/--

BORE No: BHCW09
PROJECT NO: 91570.00
DATE: 12/6/2019
SHEET: 1 of 4

DRILLING						MATERIAL				
PROGRESS		GROUND WATER LEVELS	SAMPLING			RL	DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
DRILLING & CASING	WATER		GEO	ENV	IDs and REMARKS							
SFA PVC150		No free groundwater observed				171	0		0.15m GRAVELLY SILT: brown red; with fine to coarse grained sand; with cobbles; gravel is subrounded, fine to coarse in size	M<Wp		
									CLAYEY GRAVEL: brown red; with silt; with fine to coarse grained sand; gravel is subrounded fine to coarse in size; with cobbles	dry		
						170	1		1.30m SANDY GRAVEL: brown; sand is fine to coarse grained; with clay; with silt; gravel is subrounded fine to coarse in size; (extremely weathered Conglomerate)	dry		
									1.70m CONGLOMERATE: brown			
						169	2					
						168	3					
						167	4					
WB HWT		(no water loss)				166	5		5.50m SILTSTONE / FINE GRAINED SANDSTONE: grey / brown			
						165	6					
						164	7					
							8					

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 171.2 m AHD
EASTING: 297661.9
NORTHING: 6427322.9
DIP/AZIMUTH: 90°/--

BORE No: BHCW09
PROJECT NO: 91570.00
DATE: 12/6/2019
SHEET: 2 of 4

DRILLING							MATERIAL				
PROGRESS			GROUND WATER LEVELS	SAMPLING							
DRILLING & CASING	WATER			GEO	ENV	IDs and REMARKS	RL	DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
WB HWT	(no water loss)						163 162 161 160 159 158 157 156	8 9 10 11 12 13 14 15 16		SILTSTONE / FINE GRAINED SANDSTONE: grey / brown *(continued)* 9.20m CONGLOMERATE: brown			

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 171.2 m AHD
EASTING: 297661.9
NORTHING: 6427322.9
DIP/AZIMUTH: 90°/--

BORE No: BHCW09
PROJECT NO: 91570.00
DATE: 12/6/2019
SHEET: 3 of 4

DRILLING							MATERIAL				
PROGRESS			SAMPLING								
DRILLING & CASING	WATER	GROUND WATER LEVELS	GEO	ENV	IDs and REMARKS	RL / DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
						16 / 155		CONGLOMERATE: brown *(continued)*			16.50-18.70m: moderate to high drilling resistance
	(no water loss)					17 / 154					17.00m: Partial water returns noted during advancment of HWT casing to floor of void after reaching 17.0 m depth
HWT						18 / 153		18.3-19.3m: Weathered siltstone / fine grained sandstone band			
						19 / 152		19.30m			
	(Total water loss)							VOID: 0.7 m, Drill rods lowered with no rotation, drill head open to 20.0 m depth			
WB						20 / 151		20.00m SANDSTONE: brown grey			
	(no water loss observed following installation of HWT casing)					21 / 150					
						22 / 149					
						23 / 148					
						24					

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 171.2 m AHD
EASTING: 297661.9
NORTHING: 6427322.9
DIP/AZIMUTH: 90°/--

BORE No: BHCW09
PROJECT NO: 91570.00
DATE: 12/6/2019
SHEET: 4 of 4

DRILLING: PROGRESS: DRILLING & CASING	DRILLING: PROGRESS: WATER	DRILLING: GROUND WATER LEVELS	DRILLING: SAMPLING: GEO	DRILLING: SAMPLING: ENV	DRILLING: SAMPLING: IDs and REMARKS	RL	DEPTH (m)	MATERIAL: GRAPHIC LOG	MATERIAL: DESCRIPTION OF STRATA	MATERIAL: MOISTURE CONDITION	MATERIAL: CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
WB	(no water loss observed following installation of HWT casing)					147	24		SANDSTONE: brown grey *(continued)*			
									24.50m CONGLOMERATE: pale brown			
						146	25					
							26		26.20m TUFFACEOUS CLAYSTONE: pale grey with black flecks; with coal lenses			
						145						
							27		27.30m SILTSTONE: brown			
						144						
							28		28.50m Bore discontinued at 28.50m depth Limit of investigation			
						143						
							29					
						142						
							30					
						141						
							31					
						140						
							32					

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 170.8 m AHD
EASTING: 297693.1
NORTHING: 6427305.1
DIP/AZIMUTH: 90°/--

BORE No: BHCW10
PROJECT NO: 91570.00
DATE: 14/6/2019
SHEET: 1 of 3

DRILLING						MATERIAL				
PROGRESS			SAMPLING							
DRILLING & CASING	WATER	GROUND WATER LEVELS	GEO	ENV	IDs and REMARKS	RL	DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
HA PVC150		No free groundwater observed				170	0		0.10m SANDY GRAVEL: red brown; sand is fine grained; with silt SANDY GRAVEL: brown red; sand is fine grained; with silt; with cobbles	dry		
SFA									0.90m CONGLOMERATE: brown			
WB	(No water loss)					169	1					
						168	2					
						167	3					
						166	4					
						165	5					
						164	6					
						163	7					
							8					

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 170.8 m AHD
EASTING: 297693.1
NORTHING: 6427305.1
DIP/AZIMUTH: 90°/--

BORE No: BHCW10
PROJECT NO: 91570.00
DATE: 14/6/2019
SHEET: 2 of 3

DRILLING								MATERIAL			
PROGRESS			GROUND WATER LEVELS	SAMPLING			RL / DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
DRILLING & CASING	WATER			GEO	ENV	IDs and REMARKS						
							8		CONGLOMERATE: brown *(continued)*			
							162					
							9		9.3-11m: Fine grained sandstone / siltstone band			
							161					
							10					
							160					10.50-13.20m: moderate to high drilling resistance
							11					
	WB						159					
							12					
							158					
							13					
							157					
							14					
							156					
							15					
							155					15.50-21.00m: moderate to high drilling resistance
							16					

(No water loss)

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

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BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 170.8 m AHD
EASTING: 297693.1
NORTHING: 6427305.1
DIP/AZIMUTH: 90°/--

BORE No: BHCW10
PROJECT NO: 91570.00
DATE: 14/6/2019
SHEET: 3 of 3

DRILLING							MATERIAL			
PROGRESS		GROUND WATER LEVELS	SAMPLING			RL / DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
DRILLING & CASING	WATER		GEO	ENV	IDs and REMARKS						
WB	(No water loss)					16 / 154		CONGLOMERATE: brown *(continued)*			
						17 / 153					
						18 / 152					
						19 / 151					
						20 / 150					
						21 / 149		21.00m Bore discontinued at 21.00m depth Limit of investigation			
						22 / 148					
						23 / 147					
						24					

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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DPGD_1.05.01.GLB Log DP_301.00.02_SOIL_WG.ATE 91570.00.GPJ <<DrawingFiles>> 09/07/2019 18:10 10.0.000 Datgel Lab and In Situ Tool - DGD | Lib: dpdgd 1.04.02.Prj: dpdgd 1.03.04

BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 168.7 m AHD
EASTING: 297696.1
NORTHING: 6427263.9
DIP/AZIMUTH: 90°/--

BORE No: BHCW11
PROJECT NO: 91570.00
DATE: 18/6/2019
SHEET: 1 of 3

DRILLING						MATERIAL				
PROGRESS		GROUND WATER LEVELS	SAMPLING			RL / DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
DRILLING & CASING	WATER		GEO	ENV	IDs and REMARKS						
SFA PVC150		No free groundwater observed				0 / 168		GRAVELLY SILT: brown red; gravel is subrounded, fine to coarse in size; with fine to medium grained sand; with cobbles	M<Wp		
						0.30m		SILTY CLAYEY GRAVEL: brown; with fine to coarse grained sand; with cobbles; gravel is subrounded, fine to coarsesize	dry		
						0.50m		GRAVELLY CLAY: brown red; gravel is subrounded, fine to coarse in size; with fine to medium grained sand; with cobbles	M<Wp		
						0.90m / 1 / 167		GRAVEL: brown; with clay; with cobbles; gravel is subrounded, fine to coarse size (extremely weathered Conglomerate)	dry		
WB	(No water loss)					1.80m / 2		SILTSTONE: grey brown			
						2.20m / 166		CONGLOMERATE: brown grey			
						3 / 165					
						4 / 164					
						5 / 163					
						6 / 162					
						7 / 161					
						8					

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 168.7 m AHD
EASTING: 297696.1
NORTHING: 6427263.9
DIP/AZIMUTH: 90°/--

BORE No: BHCW11
PROJECT NO: 91570.00
DATE: 18/6/2019
SHEET: 2 of 3

DRILLING							MATERIAL			
PROGRESS			GROUND WATER LEVELS	SAMPLING						
DRILLING & CASING	WATER		GEO	ENV	IDs and REMARKS	RL / DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
WB	(No water loss)					8 / 160		CONGLOMERATE: brown grey *(continued)*			
						9 / 159					
						10 / 158					
						11 / 157					
						12 / 156					
						13 / 155					
						14 / 154		14.50m SILTSTONE: grey			
						15 / 153		15.50m CONGLOMERATE: brown grey			
						16					

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

Douglas Partners
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BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 168.7 m AHD
EASTING: 297696.1
NORTHING: 6427263.9
DIP/AZIMUTH: 90°/--

BORE No: BHCW11
PROJECT NO: 91570.00
DATE: 18/6/2019
SHEET: 3 of 3

DRILLING						MATERIAL				
PROGRESS			SAMPLING							
DRILLING & CASING	WATER	GROUND WATER LEVELS	GEO	ENV	IDs and REMARKS	RL / DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
WB	(No water loss)					16 / 152		CONGLOMERATE: brown grey *(continued)*			16.50-17.00m: moderate to high drilling resistance
						17 / 151		17.00m Bore discontinued at 17.00m depth Limit of investigation			
						18 / 150					
						19 / 149					
						20 / 148					
						21 / 147					
						22 / 146					
						23 / 145					
						24					

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 167.9 m AHD
EASTING: 297726.9
NORTHING: 6427252.2
DIP/AZIMUTH: 90°/--

BORE No: BHCW12-V2
PROJECT NO: 91570.00
DATE: 20/6/2019
SHEET: 1 of 3

DRILLING						MATERIAL				
PROGRESS		GROUND WATER LEVELS	SAMPLING			RL / DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
DRILLING & CASING	WATER		GEO	ENV	IDs and REMARKS						
HA		No free groundwater observed				0		0.20m SANDY SILT: brown; sand is fine to coarse grained; with gravel; with cobbles; gravel is subrounded, fine to coarse in size	M<Wp		
								SILTY GRAVEL: dark brown; with fine to coarse grained sand; trace clay; with cobbles, gravel is subrounded, fine to coarse in size	dry		
PVC150						167 1		0.80m GRAVELLY CLAY: brown; gravel is subrounded, fine to coarse in size; with fine to coarse grained sand; with cobbles	M<Wp		
SFA								1.10m SANDY CLAY: pale brown; sand is fine to coarse grained; with gravel; with silt; gravel is subrounded up to 20 mm in size; (extremely weathered Sandstone)	M<Wp		
						166 2		2.00m CONGLOMERATE: brown grey			
WB		(No water loss)				165 3					
						164 4					4.20-9.80m: moderate to high drilling resistance
						163 5					
						162 6					5.60-5.80m: moderate to high drilling resistance
						161 7					
						160 8					

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 167.9 m AHD
EASTING: 297726.9
NORTHING: 6427252.2
DIP/AZIMUTH: 90°/--

BORE No: BHCW12-V2
PROJECT NO: 91570.00
DATE: 20/6/2019
SHEET: 2 of 3

DRILLING								MATERIAL			
PROGRESS			GROUND WATER LEVELS	SAMPLING			RL / DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
DRILLING & CASING	WATER			GEO	ENV	IDs and REMARKS						
WB	(No water loss)						159 / 9		CONGLOMERATE: brown grey *(continued)*			
							158 / 10					
							157 / 11					
							156 / 12					
							155 / 13					
							154 / 14					
							153 / 15		15.20m			
							152 / 16		SILTSTONE: pale brown			

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: AECOM
PROJECT: Proposed Stage 2 Rail Loop
LOCATION: Mt Pleasant Coal Mine, Muswellbrook

SURFACE LEVEL: 167.9 m AHD
EASTING: 297726.9
NORTHING: 6427252.2
DIP/AZIMUTH: 90°/--

BORE No: BHCW12-V2
PROJECT NO: 91570.00
DATE: 20/6/2019
SHEET: 3 of 3

DRILLING							MATERIAL				
PROGRESS			SAMPLING								
DRILLING & CASING	WATER	GROUND WATER LEVELS	GEO	ENV	IDs and REMARKS	RL / DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	TEST RESULTS & COMMENTS
WB	(No water loss)					16		SILTSTONE: pale brown *(continued)*			16.20-16.50m: moderate to high drilling resistance
						151 17		16.50m CONGLOMERATE: brown grey			
								17.50m Bore discontinued at 17.50m depth Limit of investigation			
						150 18					
						149 19					
						148 20					
						147 21					
						146 22					
						145 23					
						144 24					

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower TD-106 **DRILLER:** Total Drilling **LOGGED:** Benson **CHECKED:** Benson

REMARKS:

GRID DATUM: MGA94 Zone 56

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	▽	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▼	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)

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POINT LOAD TEST REPORT

CLIENT : AECOM
PROJECT : Proposed Stage 2 Rail Loop
LOCATION : Mt Pleasant Coal Mine, Muswellbrook
TEST METHOD: AS 4133.4.1

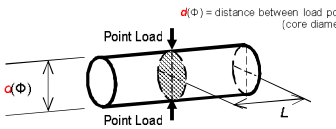
DATE: 04-07/06/19
PROJECT NO : 91570
TESTED BY : CTB

BORE: BHCW07
SHEET: 1 OF 1

DEPTH (m)	ROCK DESCRIPTION	TEST TYPE Axial (A), Diametral (D) Irregular (I)	DIMENSIONS Min. Width (*W*) (mm)	DIMENSIONS Depth (*d*) (mm)	FAILURE READING (KN)	POINT LOAD INDEX, $I_{s(60)}$ (MPa) Axial (A) or Irregular (I)	POINT LOAD INDEX, $I_{s(60)}$ (MPa) Diametral (D)	INTERPRETED ROCK STRENGTH
5.60	Failue under no load	D	-	-				
8.61	Conglomerate	D	85	85	8.24	1.20	-	HIGH
10.60	Pocket Penetrometer = 250 kPa	D	-	-				
10.90	Pocket Penetrometer = 150 kPa	D	-	-				
18.20	Failue under no load	D	-	-				
17.80	Failue under no load	D	-	-				
20.00	Conglomerate	D	61	61	0.75	0.18	-	LOW
21.00	Conglomerate	D	61	61	0.45	0.11	-	LOW

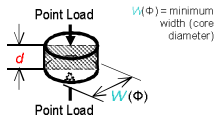
Diametral Test:
CHECK $L > 0.5 \cdot d$
L = distance from load point to nearest free end
d = distance between load points

Equivalent core diameter: $d_e = d$



Axial Test:
CHECK $0.3 \cdot W < d < W$

Equivalent core diameter: $d_e = \sqrt{4 \cdot \frac{d \cdot W}{\pi}}$



CHECKED
Initials
Date

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BHCW07 – 4.5 m to 7.0 m

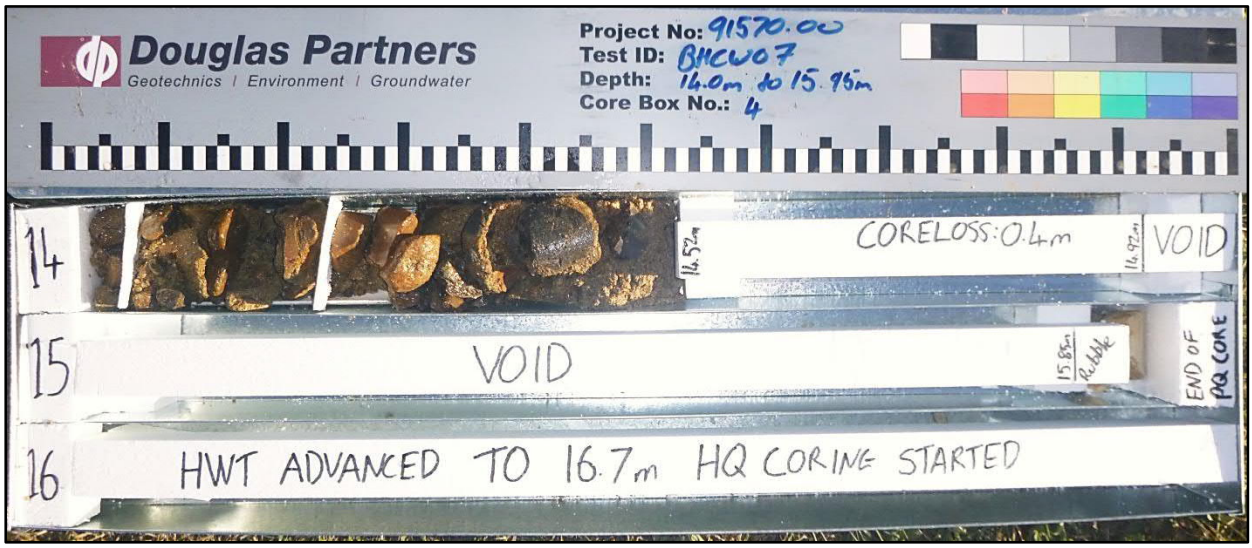


BHCW07– 8.0 m to 11.0 m

Douglas Partners Geotechnics / Environment / Groundwater	**Core Photoplates** **Proposed Rail Loop** **Mt Pleasant Coal Mine, Muswellbrook**	PROJECT: 91570.00 PLATE No: C1 REV: 0
	CLIENT: AECOM	DATE: 10-Jul-19



BHCW07– 11.0 m to 14.00 m



BHCW07– 14.0 m to 16.70 m

Douglas Partners Geotechnics / Environment / Groundwater	**Core Photoplates** **Proposed Rail Loop** **Mt Pleasant Coal Mine, Muswellbrook**	PROJECT: 91570.00 PLATE No: C2 REV: 0
	CLIENT: AECOM	DATE: 10-Jul-19

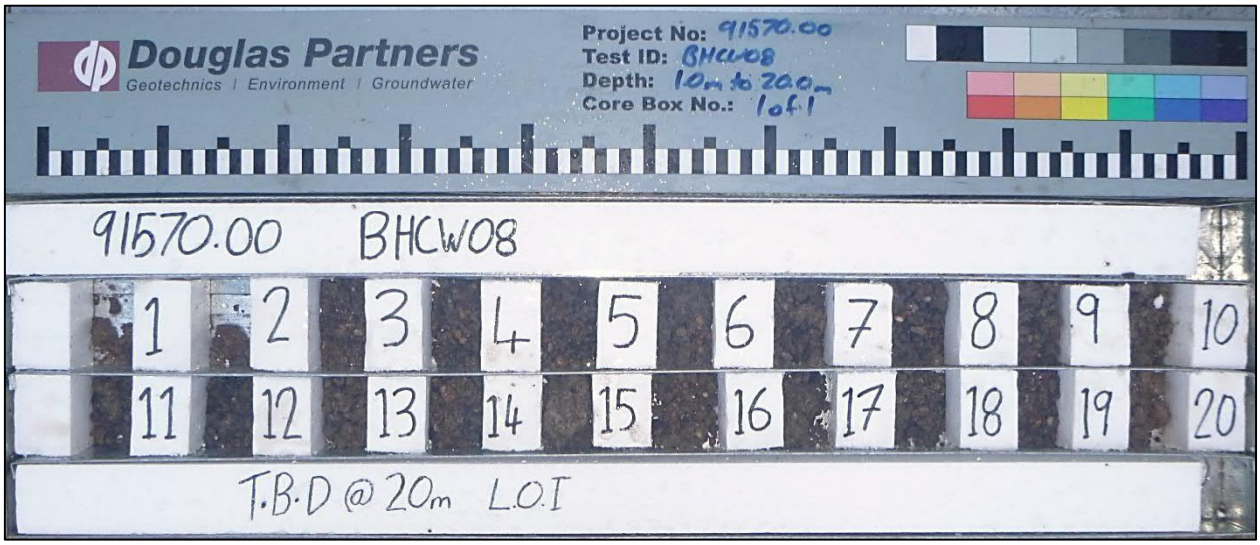


BHCW07 – 16.70 m to 20.00 m



BHCW07– 20.00 m to 21.79m

Douglas Partners Geotechnics / Environment / Groundwater	**Core Photoplates** **Proposed Rail Loop** **Mt Pleasant Coal Mine, Muswellbrook**	PROJECT: 91570.00 PLATE No: C3 REV: 0
	CLIENT: AECOM	DATE: 10-Jul-19



BHCW08 – 1.0 m to 20.0 m



BHCW09 – 1.0 m to 28.5m

Douglas Partners Geotechnics / Environment / Groundwater	**Sample Photoplates** **Proposed Rail Loop** **Mt Pleasant Coal Mine, Muswellbrook**	PROJECT: 91570.00 PLATE No: S1 REV: 0
	CLIENT: AECOM	DATE: 10-Jul-19

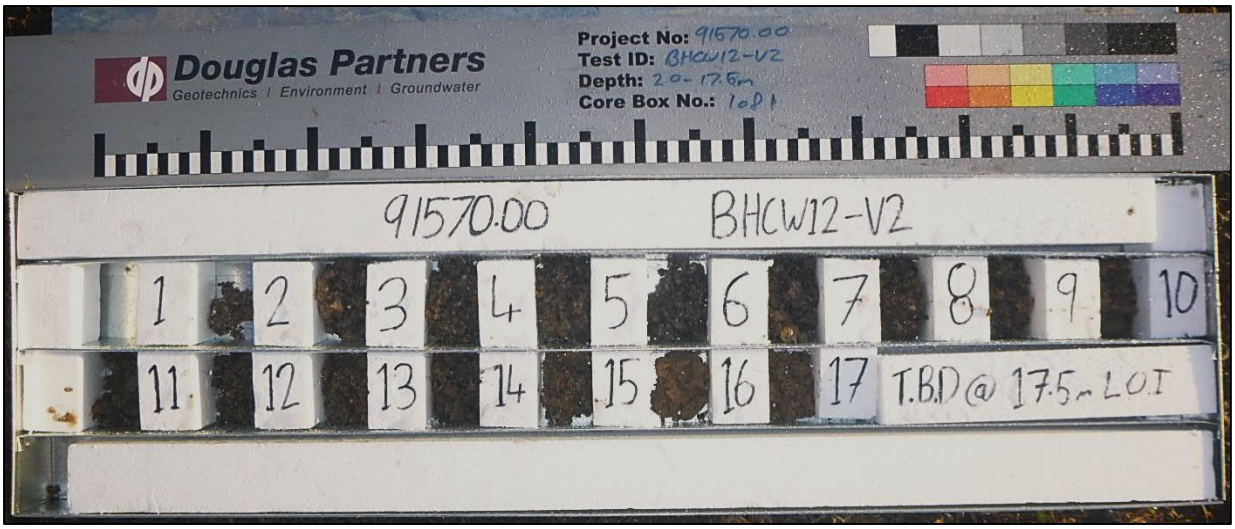


BHCW10 – 1.0 m to 21.0m



BHCW11 – 1.8 m to 17.0m

Douglas Partners Geotechnics / Environment / Groundwater	**Sample Photoplates** **Proposed Rail Loop** **Mt Pleasant Coal Mine, Muswellbrook**	PROJECT: 91570.00 PLATE No: S2 REV: 0
	CLIENT: AECOM	DATE: 10-Jul-19



BHCW12-V2 – 2.0 m to 17.5m

Douglas Partners Geotechnics / Environment / Groundwater	**Sample Photoplates** **Proposed Rail Loop** **Mt Pleasant Coal Mine, Muswellbrook**	PROJECT: 91570.00 PLATE No: S3 REV: 0
	CLIENT: AECOM	DATE: 10-Jul-19

Douglas Partners
Geotechnics / Environment / Groundwater

CCTV CAMERA RECORD SHEET

Project	Proposed Rail Loop	Project No.	91570.00	Bore	BHCW06	Date	20/6/2019
Location	Mt Pleasant Coal Mine, Muswellbrook						

Depth (m)	Comments
0.0	Ground level, Note: Top of casing at 0.3 m above ground level
8.5	Bottom of PVC casing
13.0	Top of void
13.7	Top of rubble
15.6	Possible floor – Appears to be competent rock
16.4	Ground water level
24.8	Top of void? / rubble / sediment. Camera discontinued due to rubble preventing further assessment
	Tape measure refused at 25.0 m
Notes	1. The accuracy of depths recorded during CCTV down the boreholes as presented in the CCTV Camera Record Sheets are considered to be ±1% i.e at 20 m depth typically within ± 0.2 m.

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CCTV CAMERA RECORD SHEET

Project	Proposed Rail Loop	Project No.	91570.00	Bore	BHCW07	Date	14/6/2019
Location	Mt Pleasant Coal Mine, Muswellbrook						

Depth (m)	Comments
0.0	Ground level, Note: Top of casing at 0.45 m above ground level
10.3	Bottom of PVC casing
14.1	Ground water level
From 14.1 – 15.7	Grey in walls of sediment? / possible bentonite muds?
15.7	Camera discontinued due to sediment in bore preventing further assessment
Notes	1. The accuracy of depths recorded during CCTV down the boreholes as presented in the CCTV Camera Record Sheets are considered to be ±1% i.e at 20 m depth typically within ± 0.2 m.

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CCTV CAMERA RECORD SHEET

Project	Proposed Rail Loop	Project No.	91570.00	Bore	BHCW08	Date	20/6/2019
Location	Mt Pleasant Coal Mine, Muswellbrook						
Depth (m)	**Comments**						
0.0	Ground level, Note: Top of casing at 0.65 m above ground level						
1.0	Bottom of PVC casing						
	Conglomerate						
11.7	Camera discontinued due to collapse in bore preventing further assessment						
	Tape measure refused at 11.7 m						
Notes	1. The accuracy of depths recorded during CCTV down the boreholes as presented in the CCTV Camera Record Sheets are considered to be ±1% i.e at 20 m depth typically within ± 0.2 m.						

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Geotechnics / Environment / Groundwater

CCTV CAMERA RECORD SHEET

Project	Proposed Rail Loop	Project No.	91570.00	Bore	BHCW09	Date	20/6/2019
Location	Mt Pleasant Coal Mine, Muswellbrook						

Depth (m)	Comments
0.0	Ground level, Note: Top of casing 1 m above ground level
10.9	Bottom of PVC casing (100 mm)
	Conglomerate
19.5	Top of void??. Rock visible in roof, granular material (sediment??) in immediate area
19.9	Ground water level – Near zero visibility – no observations
21.2	Camera discontinued due to sediment preventing further assessment (camera refused)
	Tape measure refused at 21.3 m
Notes	1. The accuracy of depths recorded during CCTV down the boreholes as presented in the CCTV Camera Record Sheets are considered to be ±1% i.e at 20 m depth typically within ± 0.2 m.

Douglas Partners
Geotechnics / Environment / Groundwater

CCTV CAMERA RECORD SHEET

Project	Proposed Rail Loop	Project No.	91570.00	Bore	BHCW10	Date	20/6/2019
Location	Mt Pleasant Coal Mine, Muswellbrook						

Depth (m)	Comments
0.0	Ground level, Note: Top of casing at 0.6 m above ground level
~ 0.8	Bottom of PVC casing (150 mm)
	Conglomerate
18.4	Ground water level
	Sandstone / fine grained
19.9	Conglomerate
20.5	Camera discontinued due to sediment preventing further assessment
	Tape measure refused at 20.65 m depth
Notes	1. The accuracy of depths recorded during CCTV down the boreholes as presented in the CCTV Camera Record Sheets are considered to be ±1% i.e at 20 m depth typically within ± 0.2 m.

Douglas Partners
Geotechnics / Environment / Groundwater

CCTV CAMERA RECORD SHEET

Project	Proposed Rail Loop	Project No.	91570.00	Bore	BHCW11	Date	24/6/2019
Location	Mt Pleasant Coal Mine, Muswellbrook						

Depth (m)	Comments
0.0	Ground level, Note: Top of casing at 0.86 m above ground level
3.5	Bottom of PVC casing (100 mm)
12.1	Ground water level – near zero visibility
14.8	Top of sediment - collapse
14.8	Camera discontinued due to sediment preventing further assessment
Notes	1. The accuracy of depths recorded during CCTV down the boreholes as presented in the CCTV Camera Record Sheets are considered to be ±1% i.e at 20 m depth typically within ± 0.2 m.

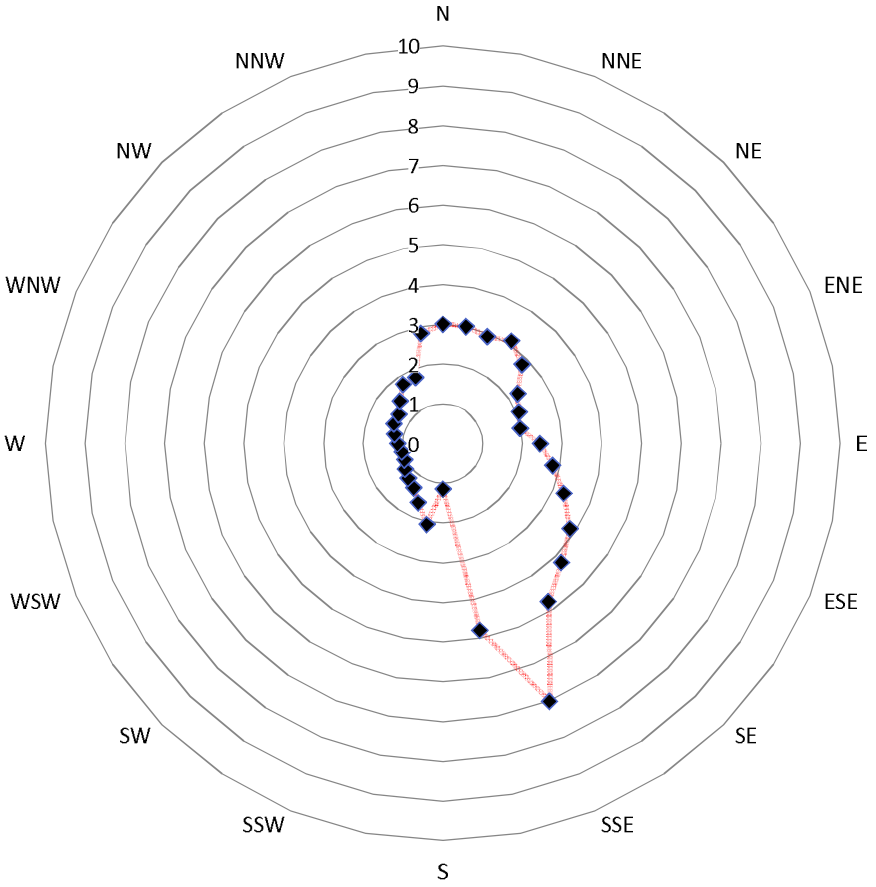
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CCTV CAMERA RECORD SHEET

Project	Proposed Rail Loop	Project No.	91570.00	Bore	BHCW 12 – V2	Date	24/6/2019
Location	Mt Pleasant Coal Mine, Muswellbrook						
Depth (m)	**Comments**						
0.0	Ground level, Note: Top of casing at 0.6 m above ground level						
2.6	Bottom of PVC casing (100 mm)						
6.0	Collapse						
6.0	Camera discontinued due to fall in preventing further assessment						
	Tap measure refused at 6.0 m						
Notes	1. The accuracy of depths recorded during CCTV down the boreholes as presented in the CCTV Camera Record Sheets are considered to be ±1% i.e at 20 m depth typically within ± 0.2 m.						

Laser Results Sheet

Client:	AECOM	**Project No:**	91570
Project:	Proposed Stage 2 Rail Loop	**Date:**	20 June 2019
Location:	Mt Pleasant Coal Mine, Muswellbrook	**Bore:**	BHCW06
		Top of Void:	13*
		Base of Void:	13.7*
		Scanning Depth:	13.3
		Bearing Correction:	0



Scale: Radial lines are 1 m intervals
*Camera Depths

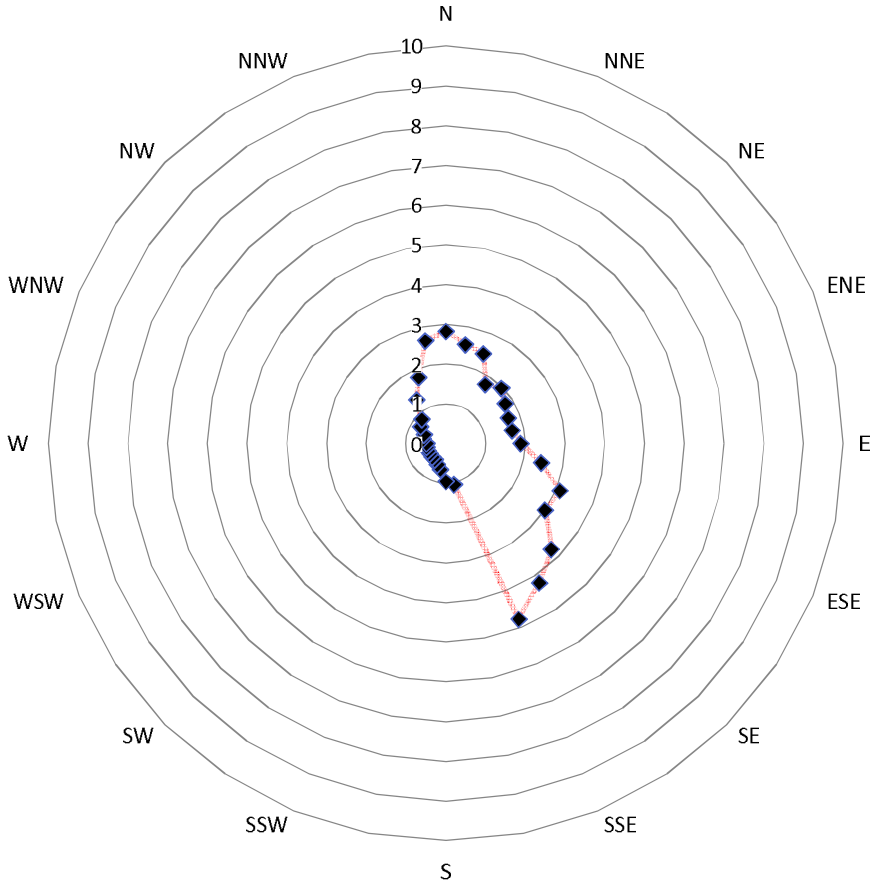
Laser Results Sheet

Project No:	91570
Bore:	BHCW06
Scanning Depth:	13.3

Direction	Magnetic Bearing		Raw Reading	Inferred Distance (m)
	Raw	Corrected		
N	0	0	7.40	3.01
	11.25	11.25	7.40	3.01
NNE	22.5	22.5	7.30	2.92
	33.75	33.75	7.50	3.10
NE	45	45	7.20	2.82
	56.25	56.25	6.60	2.26
ENE	67.5	67.5	6.40	2.08
	78.75	78.75	6.30	1.98
E	90	90	6.80	2.45
	101.25	101.25	7.20	2.82
ESE	112.5	112.5	7.70	3.29
	123.75	123.75	8.30	3.85
SE	135	135	8.70	4.22
	146.25	146.25	9.30	4.78
SSE	157.5	157.5	11.70	7.03
	168.75	168.75	9.30	4.78
S	180	180	5.40	1.14
	191.25	191.25	6.40	2.08
SSW	202.5	202.5	5.90	1.61
	213.75	213.75	5.60	1.33
SW	225	225	5.50	1.24
	236.25	236.25	5.40	1.14
WSW	247.5	247.5	5.30	1.05
	258.75	258.75	5.30	1.05
W	270	270	5.40	1.14
	281.25	281.25	5.50	1.24
WNW	292.5	292.5	5.60	1.33
	303.75	303.75	5.60	1.33
NW	315	315	5.80	1.52
	326.25	326.25	6.10	1.80
NNW	337.5	337.5	6.10	1.80
	348.75	348.75	7.20	2.82

Laser Results Sheet

Client:	AECOM	**Project No:**	91570
Project:	Proposed Stage 2 Rail Loop	**Date:**	20 June 2019
Location:	Mt Pleasant Coal Mine, Muswellbrook	**Bore:**	BHCW06
		Top of Void:	13*
		Base of Void:	13.7*
		Scanning Depth:	13.5
		Bearing Correction:	0



Scale: Radial lines are 1 m intervals
*Camera Depths

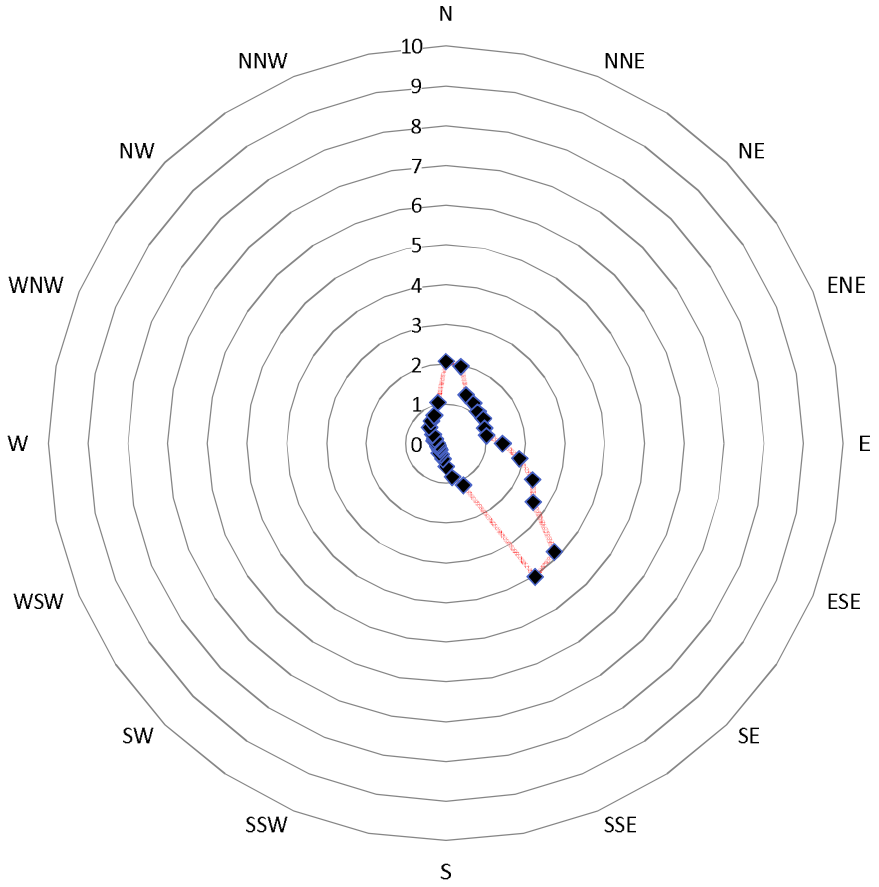
Laser Results Sheet

Project No:	91570
Bore:	BHCW06
Scanning Depth:	13.5

Direction	Magnetic Bearing		Raw Reading	Inferred Distance (m)
	Raw	Corrected		
N	0	0	7.20	2.82
	11.25	11.25	6.90	2.54
NNE	22.5	22.5	6.80	2.45
	33.75	33.75	6.10	1.80
NE	45	45	6.30	1.98
	56.25	56.25	6.10	1.80
ENE	67.5	67.5	6.00	1.70
	78.75	78.75	6.00	1.70
E	90	90	6.20	1.89
	101.25	101.25	6.80	2.45
ESE	112.5	112.5	7.50	3.10
	123.75	123.75	7.40	3.01
SE	135	135	8.20	3.76
	146.25	146.25	8.70	4.22
SSE	157.5	157.5	9.30	4.78
	168.75	168.75	5.30	1.05
S	180	180	5.20	0.96
	191.25	191.25	4.90	0.68
SSW	202.5	202.5	4.80	0.58
	213.75	213.75	4.70	0.49
SW	225	225	4.70	0.49
	236.25	236.25	4.70	0.49
WSW	247.5	247.5	4.70	0.49
	258.75	258.75	4.70	0.49
W	270	270	4.70	0.49
	281.25	281.25	4.80	0.58
WNW	292.5	292.5	4.80	0.58
	303.75	303.75	5.00	0.77
NW	315	315	5.10	0.86
	326.25	326.25	5.60	1.33
NNW	337.5	337.5	6.10	1.80
	348.75	348.75	7.00	2.64

Laser Results Sheet

Client:	AECOM	**Project No:**	91570
Project:	Proposed Stage 2 Rail Loop	**Date:**	20 June 2019
Location:	Mt Pleasant Coal Mine, Muswellbrook	**Bore:**	BHCW06
		Top of Void:	13*
		Base of Void:	13.7*
		Scanning Depth:	13.7
		Bearing Correction:	0



Scale: Radial lines are 1 m intervals
*Camera Depths

Laser Results Sheet

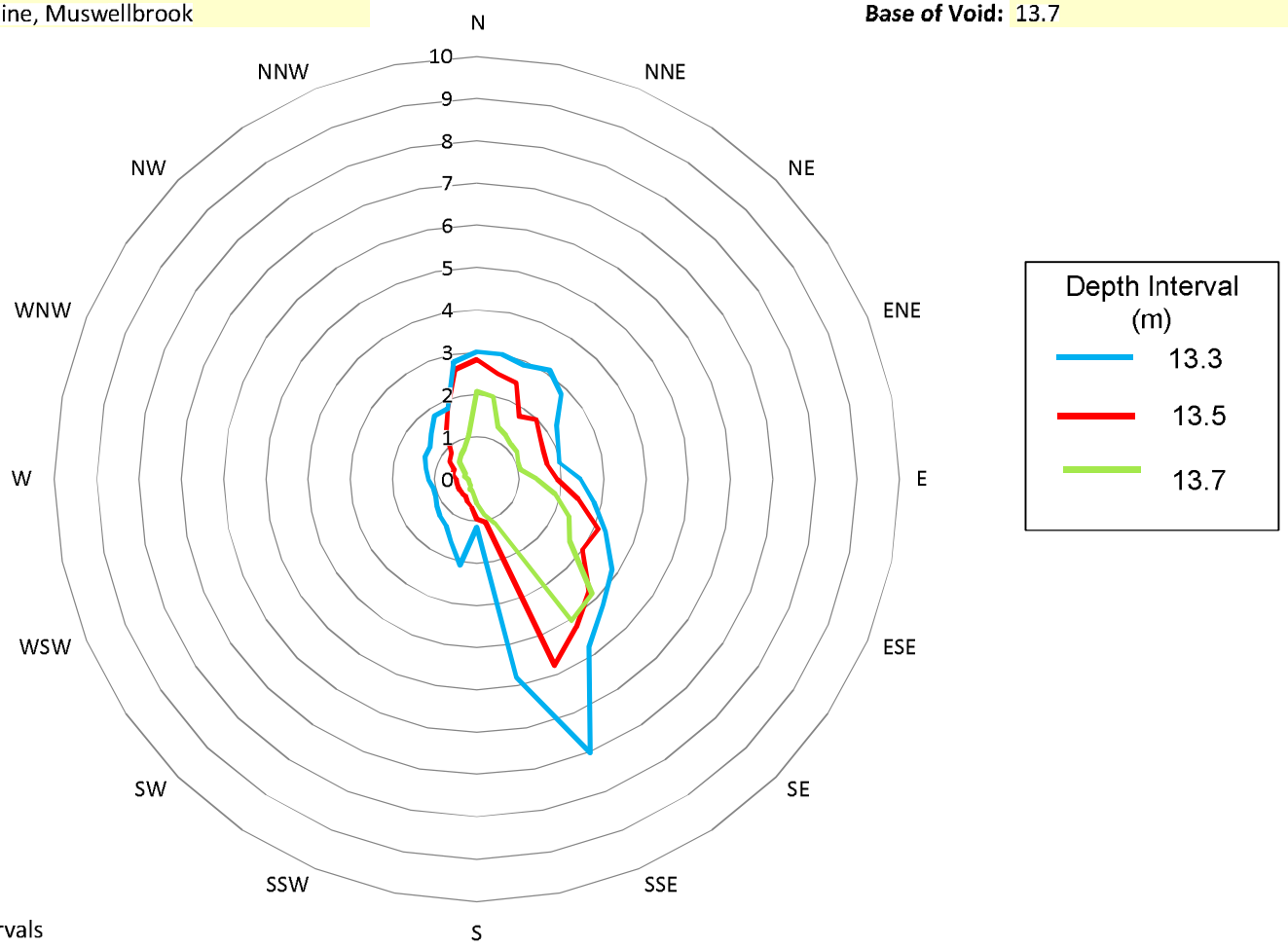
Project No:	91570
Bore:	BHCW06
Scanning Depth:	13.7

Direction	Magnetic Bearing		Raw Reading	Inferred Distance (m)
	Raw	Corrected		
N	0	0	6.40	2.08
	11.25	11.25	6.30	1.98
NNE	22.5	22.5	5.60	1.33
	33.75	33.75	5.50	1.24
NE	45	45	5.40	1.14
	56.25	56.25	5.40	1.14
ENE	67.5	67.5	5.30	1.05
	78.75	78.75	5.30	1.05
E	90	90	5.70	1.42
	101.25	101.25	6.20	1.89
ESE	112.5	112.5	6.70	2.36
	123.75	123.75	7.00	2.64
SE	135	135	8.30	3.85
	146.25	146.25	8.50	4.04
SSE	157.5	157.5	5.40	1.14
	168.75	168.75	5.10	0.86
S	180	180	4.80	0.58
	191.25	191.25	4.60	0.40
SSW	202.5	202.5	4.50	0.30
	213.75	213.75	4.50	0.30
SW	225	225	4.40	0.21
	236.25	236.25	4.40	0.21
WSW	247.5	247.5	4.40	0.21
	258.75	258.75	4.40	0.21
W	270	270	4.40	0.21
	281.25	281.25	4.50	0.30
WNW	292.5	292.5	4.50	0.30
	303.75	303.75	4.60	0.40
NW	315	315	4.80	0.58
	326.25	326.25	4.90	0.68
NNW	337.5	337.5	5.00	0.77
	348.75	348.75	5.30	1.05

Laser Results Sheet

Douglas Partners
Geotechnics / Environment / Groundwater

Client:	AECOM	**Project No:**	91570	**Bore:**	BHCW06
Project:	Proposed Stage 2 Rail Loop	**Date:**	20 June 2019	**Top of Void:**	13.0
Location:	Mt Pleasant Coal Mine, Muswellbrook			***Base of Void:***	13.7



Scale: Radial lines are 1 m intervals

Appendix B

Acoustic Televiewer Reports (Bores BHCW06, BHCW07, BHCW09 and BHCW11)
Optical Televiewer Reports (Bores BHCW06, BHCW07, BHCW08, BHCW09, BHCW10, BHCW11 and BHCW12-V2)

Douglas Partners Pty Ltd
Mt Pleasant Rail Infrastructure Project

Borehole BHCW06A

ACOUSTIC TELEVIEWER PETROPHYSICAL REPORT

Groundsearch Australia Pty. Limited

2 July 2019

DISCLAIMER

The data used in this report were obtained using equipment manufactured by the Century Geophysical Corporation. The interpretations given in this report are based on judgement and experience of Groundsearch Australia's personnel. They are provided for Douglas Partners' sole use in accordance with a specified brief. As such, the interpretation outcomes do not necessarily address all aspects of ground conditions and behaviour on the subject site. The responsibility of Groundsearch Australia is solely to Douglas Partners and it is not intended that any third party rely upon this report. This report shall not be reproduced either wholly or in part without the written permission of Groundsearch Australia Pty. Limited.

For and on behalf of Groundsearch Australia Pty. Limited



John Lea BSc (Hons) FAusIMM
Principal Geologist
Managing Director

Executive summary

The data contained in this report were obtained from one vertical, 9.6 cm diameter borehole. It was drilled as a component of the 2019 geotechnical investigation programme for Douglas Partners Mt Pleasant Rail Infrastructure Project.

A Century Geophysical LLC downhole 9804 acoustic televiewer was run to collect data in the field on 24 June 2019. The data in this report are from 16.00 to 25.31 mbgl.

The 31 identified features are interpreted as bedding planes, two fractures and the SWL.

The Century Display program has automatically recalculated the dip angle data to represent the borehole in the vertical position and the dip direction data are referenced to magnetic north.

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Appendix 1 1:10 Interpretation logs **–** 16.00 to 25.31mbgl

1.0 Background technical information

The data contained in this report were obtained from one vertical, 9.6 cm diameter borehole. It was drilled as a component of the 2019 geotechnical investigation programme for Douglas Partners Mt Pleasant Rail Infrastructure Project.

A Century Geophysical LLC downhole 9804 acoustic televiewer was run to collect data in the field on 24 June 2019. The data in this report are from 16.00 to 25.31 mbgl.

The 31 identified features are interpreted as bedding planes, two fractures and the SWL.

The Century Display program has automatically recalculated the dip angle data to represent the borehole in the vertical position and the dip direction data is referenced to magnetic north.

The OTV takes an oriented image of the borehole using light waves. This information is used to detect bedding planes, fractures, and other borehole anomalies in air-filled boreholes.

Analysis software includes colour adjustment, fracture dip and strike determination, and classification of features. It allows information to be displayed on the graphical screen, plot, and in report format.

2.0 Interpretation methodology

It should be noted that the OTV is a bowspring-type, centralised tool and is affected by poor wallrock conditions known as rugosity.

The OTV data interpretation procedure is based on the superposition of curves on feature logs directly onto the computer screen by using a subjective, manual; two-point definition of a feature's top and base to produce a sine curve. The sides of the time and amplitude plots represent magnetic north and magnetic south is in the centre of each plot. The low side, or trough, of the sine curve defines the dip direction of the feature.

The logging program automatically records the televiewer tool slant angle and bearing and corrects for any borehole deviations. The curves are automatically given an identification number for subsequent referencing in a report file.

There are possibly more bedding planes and structural fractures appearing in the televiewer logs that have not been included in this report due to their poor graphic definition or the inability to resolve their geometry by superposing a sine curve using the program's two point method.

This report contains a;

- Text summary of the interpreted features
- Circular representation of interpreted features
- Logs that show geological features with their subjective, numbered interpretation curves shown at 1:10 scale. The logs are in standard format whereby the sonic image of the borehole wall is "flattened" onto the plot. The logs have the following additional features to enhance geological interpretations of the strata;
    - Coloured tadpoles and plane curves that represent feature dip and dip direction
    - Bedding planes in **BLACK**
    - Partially open fracture in **MAGENTA**
    - Discontinuous fracture in **BLUE**
    - Slant (dip angle)
    - Slant angle bearing
- Table containing feature curve ID, top, base, dip angle, dip azimuth, feature description and the generalised rock type that hosts the feature
- Graphical representation of the interpreted fracture features

3.0 Borehole BHCW06ATV interpretations

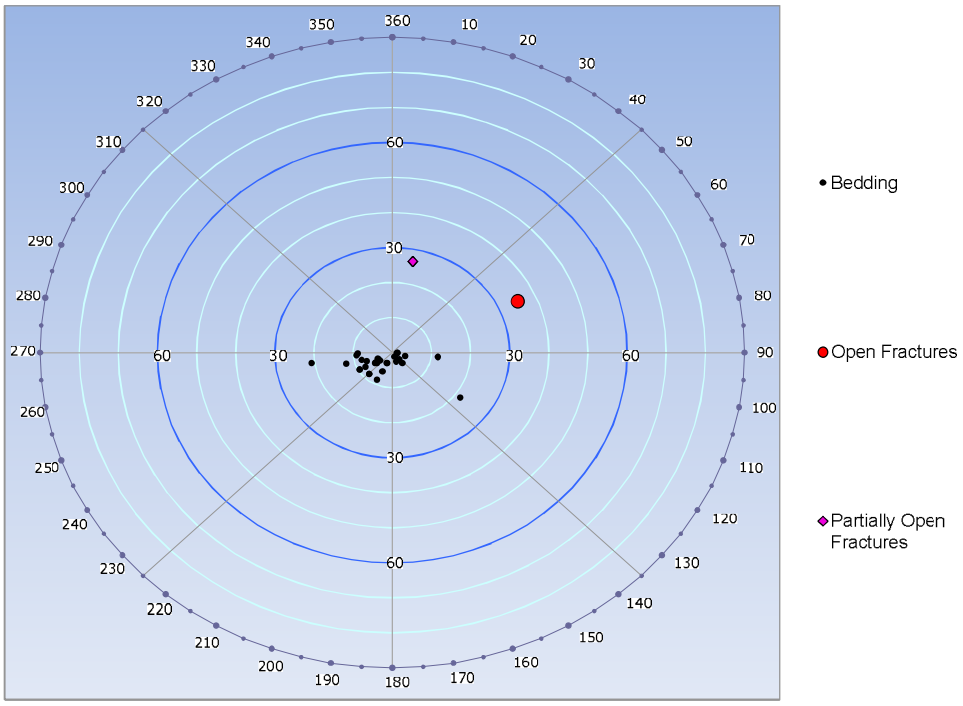
The 31 identified features are interpreted as bedding planes, two fractures and the SWL.

A description of each interpreted feature is presented in Table 1 and the log is presented in Appendix 1.

Table 1 Interpreted features report for BHCW06ATV

FEATURE ID	DIP (DEG)	AZIMUTH (DEG)	MIDPOINT (MBGL)	TOP (M)	BASE (M)	TYPE OF FEATURE
1			16.58	16.58	16.58	SWL
2	27	11	16.81	16.78	16.83	Fracture plane - partially open
3	8	224	17.00	17.00	17.01	Bedding plane
4	10	239	17.16	17.15	17.16	Bedding plane
5	5	235	18.33	18.33	18.34	Bedding plane
6	21	262	18.61	18.60	18.63	Bedding plane
7	5	236	19.14	19.14	19.15	Bedding plane
8	8	239	19.41	19.41	19.42	Bedding plane
9	3	107	19.73	19.73	19.73	Bedding plane
10	3	158	19.86	19.86	19.87	Bedding plane
11	9	265	20.25	20.24	20.26	Bedding plane
12	1	97	21.18	21.18	21.18	Bedding plane
13	35	65	21.23	21.19	21.27	Fracture plane - open
14	4	245	21.63	21.63	21.64	Bedding plane
15	3	205	22.03	22.03	22.02	Bedding plane
16	1	98	22.11	22.11	22.11	Bedding plane
17	12	255	22.28	22.27	22.29	Bedding plane
18	9	268	22.83	22.82	22.83	Bedding plane
19	4	140	22.96	22.96	22.96	Bedding plane
20	22	126	23.03	23.02	23.05	Bedding plane
21	3	202	23.21	23.21	23.21	Bedding plane
22	6	205	23.45	23.44	23.45	Bedding plane
23	1	152	23.52	23.51	23.52	Bedding plane
24	1	93	23.53	23.53	23.53	Bedding plane
25	9	207	23.73	23.73	23.73	Bedding plane
26	4	234	23.79	23.79	23.79	Bedding plane
27	12	96	24.03	24.02	24.04	Bedding plane
28	5	232	24.22	24.22	24.22	Bedding plane
29	8	254	24.24	24.24	24.25	Bedding plane
30	7	249	24.31	24.31	24.32	Bedding plane
31	3	136	24.57	24.57	24.58	Bedding plane

Figure 1 BHCW06ATV circular plan representation of interpreted features



The 28 sedimentary features identified are predominantly bedding planes that appear to range in dip from flat-lying to 22^0. The Figures 2 and 3 shows the distribution of the planes' dips angles and dip direction with depth.

Table 2 details the variation in the dip angle and dip direction data. Figure 4 shows the dip direction data in a rose diagram with the bedding planes' dip angle and dip direction data shown as histograms in Figures 5 and 6.

The two fractures identified appears to be one open and one partially open.

Table 3 details the variation in the fractures' dip angle and dip direction data. Figure 7 shows the dip direction data in a rose diagram with the fractures' plane dip angle and dip direction data as histograms in Figures 8 and 9.

Figure 2 BHCW06ATV feature dip angle data distribution

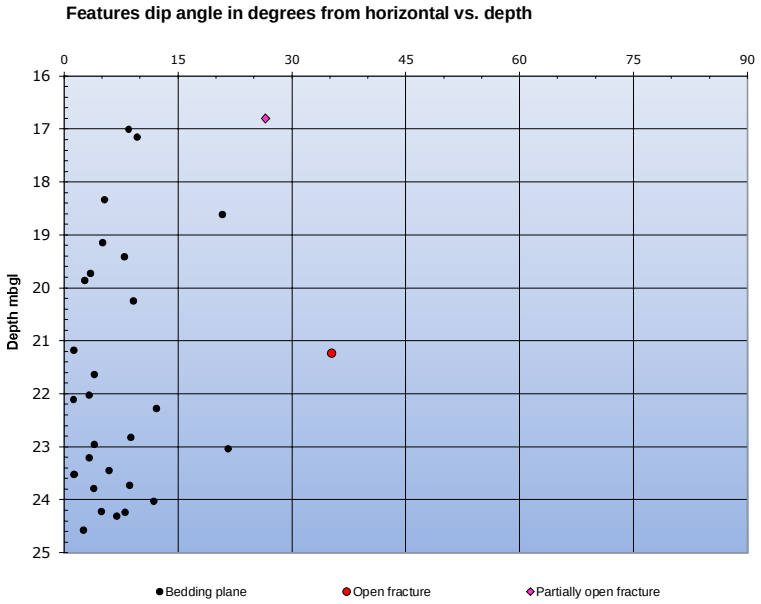


Figure 3 BHCW06ATV feature dip direction data distribution

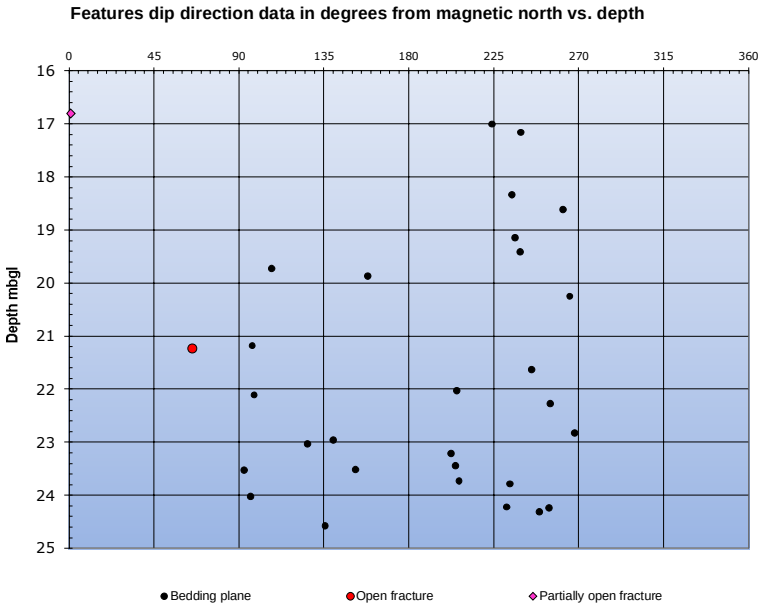


Table 2 BHCW06ATV bedding histogram data

Dip Distribution Total: 28			Orientation Distribution Total: 28		
Dip Range	Count	%	Bearing Range	Count	%
0 to 10	24	85.7	0 to 10	0	0.0
10 to 20	2	7.1	10 to 20	0	0.0
20 to 30	2	7.1	20 to 30	0	0.0
30 to 40	0	0.0	30 to 40	0	0.0
40 to 50	0	0.0	40 to 50	0	0.0
50 to 60	0	0.0	50 to 60	0	0.0
60 to 70	0	0.0	60 to 70	0	0.0
70 to 80	0	0.0	70 to 80	0	0.0
80 to 90	0	0.0	80 to 90	0	0.0
			90 to 100	4	14.3
			100 to 110	1	3.6
			110 to 120	0	0.0
			120 to 130	1	3.6
			130 to 140	1	3.6
			140 to 150	1	3.6
			150 to 160	2	7.1
			160 to 170	0	0.0
			170 to 180	0	0.0
			180 to 190	0	0.0
			190 to 200	0	0.0
			200 to 210	4	14.3
			210 to 220	0	0.0
			220 to 230	1	3.6
			230 to 240	6	21.4
			240 to 250	2	7.1
			250 to 260	2	7.1
			260 to 270	3	10.7
			270 to 280	0	0.0
			280 to 290	0	0.0
			290 to 300	0	0.0
			300 to 310	0	0.0
			310 to 320	0	0.0
			320 to 330	0	0.0
			330 to 340	0	0.0
			340 to 350	0	0.0
			350 to 360	0	0.0

Figure 5 BHCW06ATV bedding dip angles histogram

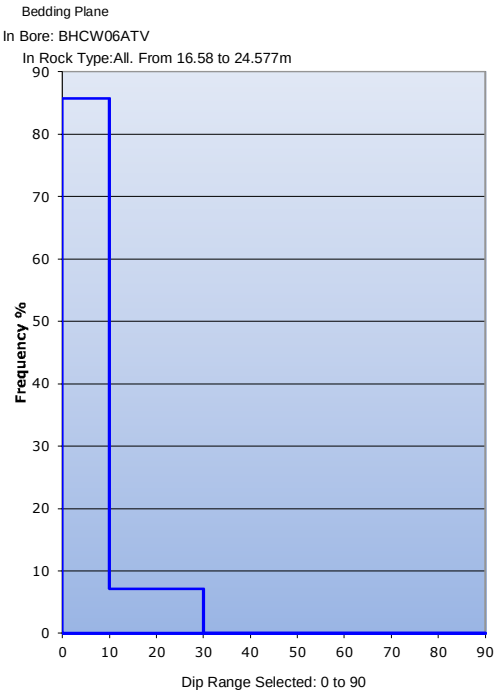


Figure 4 BHCW06ATV bedding dip direction data rose diagram

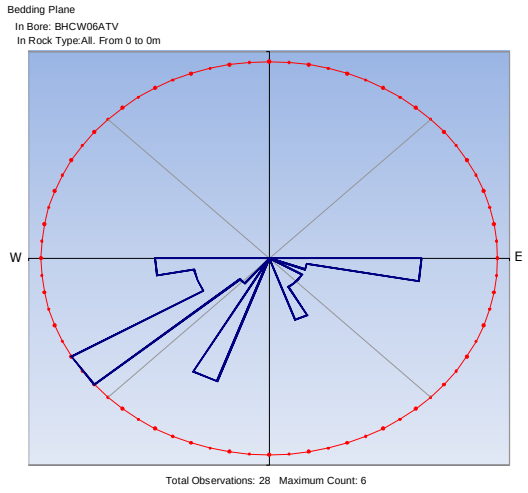


Figure 6 BHCW06ATV bedding dip directions histogram

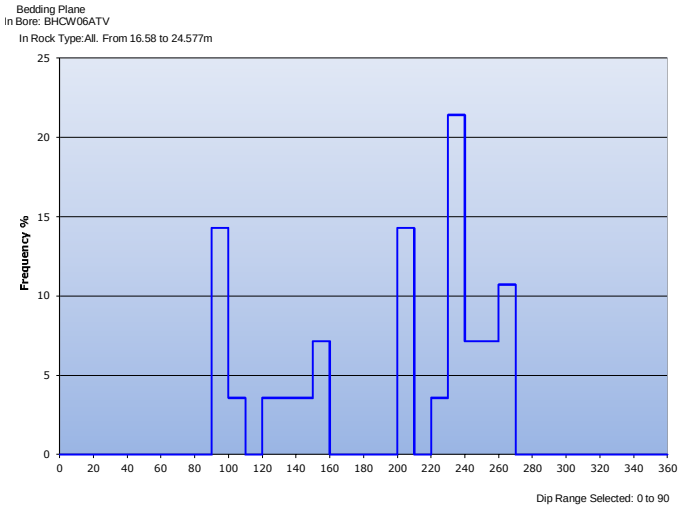


Table 3 BHCW06ATV fractures histogram data

	Dip Distribution Total: 2			Orientation Distribution Total: 2	
Dip Range	Count	%	Bearing Range	Count	%
0 to 10	0	0.0	0 to 10	0	0.0
10 to 20	0	0.0	10 to 20	1	50.0
20 to 30	1	50.0	20 to 30	0	0.0
30 to 40	1	50.0	30 to 40	0	0.0
40 to 50	0	0.0	40 to 50	0	0.0
50 to 60	0	0.0	50 to 60	0	0.0
60 to 70	0	0.0	60 to 70	1	50.0
70 to 80	0	0.0	70 to 80	0	0.0
80 to 90	0	0.0	80 to 90	0	0.0
			90 to 100	0	0.0
			100 to 110	0	0.0
			110 to 120	0	0.0
			120 to 130	0	0.0
			130 to 140	0	0.0
			140 to 150	0	0.0
			150 to 160	0	0.0
			160 to 170	0	0.0
			170 to 180	0	0.0
			180 to 190	0	0.0
			190 to 200	0	0.0
			200 to 210	0	0.0
			210 to 220	0	0.0
			220 to 230	0	0.0
			230 to 240	0	0.0
			240 to 250	0	0.0
			250 to 260	0	0.0
			260 to 270	0	0.0
			270 to 280	0	0.0
			280 to 290	0	0.0
			290 to 300	0	0.0
			300 to 310	0	0.0
			310 to 320	0	0.0
			320 to 330	0	0.0
			330 to 340	0	0.0
			340 to 350	0	0.0
			350 to 360	0	0.0

Figure 8 BHCW06ATV fractures dip angles histogram

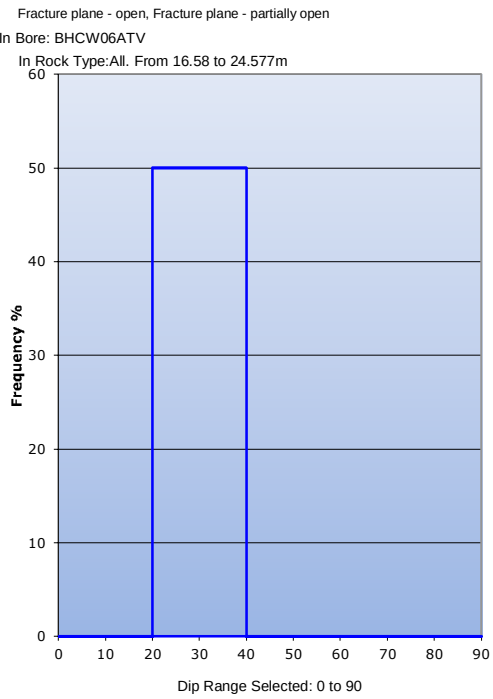


Figure 7 BHCW06ATV fractures dip direction data rose diagram

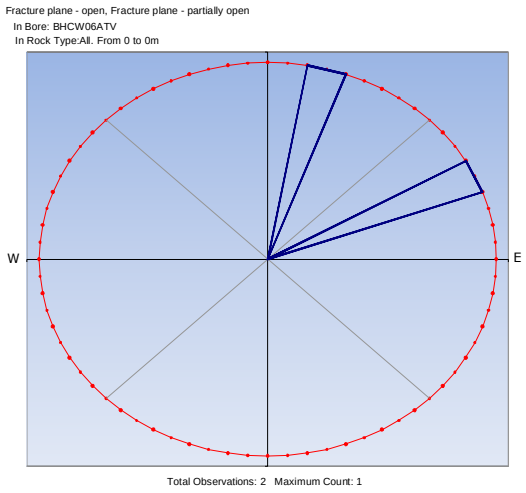
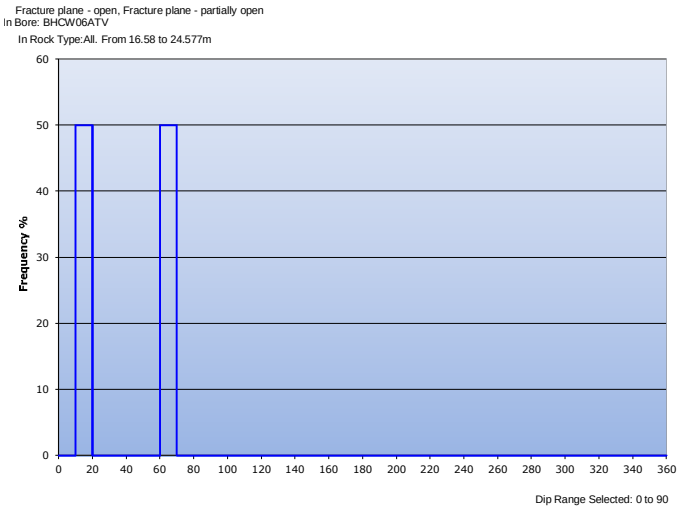


Figure 9 BHCW06ATV fractures dip directions histogram



Appendix 1

1:10 Interpretation logs

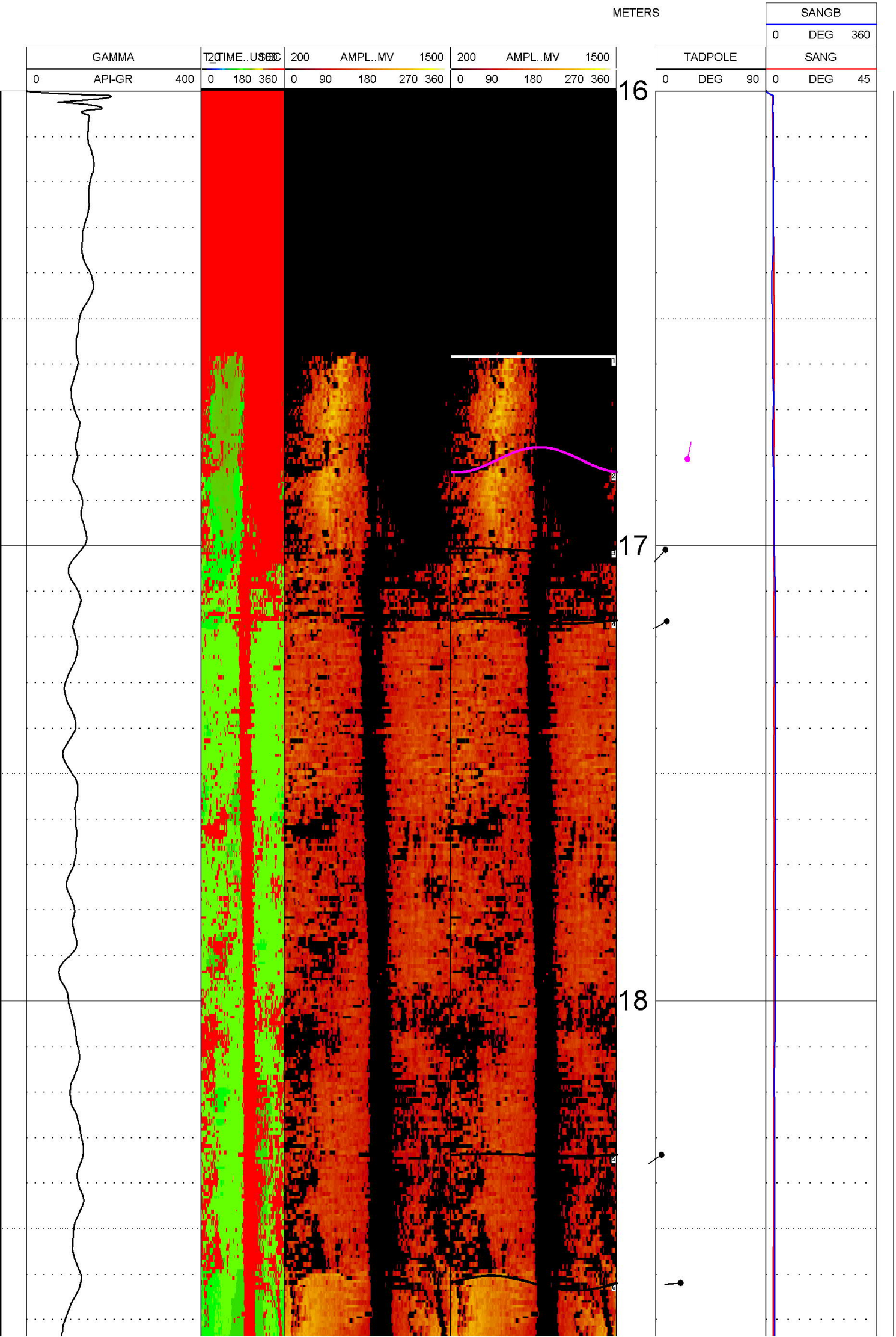
16.00 to 25.31 mbgl

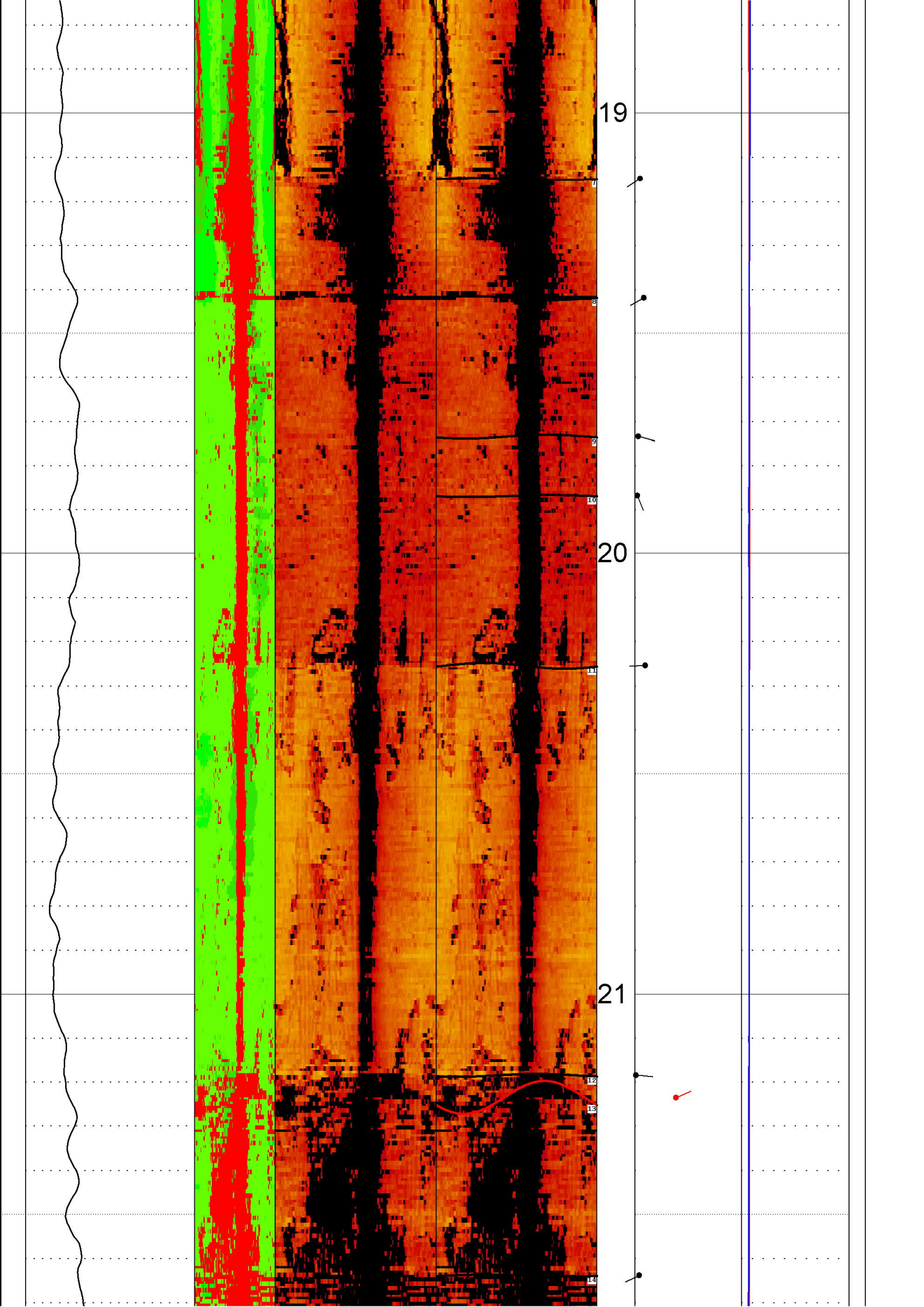
BHCW06 ATV 1:10

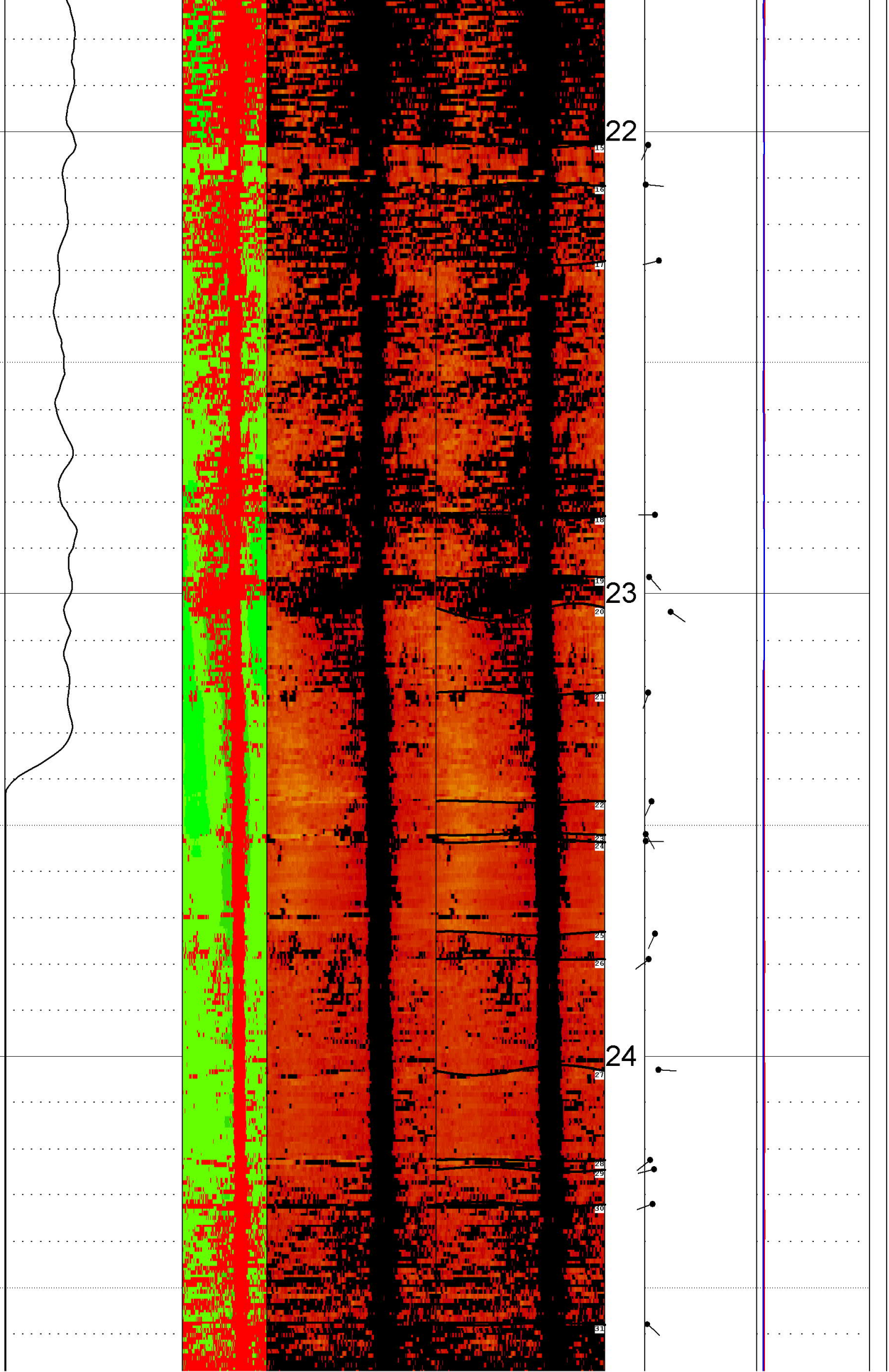
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COUNTY	:				
LOCATION	: MT PLEASANT				
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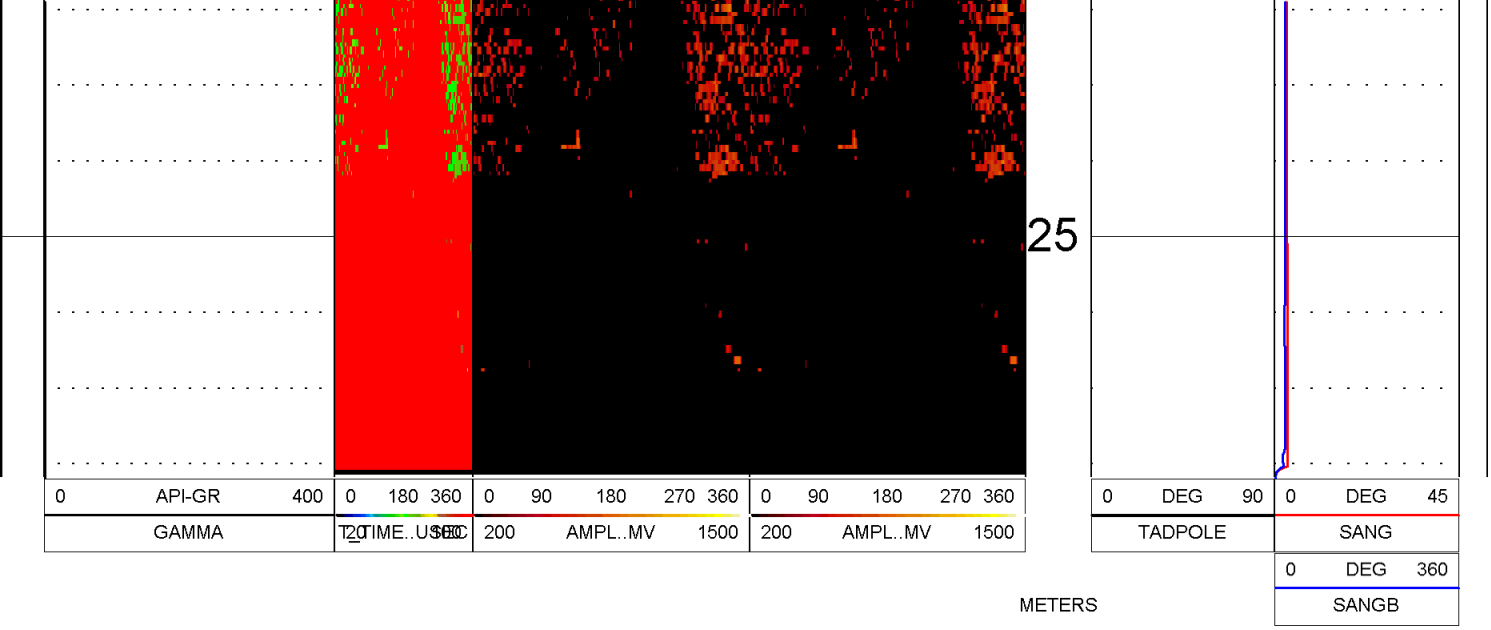
VOID 900MM 13.2M
VOID 800MM 25.5M

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0 90 180 270 360
200 AMPL..MV 1500
0 90 180 270 360
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0 DEG 90
SANG
0 DEG 45
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0 DEG 45
SANG
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METERS

Douglas Partners Pty Ltd
Mt Pleasant Rail
Infrastructure Project

Borehole BHCW06

OTV PETROPHYSICAL REPORT

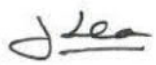
Groundsearch Australia Pty. Limited

2 July 2019

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For and on behalf of Groundsearch Australia Pty. Limited



John Lea BSc (Hons) FAusIMM
Principal Geologist
Managing Director

Summary

The data contained in this report were obtained from one, vertical, cored borehole that was drilled as a component of the 2019 geotechnical investigation programme for the Mt Pleasant Rail Infrastructure Project.

A Century Geophysical Corporation downhole optical televiewer (OTV) tool was used to collect the data in the field on 24 June 2019. The data in this report are from 7.19 to 16.91 metres below ground level.

The 11 features identified are bedding planes and the SWL.

The tool relies on contrasting colour tones of the in borehole wallrocks to produce images that are used for interpretation and presentation.

All data are referenced to magnetic north and have been automatically recalculated to represent the vertical situation for dip and dip direction.

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Appendix 1 **–** Interpretation logs 7.19 to 16.91 mbgl

1.0 Background Technical Information

The data contained in this report were obtained from one, vertical, cored borehole that was drilled as a component of the 2019 geotechnical investigation programme for the Mt Pleasant Rail Infrastructure Project.

A Century Geophysical Corporation downhole optical televiewer (OTV) tool was used to collect the data in the field on 24 June 2019. The data in this report are from 7.19 to 16.91 metres below ground level.

The 11 features identified are bedding planes and the SWL.

The tool relies on contrasting colour tones of the in borehole wallrocks to produce images that are used for interpretation and presentation.

All data are referenced to magnetic north and have been automatically recalculated to represent the vertical situation for dip and dip direction.

The OTV takes an oriented "picture" of the borehole using high-resolution sound waves. This acoustic picture is displayed in both amplitude and travel time. This information is used to detect bedding planes, fractures, and other borehole anomalies without the need to have clear fluid filling the boreholes.

The televiewer digitises 256 measurements around the borehole at each high-resolution sample interval. These data can be oriented to North and displayed real-time while logging using the Visual Compu-Log System.

Analysis software includes colour adjustment, fracture dip and strike determination, and classification of features. It allows information to be displayed on the graphical screen, plot, and in report format.

2.0 Interpretation Methodology

It should be noted that the OTV is a bowspring-type, centralised tool and is affected by poor wallrock conditions known as rugosity.

The OTV data interpretation procedure is based on the superposition of curves on feature logs directly onto the computer screen by using a subjective, manual; two-point definition of a feature's top and base to produce a sine curve. The sides of the time and amplitude plots represent magnetic north and magnetic south is in the centre of each plot. The low side, or trough, of the sine curve defines the dip direction of the feature.

The logging program automatically records the OTV tool slant angle and bearing and corrects for any borehole deviations. The curves are automatically given an identification number for subsequent referencing in a report file.

This report contains a;

- Text summary of the interpreted features
- Circular graphic representation of interpreted features
- Logs that show geological features with their subjective, numbered interpretation curves shown in colour at 1:10 scale. The logs are in standard format whereby the sonic image of the borehole wall is "flattened" onto the plot. The logs have the following additional features to enhance geological interpretations of the strata;
    - OTV image
    - Tadpoles that represent feature dip and dip direction
- Table containing feature curve ID, top, base, dip angle, dip azimuth, feature description and the generalised rock type that hosts the feature
- Graphical representation of the interpreted features

3.0 Borehole BHCW06 Interpretations

The 11 features identified are bedding planes and the SWL.

Table 1 Interpreted features report for BHCW06

FEATURE ID	DIP (DEG)	AZIMUTH (DEG)	MIDPOINT (MBGL)	TOP (M)	BASE (M)	TYPE OF FEATURE
1			8.66	8.66	8.66	Top of data
2	8	241	13.17	13.16	13.17	Bedding plane
3	4	248	14.25	14.25	14.25	Bedding plane
4	5	237	14.41	14.40	14.41	Bedding plane
5	8	267	14.45	14.45	14.45	Bedding plane
6	4	217	14.96	14.96	14.96	Bedding plane
7	3	245	15.12	15.12	15.12	Bedding plane
8	1	155	15.37	15.36	15.37	Bedding plane
9	8	6	15.57	15.56	15.57	Bedding plane
10	1	179	15.78	15.78	15.78	Bedding plane
11	6	94	15.94	15.93	15.95	Bedding plane
12			16.61	16.61	16.61	SWL

Figure 1 BHCW06 circular plan representation of interpreted features

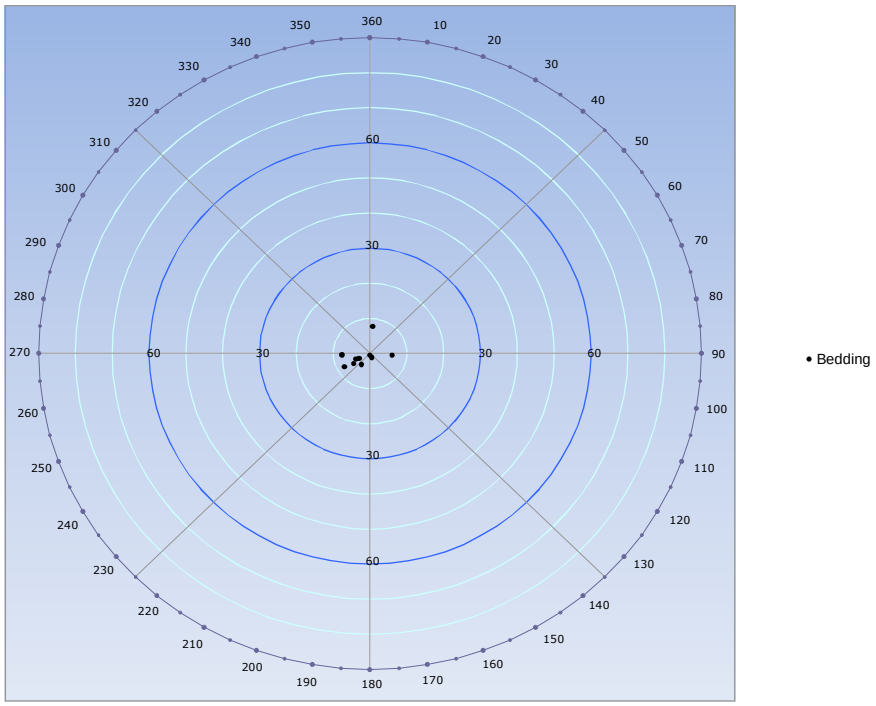


Figure 2 BHCW06 feature dip angle data distribution

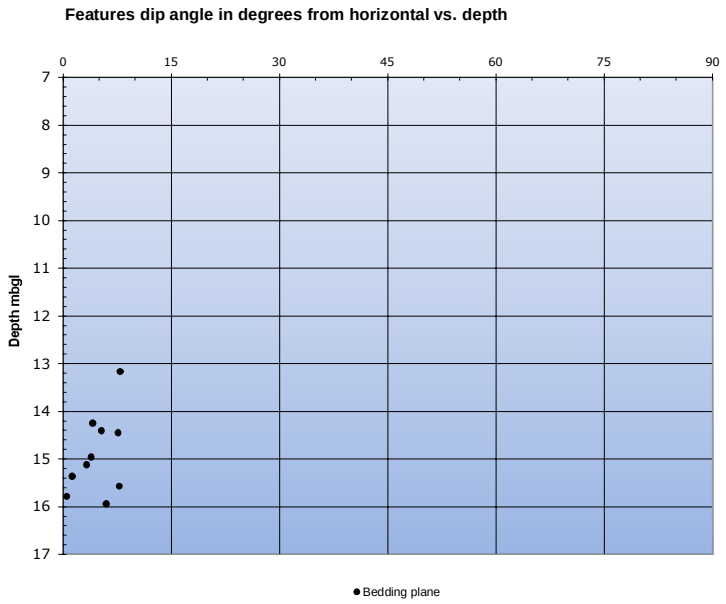


Figure 3 BHCW06 feature dip direction data distribution

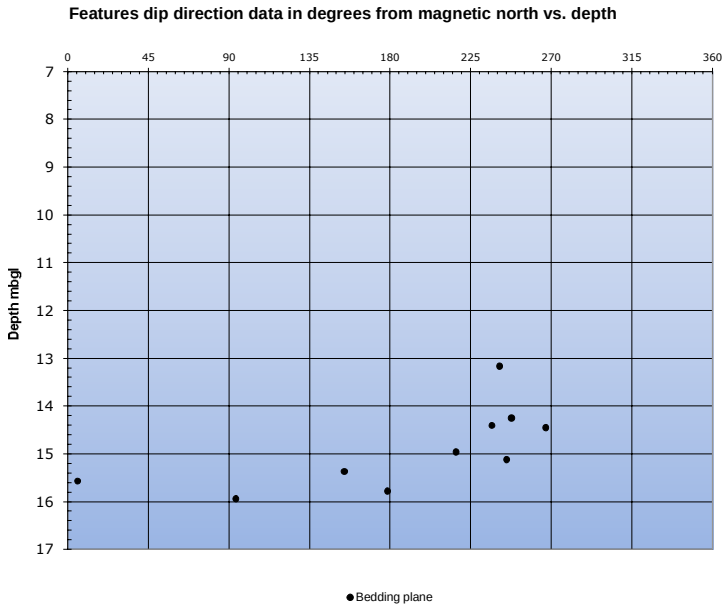


Table 2 BHCW06 bedding histogram data

Dip Distribution Total: 10			Orientation Distribution Total: 10		
Dip Range	Count	%	Bearing Range	Count	%
0 to 10	10	100.0	0 to 10	1	10.0
10 to 20	0	0.0	10 to 20	0	0.0
20 to 30	0	0.0	20 to 30	0	0.0
30 to 40	0	0.0	30 to 40	0	0.0
40 to 50	0	0.0	40 to 50	0	0.0
50 to 60	0	0.0	50 to 60	0	0.0
60 to 70	0	0.0	60 to 70	0	0.0
70 to 80	0	0.0	70 to 80	0	0.0
80 to 90	0	0.0	80 to 90	0	0.0
			90 to 100	1	10.0
			100 to 110	0	0.0
			110 to 120	0	0.0
			120 to 130	0	0.0
			130 to 140	0	0.0
			140 to 150	0	0.0
			150 to 160	1	10.0
			160 to 170	0	0.0
			170 to 180	1	10.0
			180 to 190	0	0.0
			190 to 200	0	0.0
			200 to 210	0	0.0
			210 to 220	1	10.0
			220 to 230	0	0.0
			230 to 240	1	10.0
			240 to 250	3	30.0
			250 to 260	0	0.0
			260 to 270	1	10.0
			270 to 280	0	0.0
			280 to 290	0	0.0
			290 to 300	0	0.0
			300 to 310	0	0.0
			310 to 320	0	0.0
			320 to 330	0	0.0
			330 to 340	0	0.0
			340 to 350	0	0.0
			350 to 360	0	0.0

Figure 4 BHCW06 bedding dip direction data rose diagram

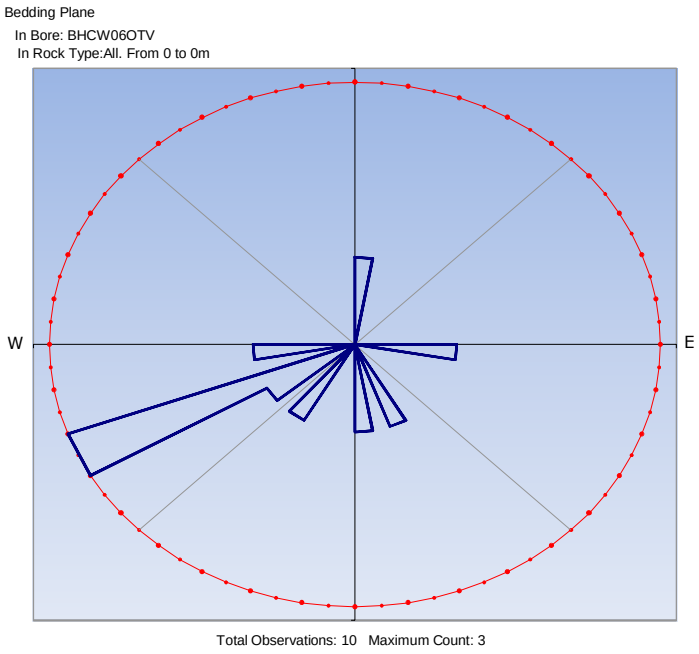


Figure 5 BHCW06 bedding dip angle histogram

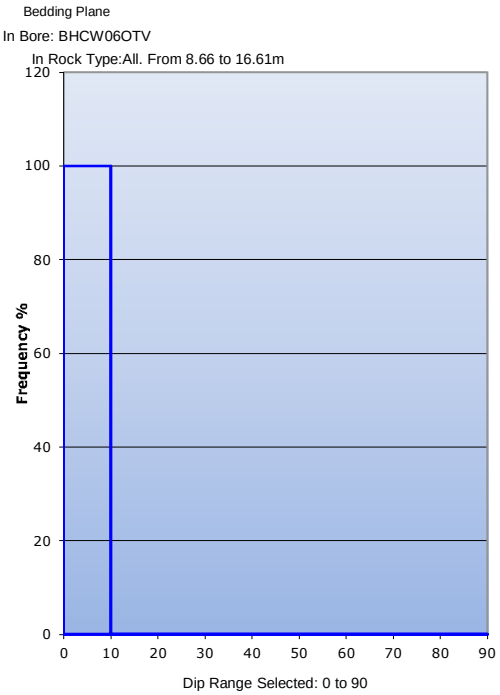
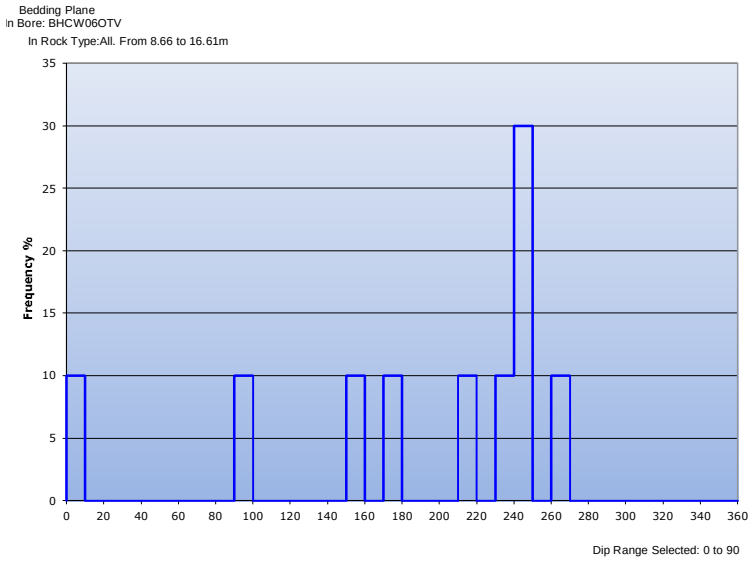


Figure 6 BHCW06 bedding dip direction histogram



Appendix 1

1:10 Interpretation Logs

7.19 to 16.91 metres



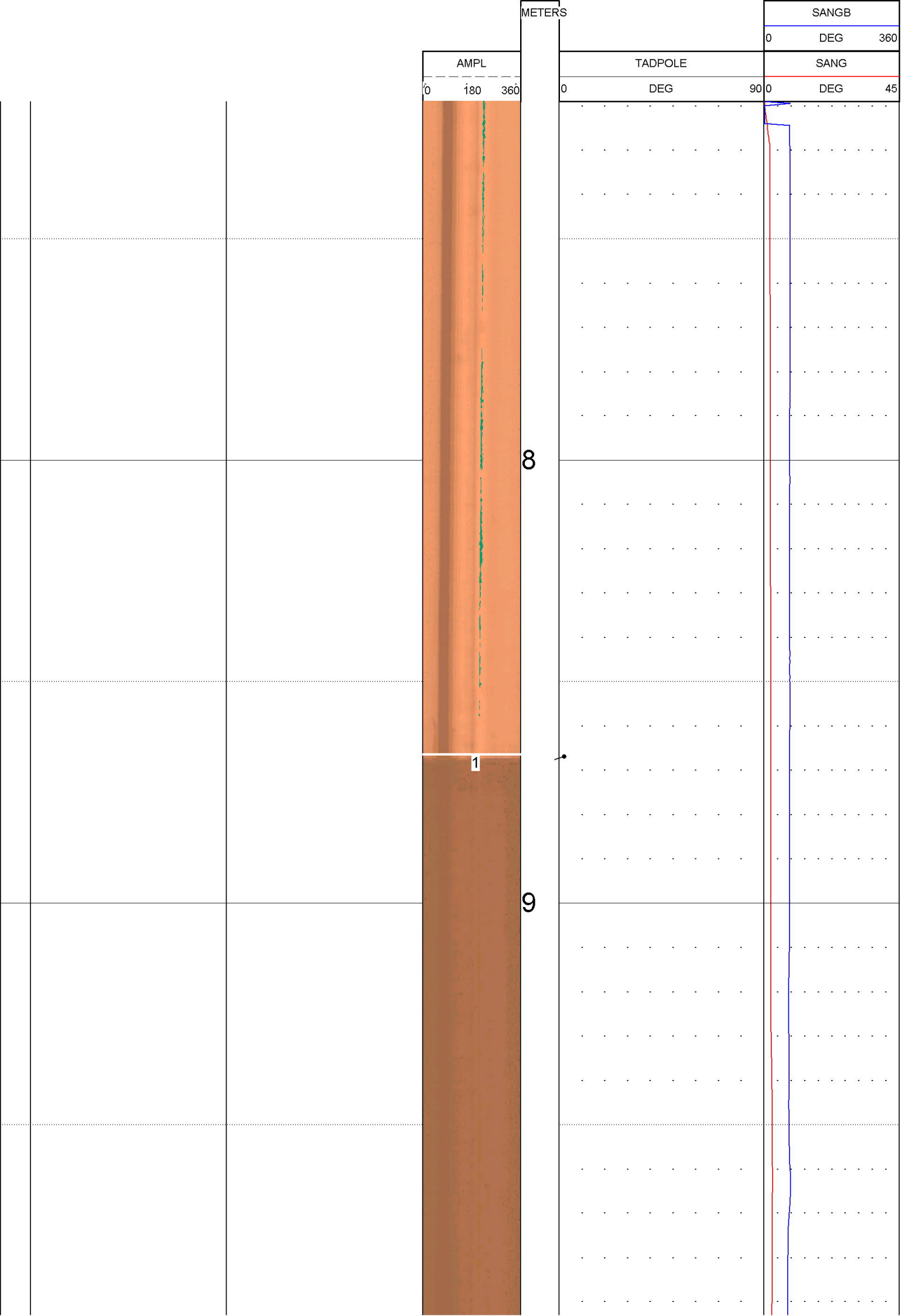
BHCW06 OTV 1:10

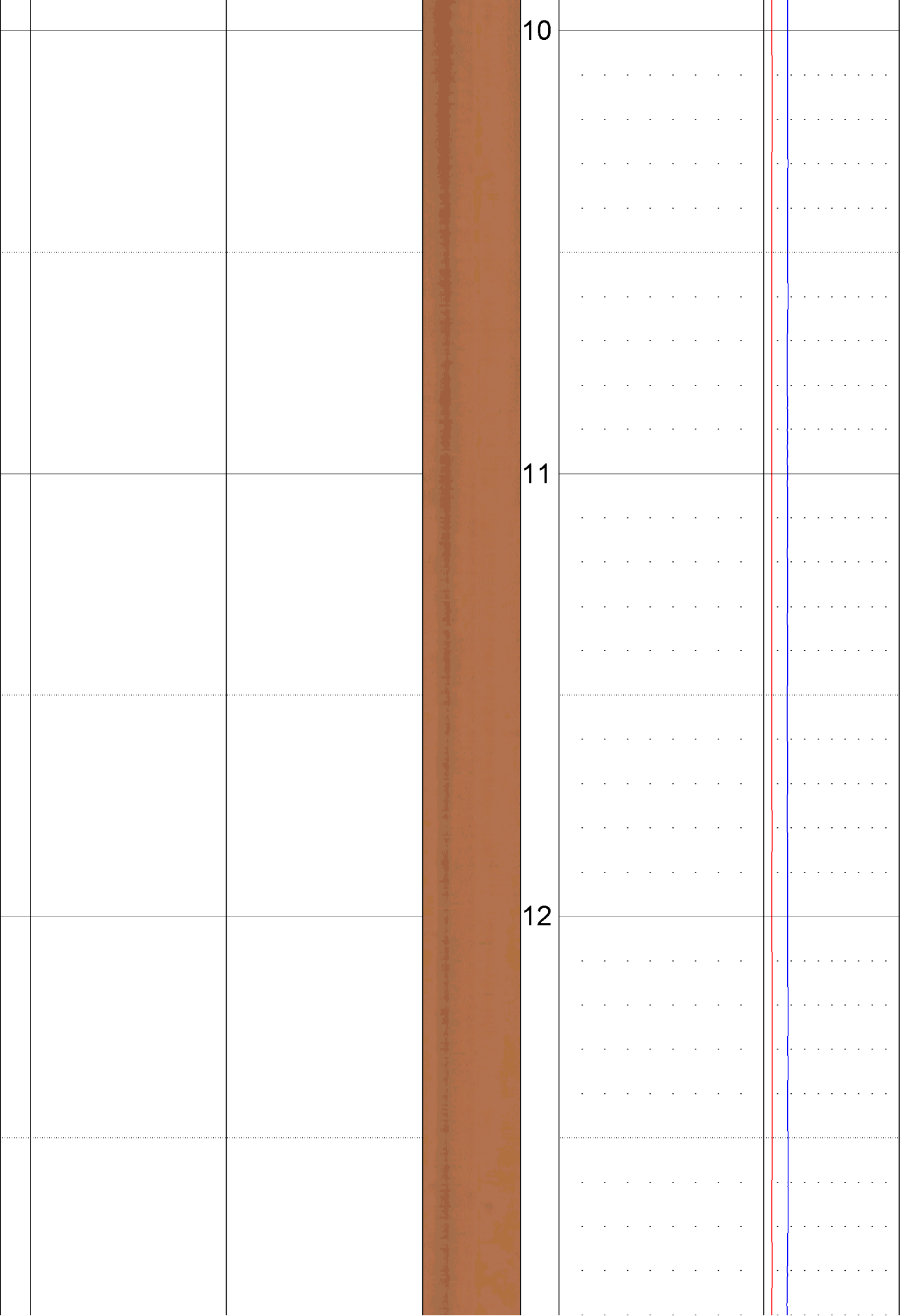
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LOCATION	: MT PLEASANT				
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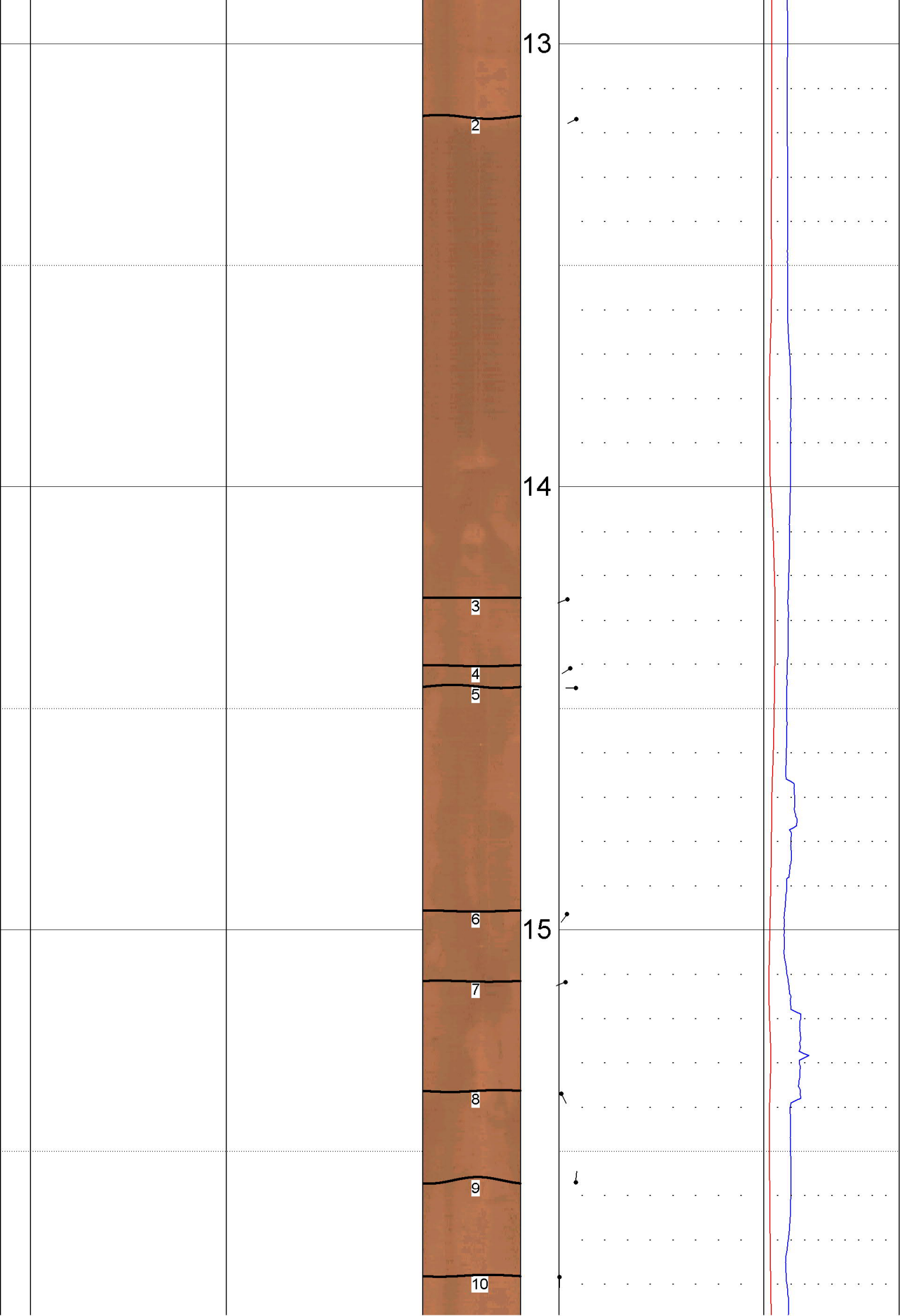
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OTV

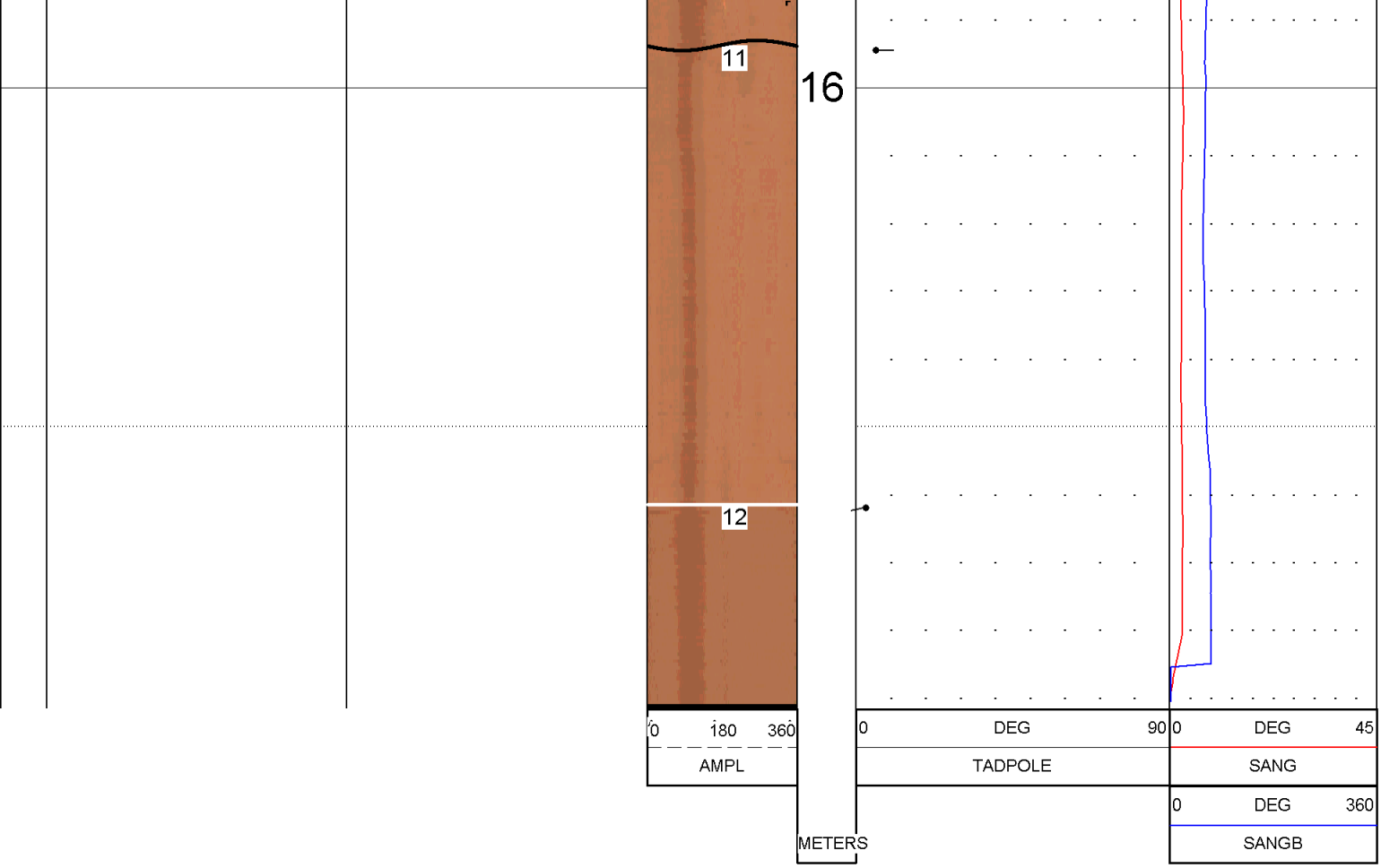
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TADPOLE
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SANG
0 DEG 45
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METERS

Douglas Partners – Mt Pleasant Rail Infrastructure Project

Borehole BHCW07

ACOUSTIC TELEVIEWER PETROPHYSICAL REPORT

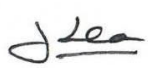
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17 June 2019

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For and on behalf of Groundsearch Australia Pty. Limited



John Lea BSc (Hons) FAusIMM
Principal Geologist
Managing Director

Executive summary

The data contained in this report were obtained from one vertical borehole that was drilled as a component of the 2018 exploration programme for Douglas Partners - Mt Pleasant Rail Infrastructure Project.

A Century Geophysical Corporation downhole 9804 acoustic televiewer (ATV) was run to collect data in the field on 12 June 2019. The data in this report are from 13.41 to 21.59 mbgl.

The 23 identified features are interpreted as bedding planes and the SWL.

The Century Display program has automatically recalculated the dip angle data to represent the borehole in the vertical position and the dip direction data are referenced to magnetic north.

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Appendix 1 1:20 Interpretation logs **–** 13.41 to 21.59 mbgl

1.0 Background technical information

The data contained in this report were obtained from one vertical borehole that was drilled as a component of the 2018 exploration programme for Douglas Partners - Mt Pleasant Rail Infrastructure Project.

Century Geophysical Corporation downhole 9804 acoustic televiewer and 9329 density tools were run to collect data in the field on 3 September 2018. The data in this report are from 311.00 to 335.64 mbgl.

The 221 identified features are interpreted as bedding planes, fractures and nine borehole breakout zones. The bedding to fracture ratio is 17:1. There are some high angle fractures in the coal units that appear to be cleats.

The average Sigma 1 orientation is $45^0/225^0$ with a standard deviation of 7.

The Century Display program has automatically recalculated the dip angle data to represent the borehole in the vertical position and the dip direction data is referenced to magnetic north.

The ATV takes an oriented image of the borehole using high-resolution sound waves. This acoustic image is displays amplitude variations. This information is used to detect bedding planes, fractures, and other borehole anomalies without the need to have clear fluid filling the boreholes. The tool works only in fluid-filled boreholes.

The televiewer digitises 256 measurements around the borehole at each high-resolution sample interval. These data can be oriented to North and displayed real-time while logging using the Visual Compu-Log System.

Analysis software includes colour adjustment, fracture dip and strike determination, and classification of features. It allows information to be displayed on the graphical screen, plot, and in report format.

2.0 Interpretation methodology

It should be noted that the ATV is a bowspring-type, centralised tool and is affected by poor wallrock conditions known as rugosity.

The ATV data interpretation procedure is based on the superposition of curves on feature logs directly onto the computer screen by using a subjective, manual; two-point definition of a feature's top and base to produce a sine curve. The sides of the time and amplitude plots represent magnetic north and magnetic south is in the centre of each plot. The low side, or trough, of the sine curve defines the dip direction of the feature.

The logging program automatically records the televiewer tool slant angle and bearing and corrects for any borehole deviations. The curves are automatically given an identification number for subsequent referencing in a report file.

There are possibly more bedding planes and structural fractures appearing in the televiewer logs that have not been included in this report due to their poor graphic definition or the inability to resolve their geometry by superposing a sine curve using the program's two point method.

This report contains a;

- Text summary of the interpreted features
- Circular representation of interpreted features
- Logs that show geological features with their subjective, numbered interpretation curves shown at 1:20 scale. The logs are in standard format whereby the sonic image of the borehole wall is "flattened" onto the plot. The logs have the following additional features to enhance geological interpretations of the strata;
    - Amplitude image differentials – one without interpretation curves
    - Colour-coded tadpoles that represent feature dip and dip direction
    - Natural gamma
    - Slant (dip angle) and slant angle bearing
- Travel time log where **RED** zones are indicative of lower strength wallrock
- Table containing feature curve ID, top, base, dip angle, dip azimuth, feature description and the generalised rock type that hosts the feature
- Graphical representation of the interpreted fracture features

3.0 BHCW07 interpretations

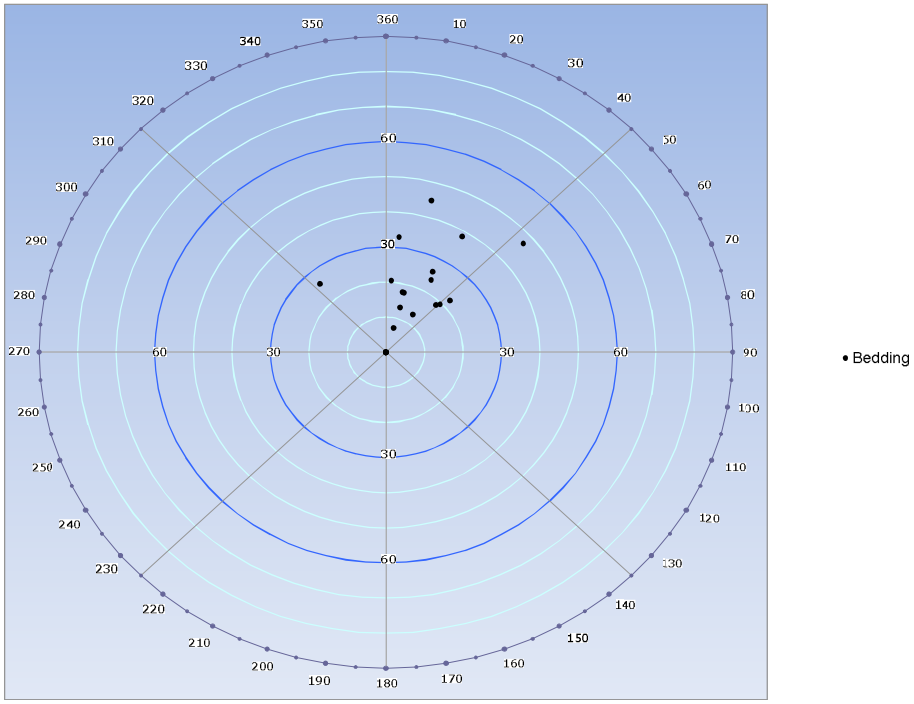
The 23 identified features are interpreted as bedding planes and the SWL.

A description of each interpreted feature is presented in Table 1 and the log is presented in Appendix 1.

Table 1 Interpreted features report for BHCW07

FEATURE ID	DIP (DEG)	AZIMUTH (DEG)	MIDPOINT (MBGL)	TOP (M)	BASE (M)	TYPE OF FEATURE
1	2	247	16.76	16.76	16.76	SWL
2	18	82	19.09	19.08	19.11	Bedding plane
3	14	77	19.13	19.11	19.14	Bedding plane
4	23	92	19.28	19.26	19.31	Bedding plane
5	32	48	19.35	19.32	19.38	Bedding plane
6	8	33	19.48	19.47	19.48	Bedding plane
7	14	53	19.50	19.49	19.52	Bedding plane
8	13	33	19.75	19.73	19.76	Bedding plane
9	13	16	20.23	20.21	20.24	Bedding plane
10	7	16	20.29	20.29	20.30	Bedding plane
11	45	15	20.79	20.74	20.84	Bedding plane
12	38	31	20.83	20.79	20.87	Bedding plane
13	26	319	20.94	20.92	20.97	Bedding plane
14	33	6	20.97	20.94	21.00	Bedding plane
15	47	49	21.03	20.97	21.08	Bedding plane
16	19	44	21.20	21.18	21.22	Bedding plane
17	20	46	21.23	21.21	21.25	Bedding plane
18	26	28	21.30	21.28	21.33	Bedding plane
19	22	49	21.34	21.32	21.36	Bedding plane
20	24	30	21.39	21.37	21.41	Bedding plane
21	18	16	21.42	21.40	21.43	Bedding plane
22	20	4	21.49	21.47	21.51	Bedding plane
23	18	14	21.50	21.48	21.51	Bedding plane

Figure 1 BHCW07 circular plan representation of interpreted features



The 22 sedimentary features identified are predominantly bedding planes that appear to range in dip from flat-lying to 47^0. The Figures 2 and 3 shows the distribution of the planes' dips angles and dip direction with depth.

Table 2 details the variation in the dip angle and dip direction data. Figure 4 shows the dip direction data in a rose diagram with the bedding planes' dip angle and dip direction data shown as histograms in Figures 5 and 6.

Figure 2 BHCW07 feature dip angle data distribution

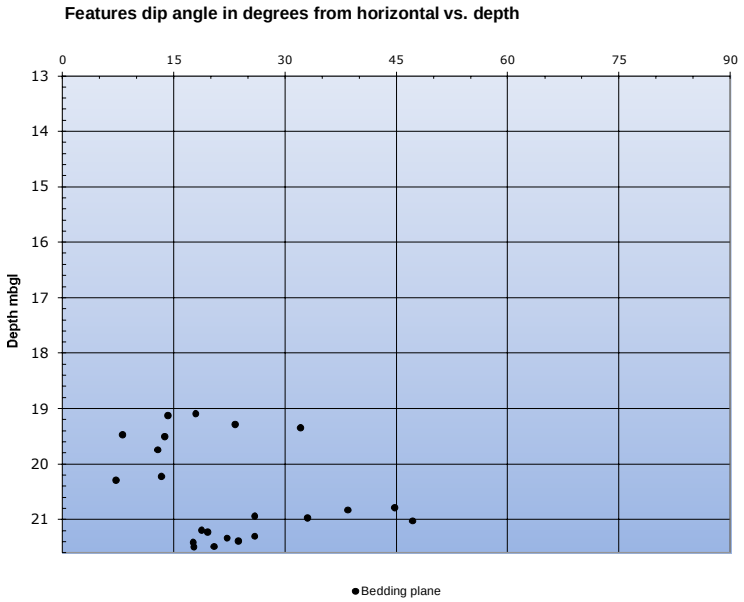


Figure 3 BHCW07 feature dip direction data distribution

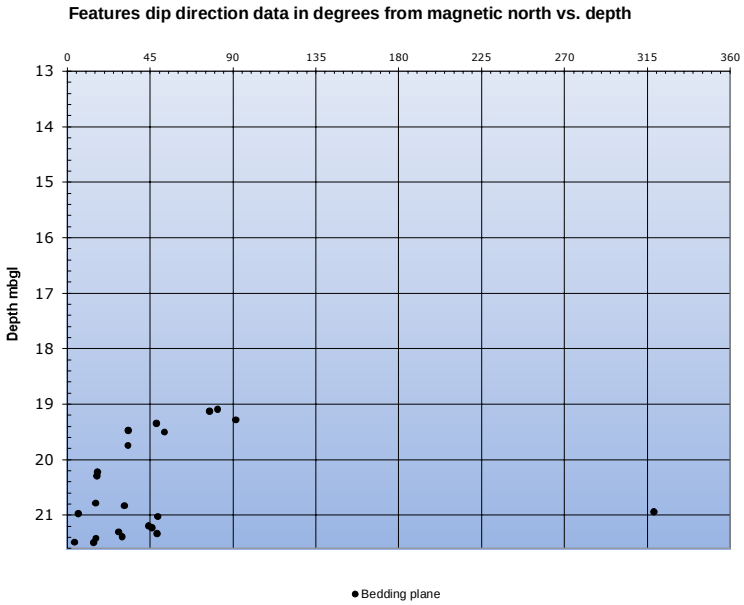


Table 2 BHCW07 bedding histogram data

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10 to 20	9	40.9	10 to 20	5	22.7
20 to 30	6	27.3	20 to 30	2	9.1
30 to 40	3	13.6	30 to 40	3	13.6
40 to 50	2	9.1	40 to 50	5	22.7
50 to 60	0	0.0	50 to 60	1	4.5
60 to 70	0	0.0	60 to 70	0	0.0
70 to 80	0	0.0	70 to 80	1	4.5
80 to 90	0	0.0	80 to 90	1	4.5
			90 to 100	1	4.5
			100 to 110	0	0.0
			110 to 120	0	0.0
			120 to 130	0	0.0
			130 to 140	0	0.0
			140 to 150	0	0.0
			150 to 160	0	0.0
			160 to 170	0	0.0
			170 to 180	0	0.0
			180 to 190	0	0.0
			190 to 200	0	0.0
			200 to 210	0	0.0
			210 to 220	0	0.0
			220 to 230	0	0.0
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			250 to 260	0	0.0
			260 to 270	0	0.0
			270 to 280	0	0.0
			280 to 290	0	0.0
			290 to 300	0	0.0
			300 to 310	0	0.0
			310 to 320	1	4.5
			320 to 330	0	0.0
			330 to 340	0	0.0
			340 to 350	0	0.0
			350 to 360	0	0.0

Figure 4 BHCW07 bedding dip direction data rose diagram

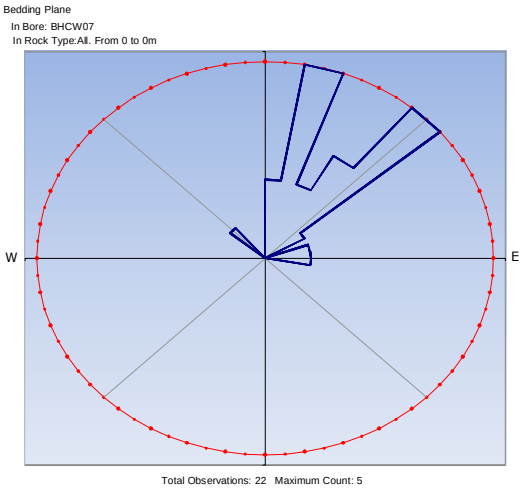


Figure 5 BHCW07 bedding dip angle histogram

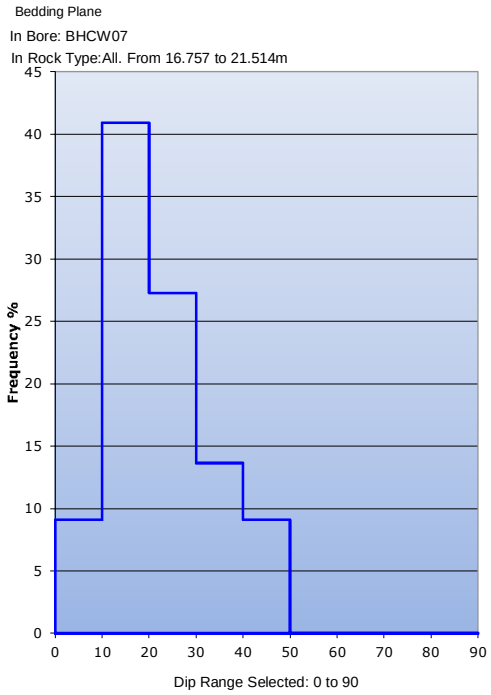
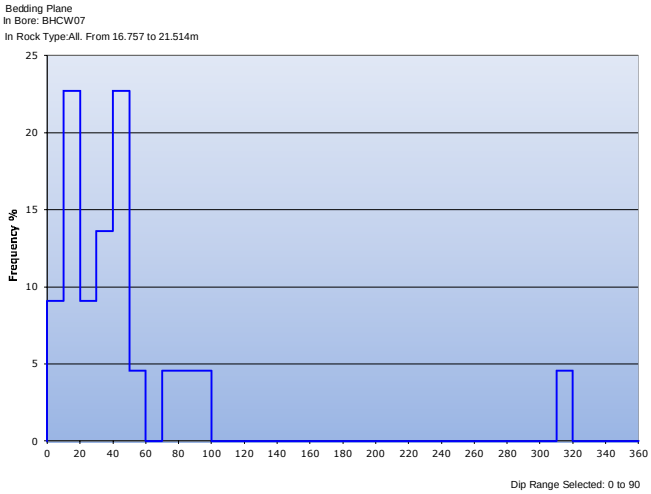


Figure 6 BHCW07 bedding dip direction histogram



Appendix 1
1:20 Interpretation logs
13.41 to 21.59 mbgl

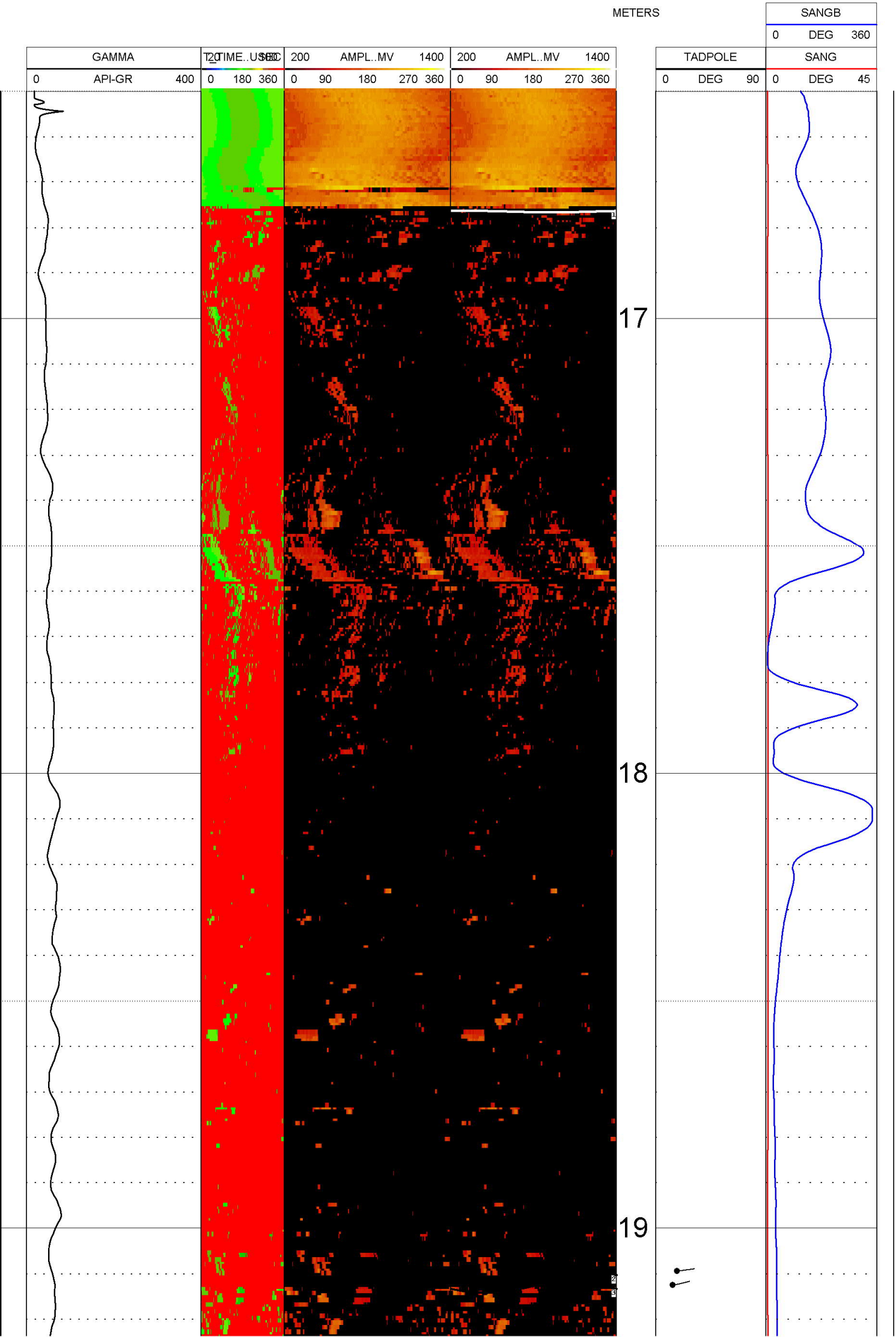


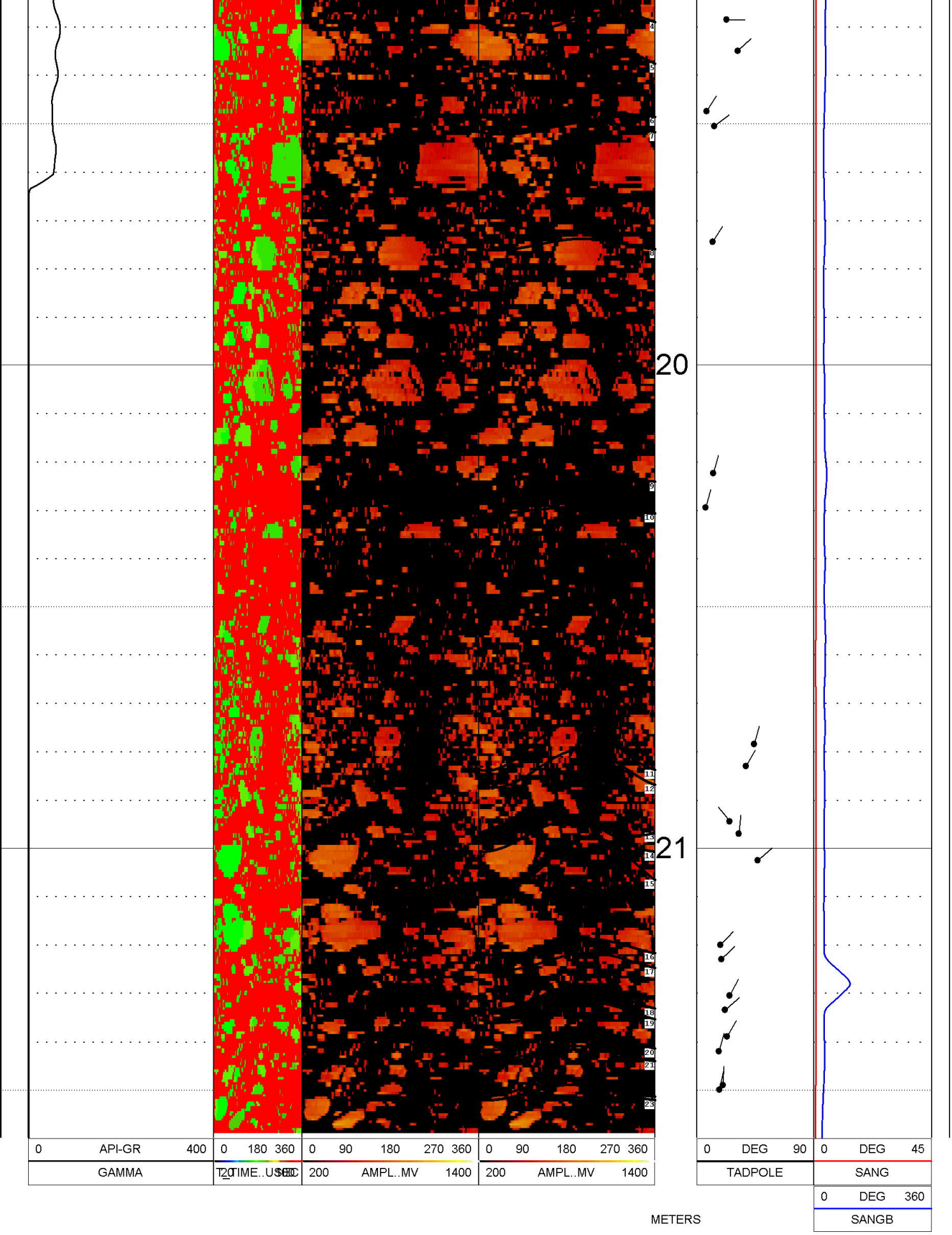
BHCW07 ATV 1:10

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COUNTY	: AUST			V			
LOCATION	: MT PLEASANT						
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NEUTRON MATRIX	: SANDSTONE	MATRIX DELTA T	: 177			LGTIME	: (09:33
						THRESH:	99999

HWT 16.7M ATV
PWT 10.3M OTV

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS


METERS
SANGB
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GAMMA
0 API-GR 400
T2 TIME..USEC
0 180 360
200 AMPL..MV 1400
0 90 180 270 360
200 AMPL..MV 1400
0 90 180 270 360
TADPOLE
0 DEG 90
SANG
0 DEG 45
17
18
19


20
21
0 API-GR 400
GAMMA
0 180 360
T2 TIME..USEC
0 90 180 270 360
200 AMPL..MV 1400
0 90 180 270 360
200 AMPL..MV 1400
0 DEG 90
TADPOLE
0 DEG 45
SANG
0 DEG 360
SANGB
METERS

Douglas Partners Pty Ltd
Mt Pleasant Rail
Infrastructure Project

Borehole BHCW07

OTV PETROPHYSICAL REPORT

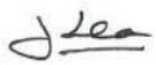
Groundsearch Australia Pty. Limited

17 June 2019

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For and on behalf of Groundsearch Australia Pty. Limited



John Lea BSc (Hons) FAusIMM
Principal Geologist
Managing Director

Summary

The data contained in this report were obtained from one, vertical, cored borehole that was drilled as a component of the 2019 geotechnical investigation programme for the Mt Pleasant Rail Infrastructure Project.

A Century Geophysical Corporation downhole optical televiewer (OTV) tool was used to collect the data in the field on 12 June 2019. The data in this report are from 7.68 to 16.56 metres below ground level.

The 13 features identified are bedding planes and the SWL.

The tool relies on contrasting colour tones of the in borehole wallrocks to produce images that are used for interpretation and presentation.

All data are referenced to magnetic north and have been automatically recalculated to represent the vertical situation for dip and dip direction.

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Appendix 1 **–** Interpretation logs 7.68 to 16.56 mbgl

1.0 Background Technical Information

The data contained in this report were obtained from one, vertical, cored borehole that was drilled as a component of the 2019 geotechnical investigation programme for the Mt Pleasant Rail Infrastructure Project.

A Century Geophysical Corporation downhole optical televiewer (OTV) tool was used to collect the data in the field on 12 June 2019. The data in this report are from 7.68 to 16.56 metres below ground level.

The 13 features identified are bedding planes and the SWL.

The tool relies on contrasting colour tones of the in borehole wallrocks to produce images that are used for interpretation and presentation.

All data are referenced to magnetic north and have been automatically recalculated to represent the vertical situation for dip and dip direction.

The OTV takes an oriented "picture" of the borehole using high-resolution sound waves. This acoustic picture is displayed in both amplitude and travel time. This information is used to detect bedding planes, fractures, and other borehole anomalies without the need to have clear fluid filling the boreholes.

The televiewer digitises 256 measurements around the borehole at each high-resolution sample interval. These data can be oriented to North and displayed real-time while logging using the Visual Compu-Log System.

Analysis software includes colour adjustment, fracture dip and strike determination, and classification of features. It allows information to be displayed on the graphical screen, plot, and in report format.

2.0 Interpretation Methodology

It should be noted that the OTV is a bowspring-type, centralised tool and is affected by poor wallrock conditions known as rugosity.

The OTV data interpretation procedure is based on the superposition of curves on feature logs directly onto the computer screen by using a subjective, manual; two-point definition of a feature's top and base to produce a sine curve. The sides of the time and amplitude plots represent magnetic north and magnetic south is in the centre of each plot. The low side, or trough, of the sine curve defines the dip direction of the feature.

The logging program automatically records the OTV tool slant angle and bearing and corrects for any borehole deviations. The curves are automatically given an identification number for subsequent referencing in a report file.

This report contains a;

- Text summary of the interpreted features
- Circular graphic representation of interpreted features
- Logs that show geological features with their subjective, numbered interpretation curves shown in colour at 1:10 scale. The logs are in standard format whereby the sonic image of the borehole wall is "flattened" onto the plot. The logs have the following additional features to enhance geological interpretations of the strata;
    - OTV image
    - Tadpoles that represent feature dip and dip direction
- Table containing feature curve ID, top, base, dip angle, dip azimuth, feature description and the generalised rock type that hosts the feature
- Graphical representation of the interpreted features

3.0 Borehole BHCW07 Interpretations

The 13 features identified are bedding planes and the SWL.

Table 1 Interpreted features report for BHCW07

FEATURE ID	DIP (DEG)	AZIMUTH (DEG)	MIDPOINT (MBGL)	TOP (M)	BASE (M)	TYPE OF FEATURE
1	4	110	12.12	12.11	12.12	Bedding plane
2	4	90	12.16	12.15	12.17	Bedding plane
3	9	104	12.85	12.83	12.86	Bedding plane
4	3	9	13.11	13.10	13.12	Bedding plane
5	30	48	13.41	13.37	13.45	Bedding plane
6	27	51	13.43	13.39	13.47	Bedding plane
7	26	53	13.46	13.42	13.49	Bedding plane
8	24	49	13.48	13.44	13.51	Bedding plane
9	26	35	13.50	13.46	13.53	Bedding plane
10	21	40	13.52	13.48	13.55	Bedding plane
11	13	21	13.83	13.81	13.85	Bedding plane
12	12	21	13.86	13.84	13.88	Bedding plane
13	2	251	14.28	14.27	14.28	SWL

Figure 1 BHCW07 circular plan representation of interpreted features

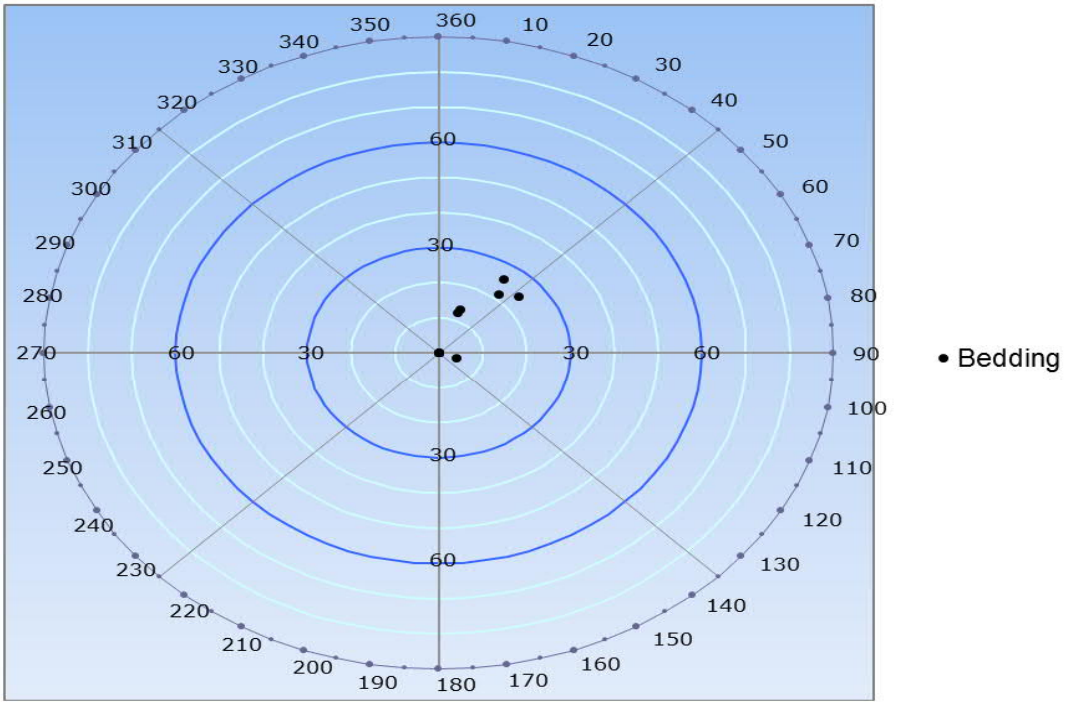


Figure 2 BHCW07 feature dip angle data distribution

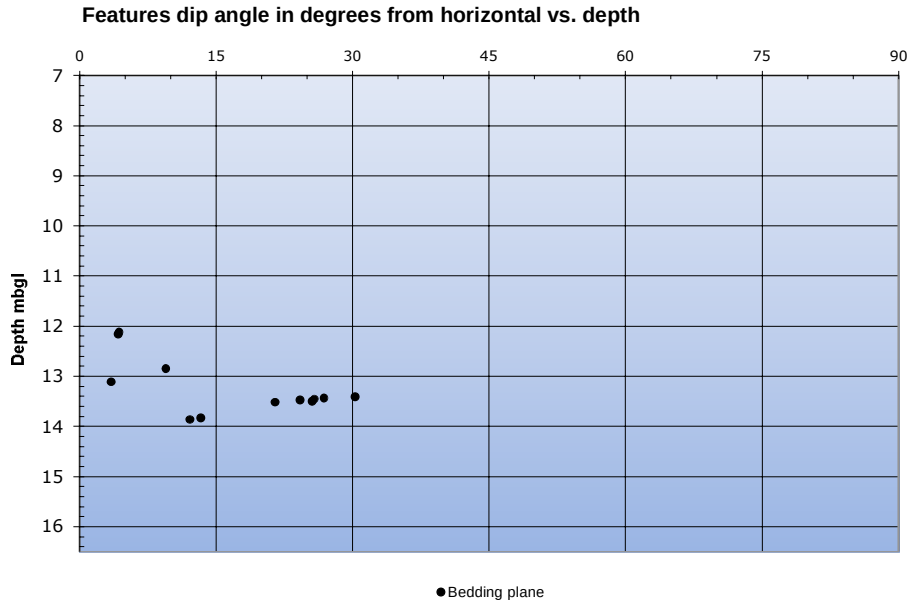


Figure 3 BHCW07 feature dip direction data distribution

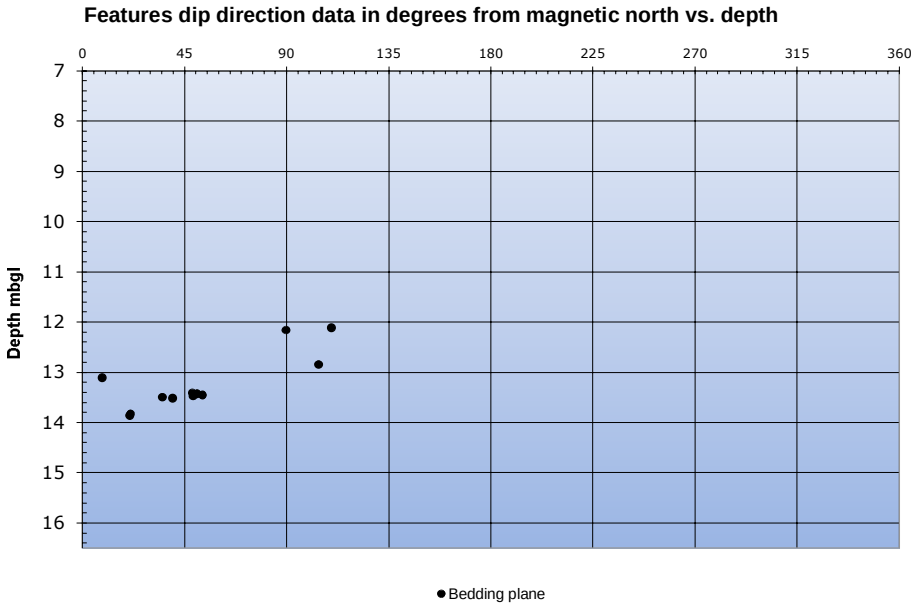


Table 2 BHCW07 bedding histogram data

Dip Distribution Total: 12			Orientation Distribution Total: 12		
Dip Range	Count	%	Bearing Range	Count	%
0 to 10	4	33.3	0 to 10	1	8.3
10 to 20	2	16.7	10 to 20	0	0.0
20 to 30	5	41.7	20 to 30	2	16.7
30 to 40	1	8.3	30 to 40	2	16.7
40 to 50	0	0.0	40 to 50	2	16.7
50 to 60	0	0.0	50 to 60	2	16.7
60 to 70	0	0.0	60 to 70	0	0.0
70 to 80	0	0.0	70 to 80	0	0.0
80 to 90	0	0.0	80 to 90	1	8.3
			90 to 100	0	0.0
			100 to 110	2	16.7
			110 to 120	0	0.0
			120 to 130	0	0.0
			130 to 140	0	0.0
			140 to 150	0	0.0
			150 to 160	0	0.0
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			180 to 190	0	0.0
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			200 to 210	0	0.0
			210 to 220	0	0.0
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			270 to 280	0	0.0
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			290 to 300	0	0.0
			300 to 310	0	0.0
			310 to 320	0	0.0
			320 to 330	0	0.0
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			340 to 350	0	0.0
			350 to 360	0	0.0

Figure 4 AP1801DP bedding dip direction data rose diagram

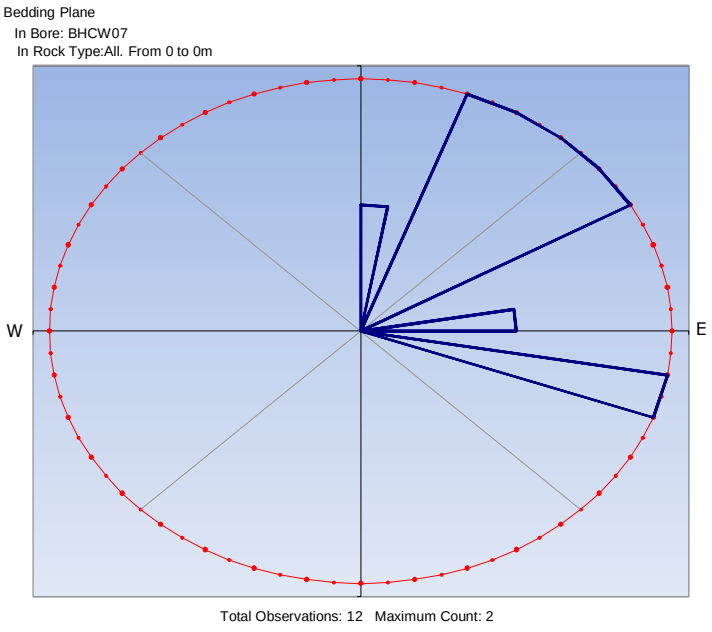


Figure 5 AP1801DP bedding dip angle histogram

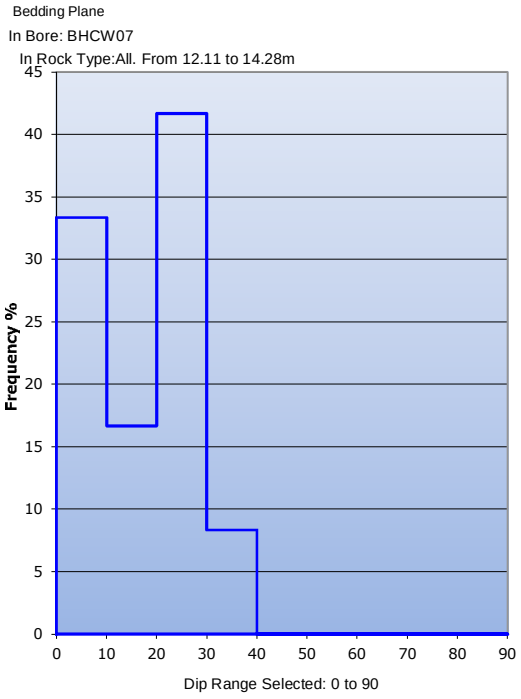
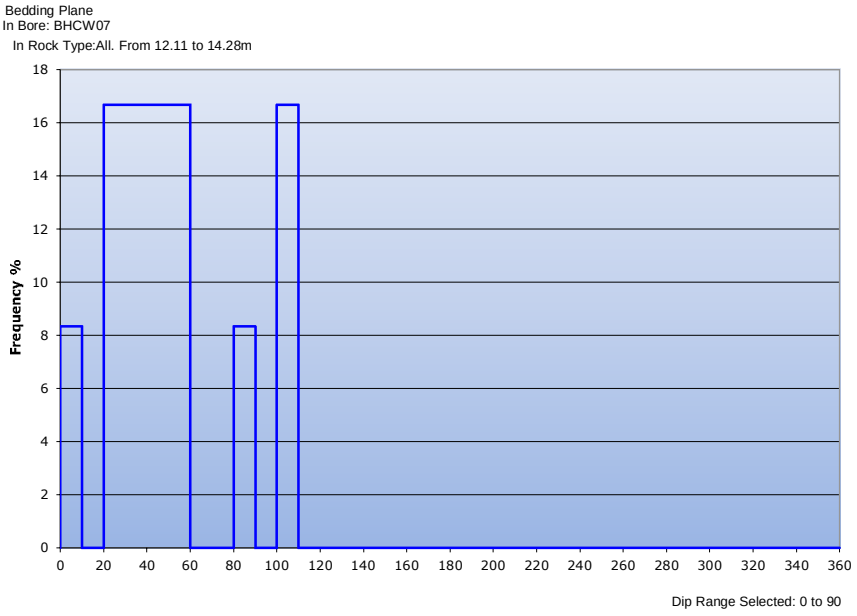


Figure 6 AP1801DP bedding dip direction histogram



Appendix 1

1:10 Interpretation Logs

7.68 to 16.56 metres



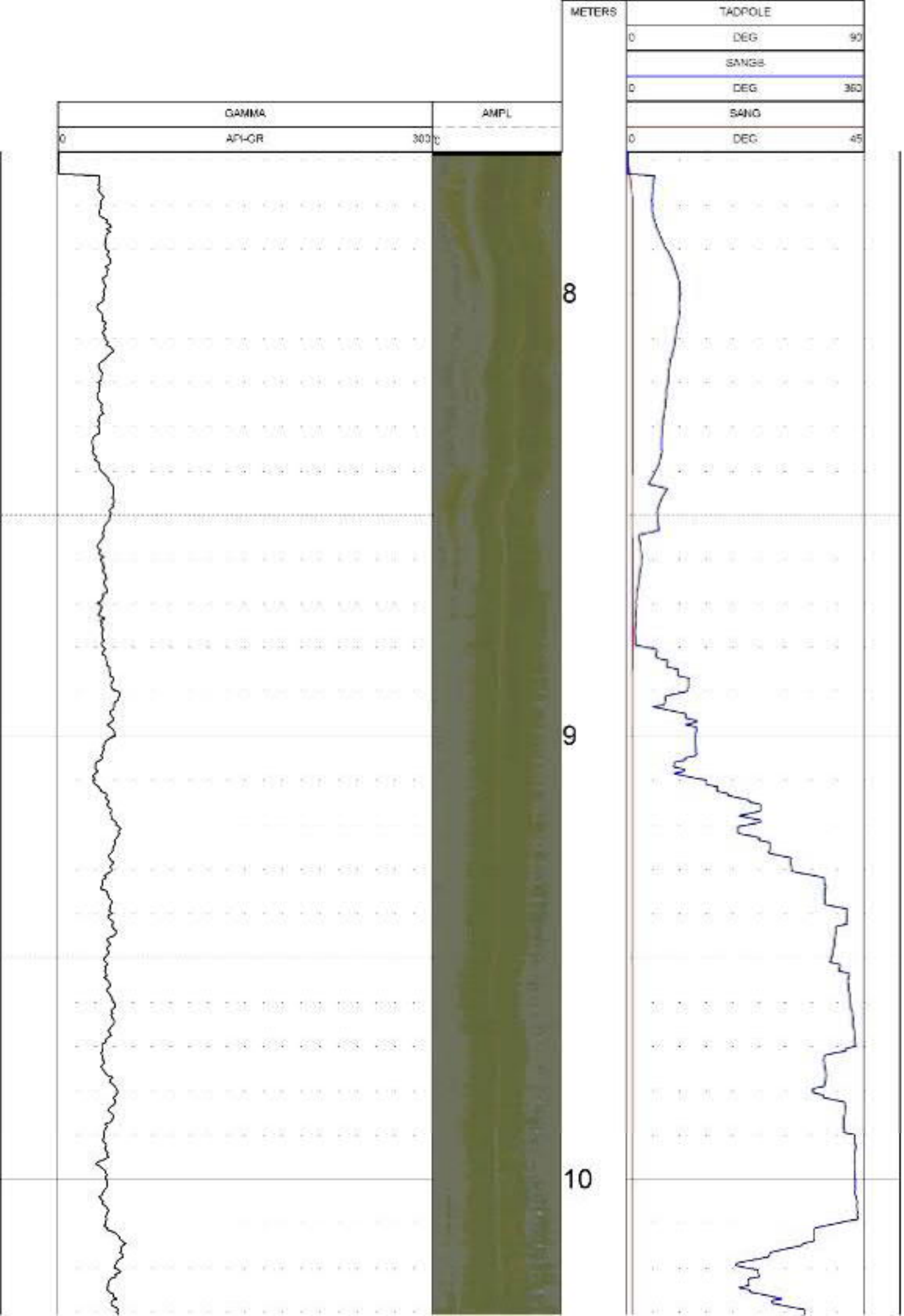
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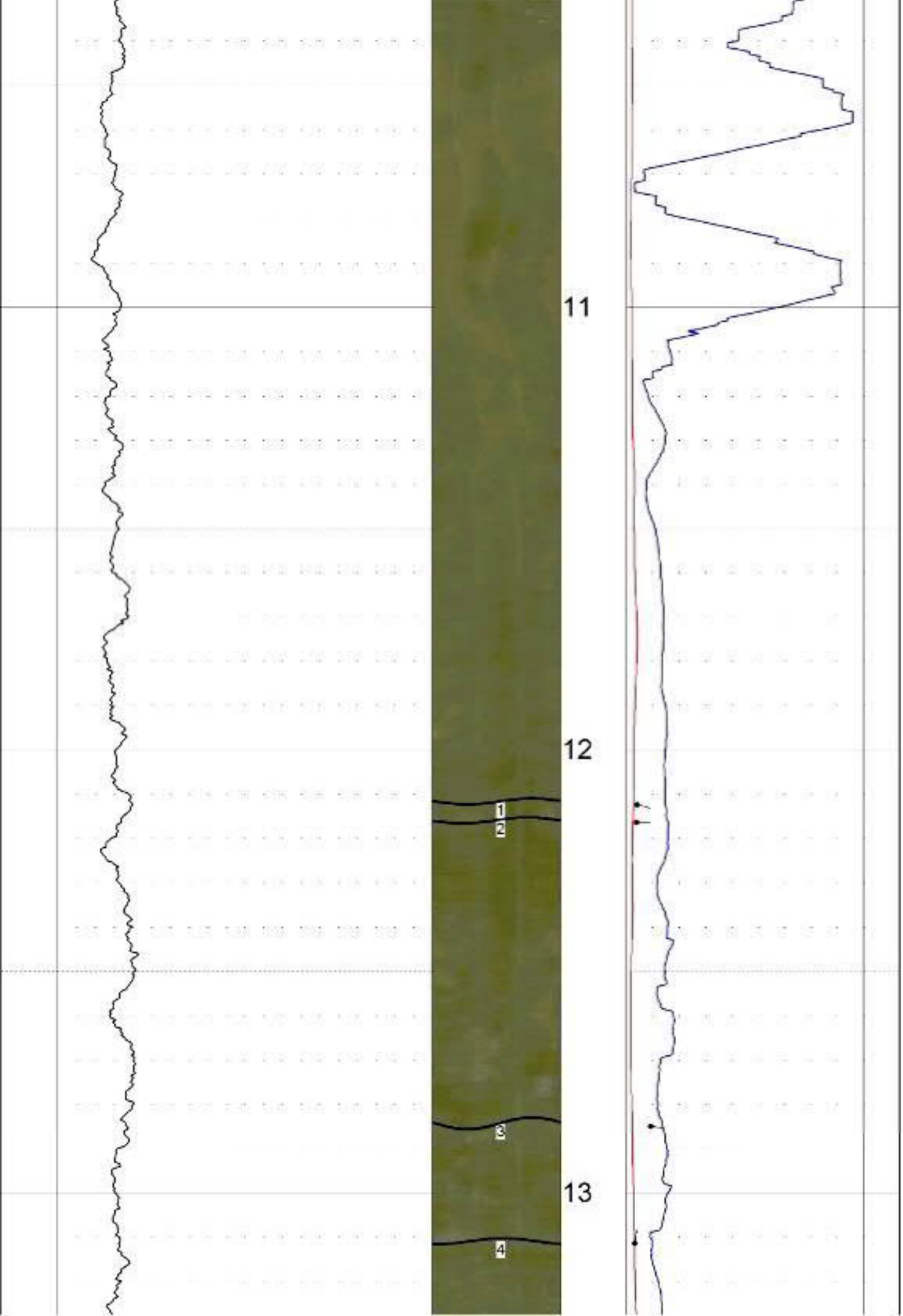
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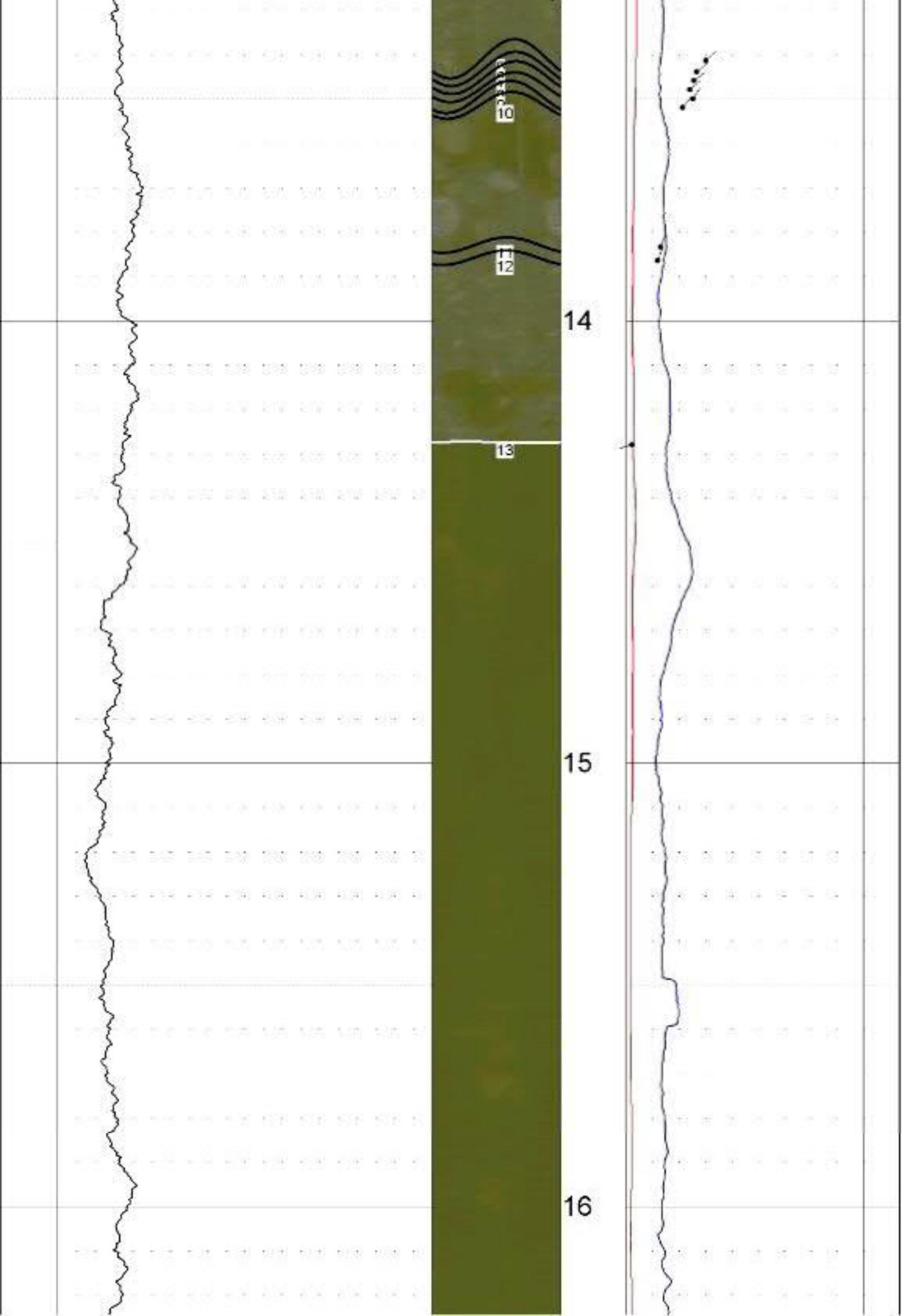
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OTV

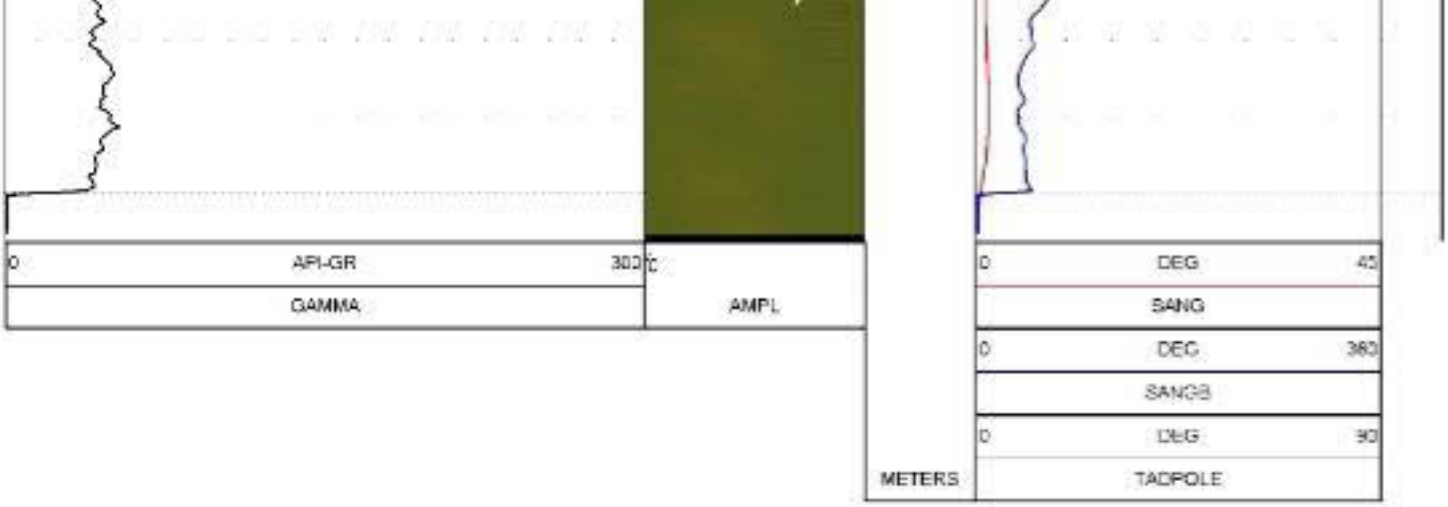
HWT 16.7M ATV
PWT 10.3M OTV

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DEG
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SANG
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DEG
45
GAMMA
AMPL
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API-GR
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Douglas Partners Pty Ltd
Mt Pleasant Rail Infrastructure Project

Borehole BHCW08

OTV PETROPHYSICAL REPORT

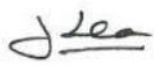
Groundsearch Australia Pty. Limited

2 July 2019

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For and on behalf of Groundsearch Australia Pty. Limited



John Lea BSc (Hons) FAusIMM
Principal Geologist
Managing Director

Summary

The data contained in this report were obtained from one, vertical, cored borehole that was drilled as a component of the 2019 geotechnical investigation programme for the Mt Pleasant Rail Infrastructure Project.

A Century Geophysical Corporation downhole optical televiewer (OTV) tool was used to collect the data in the field on 24 June 2019. The data in this report are from 0.76 to 11.67 metres below ground level.

The only feature identified is the base of casing. The remainder of the log could be affected by remnant mudcake.

The tool relies on contrasting colour tones of the in borehole wallrocks to produce images that are used for interpretation and presentation.

All data are referenced to magnetic north and have been automatically recalculated to represent the vertical situation for dip and dip direction.

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Appendix 1 **–** Interpretation logs 0.76 to 11.67 mbgl

Appendix 1

1:10 Interpretation Logs

0.76 to 11.67 metres



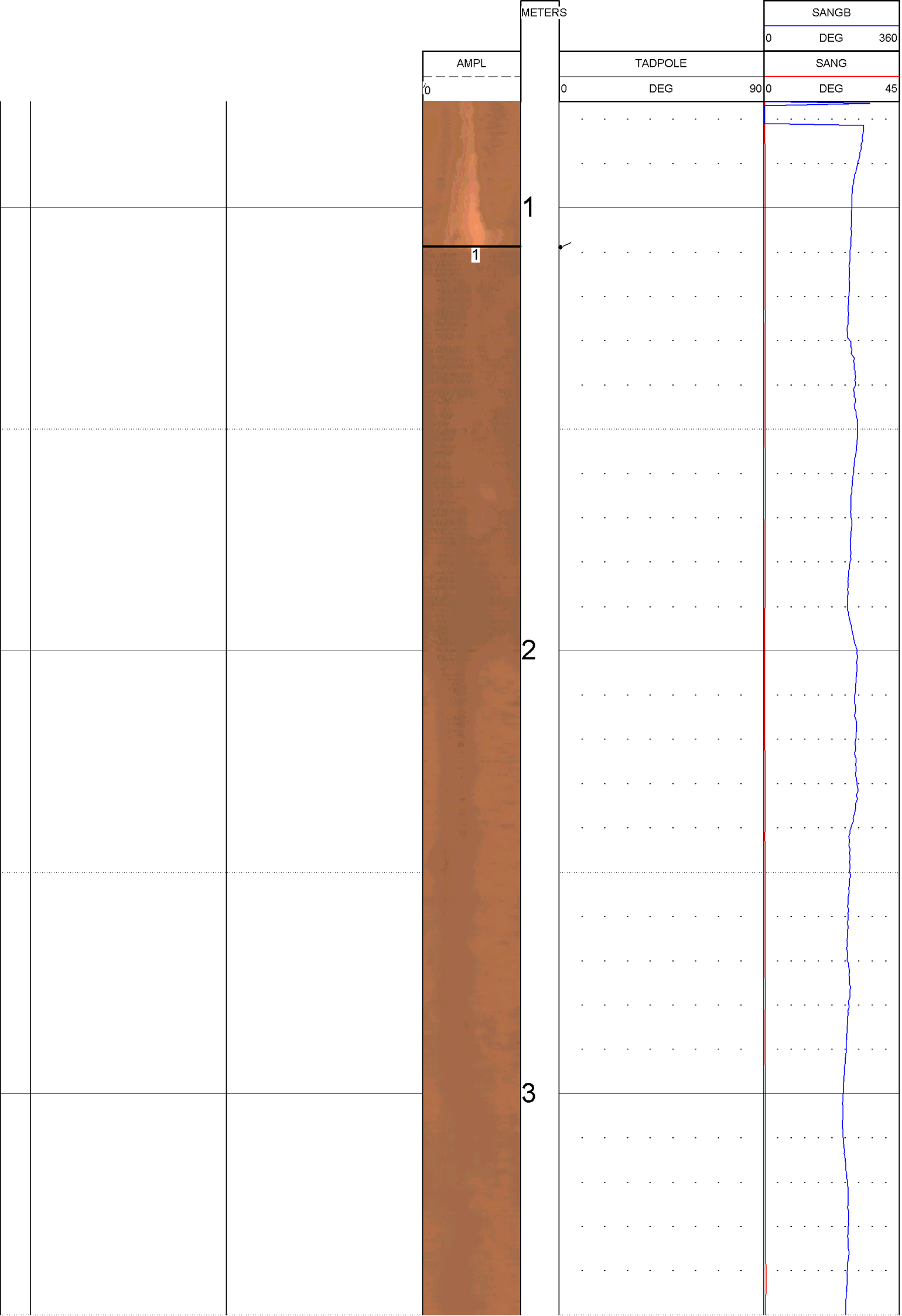
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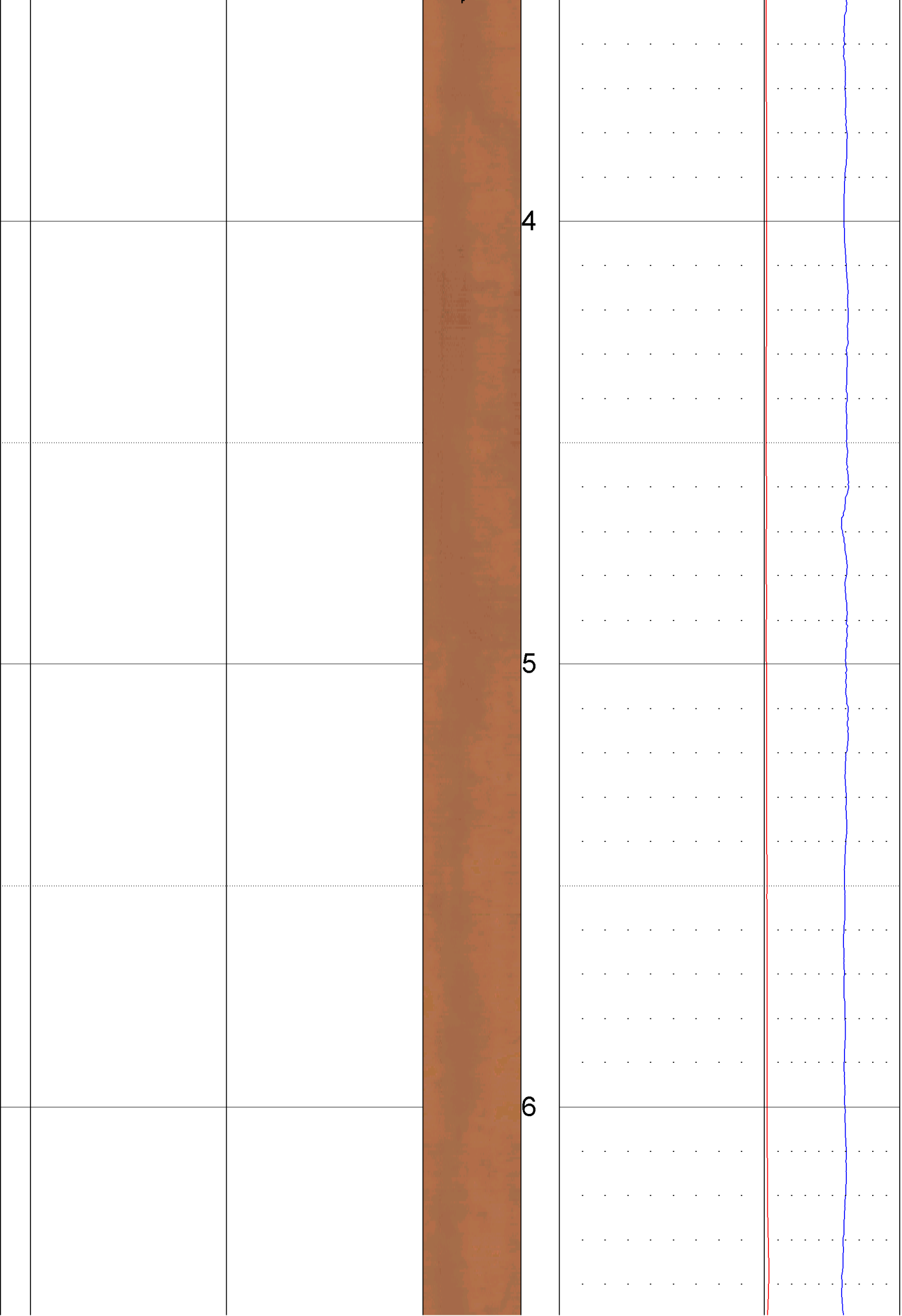
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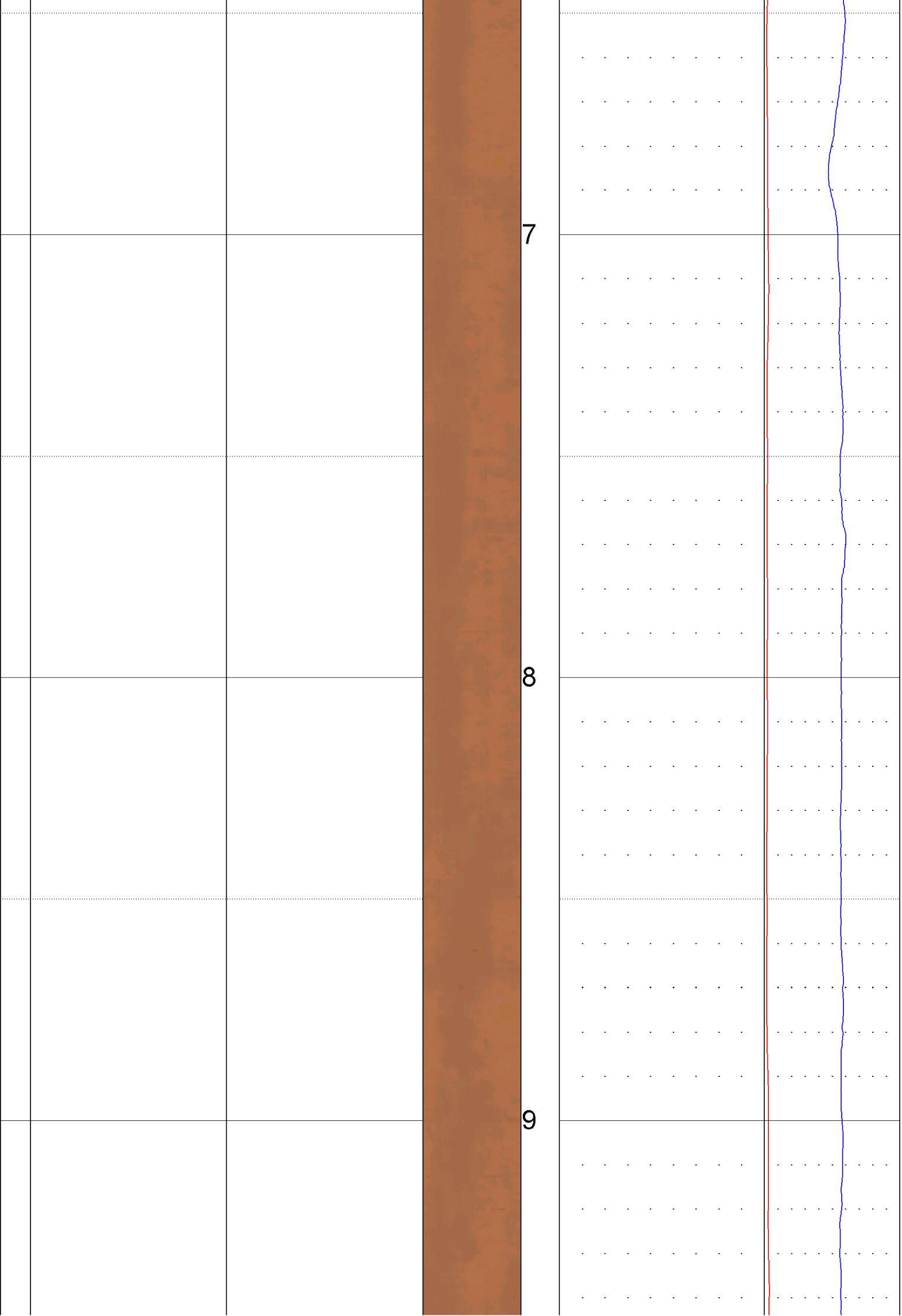
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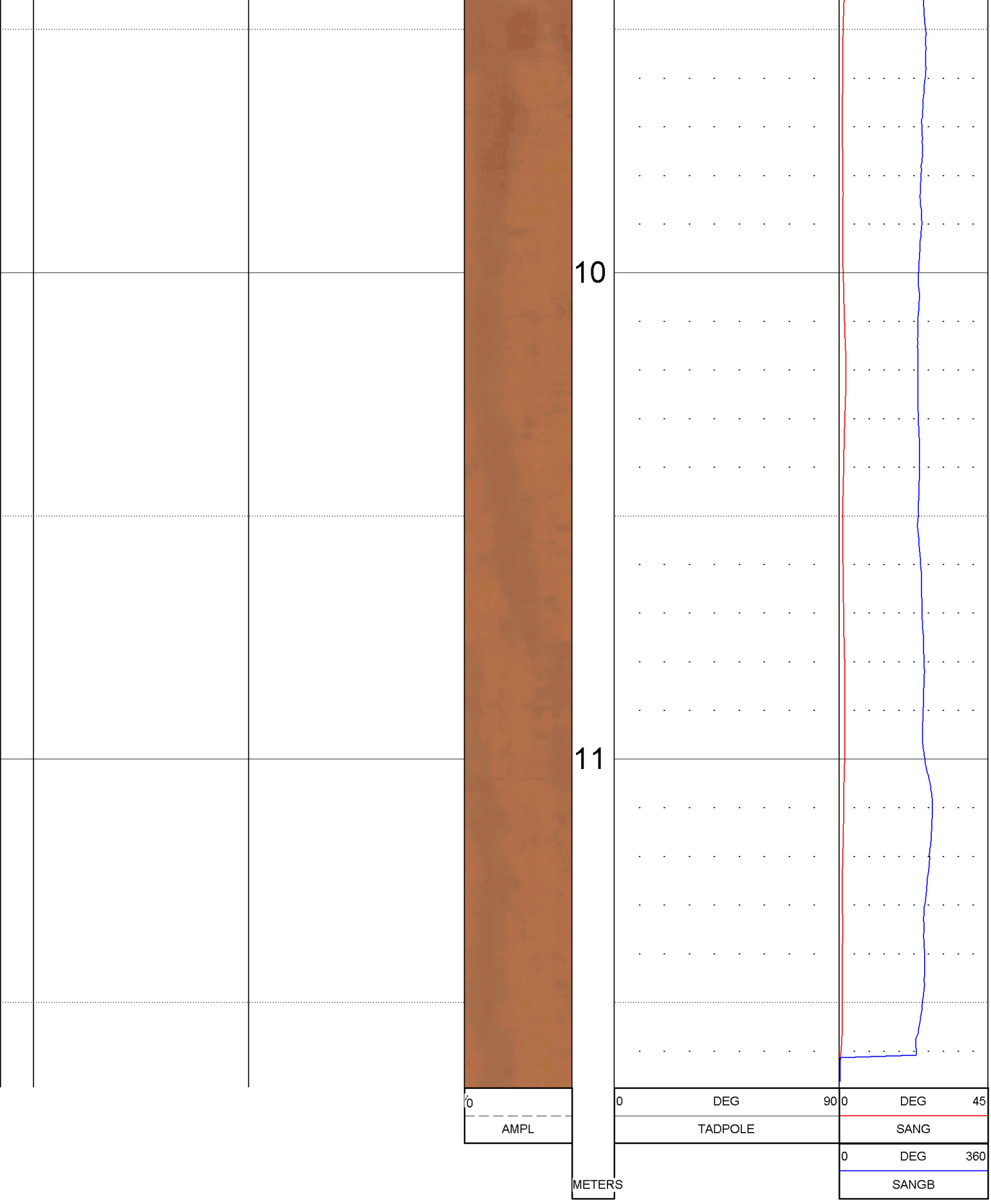
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2
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DEG
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SANG
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METERS

Douglas Partners Pty Ltd
Mt Pleasant Rail Infrastructure Project

Borehole BHCW09ATV

ACOIUSTIC TELEVIEWER PETROPHYSICAL REPORT

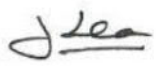
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2 July 2019

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For and on behalf of Groundsearch Australia Pty. Limited



John Lea BSc (Hons) FAusIMM
Principal Geologist
Managing Director

Summary

The data contained in this report were obtained from one, vertical, cored borehole that was drilled as a component of the 2019 geotechnical investigation programme for the Mt Pleasant Rail Infrastructure Project.

A Century Geophysical Corporation downhole optical televiewer (OTV) tool was used to collect the data in the field on 24 June 2019. The data in this report are from 20.5 to 21.09 metres below ground level.

The only feature identified is the base of casing. The remainder of the log could be affected by remnant mudcake.

The tool relies on contrasting colour tones of the in borehole wallrocks to produce images that are used for interpretation and presentation.

All data are referenced to magnetic north and have been automatically recalculated to represent the vertical situation for dip and dip direction.

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Appendix 1

1:10 Interpretation Logs

20.5 to 21.09 metres

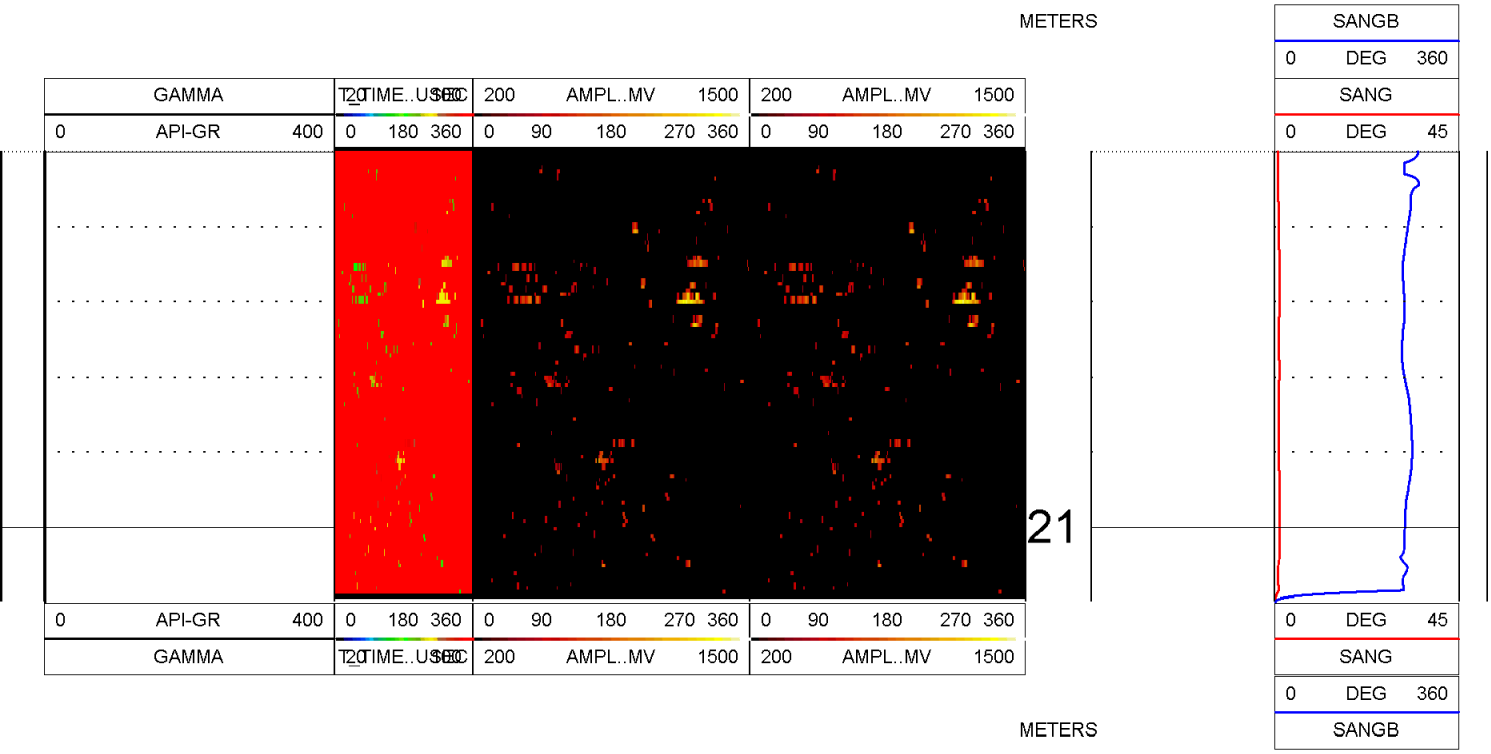


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VOID 700MM 19.3M - 20.0M

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS


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GAMMA
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21
METERS

Douglas Partners Pty Ltd
Mt Pleasant Rail
Infrastructure Project

Borehole BHCW09

OTV PETROPHYSICAL REPORT

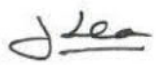
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A Century Geophysical Corporation downhole optical televiewer (OTV) tool was used to collect the data in the field on 24 June 2019. The data in this report are from 9.96 to 21.08 metres below ground level.

The nine features identified are bedding planes, fractures and the base of casing.

The tool relies on contrasting colour tones of the in borehole wallrocks to produce images that are used for interpretation and presentation.

All data are referenced to magnetic north and have been automatically recalculated to represent the vertical situation for dip and dip direction.

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Appendix 1 Interpretation logs 9.96 to 21.08 mbgl

1.0 Background Technical Information

The data contained in this report were obtained from one, vertical, cored borehole that was drilled as a component of the 2019 geotechnical investigation programme for the Mt Pleasant Rail Infrastructure Project.

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The tool relies on contrasting colour tones of the in borehole wallrocks to produce images that are used for interpretation and presentation.

All data are referenced to magnetic north and have been automatically recalculated to represent the vertical situation for dip and dip direction.

The OTV takes an oriented “picture” of the borehole using high-resolution sound waves. This acoustic picture is displayed in both amplitude and travel time. This information is used to detect bedding planes, fractures, and other borehole anomalies without the need to have clear fluid filling the boreholes.

The televiewer digitises 256 measurements around the borehole at each high-resolution sample interval. These data can be oriented to North and displayed real-time while logging using the Visual Compu-Log System.

Analysis software includes colour adjustment, fracture dip and strike determination, and classification of features. It allows information to be displayed on the graphical screen, plot, and in report format.

2.0 Interpretation Methodology

It should be noted that the OTV is a bowspring-type, centralised tool and is affected by poor wallrock conditions known as rugosity.

The OTV data interpretation procedure is based on the superposition of curves on feature logs directly onto the computer screen by using a subjective, manual; two-point definition of a feature's top and base to produce a sine curve. The sides of the time and amplitude plots represent magnetic north and magnetic south is in the centre of each plot. The low side, or trough, of the sine curve defines the dip direction of the feature.

The logging program automatically records the OTV tool slant angle and bearing and corrects for any borehole deviations. The curves are automatically given an identification number for subsequent referencing in a report file.

This report contains a;

- Text summary of the interpreted features
- Circular graphic representation of interpreted features
- Logs that show geological features with their subjective, numbered interpretation curves shown in colour at 1:10 scale. The logs are in standard format whereby the sonic image of the borehole wall is "flattened" onto the plot. The logs have the following additional features to enhance geological interpretations of the strata;
    - OTV image
    - Tadpoles that represent feature dip and dip direction
- Table containing feature curve ID, top, base, dip angle, dip azimuth, feature description and the generalised rock type that hosts the feature
- Graphical representation of the interpreted features

3.0 Borehole BHCW09 Interpretations

The nine features identified are bedding planes, fractures and the base of casing.

Table 1 Interpreted features report for BHCW09

FEATURE ID	DIP (DEG)	AZIMUTH (DEG)	MIDPOINT (MBGL)	TOP (M)	BASE (M)	TYPE OF FEATURE
1			10.97	10.97	10.97	Base of casing
2	18	14	13.42	13.40	13.43	Bedding plane
3	18	25	13.46	13.44	13.47	Bedding plane
4	7	265	13.91	13.90	13.91	Bedding plane
5	2	111	14.04	14.04	14.04	Bedding plane
6	3	75	19.32	19.31	19.32	Bedding plane
7	68	284	19.78	19.66	19.89	Fracture plane - open
8	53	234	19.93	19.87	19.99	Fracture plane - partially open
9	0	190	20.44	20.44	20.44	Bedding plane

Figure 1 BHCW09 circular plan representation of interpreted features

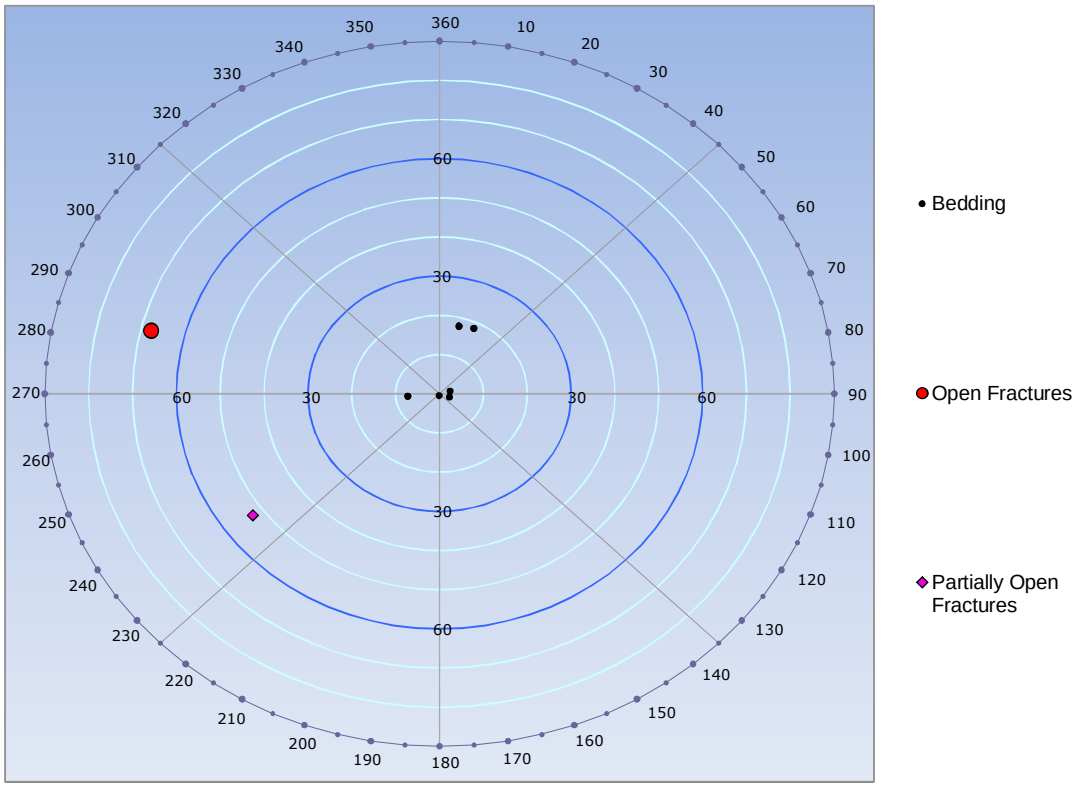


Figure 2 BHCW09 feature dip angle data distribution

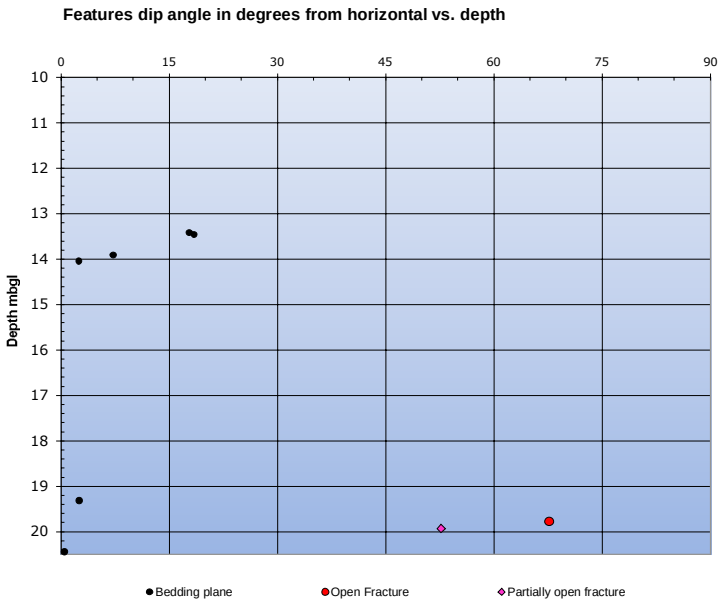


Figure 3 BHCW09 feature dip direction data distribution

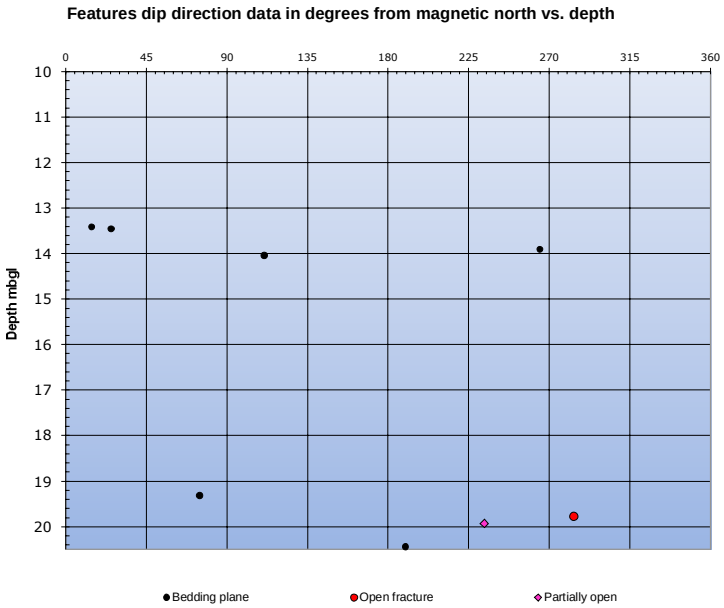


Table 2 BHCW09 bedding histogram data

Dip Distribution Total: 6			Orientation Distribution Total: 6		
Dip Range	Count	%	Bearing Range	Count	%
0 to 10	4	66.7	0 to 10	0	0.0
10 to 20	2	33.3	10 to 20	1	16.7
20 to 30	0	0.0	20 to 30	1	16.7
30 to 40	0	0.0	30 to 40	0	0.0
40 to 50	0	0.0	40 to 50	0	0.0
50 to 60	0	0.0	50 to 60	0	0.0
60 to 70	0	0.0	60 to 70	0	0.0
70 to 80	0	0.0	70 to 80	1	16.7
80 to 90	0	0.0	80 to 90	0	0.0
			90 to 100	0	0.0
			100 to 110	0	0.0
			110 to 120	1	16.7
			120 to 130	0	0.0
			130 to 140	0	0.0
			140 to 150	0	0.0
			150 to 160	0	0.0
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			260 to 270	1	16.7
			270 to 280	0	0.0
			280 to 290	0	0.0
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			300 to 310	0	0.0
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			350 to 360	0	0.0

Figure 4 BHCW09 bedding dip direction data rose diagram

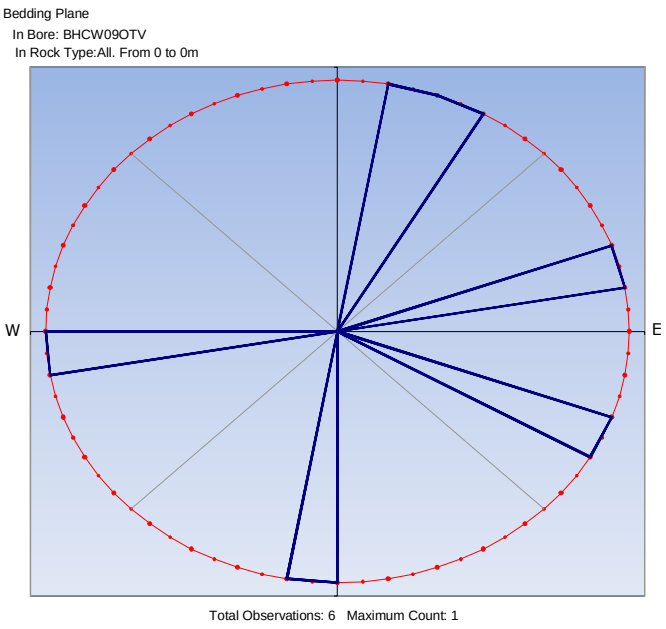


Figure 5 BHCW09 bedding dip angle histogram

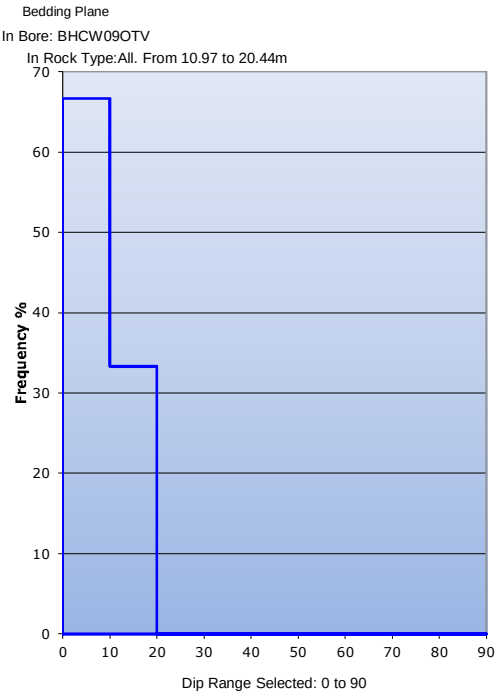


Figure 6 BHCW09 bedding dip direction histogram

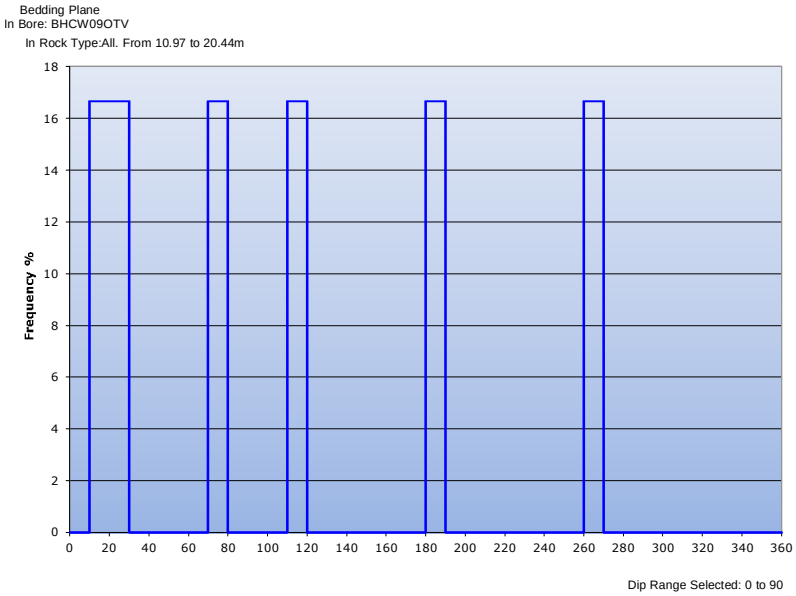


Table 3 BHCW09 fracture histogram data

Dip Distribution Total: 2			Orientation Distribution Total: 2		
Dip Range	Count	%	Bearing Range	Count	%
0 to 10	0	0.0	0 to 10	0	0.0
10 to 20	0	0.0	10 to 20	0	0.0
20 to 30	0	0.0	20 to 30	0	0.0
30 to 40	0	0.0	30 to 40	0	0.0
40 to 50	0	0.0	40 to 50	0	0.0
50 to 60	1	50.0	50 to 60	0	0.0
60 to 70	1	50.0	60 to 70	0	0.0
70 to 80	0	0.0	70 to 80	0	0.0
80 to 90	0	0.0	80 to 90	0	0.0
			90 to 100	0	0.0
			100 to 110	0	0.0
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			190 to 200	0	0.0
			200 to 210	0	0.0
			210 to 220	0	0.0
			220 to 230	0	0.0
			230 to 240	1	50.0
			240 to 250	0	0.0
			250 to 260	0	0.0
			260 to 270	0	0.0
			270 to 280	0	0.0
			280 to 290	1	50.0
			290 to 300	0	0.0
			300 to 310	0	0.0
			310 to 320	0	0.0
			320 to 330	0	0.0
			330 to 340	0	0.0
			340 to 350	0	0.0
			350 to 360	0	0.0

Figure 7 BHCW09 fracture dip direction data rose diagram

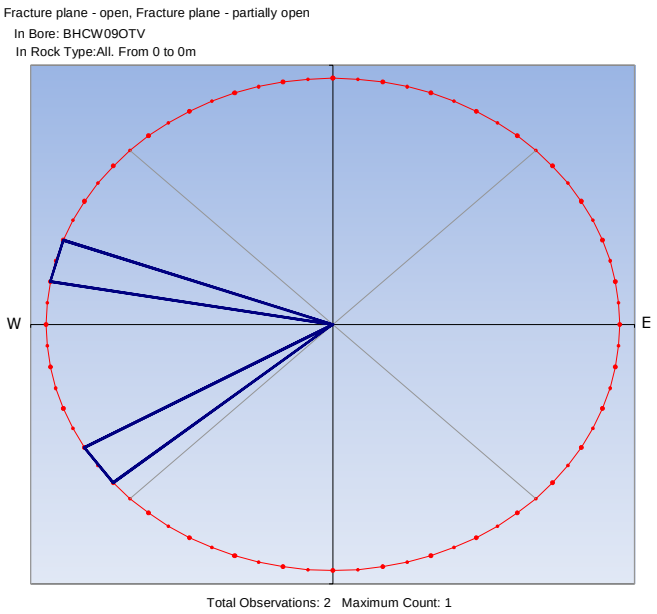


Figure 8 BHCW09 fracture dip angle histogram

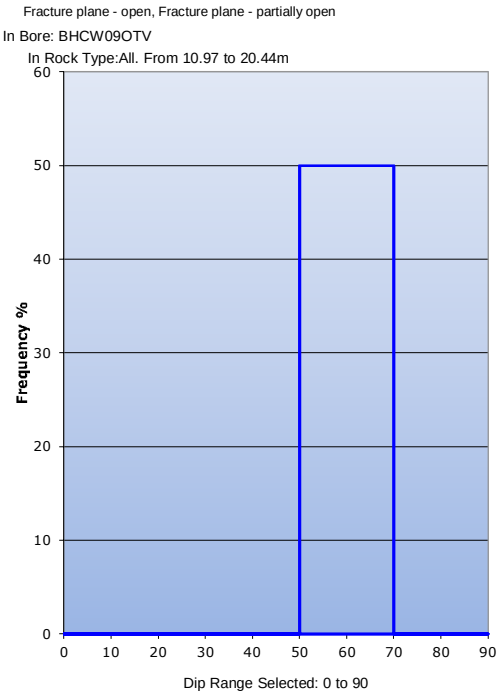
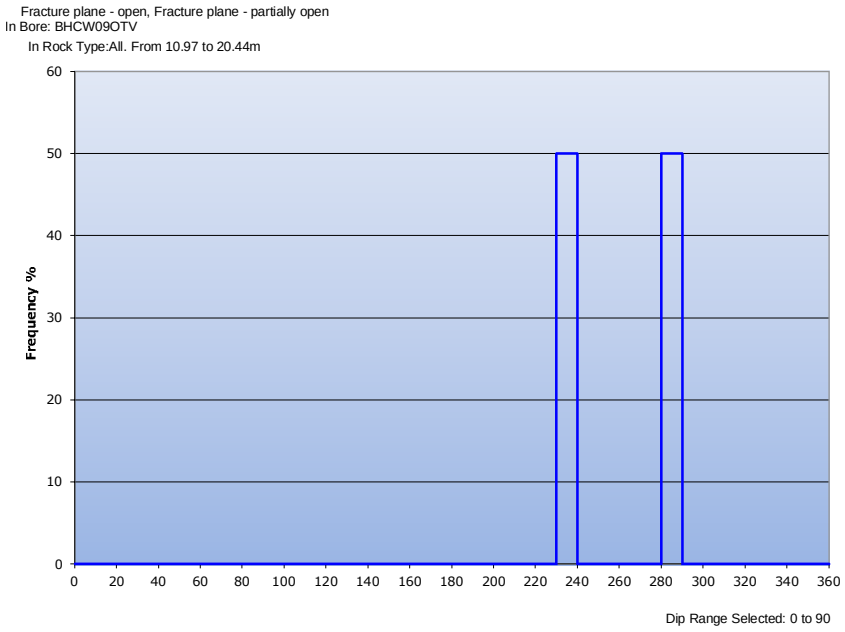


Figure 9 BHCW09 fracture dip direction histogram



Appendix 1

1:10 Interpretation Logs

9.96 to 21.08 metres

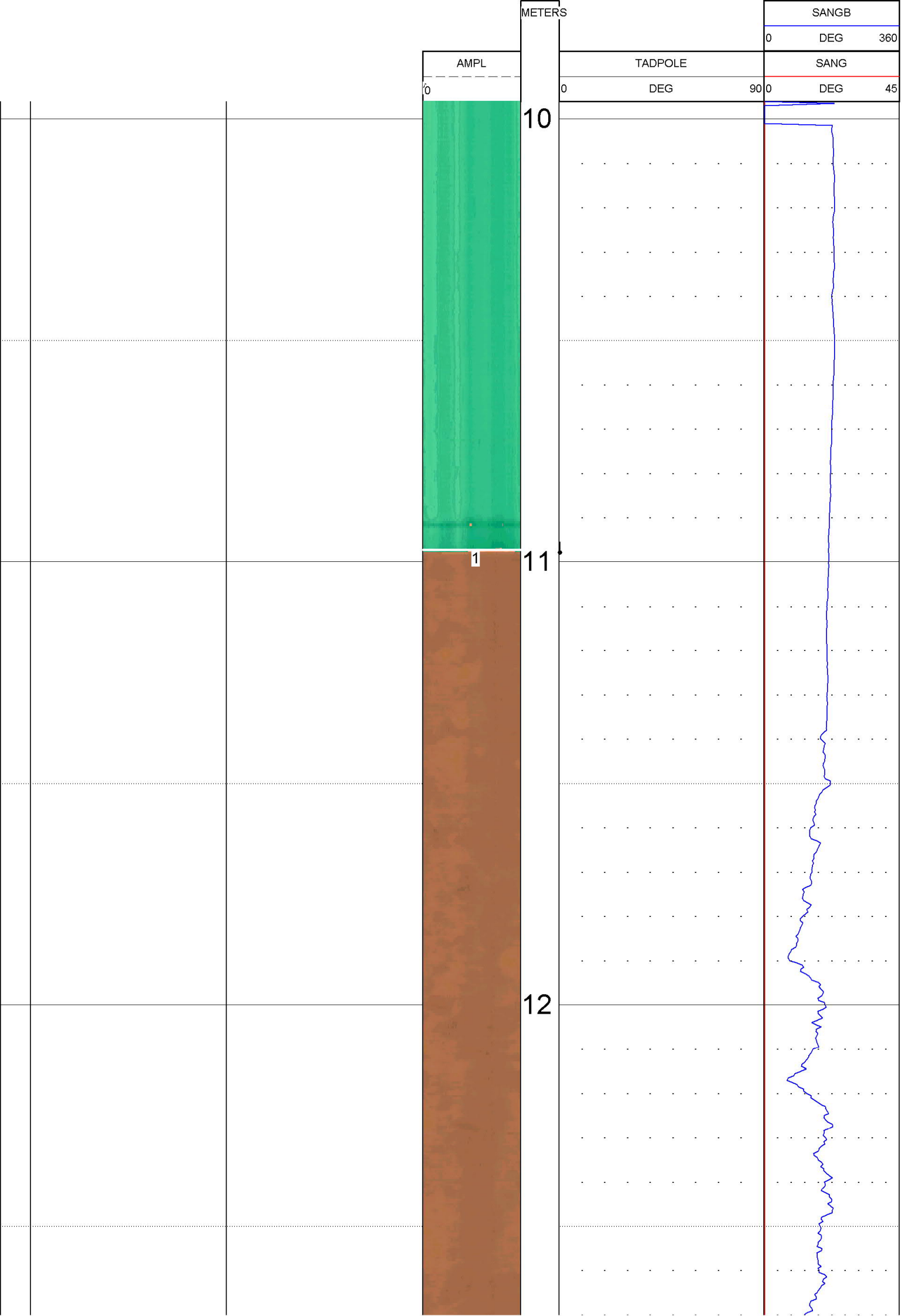


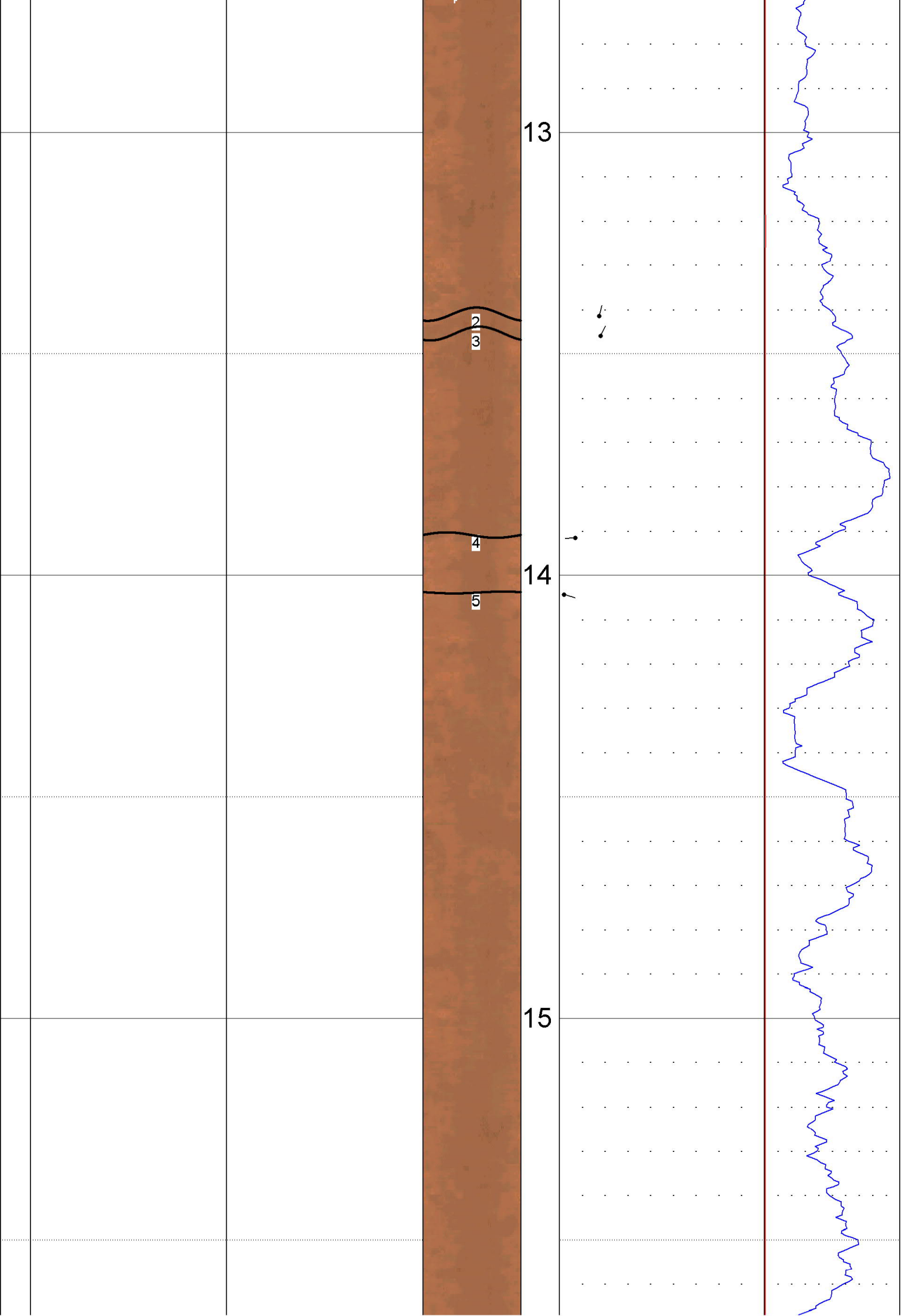
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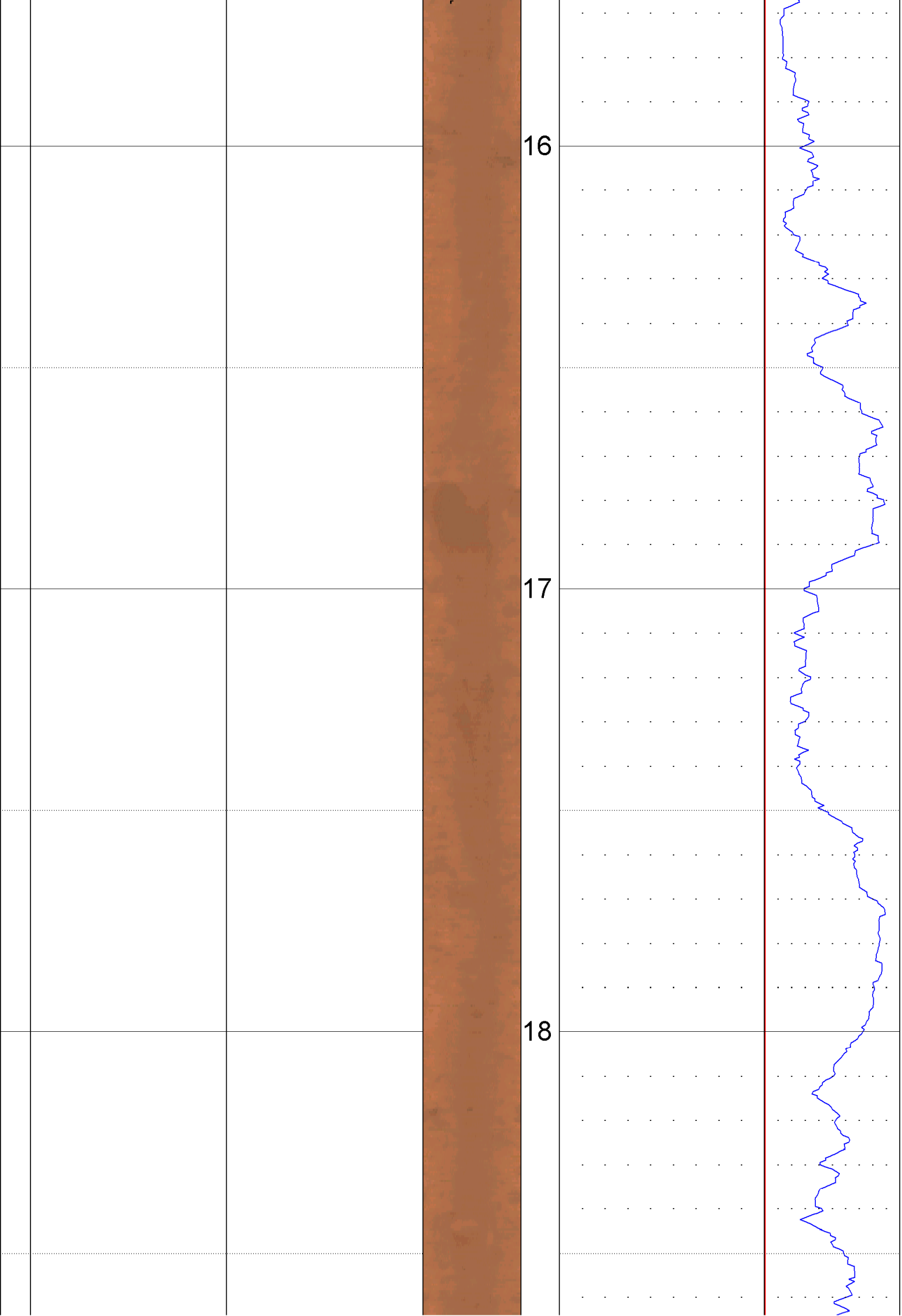
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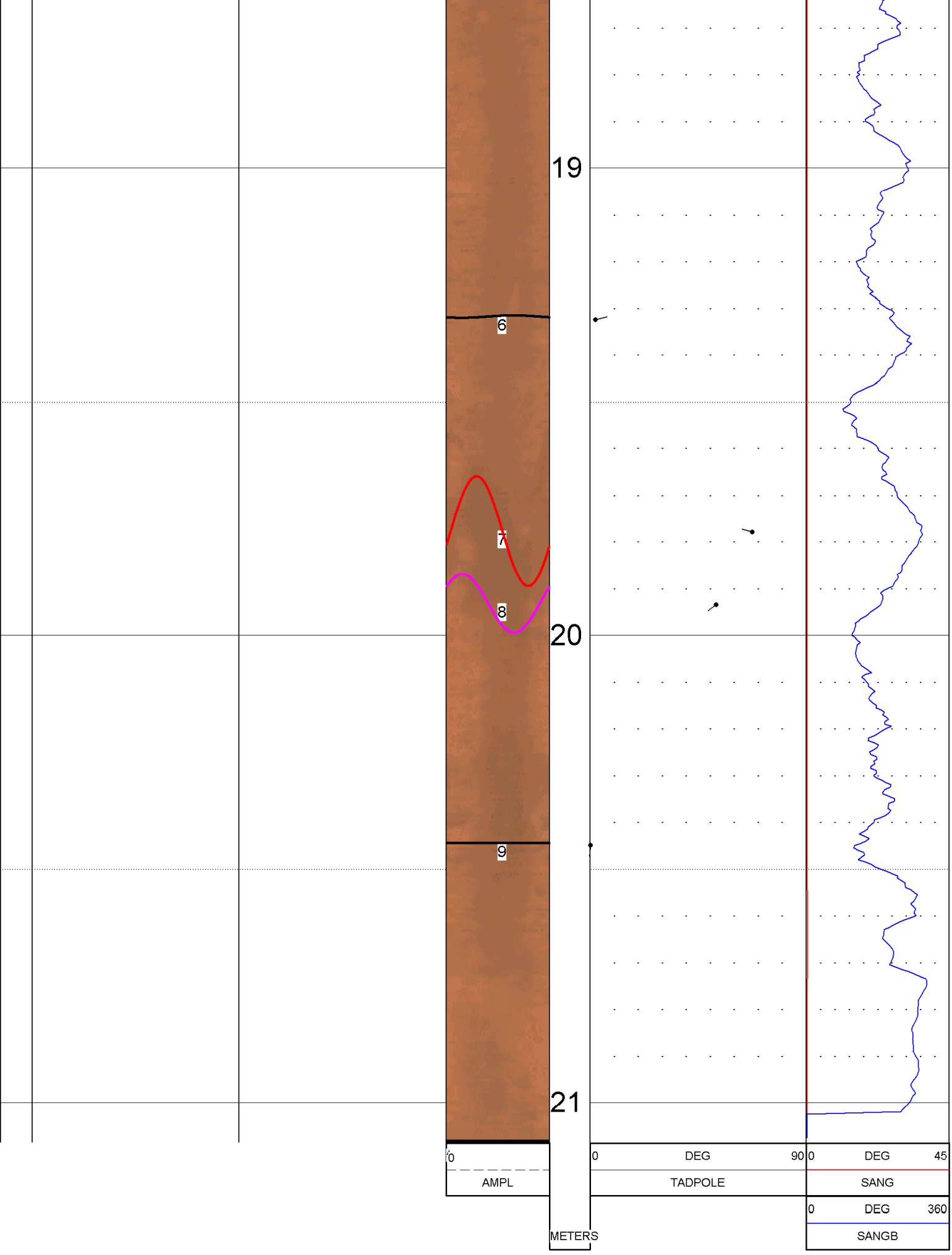
VOID 700MM 19.3M - 20.0M

ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS


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Douglas Partners Pty Ltd
Mt Pleasant Rail Infrastructure Project

Borehole BHCW10

OTV PETROPHYSICAL REPORT

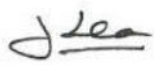
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A Century Geophysical Corporation downhole optical televiewer (OTV) tool was used to collect the data in the field on 24 June 2019. The data in this report are from 0.42 to 20.86 metres below ground level.

The only feature identified is the base of casing. The remainder of the log could be affected by remnant mudcake.

The tool relies on contrasting colour tones of the in borehole wallrocks to produce images that are used for interpretation and presentation.

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Appendix 1 **–** Interpretation logs 0.76 to 11.67 mbgl

Appendix 1

1:10 Interpretation Logs

0.42 to20.86 metres



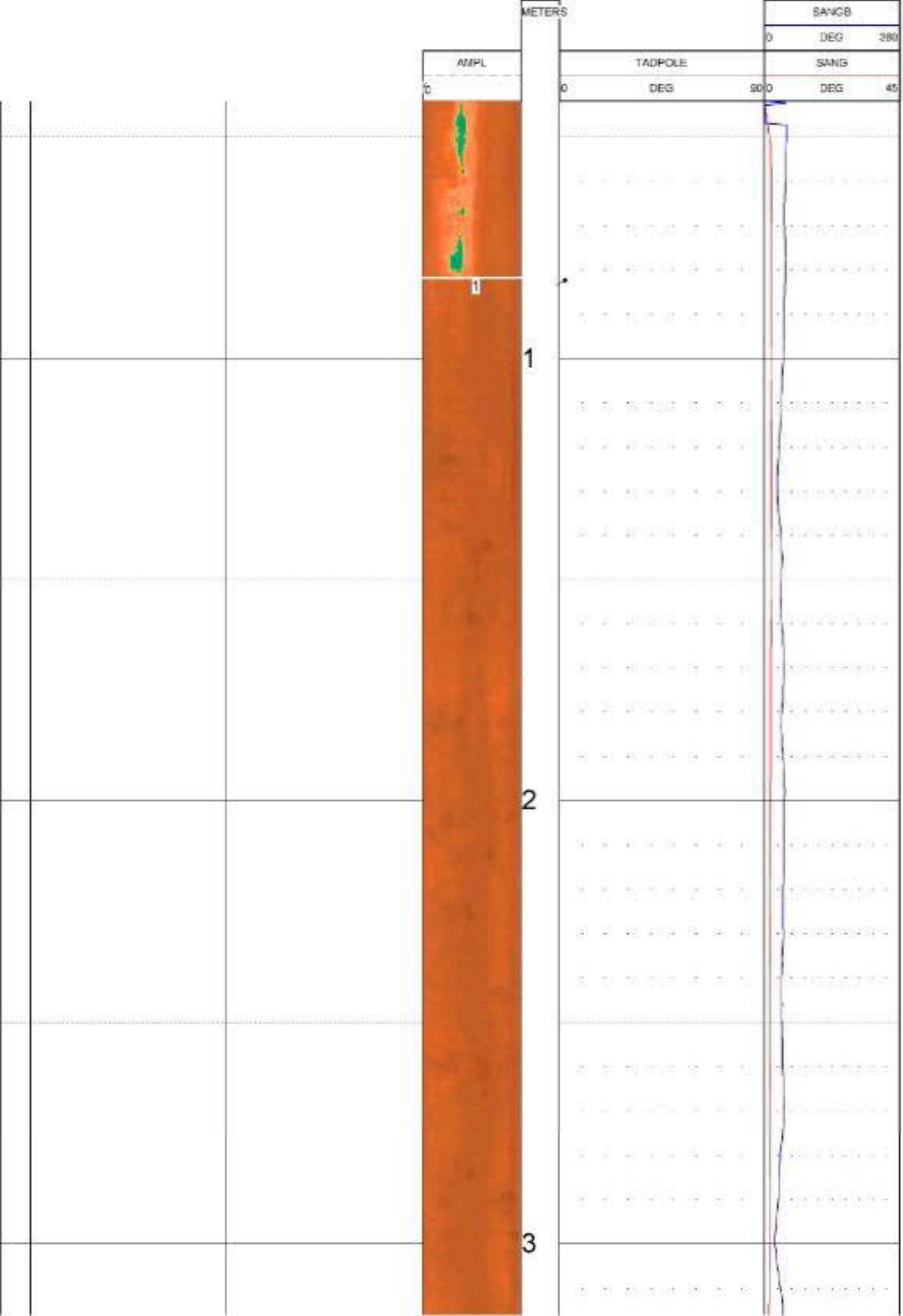
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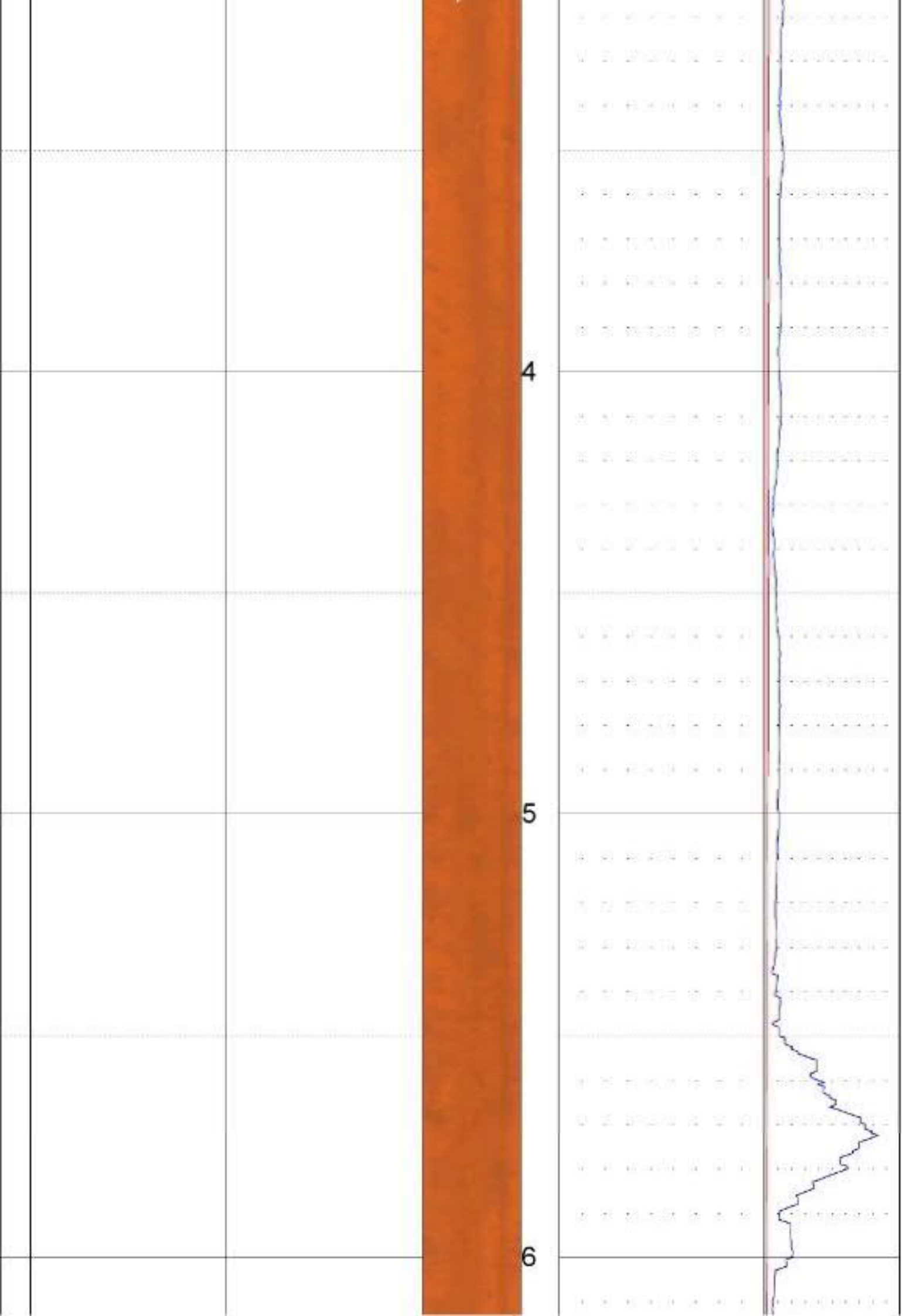
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LOG TOP	: 0.42	DRL MEASURED FROM	: N/A	GL	: N/A
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CASING THICKNESS:		RECORDED BY	:		
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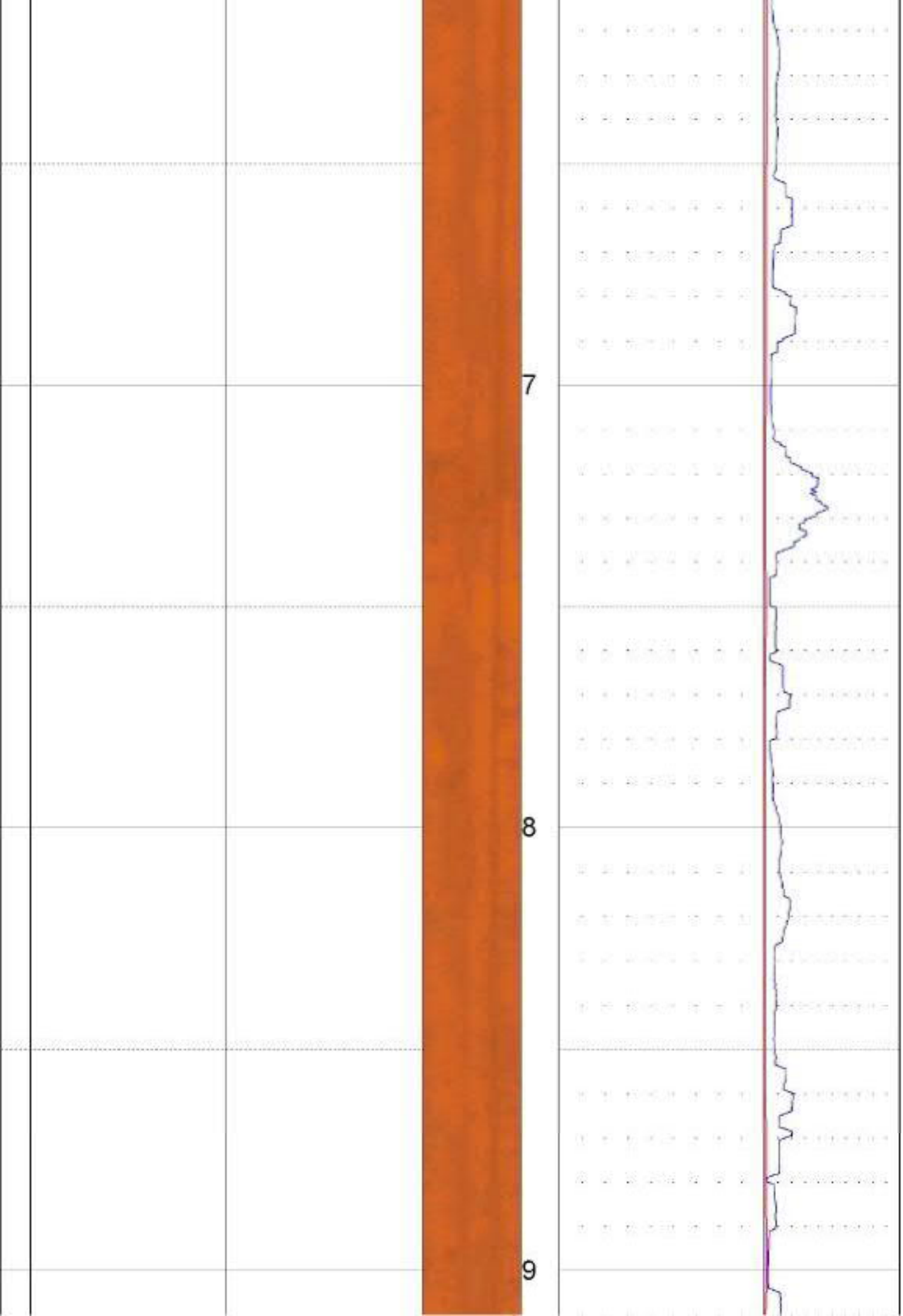
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OTV

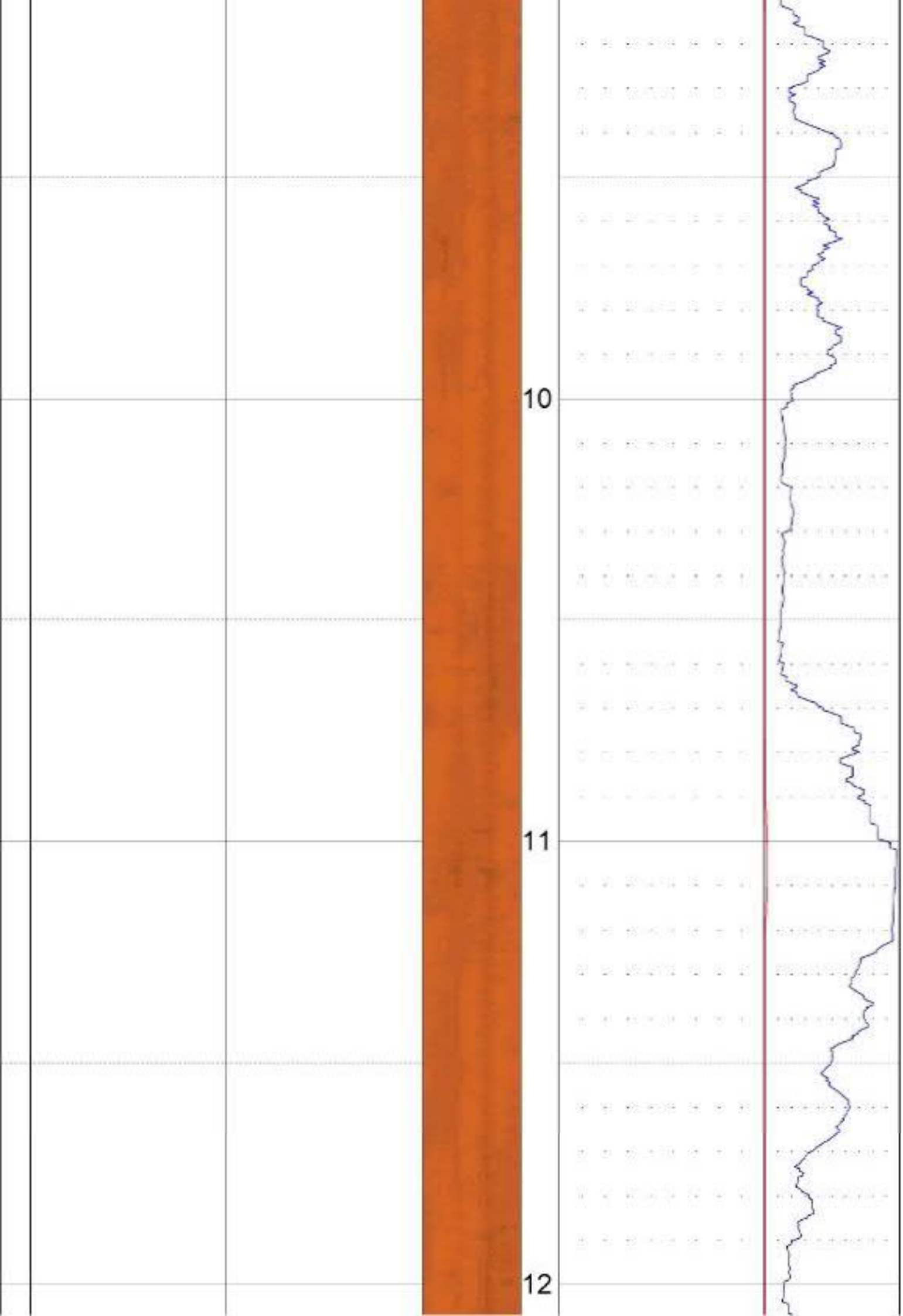
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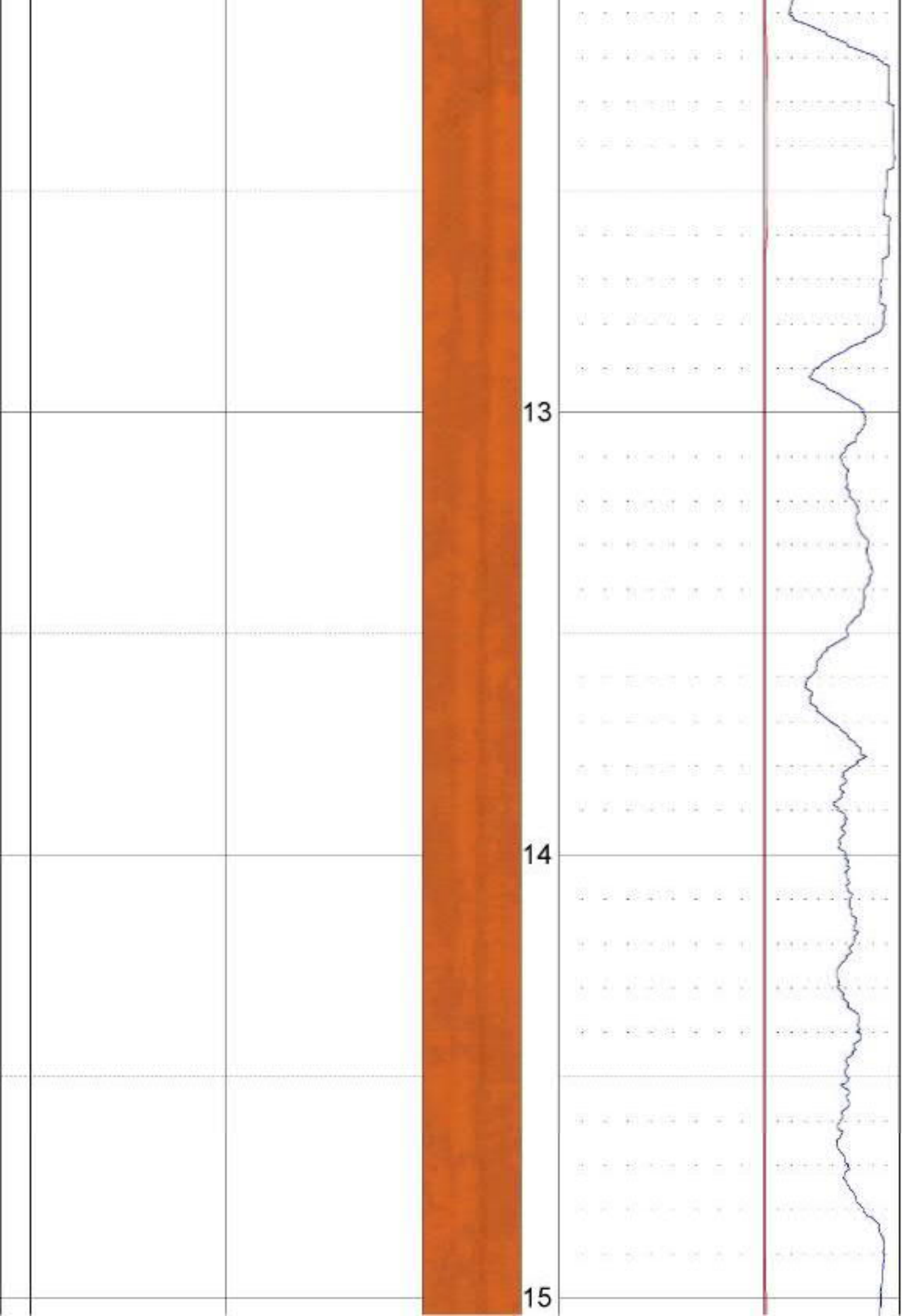
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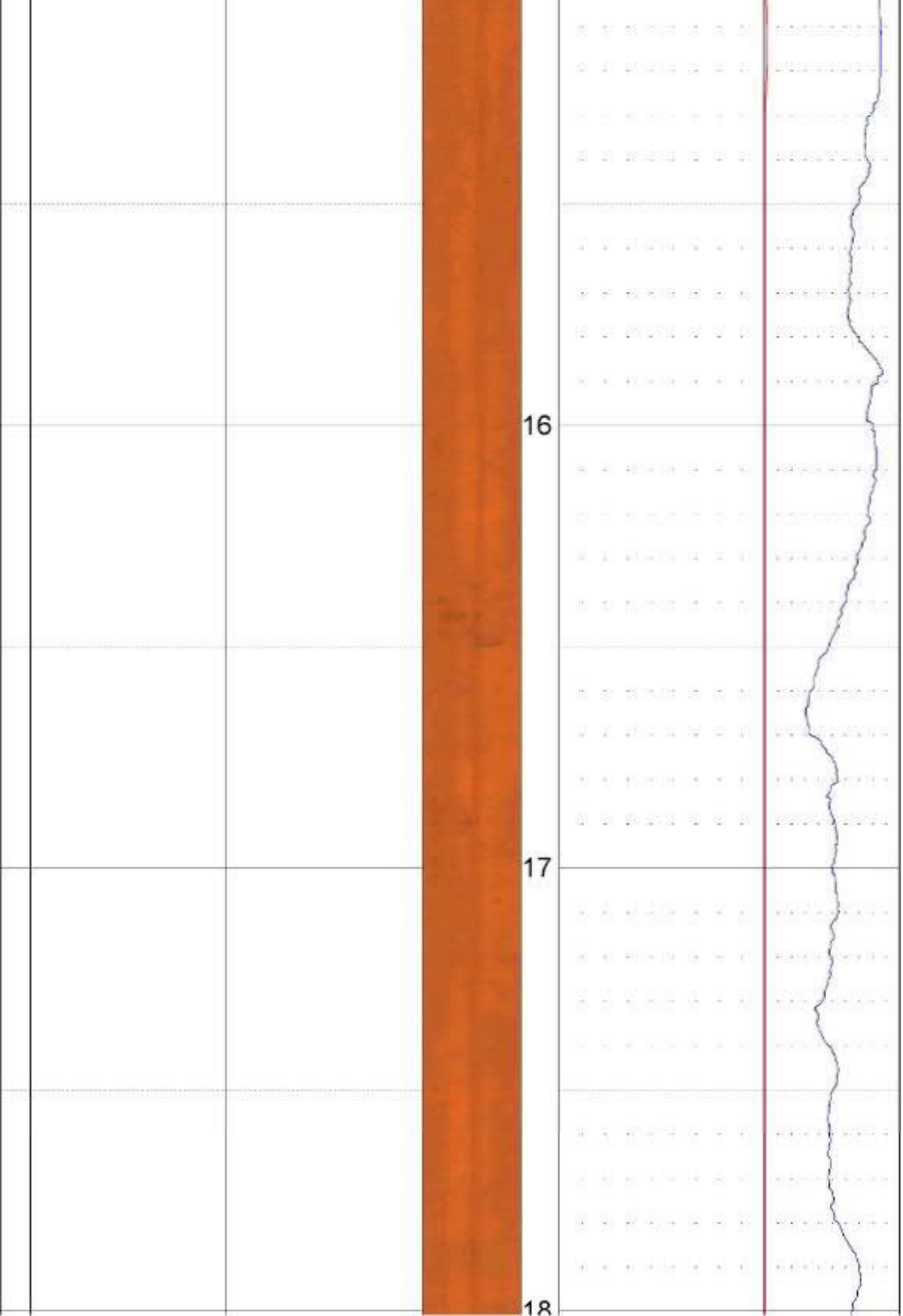

METERS
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AMPL
TADPOLE
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DEG
90
0
DEG
45
1
1
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3

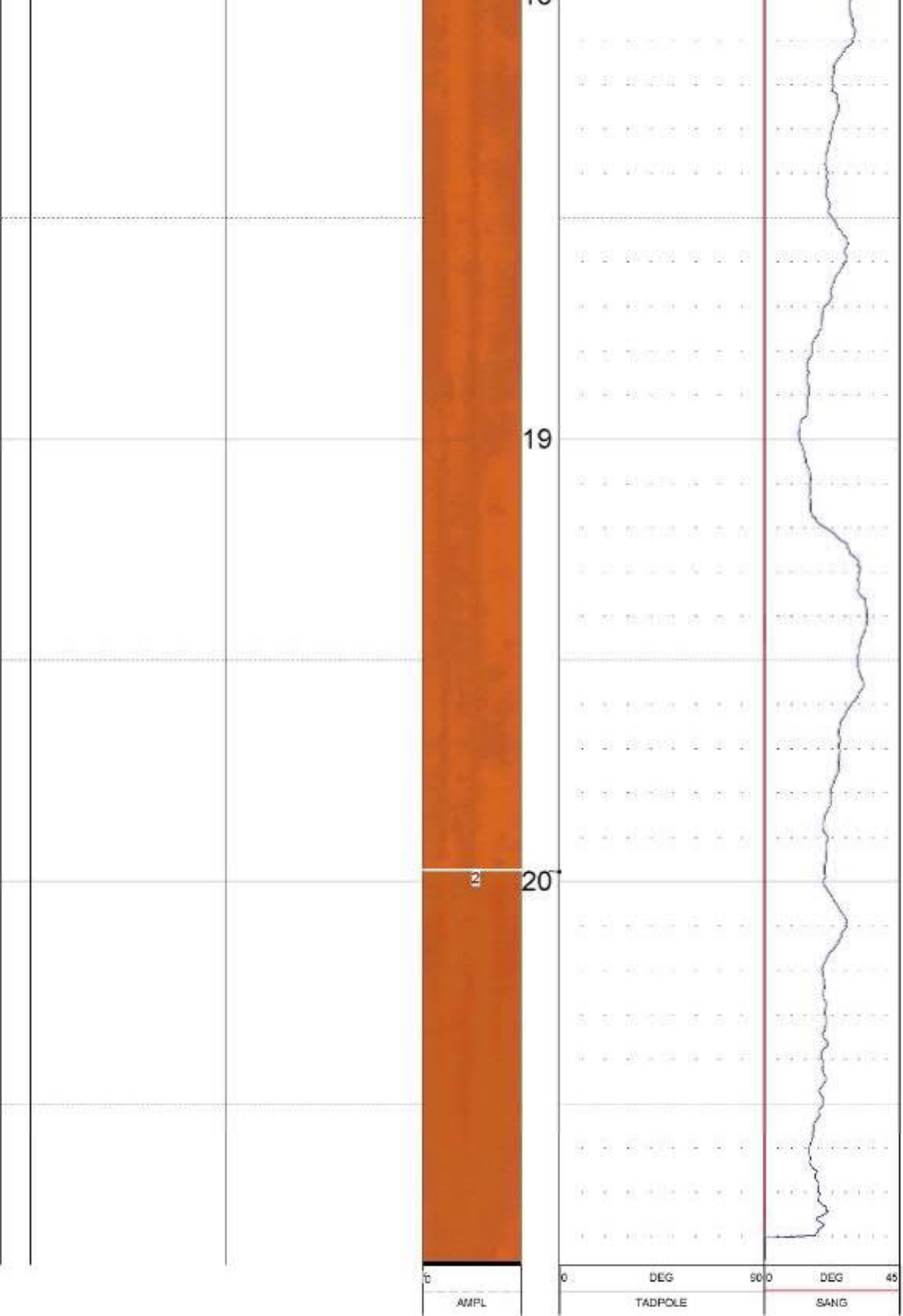

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SANG


METERS
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DEG
360
BANGB

Douglas Partners – Mt Pleasant Rail Infrastructure Project

Borehole BHCW11

ACOUSTIC TELEVIEWER PETROPHYSICAL REPORT

Groundsearch Australia Pty. Limited

2 July 2019

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For and on behalf of Groundsearch Australia Pty. Limited



John Lea BSc (Hons) FAusIMM
Principal Geologist
Managing Director

Executive summary

The data contained in this report were obtained from one vertical, 79.6 cm diameter borehole. It was drilled as a component of the 2019 geotechnical investigation programme for Douglas Partners Mt Pleasant Rail Infrastructure Project.

Century Geophysical LLC downhole 9804 acoustic televiewer was run to collect data in the field on 24 June 2019. The data in this report are from 7.50 to 14.23 mbgl.

The 10 identified features are interpreted as bedding planes and the SWL.

The Century Display program has automatically recalculated the dip angle data to represent the borehole in the vertical position and the dip direction data are referenced to magnetic north.

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Appendix 1 1:10 Interpretation logs **–** 7.50 to 14.23 mbgl

1.0 Background technical information

The data contained in this report were obtained from one vertical, 79.6 cm diameter borehole. It was drilled as a component of the 2019 geotechnical investigation programme for Douglas Partners Mt Pleasant Rail Infrastructure Project.

Century Geophysical LLC downhole 9804 acoustic televiewer was run to collect data in the field on 24 June 2019. The data in this report are from 7.50 to 14.23 mbgl.

The 10 identified features are interpreted as bedding planes and the SWL.

The Century Display program has automatically recalculated the dip angle data to represent the borehole in the vertical position and the dip direction data is referenced to magnetic north.

The ATV takes an oriented image of the borehole using high-resolution sound waves. This acoustic image is displays amplitude variations. This information is used to detect bedding planes, fractures, and other borehole anomalies without the need to have clear fluid filling the boreholes. The tool works only in fluid-filled boreholes.

The televiewer digitises 256 measurements around the borehole at each high-resolution sample interval. These data can be oriented to North and displayed real-time while logging using the Visual Compu-Log System.

Analysis software includes colour adjustment, fracture dip and strike determination, and classification of features. It allows information to be displayed on the graphical screen, plot, and in report format.

2.0 Interpretation methodology

It should be noted that the ATV is a bowspring-type, centralised tool and is affected by poor wallrock conditions known as rugosity.

The ATV data interpretation procedure is based on the superposition of curves on feature logs directly onto the computer screen by using a subjective, manual; two-point definition of a feature's top and base to produce a sine curve. The sides of the time and amplitude plots represent magnetic north and magnetic south is in the centre of each plot. The low side, or trough, of the sine curve defines the dip direction of the feature.

The logging program automatically records the televiewer tool slant angle and bearing and corrects for any borehole deviations. The curves are automatically given an identification number for subsequent referencing in a report file.

There are possibly more bedding planes and structural fractures appearing in the televiewer logs that have not been included in this report due to their poor graphic definition or the inability to resolve their geometry by superposing a sine curve using the program's two point method.

This report contains a;

- Text summary of the interpreted features
- Circular representation of interpreted features
- Logs that show geological features with their subjective, numbered interpretation curves shown at 1:10 scale. The logs are in standard format whereby the sonic image of the borehole wall is "flattened" onto the plot. The logs have the following additional features to enhance geological interpretations of the strata;
    - Amplitude image differentials with and without interpretation curves
    - Time image differentials that indicate higher strength zones in **GREEN** and lower strength zones in **RED**
    - Coloured tadpoles and plane curves that represent feature dip and dip direction
    - Bedding planes in **BLACK**
    - Slant (dip angle)
    - Slant angle bearing
- Table containing feature curve ID, top, base, dip angle, dip azimuth, feature description and the generalised rock type that hosts the feature
- Graphical representation of the interpreted fracture features

3.0 Borehole BHCW11 interpretations

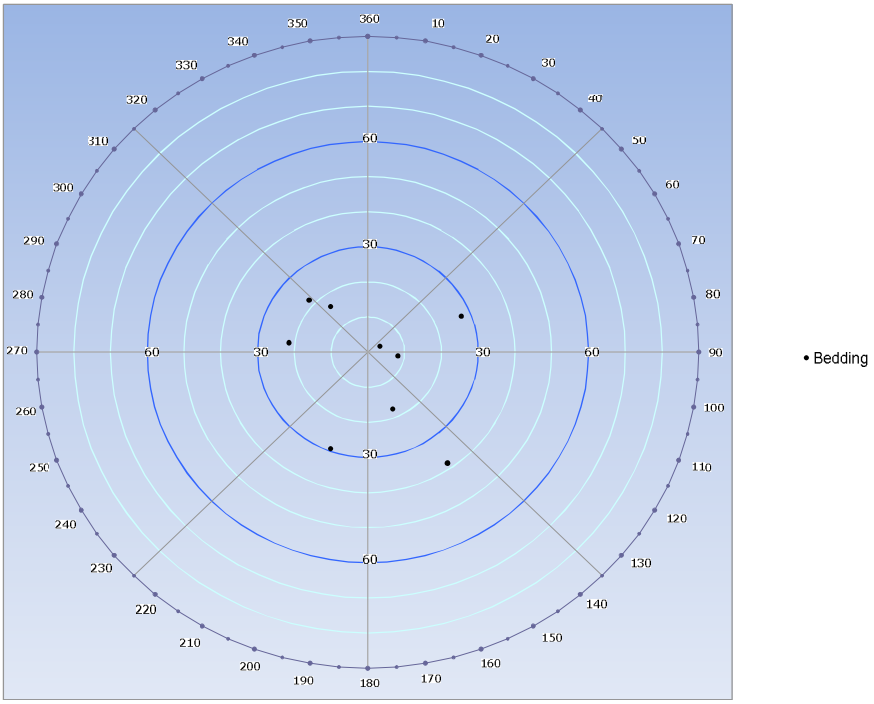
The 10 identified features are interpreted as bedding planes and the SWL.

A description of each interpreted feature is presented in Table 1 and the log is presented in Appendix 1.

Table 1 Interpreted features report for BHCW11

FEATURE ID	DIP (DEG)	AZIMUTH (DEG)	MIDPOINT (MBGL)	TOP (M)	BASE (M)	TYPE OF FEATURE
1			7.92	7.92	7.92	SWL
2	38	146	9.82	9.78	9.86	Bedding plane
3	18	157	11.18	11.17	11.20	Bedding plane
4	4	63	11.54	11.54	11.55	Bedding plane
5	22	277	12.26	12.24	12.28	Bedding plane
6	8	98	12.34	12.34	12.35	Bedding plane
7	27	68	12.70	12.67	12.72	Bedding plane
8	16	322	13.10	13.09	13.12	Bedding plane
9	22	313	13.45	13.43	13.47	Bedding plane
10	29	200	13.97	13.95	14.00	Bedding plane

Figure 1 BHCW11 circular plan representation of interpreted features



The nine sedimentary features identified are predominantly bedding planes that appear to range in dip from 4 to 38^0. The Figures 2 and 3 shows the distribution of the planes' dips angles and dip direction with depth.

Table 2 details the variation in the dip angle and dip direction data. Figure 4 shows the dip direction data in a rose diagram with the bedding planes' dip angle and dip direction data shown as histograms in Figures 5 and 6.

Figure 2 BHCW11 feature dip angle data distribution

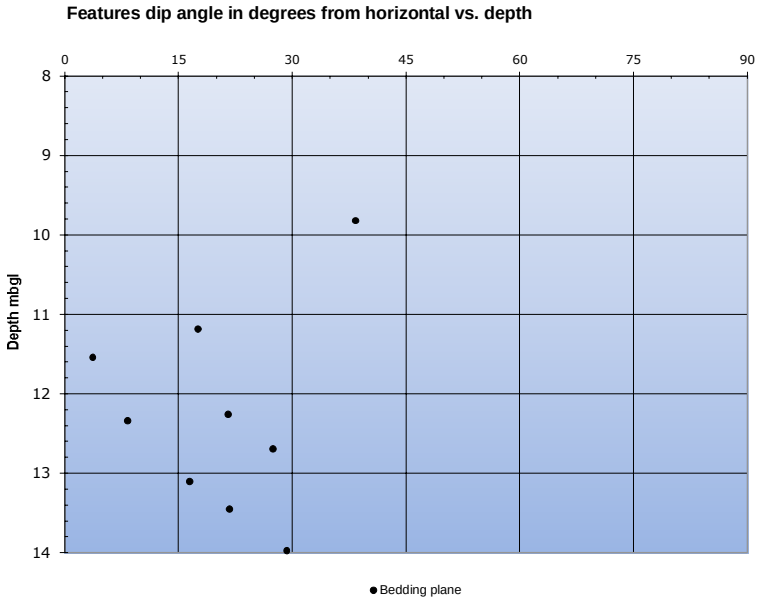


Figure 3 BHCW11 feature dip direction data distribution

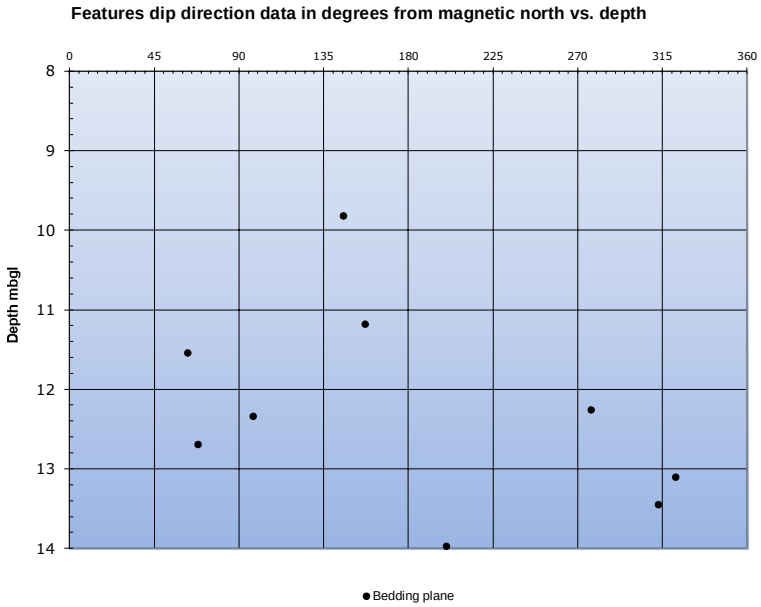


Table 2 BHCW11 bedding histogram data

Dip Distribution Total: 9			Orientation Distribution Total: 9		
Dip Range	Count	%	Bearing Range	Count	%
0 to 10	2	22.2	0 to 10	0	0.0
10 to 20	2	22.2	10 to 20	0	0.0
20 to 30	4	44.4	20 to 30	0	0.0
30 to 40	1	11.1	30 to 40	0	0.0
40 to 50	0	0.0	40 to 50	0	0.0
50 to 60	0	0.0	50 to 60	0	0.0
60 to 70	0	0.0	60 to 70	2	22.2
70 to 80	0	0.0	70 to 80	0	0.0
80 to 90	0	0.0	80 to 90	0	0.0
			90 to 100	1	11.1
			100 to 110	0	0.0
			110 to 120	0	0.0
			120 to 130	0	0.0
			130 to 140	0	0.0
			140 to 150	1	11.1
			150 to 160	1	11.1
			160 to 170	0	0.0
			170 to 180	0	0.0
			180 to 190	0	0.0
			190 to 200	0	0.0
			200 to 210	1	11.1
			210 to 220	0	0.0
			220 to 230	0	0.0
			230 to 240	0	0.0
			240 to 250	0	0.0
			250 to 260	0	0.0
			260 to 270	0	0.0
			270 to 280	1	11.1
			280 to 290	0	0.0
			290 to 300	0	0.0
			300 to 310	0	0.0
			310 to 320	1	11.1
			320 to 330	1	11.1
			330 to 340	0	0.0
			340 to 350	0	0.0
			350 to 360	0	0.0

Figure 5 BHCW11 bedding dip angles histogram

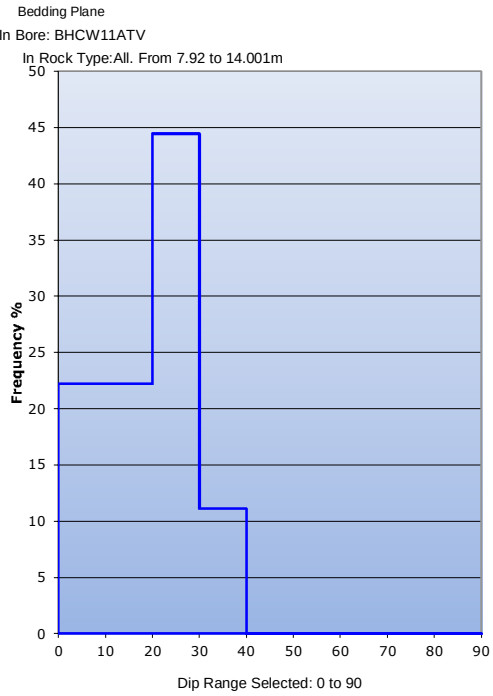


Figure 4 BHCW11 bedding dip direction data rose diagram

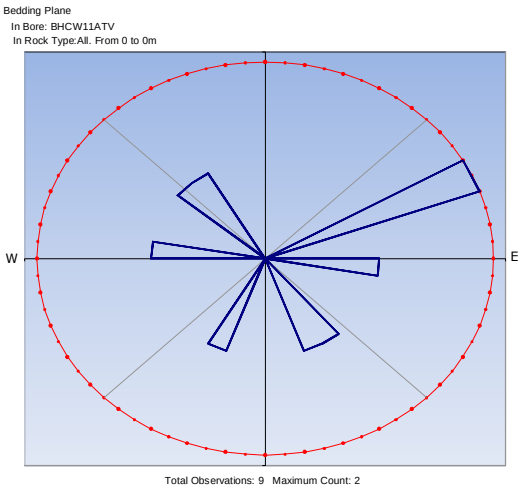
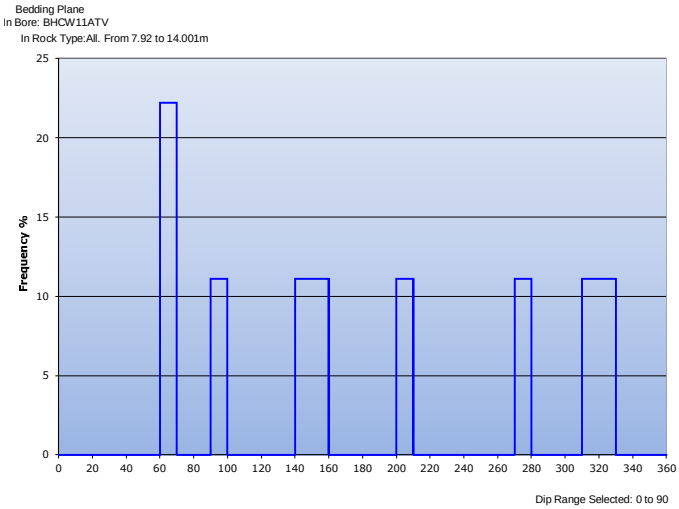


Figure 6 BHCW11 bedding dip directions histogram



Appendix 1

1:10 Interpretation logs

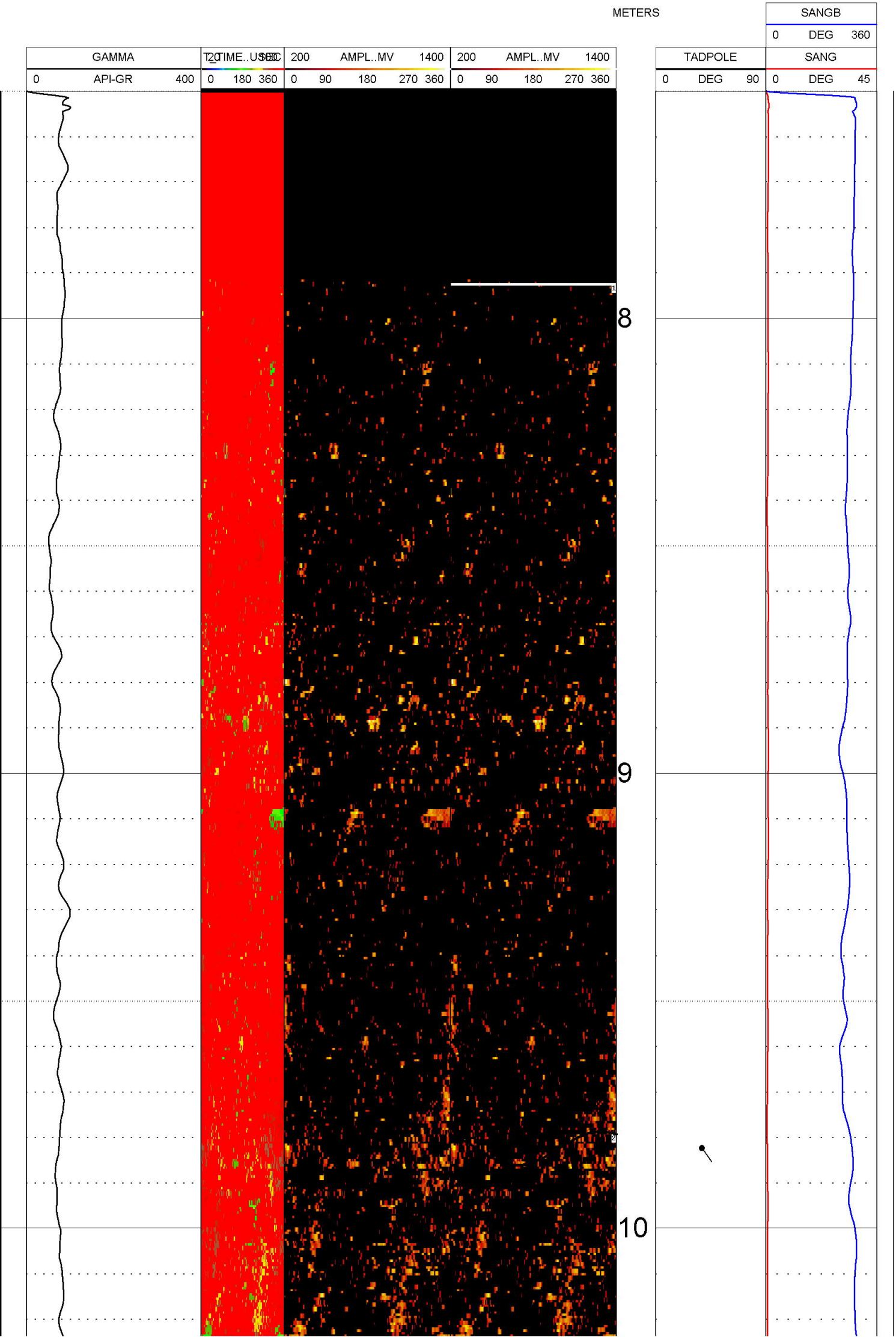
2.00 to 27.29 mbgl

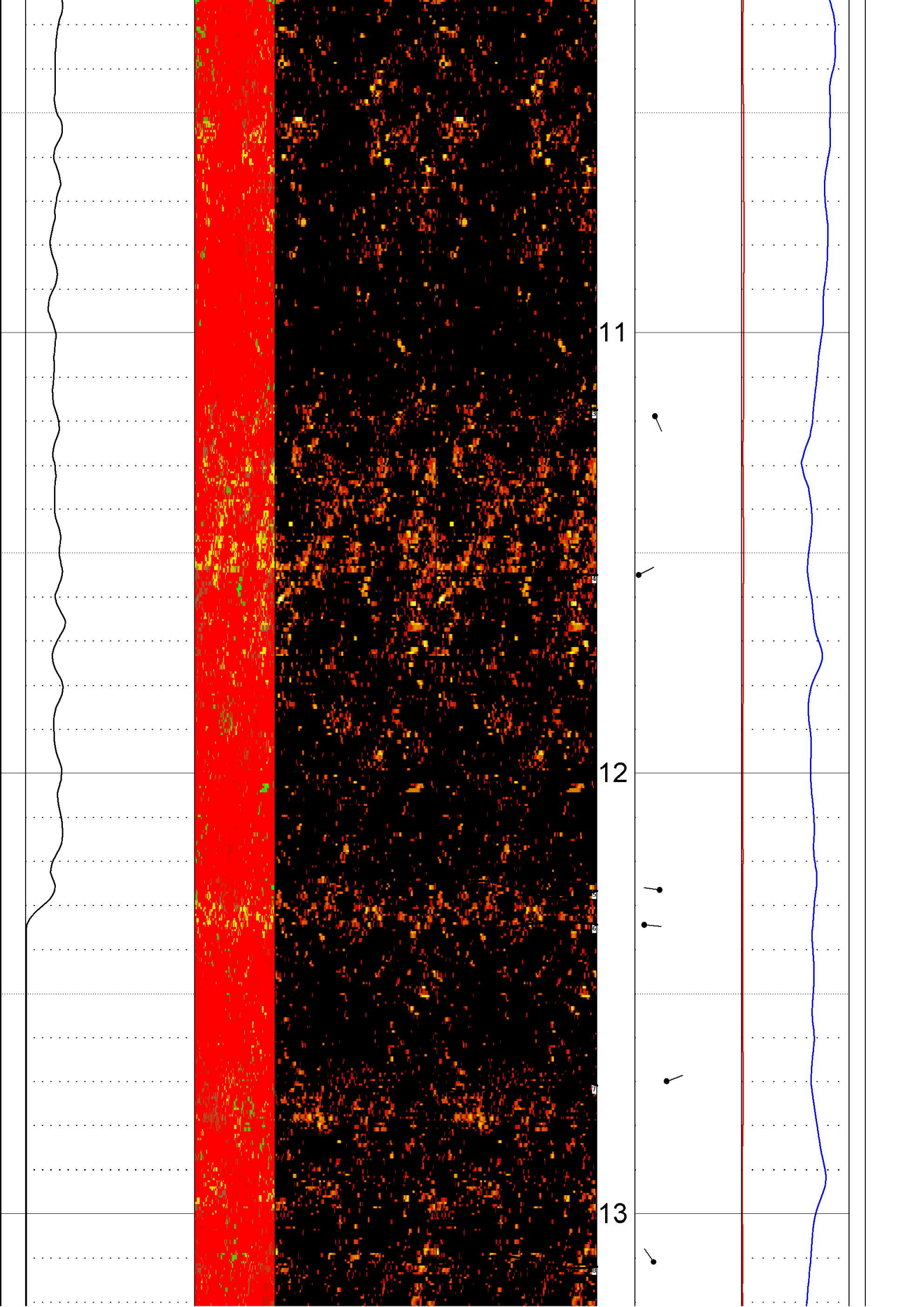


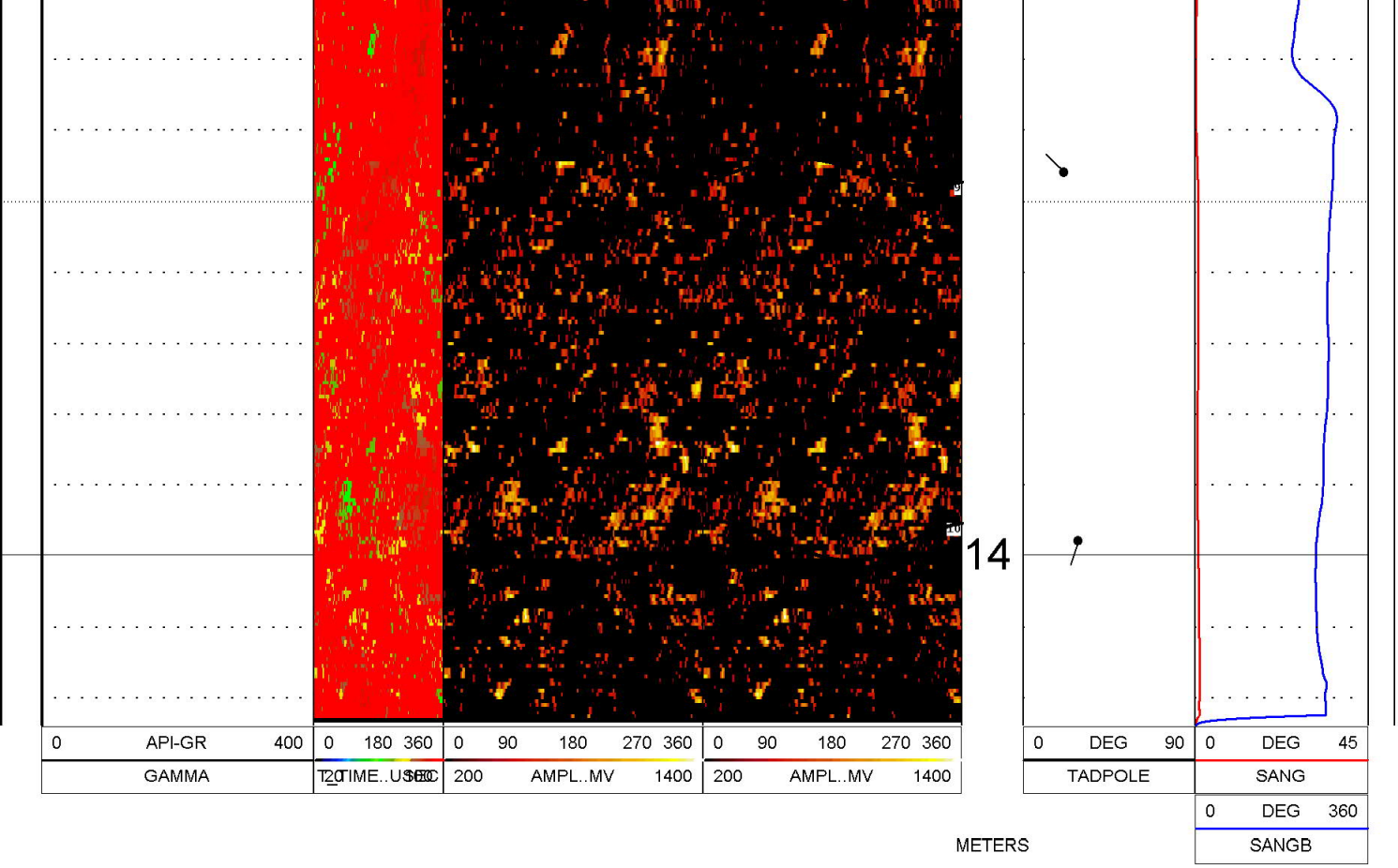
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COUNTY	:				
LOCATION	: MT PLEASANT				
SECTION	: N/A	TOWNSHIP	: N/A	RANGE	: N/A
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LOG TOP	: 7.500	DRL MEASURED FROM	: N/A	GL	: N/A
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CASING THICKNESS:		RECORDED BY	: A DAVIS		
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NEUTRON MATRIX	: DOLOMITE	MATRIX DELTA T	: 144	LGTIME	: 11:55
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ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS


METERS
SANGB
0 DEG 360
GAMMA
0 API-GR 400
T2 TIME..USEC
0 180 360
200 AMPL..MV 1400
0 90 180 270 360
200 AMPL..MV 1400
0 90 180 270 360
TADPOLE
0 DEG 90
SANG
0 DEG 45
8
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11
12
13


14
0 API-GR 400
GAMMA
0 180 360
T2 TIME..USEC
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200 AMPL..MV 1400
0 90 180 270 360
200 AMPL..MV 1400
0 DEG 90
TADPOLE
0 DEG 45
SANG
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METERS

Douglas Partners Pty Ltd
Mt Pleasant Rail
Infrastructure Project

Borehole BHCW11

OTV PETROPHYSICAL REPORT

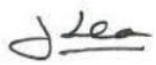
Groundsearch Australia Pty. Limited

2 July 2019

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For and on behalf of Groundsearch Australia Pty. Limited



John Lea BSc (Hons) FAusIMM
Principal Geologist
Managing Director

Summary

The data contained in this report were obtained from one, vertical, cored borehole that was drilled as a component of the 2019 geotechnical investigation programme for the Mt Pleasant Rail Infrastructure Project.

A Century Geophysical Corporation downhole optical televiewer (OTV) tool was used to collect the data in the field on 24 June 2019. The data in this report are from 4.83 to 14.64 metres below ground level.

The nine features identified are bedding planes and the SWL.

The tool relies on contrasting colour tones of the in borehole wallrocks to produce images that are used for interpretation and presentation.

All data are referenced to magnetic north and have been automatically recalculated to represent the vertical situation for dip and dip direction.

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Appendix 1 **–** Interpretation logs 4.83 to 14.64 mbgl

1.0 Background Technical Information

The data contained in this report were obtained from one, vertical, cored borehole that was drilled as a component of the 2019 geotechnical investigation programme for the Mt Pleasant Rail Infrastructure Project.

A Century Geophysical Corporation downhole optical televiewer (OTV) tool was used to collect the data in the field on 24 June 2019. The data in this report are from 4.83 to 14.64 metres below ground level.

The nine features identified are bedding planes and the SWL.

The tool relies on contrasting colour tones of the in borehole wallrocks to produce images that are used for interpretation and presentation.

All data are referenced to magnetic north and have been automatically recalculated to represent the vertical situation for dip and dip direction.

The OTV takes an oriented "picture" of the borehole using high-resolution sound waves. This acoustic picture is displayed in both amplitude and travel time. This information is used to detect bedding planes, fractures, and other borehole anomalies without the need to have clear fluid filling the boreholes.

The televiewer digitises 256 measurements around the borehole at each high-resolution sample interval. These data can be oriented to North and displayed real-time while logging using the Visual Compu-Log System.

Analysis software includes colour adjustment, fracture dip and strike determination, and classification of features. It allows information to be displayed on the graphical screen, plot, and in report format.

2.0 Interpretation Methodology

It should be noted that the OTV is a bowspring-type, centralised tool and is affected by poor wallrock conditions known as rugosity.

The OTV data interpretation procedure is based on the superposition of curves on feature logs directly onto the computer screen by using a subjective, manual; two-point definition of a feature's top and base to produce a sine curve. The sides of the time and amplitude plots represent magnetic north and magnetic south is in the centre of each plot. The low side, or trough, of the sine curve defines the dip direction of the feature.

The logging program automatically records the OTV tool slant angle and bearing and corrects for any borehole deviations. The curves are automatically given an identification number for subsequent referencing in a report file.

This report contains a;

- Text summary of the interpreted features
- Circular graphic representation of interpreted features
- Logs that show geological features with their subjective, numbered interpretation curves shown in colour at 1:10 scale. The logs are in standard format whereby the sonic image of the borehole wall is "flattened" onto the plot. The logs have the following additional features to enhance geological interpretations of the strata;
    - OTV image
    - Tadpoles that represent feature dip and dip direction
- Table containing feature curve ID, top, base, dip angle, dip azimuth, feature description and the generalised rock type that hosts the feature
- Graphical representation of the interpreted features

3.0 Borehole BHCW11 Interpretations

The nine features identified are bedding planes and the SWL.

Table 1 Interpreted features report for BHCW11

FEATURE ID	DIP (DEG)	AZIMUTH (DEG)	MIDPOINT (MBGL)	TOP (M)	BASE (M)	TYPE OF FEATURE
1	48	252	6.79	6.73	6.84	Bedding plane
2	51	251	6.90	6.84	6.96	Bedding plane
3	41	141	7.10	7.06	7.14	Bedding plane
4	55	141	7.35	7.28	7.41	Bedding plane
5	57	148	7.38	7.31	7.45	Bedding plane
6	48	137	7.49	7.44	7.54	Bedding plane
7	47	135	7.58	7.53	7.63	Bedding plane
8	48	140	7.64	7.59	7.69	Bedding plane
9	5	255	7.99	7.98	7.99	SWL

Figure 1 BHCW11 circular plan representation of interpreted features

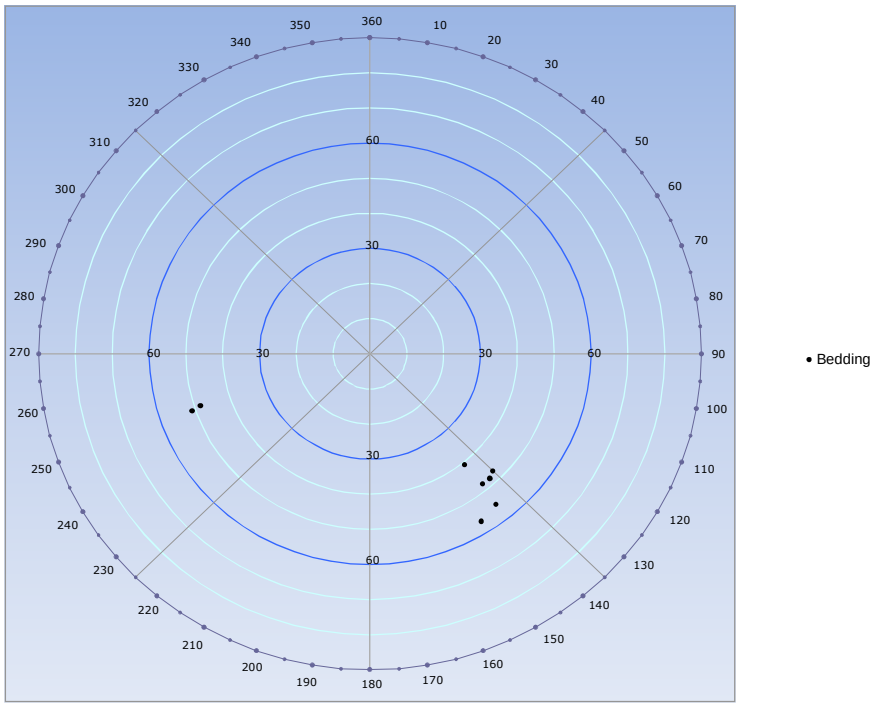


Figure 2 BHCW11 feature dip angle data distribution

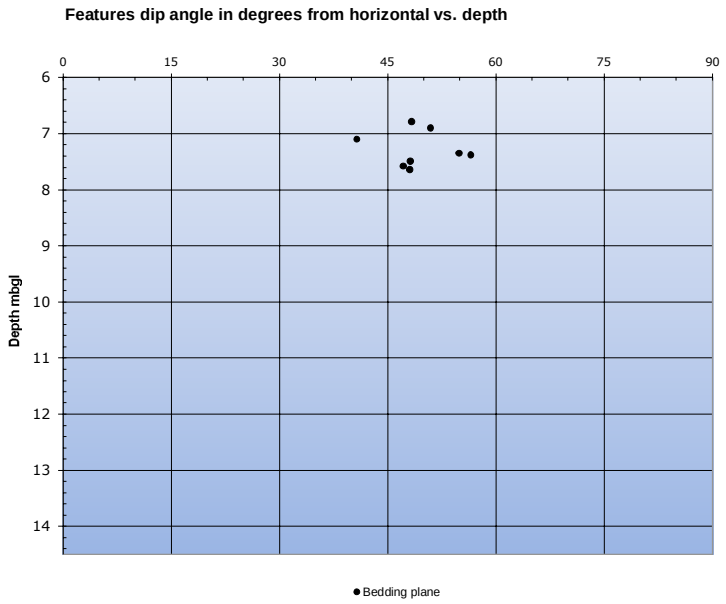


Figure 3 BHCW11 feature dip direction data distribution

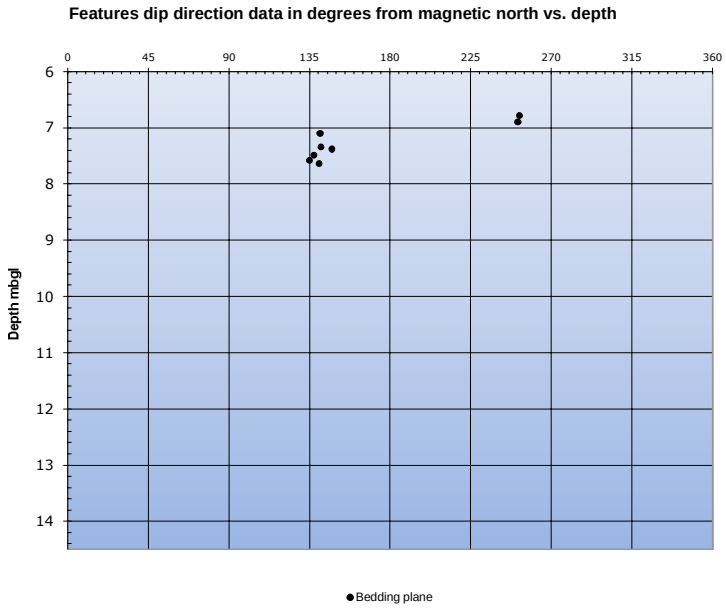


Table 2 BHCW11 bedding histogram data

Dip Distribution Total: 8			Orientation Distribution Total: 8		
Dip Range	Count	%	Bearing Range	Count	%
0 to 10	0	0.0	0 to 10	0	0.0
10 to 20	0	0.0	10 to 20	0	0.0
20 to 30	0	0.0	20 to 30	0	0.0
30 to 40	0	0.0	30 to 40	0	0.0
40 to 50	5	62.5	40 to 50	0	0.0
50 to 60	3	37.5	50 to 60	0	0.0
60 to 70	0	0.0	60 to 70	0	0.0
70 to 80	0	0.0	70 to 80	0	0.0
80 to 90	0	0.0	80 to 90	0	0.0
			90 to 100	0	0.0
			100 to 110	0	0.0
			110 to 120	0	0.0
			120 to 130	0	0.0
			130 to 140	2	25.0
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			150 to 160	0	0.0
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			300 to 310	0	0.0
			310 to 320	0	0.0
			320 to 330	0	0.0
			330 to 340	0	0.0
			340 to 350	0	0.0
			350 to 360	0	0.0

Figure 4 BHCW11 bedding dip direction data rose diagram

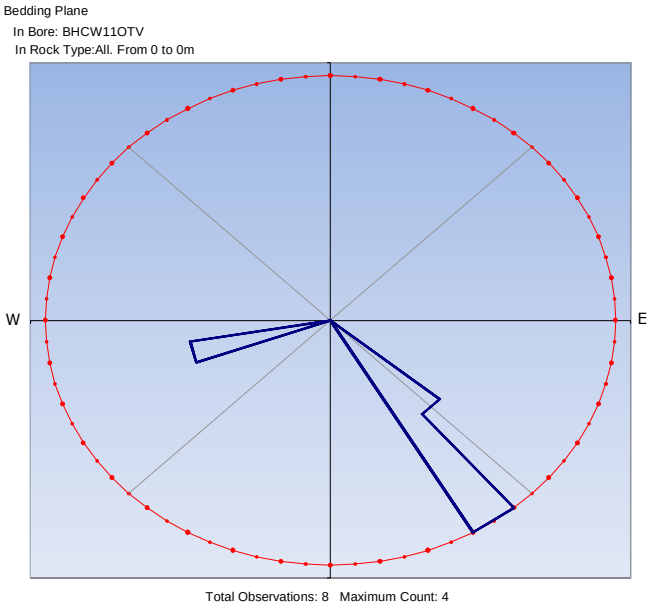


Figure 5 BHCW11 bedding dip angle histogram

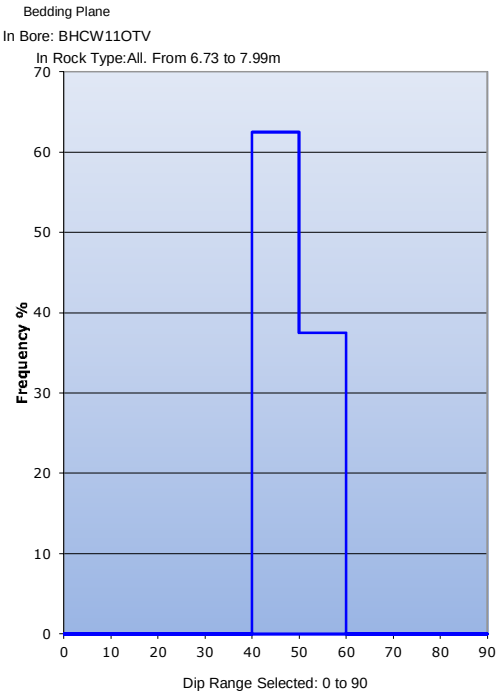
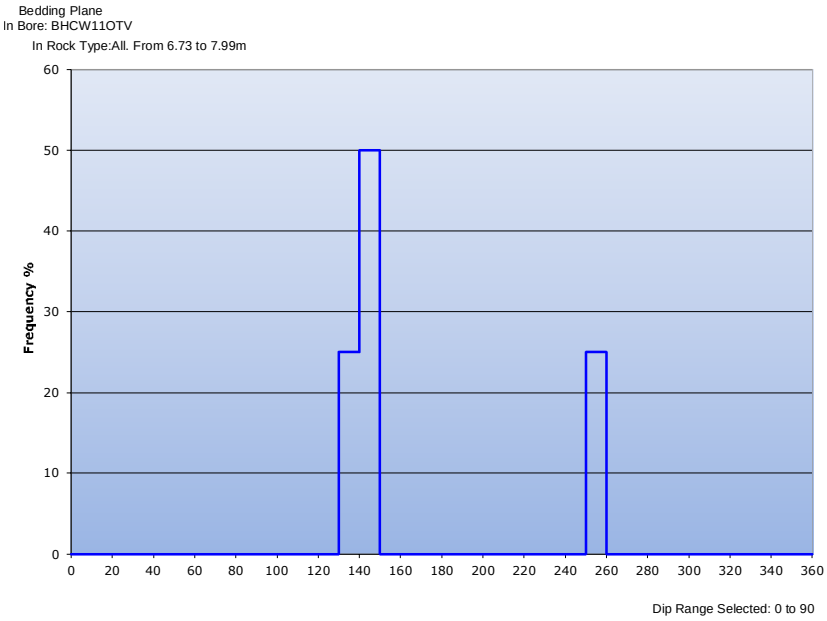


Figure 6 BHCW11 bedding dip direction histogram



Appendix 1

1:10 Interpretation Logs

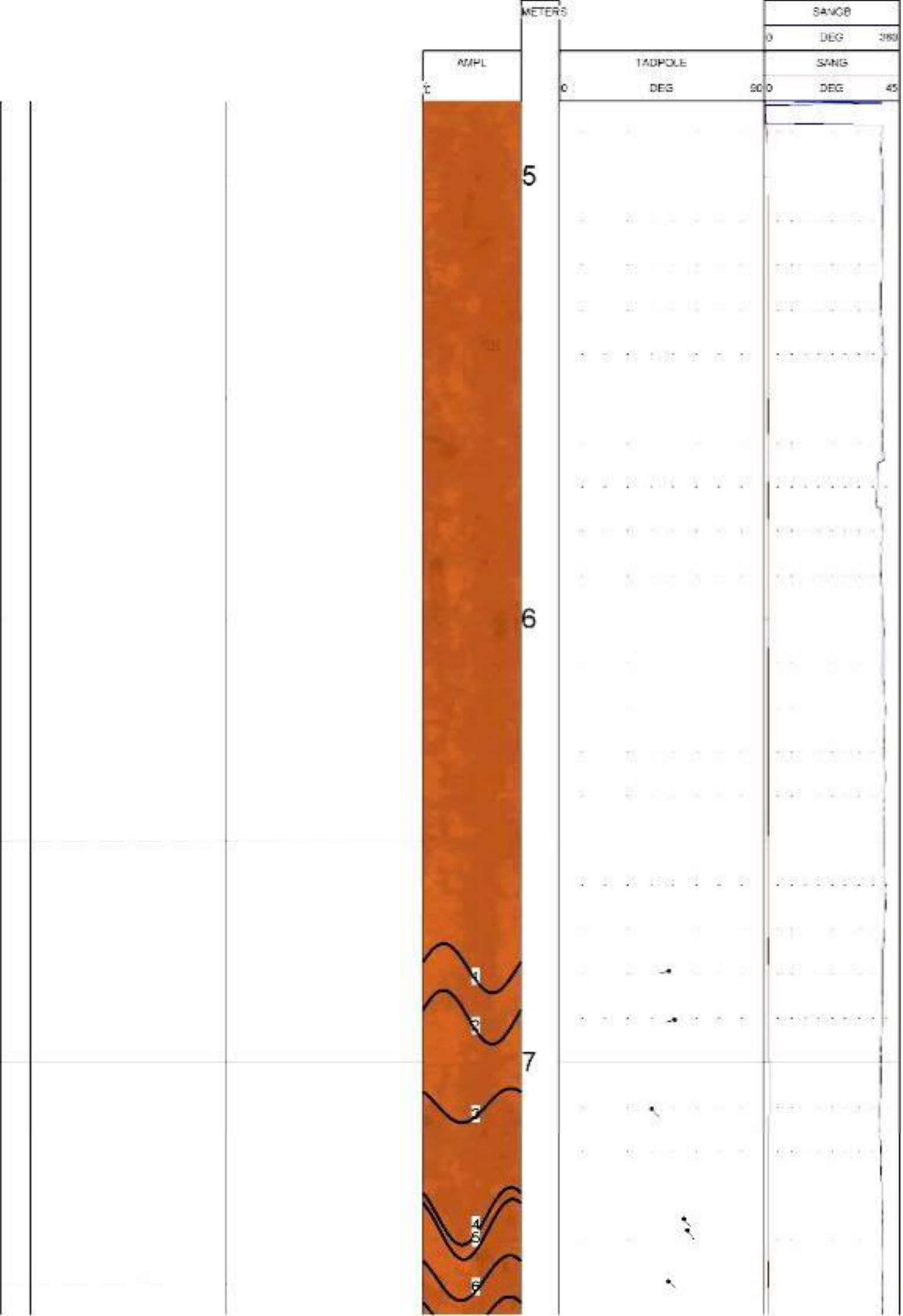
4.83 to 14.64 metres

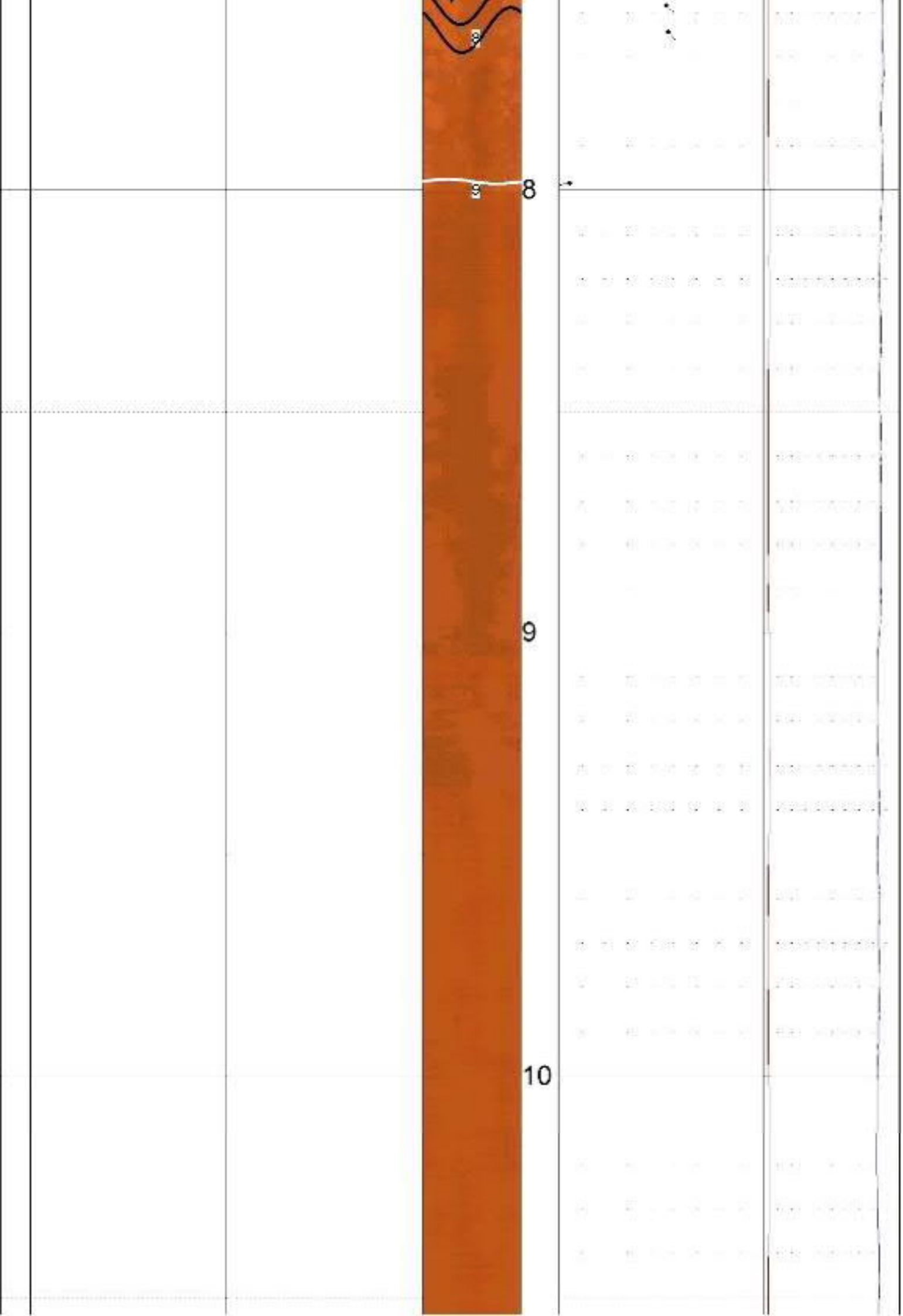


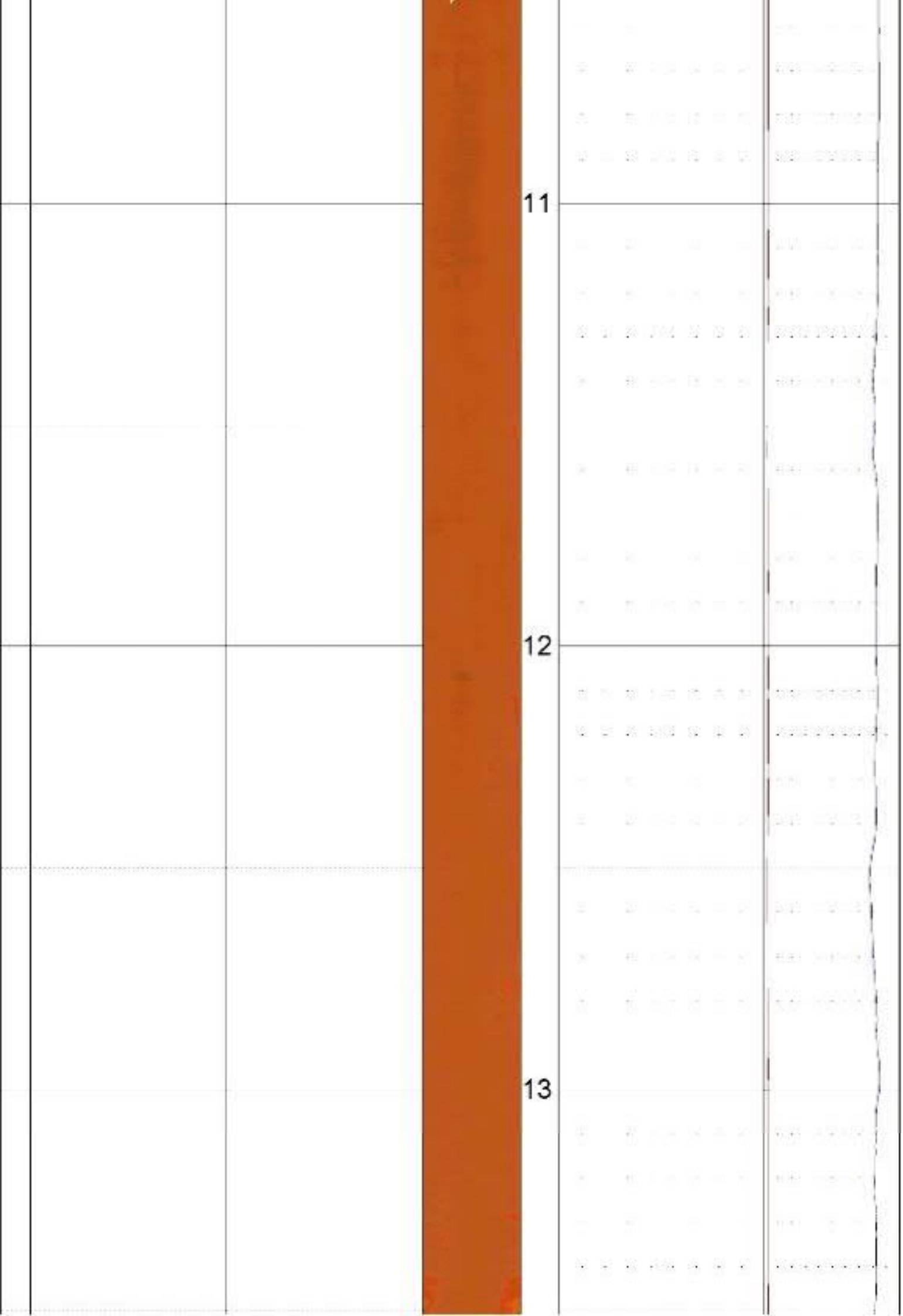
BHCW11 OTV 1:10

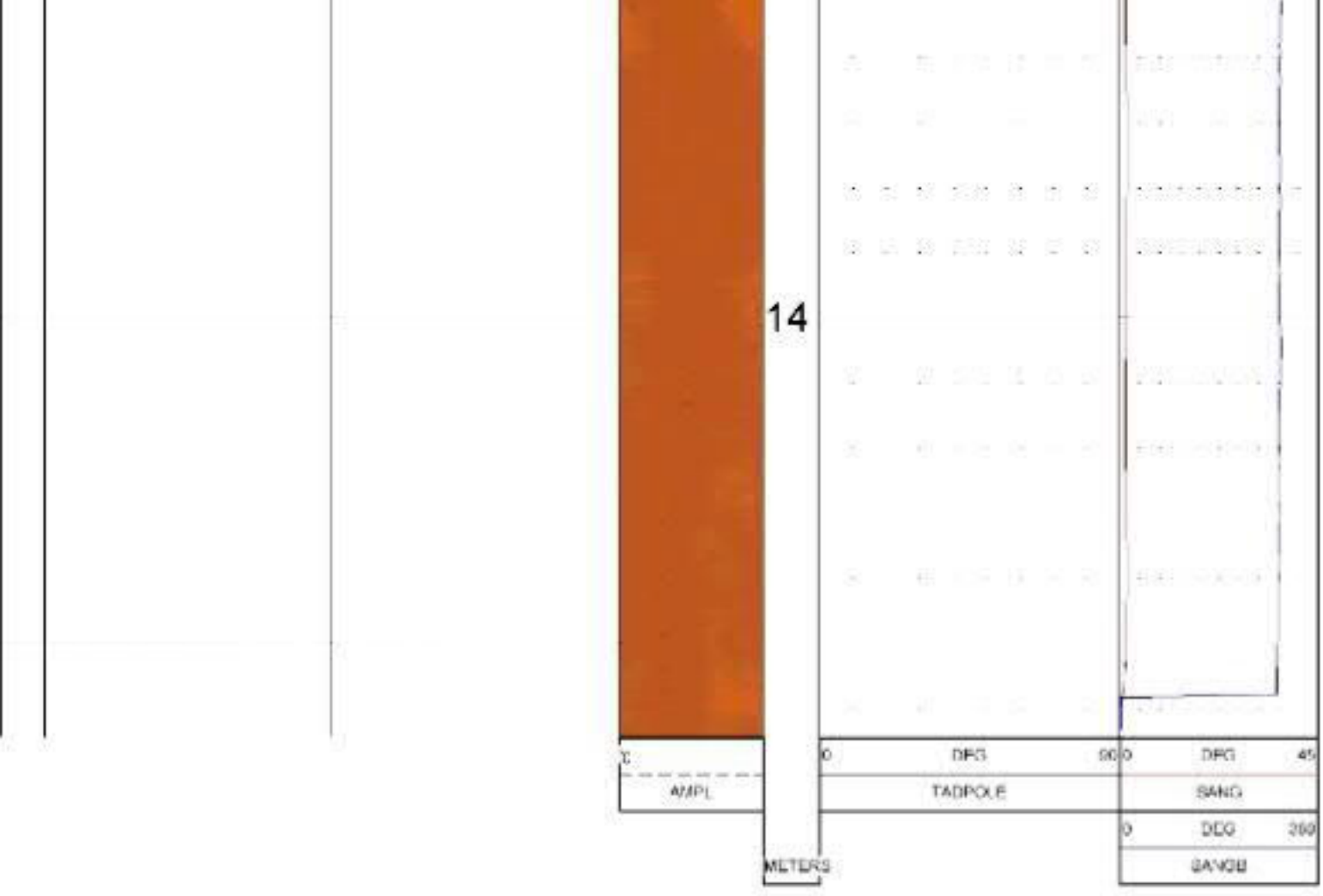
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COUNTY	:				
LOCATION	: MT PLEASANT				
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ALL SERVICES PROVIDED SUBJECT TO STANDARD TERMS AND CONDITIONS


METERS
SANGB
0 DEG 360
AMPL
TADPOLE
SANG
C
0 DEG 90
0 DEG 45
5
6
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8
9
10


11
12
13


14
AMPL
TADPOLE
SANG
METERS

Douglas Partners Pty Ltd
Mt Pleasant Rail Infrastructure Project

Borehole BHCW12_V2

OTV PETROPHYSICAL REPORT

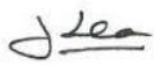
Groundsearch Australia Pty. Limited

2 July 2019

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For and on behalf of Groundsearch Australia Pty. Limited



John Lea BSc (Hons) FAusIMM
Principal Geologist
Managing Director

Summary

The data contained in this report were obtained from one, vertical, cored borehole that was drilled as a component of the 2019 geotechnical investigation programme for the Mt Pleasant Rail Infrastructure Project.

A Century Geophysical Corporation downhole optical televiewer (OTV) tool was used to collect the data in the field on 24 June 2019. The data in this report are from 1.74 to 6.12 metres below ground level.

The only feature identified is the base of casing. The remainder of the log could be affected by remnant mudcake.

The tool relies on contrasting colour tones of the in borehole wallrocks to produce images that are used for interpretation and presentation.

All data are referenced to magnetic north and have been automatically recalculated to represent the vertical situation for dip and dip direction.

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Appendix 1

1:10 Interpretation Logs

1.74 to 6.12 metres



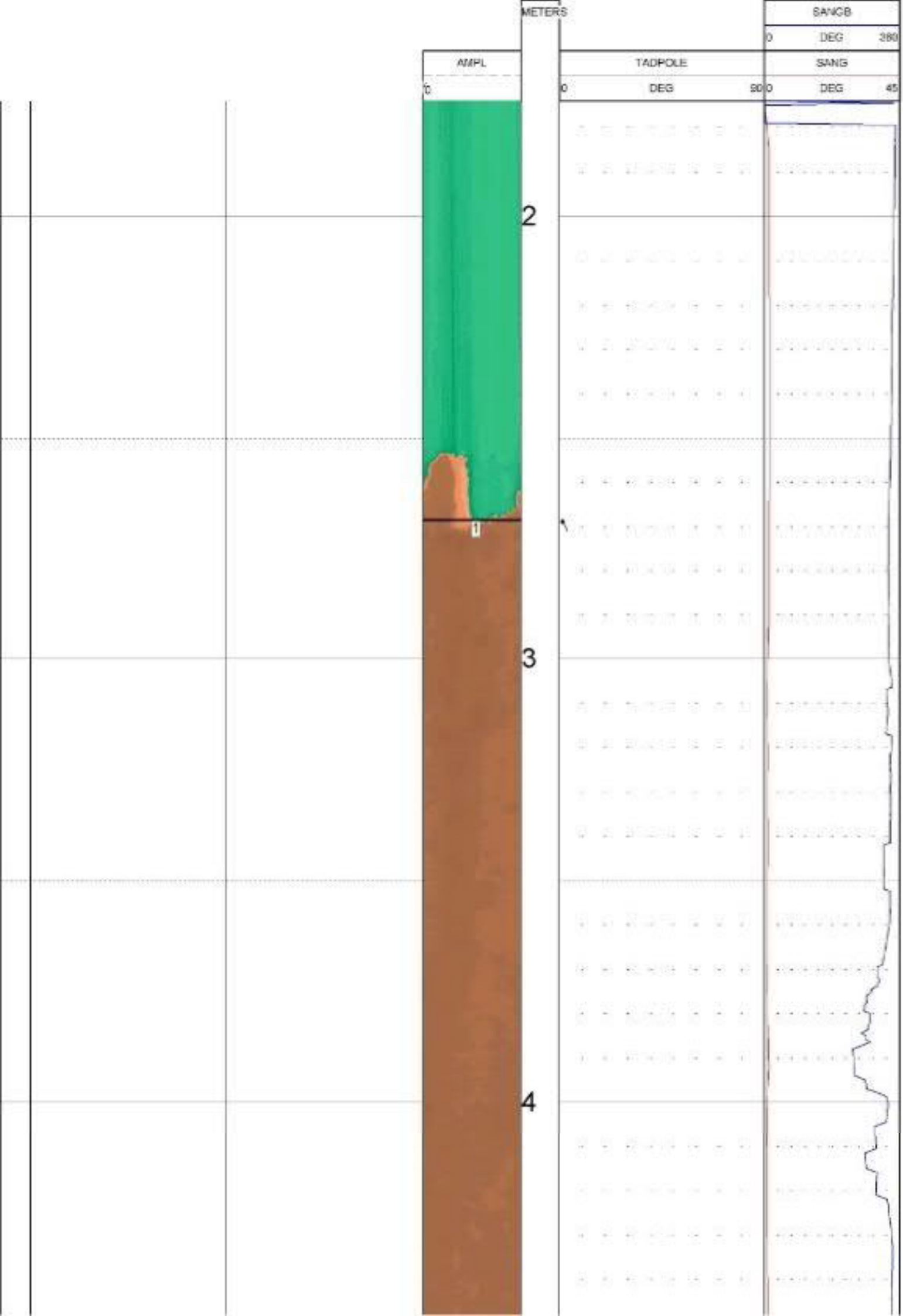
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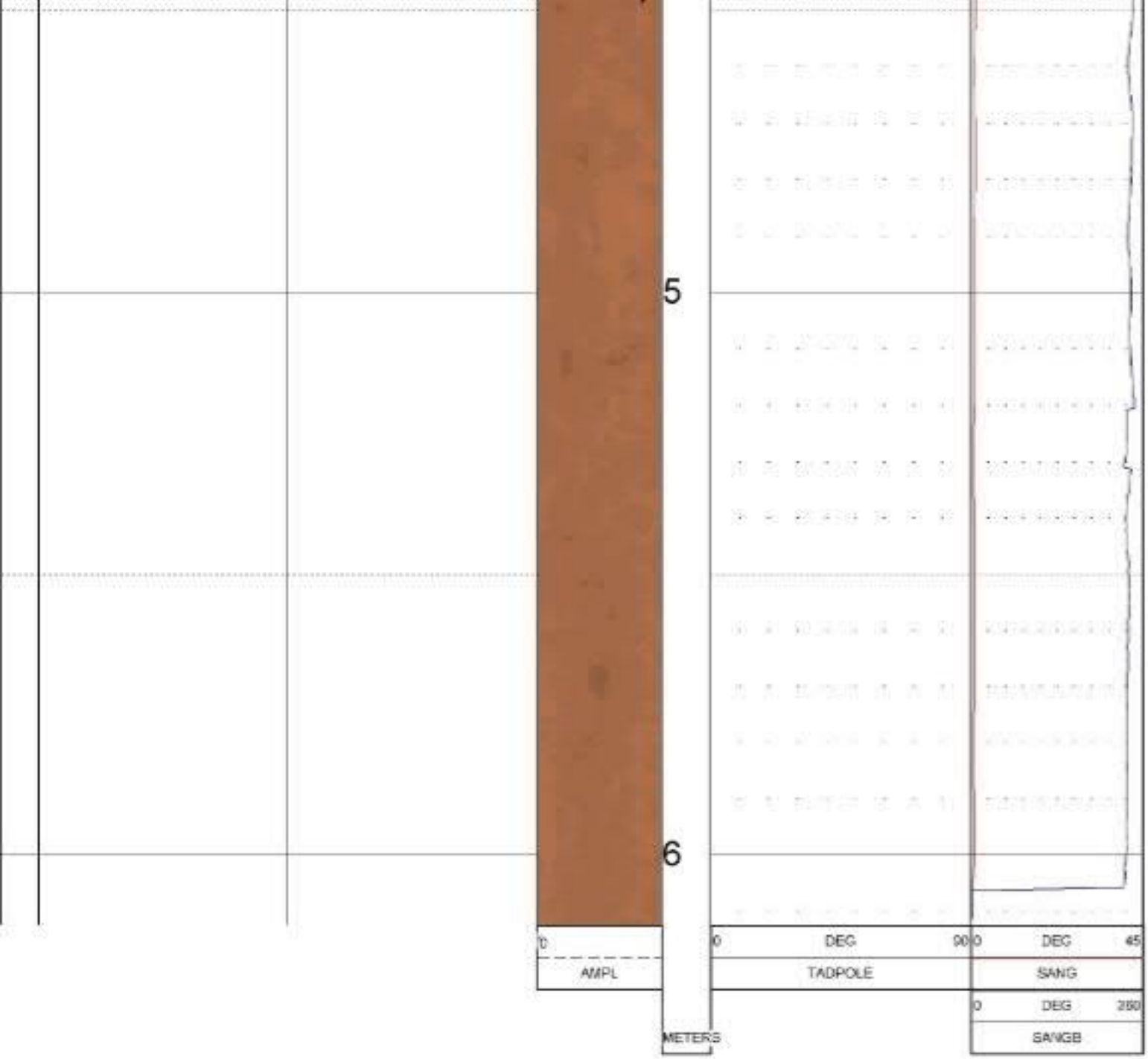
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OTHER SERVICES:
TV
OTV

BLOCKED @ 6M
NO WATER

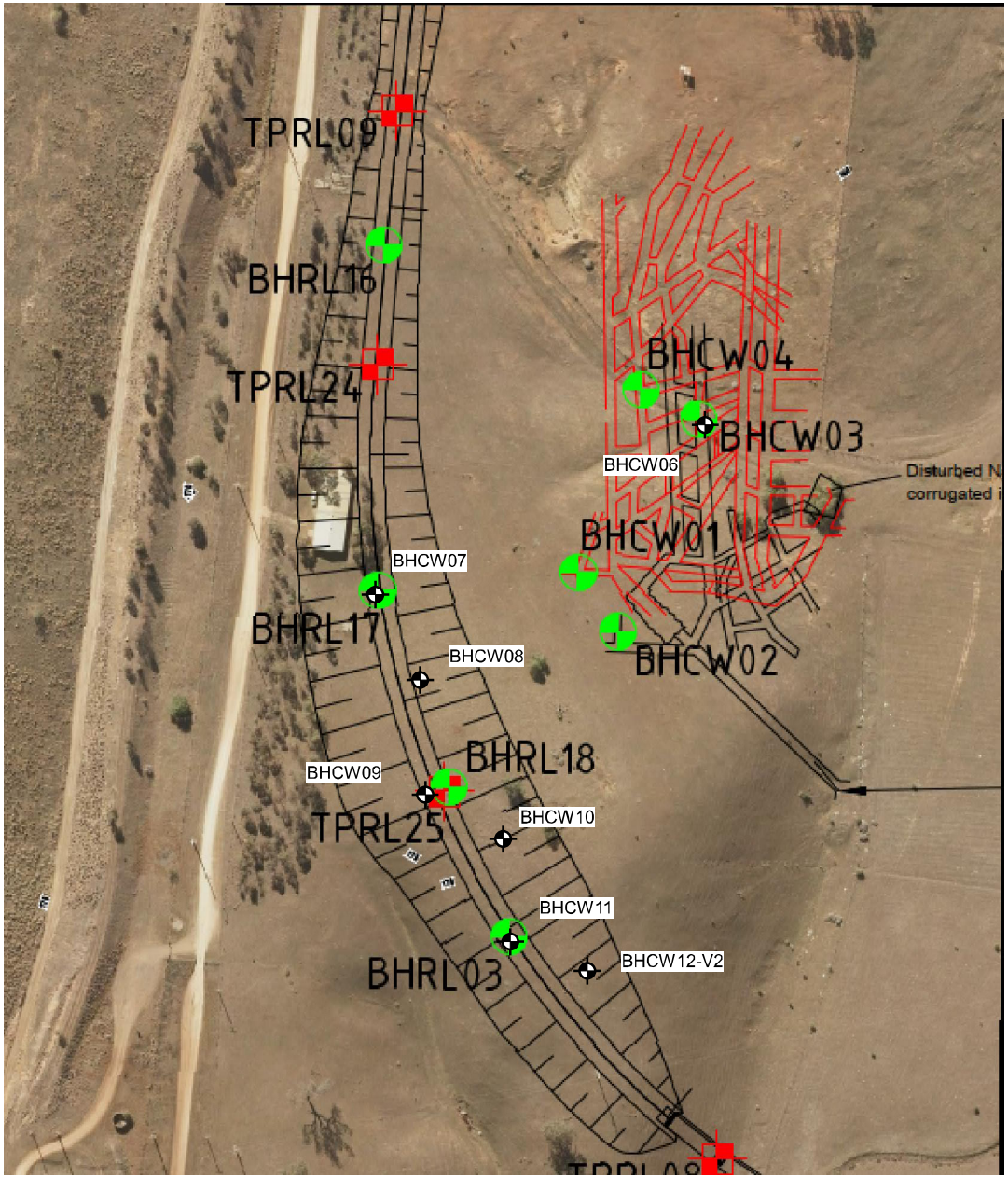
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SANG
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2
3
4

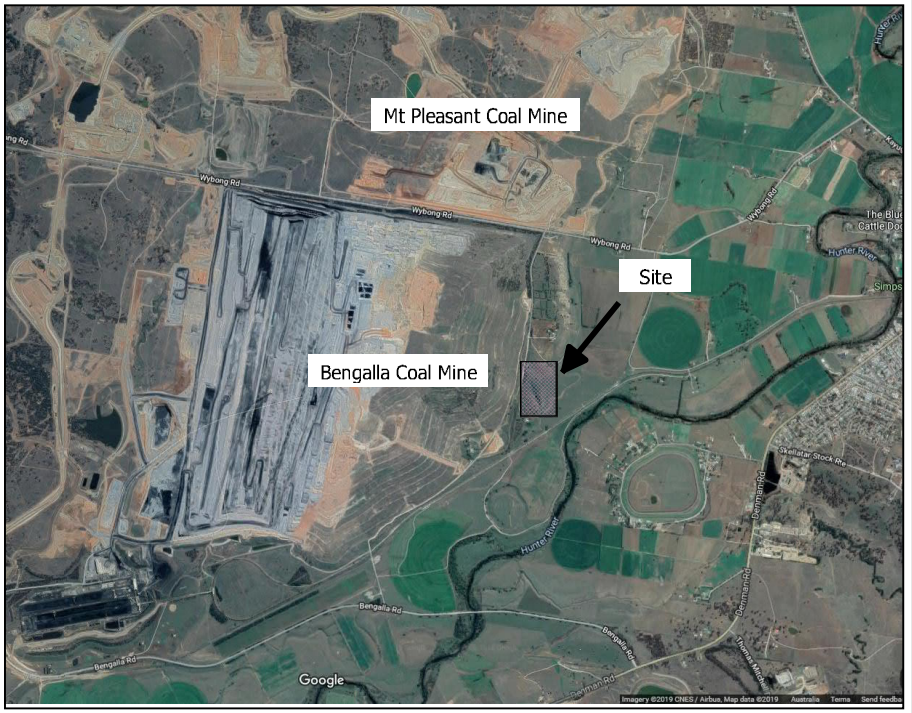

5
6
0
AMPL
0 DEG 90
TADPOLE
METERS
0 DEG 45
SANG
0 DEG 250
SANGB

Appendix C

Drawing 1 – Test Location Plan



Drawing adapted from test location plan supplied by AECOM



Site Location

Legend

- Current Investigation - Approximate Bore Location
- Previous Test Bore
- Previous Test Pit

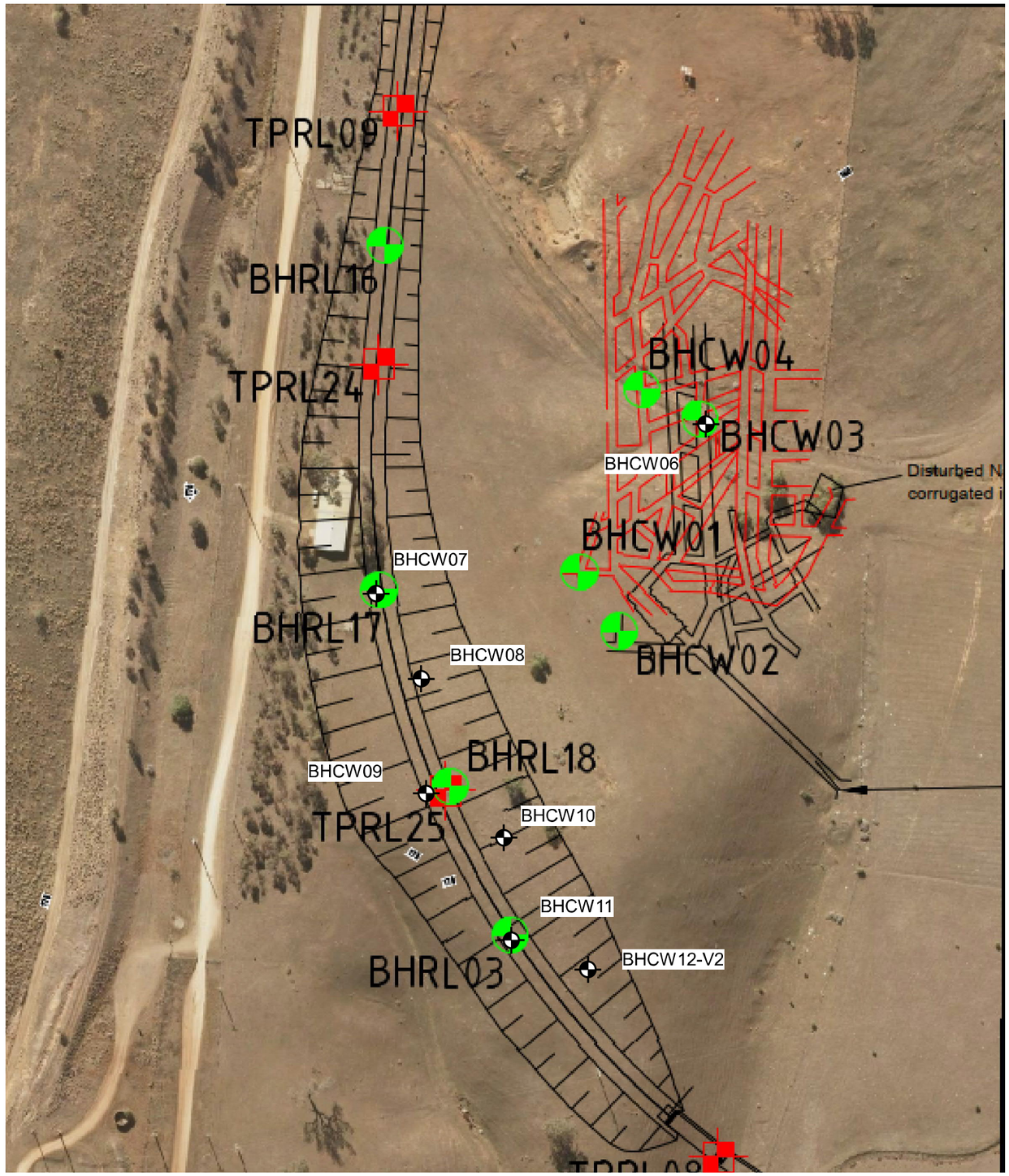
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	OFFICE: Newcastle / DRAWN BY: CTB	**Proposed Stage 2 Rail Loop**	DRAWING No: 1
	SCALE: 1:2000 @ A3 / DATE: 10 July 2019	**Mt Pleasant Coal Mine, Muswellbrook**	REVISION: 0

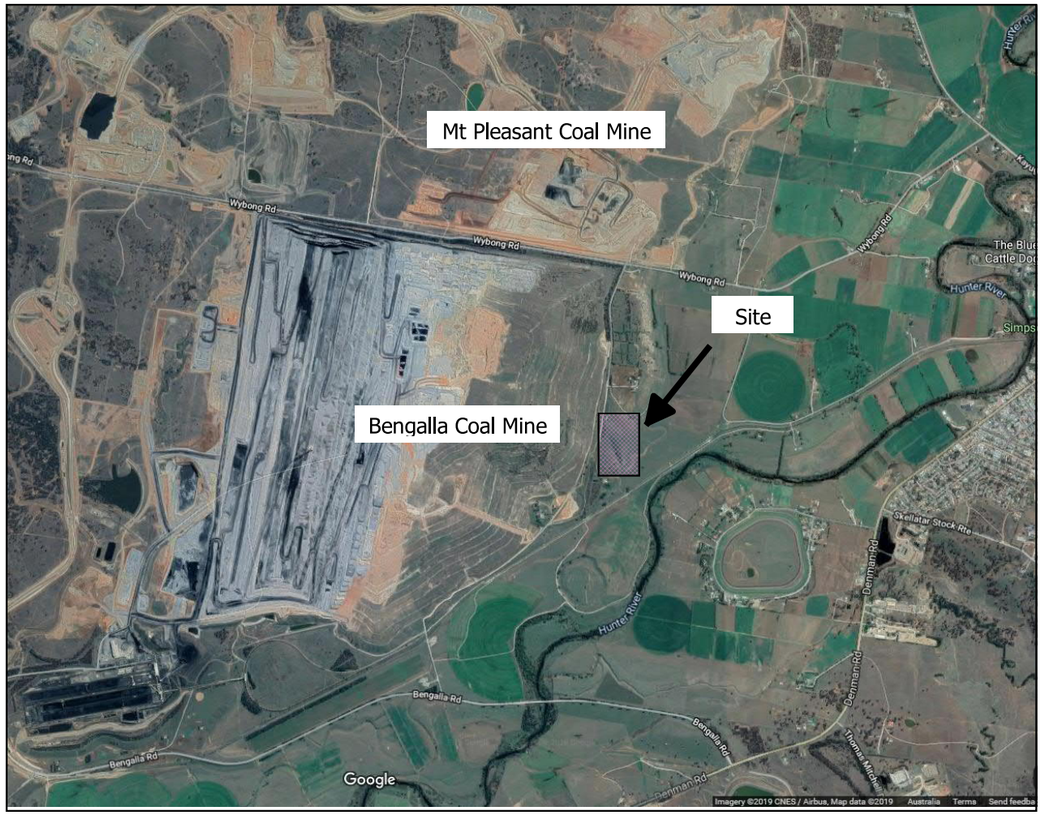
Appendix C

Bore Location Plan (Douglas Partners)

Appendix C Bore Location Plan (Douglas Partners)



Drawing adapted from test location plan supplied by AECOM



Site Location

Legend

- Current Investigation - Approximate Bore Location
- Previous Test Bore
- Previous Test Pit

0 50 100 150 200 m

Douglas Partners Geotechnics / Environment / Groundwater	CLIENT: AECOM	TITLE: **Test Location Plan**	PROJECT: 91570.00
	OFFICE: Newcastle / DRAWN BY: CTB	**Proposed Stage 2 Rail Loop**	DRAWING No: 1
	SCALE: 1:2000 @ A3 / DATE: 10 July 2019	**Mt Pleasant Coal Mine, Muswellbrook**	REVISION: 0

Appendix D

Investigation Report (WSP)

Appendix D Investigation Report (WSP)

MACH ENERGY

GEOTECHNICAL INVESTIGATION OF PROPOSED RAIL LOOP SPUR AND OVERTON ROAD REALIGNMENT SOUTH OF WYBONG ROAD, MT PLEASANT COAL MINE

GEOTECHNICAL INTERPRETIVE REPORT

MAY 2019



Question today
Imagine tomorrow
Create for the future

Geotechnical investigation of proposed rail loop spur and Overton Road realignment South of Wybong Road, Mt Pleasant Coal Mine
Geotechnical Interpretive Report

MACH Energy

WSP
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Newcastle NSW 2300
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Newcastle NSW 2300

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REV	DATE	DETAILS
A	May 2019	DRAFT

	NAME	DATE	SIGNATURE
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Reviewed by:	David L Knott	May 2019	
Approved by:	Jamie Anderson	May 2019	

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1 INTRODUCTION

The Mt Pleasant Rail Loop Project includes a proposed new rail loop alignment and a product coal conveyor at the Mt Pleasant Coal Mine, west of Muswellbrook NSW. The concept design for the new rail loop has been developed by MACH Energy and includes the following:

— Realignment of a section of Overton Road south of Wybong Road (addressed in this report)

— Excavation of cuts down to approximately 18 m deep for the rail alignment (addressed in this report)

— Construction of fill embankments for the rail alignment (addressed in this report)

— Construction of an overland conveyor from the rail loop to the product stockpile area (see separate report)

— Construction of a rail bridge over Wybong Road and Overton Road, near their intersection (see separate report)

— Construction of a rail viaduct over an unnamed creek, northwest of the Hunter River. The viaduct has been addressed in a separate report, however it is noted that it is located within the rail alignment south of Wybong Road, which is the subject of this report.

— Construction of two sedimentation dams (see separate report)

This report presents the results of the geotechnical investigation undertaken by WSP for proposed rail loop spur and road south of Wybong Road, as shown on Drawing 1 in Appendix A. The objective of the investigation was to assess the subsurface conditions along the alignment of the spur and Overton Road and to provide comments and recommendations for design.

This report provides comments and recommendations relating to the following:

— Ground conditions

— Geotechnical design parameters

— General earthworks and site preparation

— Excavation characteristics of soil and rock

— Batter stability

— Suitability of materials encountered for use in construction

— Rail formation design

— Roadway subgrade

An abandoned underground coal mine is located near the rail alignment, which has been assessed by others. No comment regarding potential mine subsidence has been included in this report.

2 SITE INFORMATION

2.1 SITE DESCRIPTION

The 1: 25 000 Muswellbrook Topographic map indicated that the site is located in an area of gently to moderately undulating hills cut by drainage lines which generally flow southeast toward the Hunter River. Much of the land to the south and north of the alignment has been disturbed and modified by open cut coal mining and construction of mining infrastructure. The land east of Overton Road has been cleared for farming, however the natural undulating topography remains.

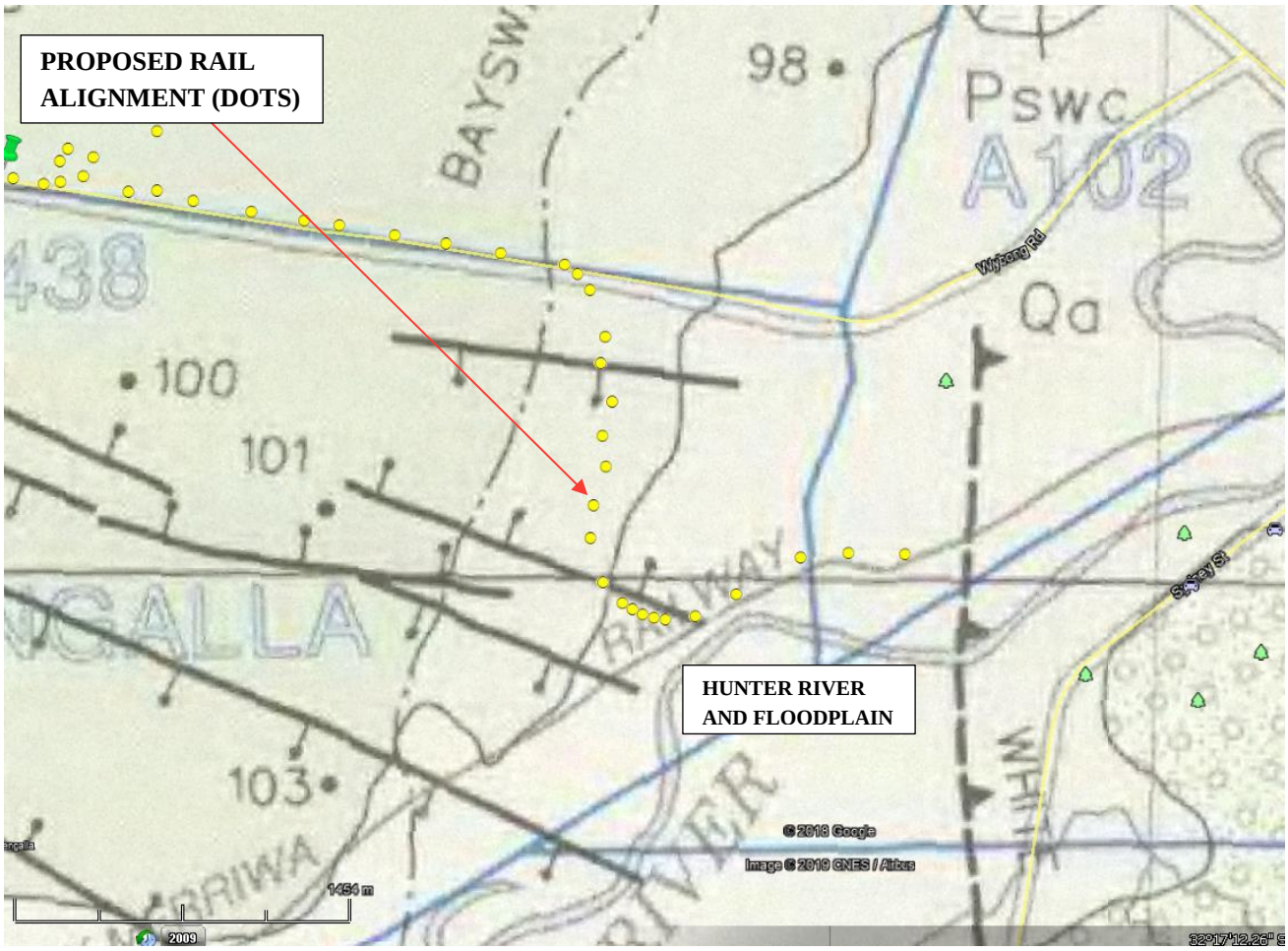
2.2 GEOLOGY

As shown in Figure 2-1, an extract from the 1:100,000 Hunter Coalfield Regional Geology Map, the site is located within the following geological units:

— Quaternary alluvium, comprising sand, silt and gravel associated with the Hunter River (Map symbol Qa) at lower elevations in the valley,

— Sandstone, siltstone, shale, conglomerate, and coal of the late Permian age Wittingham Coal Measures (Map symbols Pswc and Pswv, for the Saltwater Creek Formation and Vane subgroup respectively) at higher elevations to the west and underlying the alluvium. The dip is generally to the west at a low angle.

A number of faults and a thrust fault are also shown near the proposed rail loop. These faults may be exposed during excavations for foundations and cuttings. These faults may affect seam depths at different borehole locations.



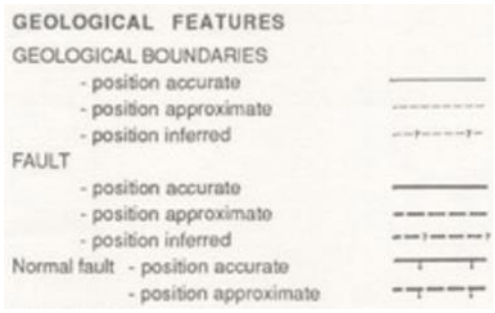


Figure 2-1 Regional geology in the area of the proposed rail loop
Source; 1:100,000 Hunter Coalfield Regional Geology Map, 1993

3 METHOD OF INVESTIGATION

3.1 FIELDWORK

The geotechnical investigation involved excavation of test pits and borehole drilling. The investigation locations are shown on the following drawings included in Appendix A;

— Drawing 1, area east of the viaduct

— Drawing 3, area north of the viaduct

Test locations and depths were provided by MACH Energy.

Test pits were excavated along the rail spur and Overton Road realignment south of Wybong Road. They were excavated using 5-tonne and 8-tonne excavators and a backhoe to a depth of approximately 3 m or prior refusal and backfilled upon completion using the excavated material. All test pits were photographed prior to backfilling.

Twelve boreholes were drilled in areas of proposed cuts or structures. Boreholes were drilled using a truck mounted drilling rig equipped with solid flight augers and rock coring equipment. Boreholes were augured to refusal then extended into rock to the depth of the proposed cut or deeper. Standard Penetration Tests (SPTs) were completed at generally 1.5 m intervals until top of rock was reached, where coring started. Rock coring using NMLC and HQ techniques was undertaken at the site, with all core boxed and photographed. BHLR18A was drilled as a supplementary borehole, adjacent to BHRL18, due to a sheared drill bit which prevented the borehole reaching its target depth.

Fieldwork was carried out under the full-time supervision of engineering geologists and geotechnical engineers from WSP who were responsible for recording subsurface conditions encountered in the test pits and boreholes, preparing engineering logs, and nominating sampling and testing locations. Logging was undertaken in general accordance with AS1726-2017 – Geotechnical Site Investigations. Engineering logs are included in Appendix B together with explanatory notes that describe the terms and symbols used.

Pocket penetrometer testing was completed on cohesive soils recovered from the test pits and boreholes. These results are included on the engineering logs. The strength of weathered bedrock was assessed by observation of the excavation progress in test pits and Point Load Index testing completed on rock core.

Groundwater observations were made in the test pits and boreholes during and a short time after excavation prior to backfilling. Meaningful groundwater measurements could not be undertaken in the boreholes once rock coring commenced. Long-term groundwater monitoring was not part of the scope.

A summary of the geotechnical investigation locations relevant to this report are shown in Table 3-1.

Table 3-1 Summary of investigation locations relevant to this report

INVESTIGATION DESIGNATION	ELEVATION (RL m AHD)	STARTED	COMPLETED	MACHINE	DEPTH (m bgl)	BOTTOM RL
BHRL01	139.97	21/02/2019	21/02/2019	GD03 Scout	26.2	113.8
BHRL02	139.73	23/02/2019	24/02/2019	GD03 Scout	29	110.7
BHRL03	168.89	24/02/2019	25/02/2019	GD03 Scout	18	150.9
BHRL05	169.23	7/03/2019	7/03/2019	GD03 Scout	18.4	150.9
BHRL06	180.3	27/02/2019	27/02/2019	GD03 Scout	18.6	161.7
BHRL07	187.47	26/02/2019	26/02/2019	GD03 Scout	19.1	168.4
BHRL08	173.59	25/02/2019	26/02/2019	GD03 Scout	18	155.6
BHRL15	186.02	28/02/2019	28/02/2019	GD03 Scout	18.1	167.9
BHRL16	165.78	7/03/2019	8/03/2019	GD03 Scout	18.1	147.7
BHRL17	169.94	9/03/2019	11/03/2019	GD03 Scout	45.9	124
BHRL18	171.27	12/03/2019	21/03/2019	GD03 Scout	28	143.3
BHRL18A	171.27	21/03/2019	23/03/2019	GD03 Scout	50.6	120.7
TPRL01	142.63	30/01/2019	30/01/2019	Backhoe	4.1	138.5
TPRL02	142	30/01/2019	30/01/2019	Backhoe	4.5	137.5
TPRL03	141.24	30/01/2019	30/01/2019	Backhoe	4.2	137
TPRL04	140.86	26/02/2019	26/02/2019	Backhoe	4.1	136.8

INVESTIGATION DESIGNATION	ELEVATION (RL m AHD)	STARTED	COMPLETED	MACHINE	DEPTH (m bgl)	BOTTOM RL
TPRL05	140.41	26/02/2019	26/02/2019	Backhoe	4.1	136.3
TPRL06	140.14	26/02/2019	26/02/2019	Backhoe	4	136.1
TPRL07	140.14	26/02/2019	26/02/2019	Backhoe	4	136.1
TPRL08	140.33	26/02/2019	26/02/2019	Backhoe	3.7	136.6
TPRL09	164.85	27/02/2019	27/02/2019	Backhoe	3	161.9
TPRL24	166.51	27/02/2019	27/02/2019	Backhoe	4	162.5
TPRL25	171.35	26/02/2019	26/02/2019	Backhoe	4	167.3

3.2 LABORATORY TESTING

Disturbed and undisturbed soil samples were collected from the test pits and boreholes, and sent to a laboratory for the following NATA accredited geotechnical testing:

— 12 x Atterberg limits and linear shrinkage

— 5 x Particle size distribution

— 7 x 4-day soaked CBR and standard compaction

— 6 x Emerson dispersion

— 12 x Moisture content

4 RESULTS OF INVESTIGATION

4.1 SUBSURFACE CONDITIONS

A summary of the subsurface conditions encountered along the proposed spur and Overton Road realignment south of Wybong Road is provided below. Reference should be made to the test pit and borehole logs included in Appendix B for more detailed information.

Test pits TPRL01 to TPRL09, TPRL24, TPRL25 were excavated and boreholes BHRL01, BHRL02, BHRL03, BHRL05, BHRL06, BHRL07, BHRL08, BHRL15, BHRL16, BHRL17, BHRL18, BHRL18A drilled along the proposed rail spur alignment as shown on Drawings 1 and 3 in Appendix A.

The rail spur is sectioned into a northern section (including the cutting), north of the viaduct and an eastern section, east of the viaduct, with the rail viaduct discussed in a separate report.

The geotechnical profiles on Drawing 2 and 4 in Appendix A indicates the approximate depth to the top of rock at locations where rock was encountered with respect to the proposed rail alignment grade. For further information, refer to the logs in Appendix B.

4.1.1 EASTERN SECTION – RAIL SPUR

This portion of the rail spur connects to the existing rail line and extends to the eastern end of the viaduct. The investigation data is shown along the alignment profile on Drawing 2. The test pits and boreholes generally encountered topsoil to depths of approximately 0.2 m, underlain by alluvium, low to high plasticity, generally stiff to hard silty and sandy clays. In some test pits, the clay soil was underlain by dense to very dense clayey sand layers, greater than 2.4 m thick and sandy silt in one test pit. Sandy gravel to gravel was encountered below these materials in BHRL01. Rock was encountered in BHRL01 at a depth of 14.5 m and consisted of very low to medium strength, extremely to slightly weathered siltstone and low to high strength sandstone.

The geotechnical investigation did not extend into the rail corridor or through the existing rail formation.

4.1.2 NORTHERN SECTION – RAIL SPUR

This portion of the rail spur is north of the viaduct. Based on the results of the investigation and the proposed rail alignment, the rail spur between Overton Road and the viaduct was split into two sections:

— Cutting 1 (Ch1500 – 1940) This cut is expected to be in soil. Closer to the floodplain of the Hunter River, test pits and boreholes typically encountered topsoil to depths of 0.1 - 0.2 m, underlain by alluvial silty clays and sandy clayey gravels, BHRL02-BHRL03 and BHRL16-BHRL18A encountered clayey gravel deposits, ranging from 3.5 m to 12.5 m.

— Cutting 2 (Ch1940 – 2760) This cut is expected to be in rock. Moving north along the spur, the boreholes and test pits north of TPRL09 transition from alluvium to residual very stiff to hard silty and sandy clays to depths down to 2.5 m. The underlying rock was encountered in the boreholes at varying depths. It typically comprised very low to medium strength siltstone and low to very high strength sandstone. Coal seams of various thicknesses were also present as shown on the profile in Drawing 4 in Appendix A. They may outcrop in the cuts.

4.1.3 OVERTON ROAD REALIGNMENT

Test pits TPOR01 to TPOR03 were excavated along the proposed realignment of Overton Road. The conditions encountered are summarised in Table 4-1.

Table 4-1 Overton Road Realignment Test Pit Summary

UNIT	TYPICAL DEPTH RANGE (m)	DESCRIPTION
Topsoil	0.00 - 0.15	Silty Clay; high plasticity, trace angular gravel.
Residual	0.15 - 0.80	Silty Clay; hard, high plasticity with fine to medium grained angular gravel.
Weathered Rock/Rock	> 0.80	Siltstone/sandstone; very low to low strength.

4.2 GROUNDWATER

Groundwater was not encountered in any of the investigation locations for the period that they remained open. Long-term groundwater monitoring was not part of this scope. It is noted that groundwater observations within the boreholes was not possible due to use of drilling fluids for installation of casing and coring.

It is expected that groundwater will be present within the alluvium adjacent to the Hunter River to the south-east and other materials particularly after periods of precipitation. Groundwater levels can also be expected to vary over time.

4.3 LABORATORY TEST RESULTS

Laboratory test results are summarised below and provided in Table 4-2. Laboratory certificates are provided in Appendix C.

4.3.1 OVERTON ROAD REALIGNMENT

— Material typically tested was a residual Silty CLAY

— Field moisture content was in the range of 9.8 % – 15.8 %, which was dry of the optimum moisture content. The optimum moisture content ranged between 17.5 % - 21 %

— Maximum standard dry density was 1.58 t/m^3 - 1.66 t/m^3

— 4 Day soaked CBRs were in the range of 3 % – 4 %, with swell values in the range of 2 % - 3.5 %

— Linear shrinkage ranged between 7 % - 16.5 % with a Plasticity Index (PI) of 27 % – 41 %

— Emerson Class test results of 4 generally indicated the soils tested were not prone to dispersion.

4.3.2 RAIL SPUR (EASTERN SECTION)

— Material tested was an alluvial Silty CLAY

— Field moisture content was in the range of 13.5 % – 15.2 %, which was dry of the optimum moisture content. The optimum moisture content ranged between 21 % – 21.5 %

— Maximum standard dry density was 1.53 t/m^3 – 1.60 t/m^3

— 4 Day soaked CBRs were in the range of 2.5 % - 3.5 % with swell values in the range of 3 % - 4 %

— Linear shrinkage ranged between 11% - 13 % with a PI of 25 % – 34 %

— Emerson Class test results of 5 which indicate soils are not prone to dispersion

4.3.3 RAIL CUTTING 1 (NORTHERN SECTION)

— Material tested was an alluvial Silty CLAY

— Field moisture content was 12.4 % for the one sample tested, which was dry of the optimum moisture content, at approximately of 22 %. Note, residual soils were tested as part of the Overton Road work.

— Maximum dry density was 1.60 t/m^3

— 4 Day soaked CBR of 6.0 % with a swell value of 1 %

— Linear shrinkage 13 % with a PI of 43 %

— Emerson Class test results of 4 and 5 generally indicated the soils tested were not prone to dispersion.

Table 4-2 Laboratory test results summary

SAMPLE ID	FIELD DESCRIPTION	LL (%)	PL (%)	PI	LS (%)	FMC (%)	FMC+-PL	CBR %	CBR SWELL %	SMDD (t/m^3)	SOMC (%)	GRAVEL %	SAND %	CLAY AND SILT %	EMERSON CLASS	CLASSIFICATION GROUP
TPOR01 0.10 - 0.70m	Silty CLAY (Residual)	44	17	27	8.5	9.8	-7.2	4.0	2.0	1.7	17.5	3	12	85	4	CI
TPOR02 0.20 - 0.60m	Silty CLAY (Residual)	58	19	39	16.5	15.8	-3.2	3.0	3.0	1.6	21.0	3	19	78	4	CH
TPOR03 0.10 - 0.50m	Silty CLAY (Residual)	58	17	41	7	13.7	-3.3	3.5	3.5	1.6	20.5	-	-	-	-	CH
TPRL04 0.20 - 0.70m	Silty CLAY (Residual)	41	16	25	13	14	-2	3.5	3.0	1.6	21.0	-	-	-	5	CI
TPRL05 0.20 - 0.90m	Silty CLAY (Alluvium)	56	22	34	11	13.1	-8.9	3.5	3.0	1.5	21.0	-	-	-	-	CH
TPRL06 0.20 - 1.20m	Silty CLAY (Alluvium)	52	18	34	11.5	15.2	-2.8	2.5	4.0	1.6	21.5	-	-	-	5	CH
TPRL06 3.10 - 3.70m	Sandy SILT (Alluvium)	25	15	10	5	10.1	-4.9	-	-	-	-	0	47	53	4	CI
TPRL07 0.20 - 0.70m	Silty CLAY (Alluvium)	34	14	20	7	9.9	-4.1	-	-	-	-	0	43	57	5	CL
TPRL07 0.70 - 1.80m	Silty CLAY (Alluvium)	61	26	35	13	19.3	-6.7	-	-	-	-	-	-	-	-	CH
TPRL07 2.90 - 4.00m	Silty CLAY (Alluvium)	41	15	26	10.5	19.9	4.9	-	-	-	-	-	-	-	-	CI

SAMPLE ID	FIELD DESCRIPTION	LL (%)	PL (%)	PI	LS (%)	FMC (%)	FMC+-PL	CBR %	CBR SWELL %	SMDD (t/m^3)	SOMC (%)	GRAVEL %	SAND %	CLAY AND SILT %	EMERSON CLASS	CLASSIFICATION GROUP
TPRL08 0.10 - 0.90m	Silty CLAY (Alluvium)	66	19	47	12.5	18.2	-0.8	-	-	-	-	-	-	-	-	CH
TPRL25 0.10 - 0.80m	Clayey GRAVEL (Alluvium)	66	23	43	13	12.4	-10.6	6.0	1.0	1.6	22.0	48	10	42	4	CH
FMC: Field moisture content, LL: Liquid limit, PL: Plastic limit, PI: Plasticity index, LS: Linear shrinkage, CBR: California Bearing Ratio, SMDD: Standard maximum dry density, SOMC: Standard optimum moisture content.																

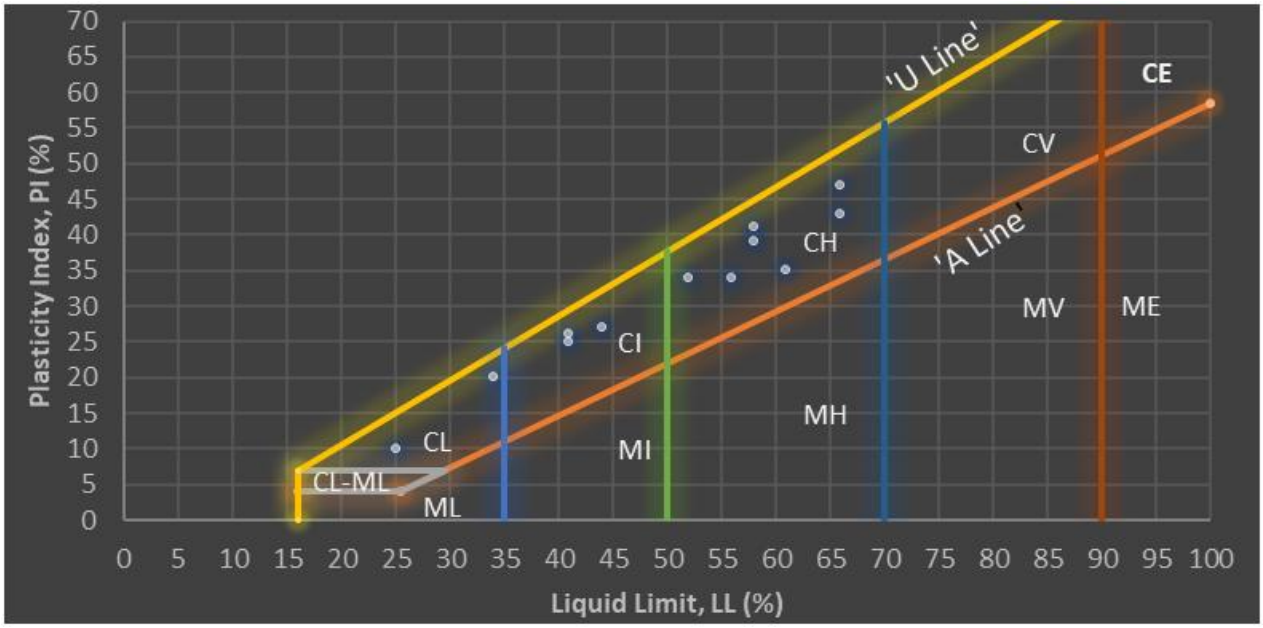


Figure 4-1 Casagrande chart of Atterberg Limit test results

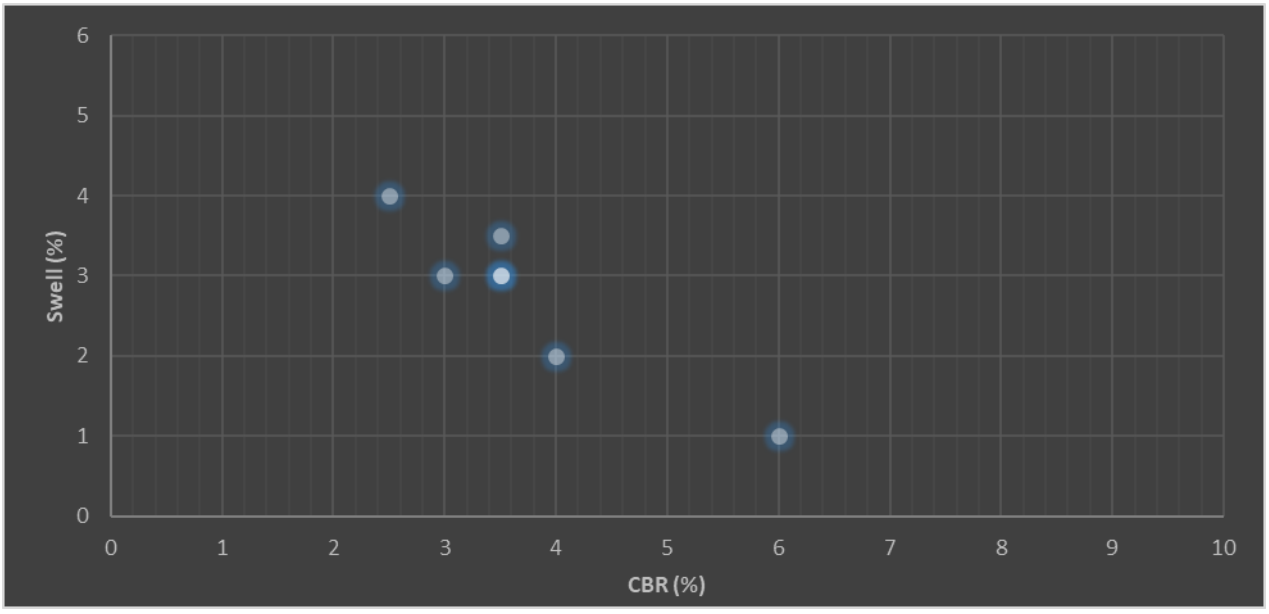


Figure 4-2 Summary of California Bearing Ratio versus swell results

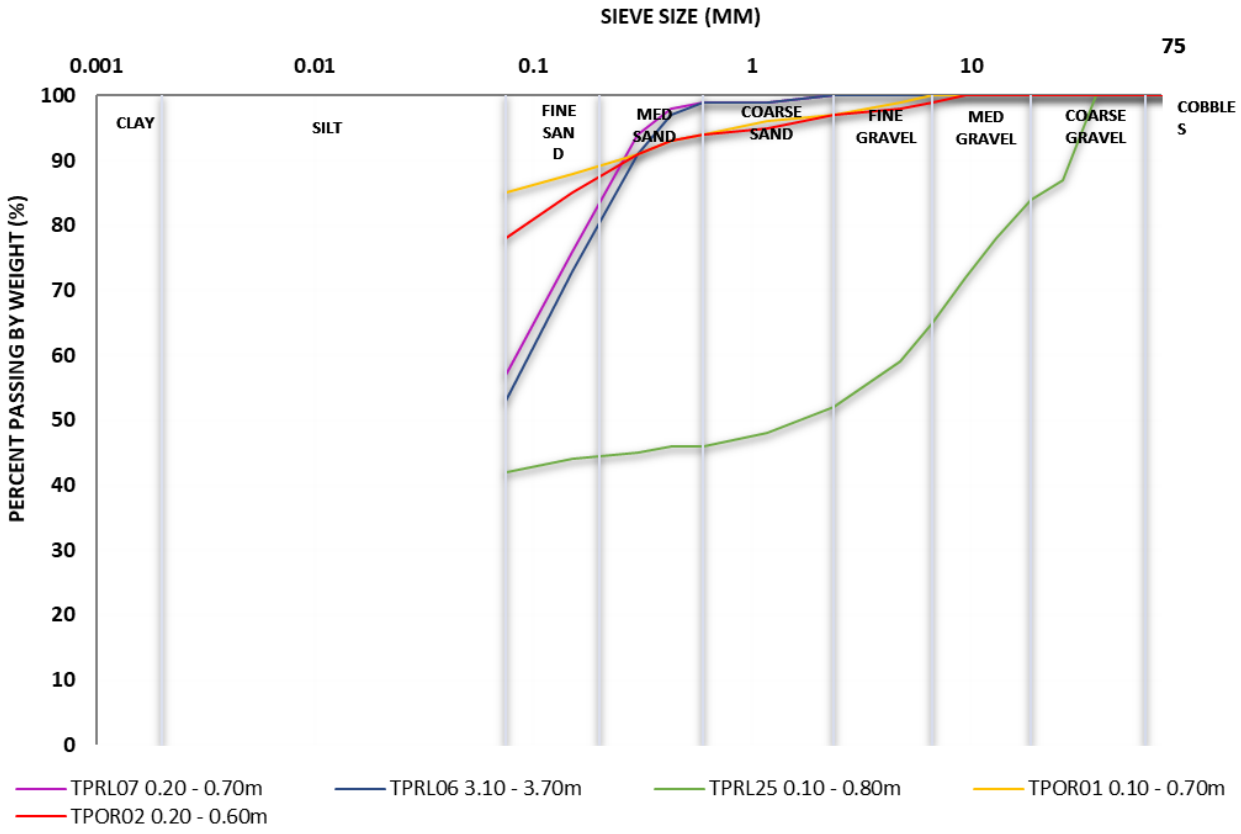


Figure 4-3 Summary of particle-size distribution results

5 EARTHWORKS

5.1 GENERAL

Earthworks for construction of the rail corridor should be completed in accordance with the recommendations provided in this report and ARTC Heavy Haul Infrastructure Guidelines, V7, 2013.

Earthworks for the Overton Road realignment should be undertaken in accordance with this report and RMS QA Specification R44 Earthworks.

5.2 SITE PREPARATION

In areas where engineered fill is required to raise the existing site levels, the following preparation should be completed:

— All topsoil, any root affected material and any unsuitable material should be removed from within the footprint of the proposed fill area. Unsuitable material may comprise organic matter, soft and wet soils, soils with high silt content, filling with uncontrolled or unknown compaction and material with a CBR of less than 1%.

— Based on borehole and test pit logs, the topsoil at the site is typically less than 0.2 m. Although not encountered, thicker topsoil units may be encountered near drainage lines and depressions (i.e. in vicinity of the proposed viaduct and rail embankment).

— Following stripping, the embankment foundations are expected to mainly expose stiff to hard natural clay. These conditions may change with variations in topography and geology along the rail alignment. The exposed foundations should be ripped to a depth of 300 mm, moisture conditioned and compacted to the requirements specified in the separate rail viaduct report (ref. PS112915-GEO-REP-19065 Rev A, dated May 2019). The materials should then be proof rolled under inspection by an experienced geotechnical engineer. Any noticeable soft or heaving areas should be removed and replaced with suitable fill material, at the direction of an experienced Geotechnical Engineer or Engineering Geologist.

— Any coaly material encountered during excavation should be over-excavated and replaced with engineered fill to the compaction requirements specified in Section 7.4.5.

5.3 EXCAVATION CONDITIONS

Excavation conditions have been assessed for the two major cuts using material and strength data from the test pits and boreholes. Assessment of rock excavatability has been based on use of this information in combination with excavatability parameters developed by Pettifer and Fookes (1994).

Based on the results of the borehole drilling, there is potential for coal seams and faults to be encountered during the excavation.

5.3.1 CUTTING 1 (CH1500 – CH1940) - SOIL

The proposed cut between approximate chainage Ch1500 – Ch1940 is anticipated to be down to 15.5 m depth and within alluvial soil typically comprised of clayey gravel and gravelly clay, very dense and hard.

As such, digging is expected to be relatively easy and normal earth moving equipment is considered appropriate.

Voids were encountered during the geotechnical investigation, which may be an indication of boulders or buried organic matter, or piping features. If encountered, they should be over-excavated and backfilled as per the supervising geotechnical engineer's requirements.

Hydrogen sulphide gas was encountered in this area during the geotechnical investigation. A gas monitoring regime should be developed for excavation works in this area, and care should be taken to control risk of gas ignition.

5.3.2 CUTTING 2 (CH1940 - CH2760) – WEATHERED ROCK

The proposed cut between approximate chainage Ch1940 – Ch2760 is anticipated to be down to 8.5 m depth and primarily within interbedded siltstone and sandstone, typically very low to low strength. Defect spacing is anticipated to be in the order of 200 mm to 1m. A cover of topsoil and residual soil is expected.

The results of a rippability assessment was completed as per Pettifer and Fookes (1994). The results indicate that excavatability is expected to range between hard digging and hard ripping, and may need large dozers (CAT D8 or equivalent) for some areas. Blasting may be required in discrete massive units.

5.3.3 FAULTS

Faults may present zones of more intense weathering, and water inflows. Where encountered in the rail cut, faults and weathered zones should be over-excavated and backfilled with engineered fill to the compaction requirements specified in Section 7.4.5, and to the requirements of the supervising geotechnical engineer.

Additional drainage is to be provided at the direction of the supervising geotechnical engineer.

5.3.4 COAL SEAMS AND SPONTANEOUS COMBUSTION/BURNING

Ensure all coal seams encountered in the side of the cut are covered with clay, and allowed to drain, to mitigate potential spontaneous combustion and/or burning from bush fires.

Where coal seams are intercepted in the floor of the cut, the following remedial works should be completed:

— Over-excavate to below the seam level and longitudinally until the area of over-excavation daylights within the cut and provides positive drainage.

— Build back up to design subgrade levels and construct drainage blanket wrapped in geotextile fabric (Bidim A14 or equivalent). Drainage blanket material is to comprise free draining, high strength, durable rock fill.

— Provide sub-soil drainage adjacent to the exposed seam and allow to drain to cess.

5.4 TEMPORARY BATTERS

Temporary excavations should be undertaken as per the recommendations made in the Safe Work Australia Excavation Work Code of Practice (2018).

Temporary excavations through natural soils (with the exception of gravels and sands), down to a maximum depth of 1.5 m, may be excavated near vertical, provided that:

— they are barricaded when not in use

— they are not left open for more than 24 hours

— no surcharge loading is applied within 2.5m of the edge of the excavation

— no groundwater inflows are encountered

— are not used for access by a worker

Where access is required for a worker and for the excavation to be extended down to a depth of 4.5m, the temporary excavation batters or benching should be regraded to no steeper than 1.5 Horizontal (H) in 1 Vertical (V), or supported by properly designed shoring. If any portion of the excavation exposes low strength or better bedrock, side slopes could be steepened to 1H:1V, subject to an inspection by an engineering geologist or geotechnical engineer.

If a period of heavy rainfall occurs during construction, the stability of the excavation should be assessed by a suitably qualified geotechnical engineer or engineering geologist prior to recommencement of work. If the exposed soils have undergone significant softening due to increased moisture content, then temporary shoring may be required.

All excavations should be inspected by a geotechnical engineer or engineering geologist, who shall assess safe batter angles appropriate for the conditions encountered.

5.5 PERMANENT BATTER SLOPES

5.5.1 CUTTING BATTER SLOPES

Permanent batter slopes within Cut 1 (soil) should have a maximum slope of 2 horizontal to 1 vertical.

Permanent batter slopes within Cut 2 (weathered rock) should have a maximum slope of 1.5 horizontal to 1 vertical.

5.5.2 CUTTING BATTER SLOPE CONSTRUCTION

Cut slopes should be designed as per the requirements of ARTC Earthworks Material Specification ETC-08-03, and have a maximum height of 7 m without a bench. Excavation should be carried out in such a manner as to prevent erosion or slides, working faces shall be limited to safe heights and slopes, and the surface shall be drained to avoid ponding and erosion. Overhanging, loose or unstable material likely to slide should be cut back, removed or stabilised.

Rock cuttings and exposed rock surfaces shall be excavated so as to obtain smooth, uniformly trimmed surfaces. Batters in cuttings shall be carried around curves in an even and regular manner. Finished batters shall not have a slope steeper than that specified.

Excavation at the base of cutting shall be finished at a level to suit the capping thickness, normally 150 mm, and with crossfall. Compaction of the top 150mm layer in the base of cutting shall be compacted to:

— Not less than 100% MDD by standard compaction for cohesive soils.

— No visible deflection of surface under 10 tonnes vibratory rollers after 6-8 passes for cohesionless soils.

— Base of cuttings in weathered rock shall be cleared of soft or deleterious material prior to placement of formation layers.

Groundwater was not encountered in any of the boreholes. It is assumed that long term groundwater levels are below the proposed works and therefore will not impact on the stability of the cut batters. However, seepage may be present after precipitation.

Permanent batter slopes in weathered rock more than 3 m high should be inspected by an experienced geotechnical engineer or engineering geologist for potential distress. The contractor shall construct additional rock anchors, rock bolts, and shotcrete applications where required as directed.

Soil and rock batters could potentially be steepened where required with use of soil or rock reinforcing, such as reinforced earth walls, rock anchors, rock bolts, and shotcrete.

5.5.3 DRAINAGE

Longitudinal drainage should be provided at the crest and toe of cut slopes to re-direct surface flows from the rail spur and to limit scour and erosion. Drainage channels within the cut should be concrete lined.

5.6 RE-USE OF MATERIALS

Potential uses for materials excavated from cuts are summarised in **Error! Reference source not found.**.

Table 5-1 Summary of material re-use applications

MATERIAL	POTENTIAL USES
Topsoil	Reuse on 2H:1V cut and fill batters to re-establish vegetation on slopes
Cuttings in soil	Borrow for general fill (i.e. embankments)
Cuttings in weathered rock	Borrow for general fill (surface soils and XW-HW) Structural fill for rail formation

5.7 EMBANKMENTS

The rail viaduct east approach embankment is discussed in a separate viaduct report (ref. PS112915-GEO-REP-19065 Rev A, dated May 2019).

The Overton Road overbridge approach embankments are discussed in a separate report for north of Wybong Road (ref. PS112915-GEO-RPT-19061 Rev B, dated May 2019).

No other embankments are proposed.

6 OVERTON ROAD

Recommendations are provided for preparation of pavement subgrade and general road construction. Pavement design is outside the scope of this report.

6.1 SUBGRADE DESIGN PARAMETERS

For design purposes, a subgrade CBR of 3% should be adopted.

6.2 SUBGRADE PREPARATION

Once topsoil and any deleterious material is removed, the subgrade should be ripped to a depth of 150 mm, moisture conditioned and compacted to achieve a minimum relative density of 98% SMDD at ± 2% of SOMC.

Once the subgrade is exposed, vehicle trafficking should be kept to a minimum until pavement installation.

6.3 REACTIVITY

The soils along the Overton Road alignment are expected to be moderately reactive to changes in soils moisture. Reactive soil materials shrink and swell with variations in moisture content. To reduce the potential for cracking of pavement due to ground induced movements it is important to ensure that, as far as practicable, the subgrade soil moisture conditions are kept uniform along the alignment prior to placement of pavement materials.

Appropriate surface drainage should be provided to prevent surface water pooling against or around the pavement.

6.4 PAVEMENT MATERIALS

Pavement materials should comply with the RMS QA Specification 3051 for granular pavement base and subbase materials.

6.5 PAVEMENT DRAINAGE

Properly engineered and constructed surface and subsurface drainage should be provided adjacent to the edges of pavements. Free draining subsoil drains should also be installed where required.

7 RAIL FORMATION DESIGN

7.1 SUBGRADE CONDITIONS

Based on the results of the geotechnical investigation and laboratory testing, the following Design Subgrade CBR values are recommended for design of the rail formation;

— Cutting 1 (Ch1500 – Ch1940): CBR results in the range of approximately 3 – 6 % were obtained within Cutting 1 and where the track joins the Ulan Line (eastern rail spur). As such a formation design based on a minimum design CBR of 3% is recommended for this area;

— Cutting 2 (Ch1940 – Ch2760); A design CBR of > 20% is recommended for formation design on weathered rock. (i.e. Cutting 2 (Ch1940 – Ch2760)).

— Other areas in engineered fill (i.e. embankments) or natural soil (i.e. at grade'); A formation design based on a minimum design CBR of 3% is recommended for other areas where the subgrade comprises soil.

Recommended rail formation designs based on these subgrade conditions are presented in Table 7-1.

7.2 RECOMMENDED RAIL FORMATION THICKNESS DESIGN

The recommended formation thicknesses from the ARTC Heavy Haul Infrastructure Guidelines; Track, Civil and Structures (2013) are presented in Table 7-1. Alternatively, the rail formation could be assessed using mechanistic design procedures by Li and Selig (1998).

Unsuitable materials including material with a CBR<3% should be removed and replaced within the depth of influence of the formation subgrade.

Table 7-1 Minimum railway formation thickness designs

MATERIAL	RAIL FORMATION ON GRADE AND ON FILL EMBANKMENTS (CBR > 3%)	RAIL FORMATION ON ROCK (CBR > 20%)[2]
Ballast [1]	300	300
Capping	200	400
Structural zone	500	-

(1) The ballast depth is measured from the base of sleeper to top of formation (capping).

(2) A drainage blanket beneath the capping may be required in cut where there is non rippable rock and/or where groundwater is present

7.3 DESIGN CONSIDERATIONS

7.3.1 LOW DURABILITY ROCK

The rock exposed in the base of the cuts is likely to have poor durability and break down overtime due to weathering and possibly rail loading, which may result in fouling of the ballast. Adequate drainage of this material is a key to reducing

weathering impacts. Future maintenance may still be needed. Further assessment of this issue should be performed prior to construction, including 2 and 5 cycle slake durability testing.

7.3.2 TRANSITION ZONES

The transition of the subgrade from soil to rock is likely to occur over the alignment. Where this occurs, differential settlement may occur. An option to mitigate this impact includes over-excavation of the rock to a depth of 1m and sloping back to grade over a distance of about 15m in both directions, installing a minimum 150mm thick drainage blanket over the over-excavated area with an underdrain at the low point, and then backfilling with compacted soil. Geotextiles should be placed above the below the drainage layer that have been designed for filter compatibility and strength requirements. The underdrain also needs to daylight to allow water to leave.

Transition zones in the sides of the cut will be needed where the cut goes from soil to rock to reduce potential instability. These transitions should be developed during the civil design work.

7.3.3 DRAINAGE DESIGN

Grading of the formation capping toward cess drains is recommended. Cess drains should be graded to direct water away from embankment toes and into culverts.

Where the new rail is to join the existing line, care should be taken to avoid trapping moisture within the permeable ballast layers by:

— Allowing sufficient fall on the permeable layers such that water drains away from the intersection of the rail formation embankments.

— Using ballast and/or capping layers of similar or greater permeability to the existing ballast layers and constructing the base of the new ballast and/or capping lower than the adjoining existing ballast. This may require increasing the thickness of the ballast and/or capping at the Ulan Line/new rail spur interface.

— Deepening ballast and/or capping where this can be done without leading to an excessive ballast thickness (generally < 0.5 m beneath the sleeper is acceptable).

Alternatively, in areas where ‘deep’ ballast already exists, additional subsoil drainage could be provided through construction of trench drains between lines with sufficient outlets to the cess and/or drainage blankets at the level of the adjacent base of ballast.

If the existing formation is to be reconstructed, the existing fill should be replaced with an approved structural zone material. Where the base of the structural zone extends below the adjoining ground surface, the cess should be deepened to allow the base of the structural zone to ‘daylight’.

7.4 FORMATION MATERIALS

The recommended material specifications for the various embankment and formation materials are presented in the following sections.

7.4.1 BALLAST

Based on the ARTC specification ETA-04-01, ballast material shall have a 60mm nominal size and conform to the particle size distribution as shown in that specification. The ballast must also comply with the specifications given in ETA-04-01 for particle shape, flakiness index, crushed particles, durability, Los Angeles values, weak particles and electrical conductivity.

7.4.2 CAPPING

Capping material will need to meet the requirements in the ARTC Earthworks Materials Specification ETC-08-03.

7.4.3 STRUCTURAL ZONE

Based on the information to date, the soil and rock material in the cuts may be suitable for crushing and blending and re-used in the structural zone. However, the quantity of material available is difficult to define due to the variability in the cuts. Material suitable for the structural zone may need to be imported to the site.

Material to be used in the structural zone will need to meet the requirements in the ARTC Earthworks Materials Specification ETC-08-03.

7.4.4 ENGINEERED FILL

The material and compaction specification and batter slopes for construction of rail embankments should be as per the recommendations given in Section **Error! Reference source not found.**, and the requirements in the ARTC Earthworks Materials Specification ETC-08-03.

7.4.5 COMPACTION SPECIFICATION

The recommended compaction specifications for the rail formation materials should be in accordance with ARTC Heavy Haul Infrastructure Guidelines.

8 LIMITATIONS

This report should be read in conjunction with the 'Limitations of Geotechnical Site Investigation' contained in Appendix D, which provides important information regarding geotechnical investigations and assessments.

If during site works, the subsurface, including groundwater, conditions are found to be significantly different from those anticipated based on this investigation, then we recommend that you immediately contact this office.

9 REFERENCES

— 1:100,000 Hunter Coalfield Regional Geology Map, 1993.

— 1:250 000 Singleton Soil Landscape map, Office of Environment and Heritage (OEH), Dataset updated 2018.

— ARTC Earthworks Materials Specification, ETC-08-03, 1.1 23/11/2017

— ARTC Heavy Haul Infrastructure Guidelines; Track, Civil and Structures, 20 June 2013, Version 7.0

— Geotechnical Investigation for Proposed Rail Loop Viaduct Structure, Mount Pleasant Coal Mine, reference PS112915-Geo-Rep-19065 RevA, Dated 03/05/2019

— Method for Railroad Track Foundation Design. April 1998Journal of Geotechnical and Geoenvironmental Engineering 124(4):323-329, Dingqing Li, Ernest T. Selig

APPENDIX A

GEOTECHNICAL INVESTIGATION SITE PLANS

DRAWING-1-WYBONG-EAST

TPRL24
BHRL04
BHRL17
TPRL25
BHRL18
BHRL03
PROPOSED SOUTH OF WYBONG ROAD - NORTHERN RAIL SPUR
A
TPRL08
BHRL02
TPRL07
B
TPRL06
BHRL01
PROPOSED VIADUCT
TPRL05
TPRL04
TPRL03
TPRL02
PROPOSED SOUTH OF WYBONG ROAD - EASTERN RAIL SPUR
A'
TPRL01
HUNTER RIVER

LEGEND
TP XXX TEST PIT
BH XXX BOREHOLE

REV	DATE	BY	DESCRIPTION	CHK	APPD
A	01.05.19	T.C	PRELIMINARY ISSUE	JA	JA

REFERENCE COORDINATION DRAWINGS

DESCRIPTION	DRAWING NO.	REV	CHK

SURVEY DATUM

HORIZONTAL DATUM:	VERTICAL DATUM:

SCALES
0 20 40 80 120
Full Size 1:2000 (A1), Half Size (A3) 1:4000
SCALE (m)

A1 ORIGINAL
DO NOT SCALE THIS DRAWING

APPROVED
SIGNED:
DATE: RPEQ:

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CLIENT: MACHEnergy

PROJECT: GEOTECHNICAL INVESTIGATION FOR PROPOSED RAIL LOOP - MT PLEASANT COAL MINE

TITLE: BOREHOLE AND TEST PIT LOCATION PLAN PROPOSED WYBONG ROAD SOUTH RAIL SPUR

DRAWING STATUS:

DESIGNED:	CHECKED:	APPROVED:
A.FARQUAHARSON	J.ANDERSON	J.ANDERSON
PROJECT No:	DRAWN:	DATE:
MP002	T.CHIARENTIN	05.04.19

DRAWING No: DRAWING - 1 REV: A

File name:\\CORP.PBWAN.NET\ANZ\PROJECTS\PS112915_GEOTECH_INVESTIGA4_WIP\BIM\WYBONG RD SOUTH RAIL SPUR\DRAWING-1-WYBONG-EAST.DWG, printed on 10 May, 2019 3:09:47 PM, by Chiarentin, Tim

DRAWING-2-WYBONG-EAST

JOINS DRAWING 2 SHEET 2

A

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135
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125
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105

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N=21
N=16
N=8
N=7
N=R
N=R
N=R
H
VSt to H
VSt
St to VSt
F - St
D
100
3000
VH
H
26.16 m
113.81 m

TPRL05
(8 m)
H
4.10 m
136.31 m

TPRL04
(17 m)
H
VSt - H
4.10 m
136.76 m

PROPOSED FILL

PRELIMINARY DESIGN RAIL LEVEL

APPROXIMATE NATURAL SURFACE

ESTIMATED TOP OF ROCK

? ?

REFER TO LOG FOR STRENGTH (TYP),

LONGITUDINAL SECTION A-A'

SOIL AND ROCK MATERIAL DESCRIPTION

Core Loss	Coal	Interlaminated Siltstone and Sandstone	Sandy GRAVEL	Siltstone
Clayey GRAVEL	GRAVEL	Sandstone	Sandy SILT	Silty CLAY
Clayey SAND	Gravelly CLAY	Sandy CLAY	Shale	Topsoil

REV	DATE	BY	DESCRIPTION	CHK	APPD
A	01.05.19	T.C	PRELIMINARY ISSUE	JA	JA

REFERENCE COORDINATION DRAWINGS

DESCRIPTION	DRAWING NO.	REV	CHK

SURVEY DATUM

HORIZONTAL DATUM: VERTICAL DATUM:

SCALES
0 25 50
HOR: Full Size (A1) 1:375, Half Size (A3) 1:750
SCALE (m)
0 3 6
VERT: Full Size (A1) 1:62.5, Half Size (A3) 1:125
SCALE (m)

A1 ORIGINAL
DO NOT SCALE THIS DRAWING

APPROVED

SIGNED:

DATE: RPEQ:

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CLIENT: MACHEnergy

PROJECT: GEOTECHNICAL INVESTIGATION FOR PROPOSED RAIL LOOP - MT PLEASANT COAL MINE

TITLE: GEOTECHNICAL LONG SECTION
PROPOSED EAST WYBONG ROAD SPUR
SHEET 1

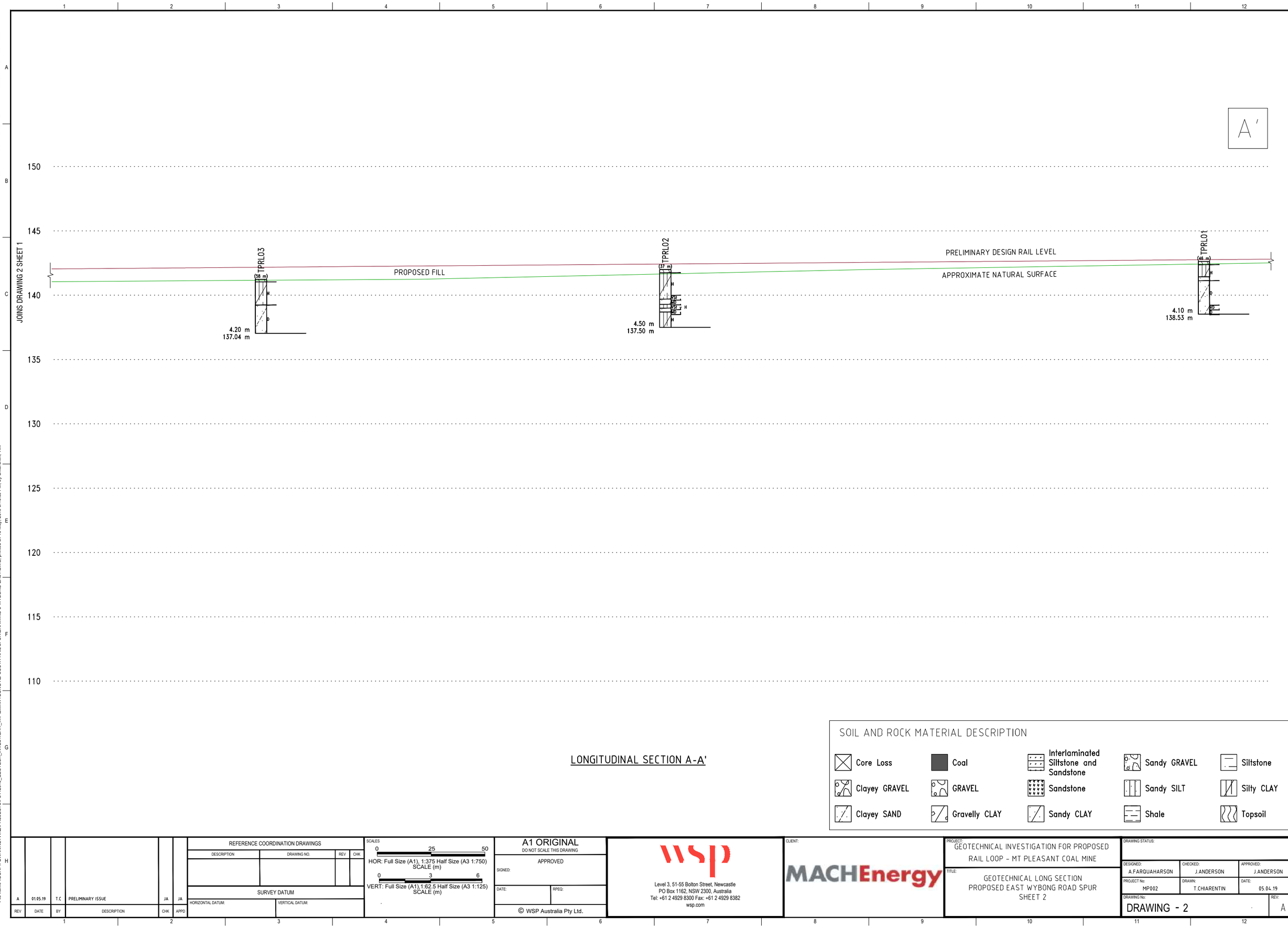
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PROJECT No:	DRAWN:	DATE:
MP002	T.CHIARENTIN	05.04.19

DRAWING No: DRAWING - 2 REV: A

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DRAWING-2-WYBONG-EAST



LONGITUDINAL SECTION A-A'

SOIL AND ROCK MATERIAL DESCRIPTION

Core Loss	Coal	Interlaminated Siltstone and Sandstone	Sandy GRAVEL	Siltstone
Clayey GRAVEL	GRAVEL	Sandstone	Sandy SILT	Silty CLAY
Clayey SAND	Gravelly CLAY	Sandy CLAY	Shale	Topsoil

REV	DATE	BY	DESCRIPTION	CHK	APPD
A	01.05.19	T.C	PRELIMINARY ISSUE	JA	JA

REFERENCE COORDINATION DRAWINGS

DESCRIPTION	DRAWING NO.	REV	CHK

SURVEY DATUM

HORIZONTAL DATUM: VERTICAL DATUM:

SCALES

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HOR: Full Size (A1), 1:375 Half Size (A3 1:750)
SCALE (m)

0 3 6
VERT: Full Size (A1),1:62.5 Half Size (A3 1:125)
SCALE (m)

A1 ORIGINAL
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PROJECT: GEOTECHNICAL INVESTIGATION FOR PROPOSED RAIL LOOP - MT PLEASANT COAL MINE

TITLE: GEOTECHNICAL LONG SECTION
PROPOSED EAST WYBONG ROAD SPUR
SHEET 2

DRAWING STATUS:

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MP002	T.CHIARENTIN	05.04.19

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DRAWING-1



REV	DATE	BY	DESCRIPTION	CHK	APPD
A	01.05.19	T.C	PRELIMINARY ISSUE	JA	JA

REFERENCE COORDINATION DRAWINGS

DESCRIPTION	DRAWING NO.	REV	CHK

SURVEY DATUM

HORIZONTAL DATUM: VERTICAL DATUM:

SCALES
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Full Size 1:2000 (A1), Half Size (A3) 1:4000
SCALE (m)

A1 ORIGINAL
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CLIENT: MACHEnergy

PROJECT: GEOTECHNICAL INVESTIGATION FOR PROPOSED RAIL LOOP - MT PLEASANT COAL MINE

TITLE: BOREHOLE AND TEST PIT LOCATION PLAN PROPOSED WYBONG ROAD SOUTH RAIL SPUR

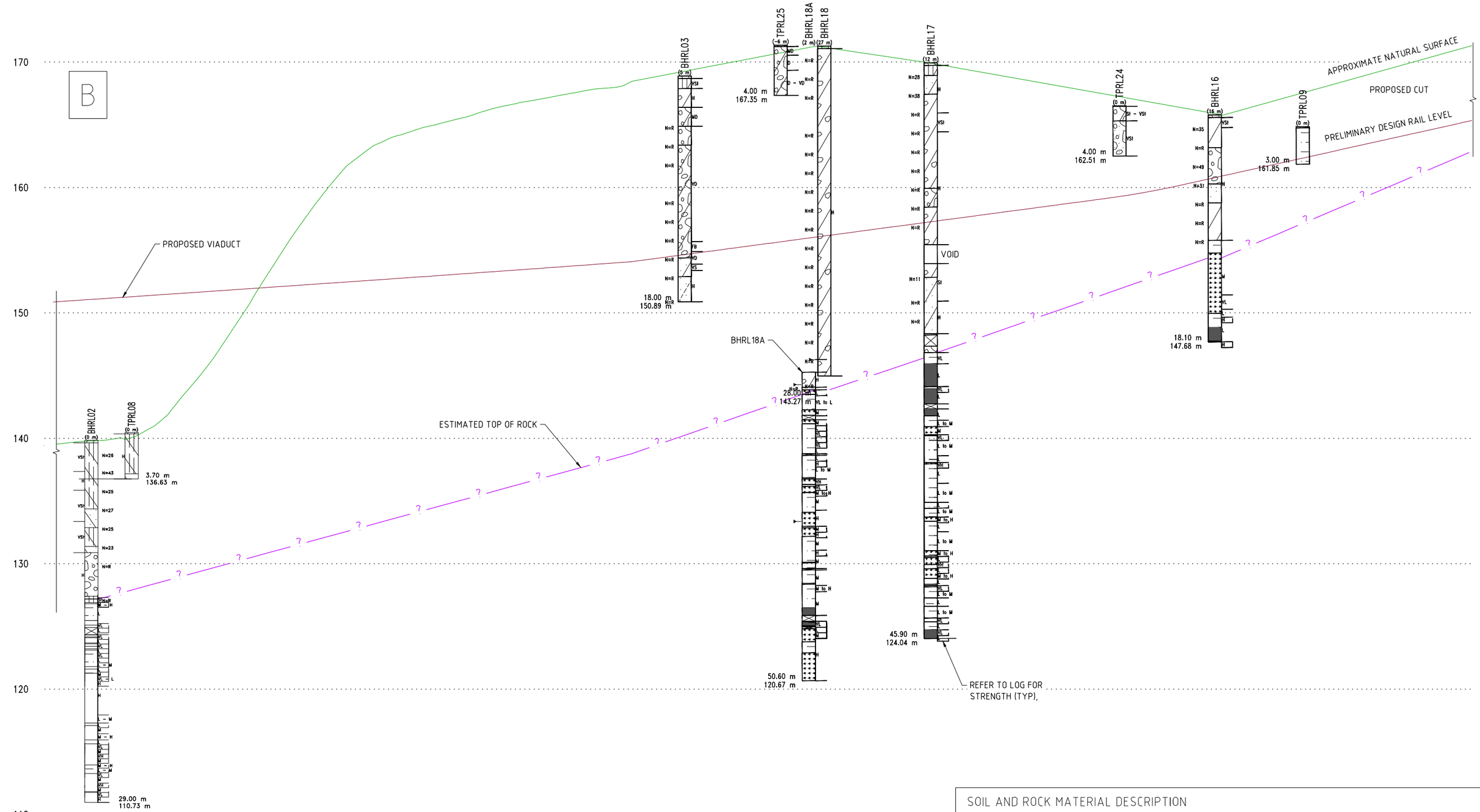
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DESIGNED:	CHECKED:	APPROVED:
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PROJECT No:	DRAWN:	DATE:
MP002	T.CHIARENTIN	05.04.19

DRAWING No: DRAWING - 3 REV: A

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DRAWING-4



LONGITUDINAL SECTION B - B'

SOIL AND ROCK MATERIAL DESCRIPTION

- Core Loss
- Coal
- Interlaminated Siltstone and Sandstone
- Sandy GRAVEL
- Siltstone
- Clayey GRAVEL
- GRAVEL
- Sandstone
- Sandy SILT
- Silty CLAY
- Clayey SAND
- Gravelly CLAY
- Sandy CLAY
- Shale
- Topsoil

REV	DATE	BY	DESCRIPTION	CHK	APPD
A	01.05.19	T.C	PRELIMINARY ISSUE	JA	JA

REFERENCE COORDINATION DRAWINGS

DESCRIPTION	DRAWING NO.	REV	CHK

SURVEY DATUM

HORIZONTAL DATUM: | VERTICAL DATUM:

SCALES
HOR: Full Size 1:500 (A1), Half Size (A3) 1:1000 SCALE (m)
VERT: Full Size 1:150 (A1), Half Size (A3) 1:300 SCALE (m)

A1 ORIGINAL
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SIGNED:
DATE: | RPEQ:

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CLIENT: MACHEnergy

PROJECT: GEOTECHNICAL INVESTIGATION FOR PROPOSED RAIL LOOP - MT PLEASANT COAL MINE

TITLE: GEOTECHNICAL LONG SECTION PROPOSED WYBONG ROAD BRIDGE SHEET 1

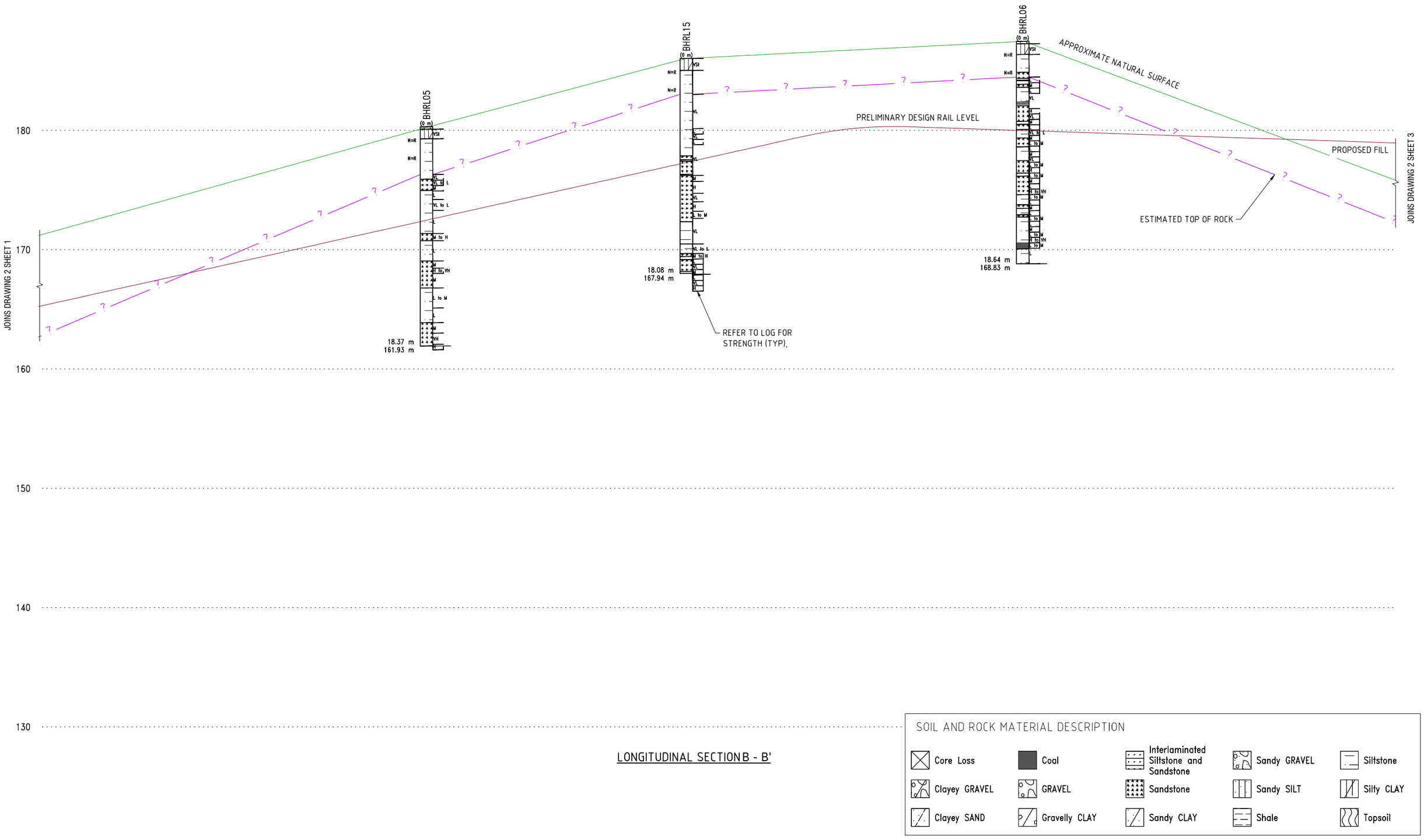
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DESIGNED:	CHECKED:	APPROVED:
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PROJECT No:	DRAWN:	DATE:
MP002	T.CHIARENTIN	05.04.19

DRAWING No: DRAWING - 4 REV: A

File name:\\CORP.PBWAN.NET\ANZ\PROJECTS\PS112915_GEOTECH_INVESTIGA4_WIP\BIM\WYBONG RD SOUTH RAIL SPUR\DRAWINGS-2.DWG, printed on 10 May, 2019 3:09:49 PM, by Chiarentin, Tim

DRAWING-4



LONGITUDINAL SECTION B - B'

SOIL AND ROCK MATERIAL DESCRIPTION

Core Loss	Coal	Interlaminated Siltstone and Sandstone	Sandy GRAVEL	Siltstone
Clayey GRAVEL	GRAVEL	Sandstone	Sandy SILT	Silty CLAY
Clayey SAND	Gravelly CLAY	Sandy CLAY	Shale	Topsoil

REV	DATE	BY	DESCRIPTION	CHK	APPD
A	01.05.19	T.C	PRELIMINARY ISSUE	JA	JA

REFERENCE COORDINATION DRAWINGS

DESCRIPTION	DRAWING NO.	REV	CHK

SURVEY DATUM

HORIZONTAL DATUM: VERTICAL DATUM:

SCALES
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HOR: Full Size 1:500 (A1), Half Size 1:1000 SCALE (m)
0 2.5 5 10
VERT: Full Size 1:150 (A1), Half Size 1:300 SCALE (m)

A1 ORIGINAL
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PROJECT: GEOTECHNICAL INVESTIGATION FOR PROPOSED RAIL LOOP - MT PLEASANT COAL MINE

TITLE: GEOTECHNICAL LONG SECTION PROPOSED WYBONG ROAD BRIDGE SHEET 2

DRAWING STATUS:

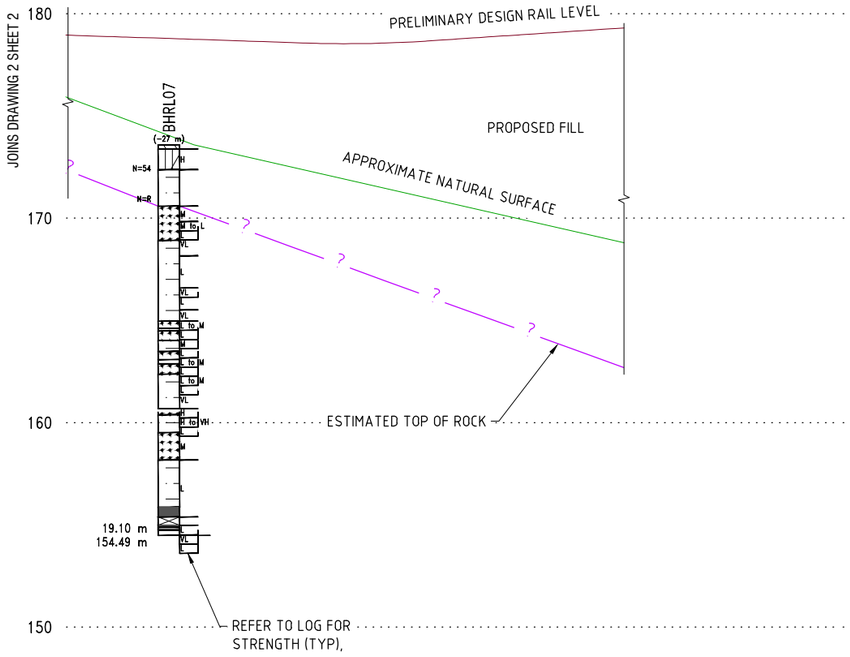
DESIGNED:	CHECKED:	APPROVED:
A.FARQUAHARSON	J.ANDERSON	J.ANDERSON
PROJECT No:	DRAWN:	DATE:
MP002	T.CHIARENTIN	05.04.19

DRAWING No: DRAWING - 4 REV: A

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DRAWING-4

B'



LONGITUDINAL SECTION B - B'

SOIL AND ROCK MATERIAL DESCRIPTION

Core Loss	Coal	Interlaminated Siltstone and Sandstone	Sandy GRAVEL	Siltstone
Clayey GRAVEL	GRAVEL	Sandstone	Sandy SILT	Silty CLAY
Clayey SAND	Gravelly CLAY	Sandy CLAY	Shale	Topsoil

REV	DATE	BY	DESCRIPTION	CHK	APPD
A	01.05.19	T.C	PRELIMINARY ISSUE	JA	JA

REFERENCE COORDINATION DRAWINGS

DESCRIPTION	DRAWING NO.	REV	CHK

SURVEY DATUM

HORIZONTAL DATUM: | VERTICAL DATUM:

SCALES
0 5 10 20 30
HOR: Full Size 1:500 (A1), Half Size (A3) 1:1000
SCALE (m)
0 2.5 5 10
VERT: Full Size 1:150 (A1), Half Size 1:300
SCALE (m)

A1 ORIGINAL
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SIGNED:

DATE: | RPEQ:

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PROJECT: GEOTECHNICAL INVESTIGATION FOR PROPOSED RAIL LOOP - MT PLEASANT COAL MINE

TITLE: GEOTECHNICAL LONG SECTION PROPOSED WYBONG ROAD BRIDGE SHEET 3

DRAWING STATUS:

DESIGNED:	CHECKED:	APPROVED:
A.FARQUAHARSON	J.ANDERSON	J.ANDERSON
PROJECT No:	DRAWN:	DATE:
MP002	T.CHIARENTIN	05.04.19

DRAWING No: DRAWING - 4 REV: A

File name:\\CORP.PBWAN.NET\AN2\PROJECTS\PS112915_GEOTECH_INVESTIGA\4_WIP\BIM\WYBONG RD SOUTH RAIL SPUR\DRAWING-4.DWG, plotted on 10 May, 2019 3:09:25 PM, by Chiarentin, Tim

APPENDIX B

ENGINEERING LOGS AND EXPLANATORY NOTES

Explanatory Notes – Soil Description

In engineering terms, soil includes every type of uncemented or partially cemented inorganic material found in the ground. In practice, if the material can be remoulded by hand in its field condition or in water, it is described as a soil. The dominant soil constituent is given in CAPITAL LETTERS, with secondary textures in lower case. The dominant feature is assessed from the Unified Soil Classification System (USCS) and a soil symbol is used to define a soil layer as follows:

SUPPORT

C Casing
M Drill mud
Nil No support

FIELD TEST

DM Dilatometer test
HB Hammer bounce
OT Other test (eg. plate load test)
PE Permeability test
PM Pressuremeter test
PP Pocket penetrometer
SPT Standard penetration test
DCP Dynamic cone penetrometer test
SV Shear vane test

SAMPLE

B Bulk disturbed sample
D Disturbed sample
PT Push tube
SPT SPT sample
U50 Undisturbed sample in 50 mm diameter tube
U75 Undisturbed sample in 75 mm diameter tube

UNIFIED SOIL CLASSIFICATION

The appropriate symbols are selected on the result of visual examination, field tests and available laboratory tests, such as: sieve analysis, liquid limit and plasticity index.

USC Symbol	Description
GW	Well graded gravel
GP	Poorly graded gravel
GM	Silty gravel
GC	Clayey gravel
SW	Well graded sand
SP	Poorly graded sand
SM	Silty sand
SC	Clayey sand
ML	Silt of low plasticity
CL	Clay of low plasticity
OL	Organic soil of low plasticity
CI	Clay of medium or intermediate plasticity
MH	Silt of high plasticity
CH	Clay of high plasticity
OH	Organic soil of high plasticity
Pt	Peaty Soil

MOISTURE CONDITION

Dry - Cohesive soils are friable or powdery
Cohesionless soil grains are free-running

Moist - Soil feels cool, darkened in colour
Cohesive soils can be moulded
Cohesionless soil grains tend to adhere

Wet - Cohesive soils usually weakened
Free water forms on hands when handling

For cohesive soils, the following codes may also be used:

>PL Moisture content greater than the Plastic Limit.
~PL Moisture content near the Plastic Limit.
<PL Moisture content less than the Plastic Limit.

WATER SYMBOLS AND DEFINITIONS

Partial water loss Water inflow

Complete water loss

Water level at date shown

COHESIVE SOILS - CONSISTENCY

The consistency of a cohesive soil is defined by descriptive terminology such as very soft, soft, firm, stiff, very stiff and hard. These terms are assessed by the shear strength of the soil as observed visually, by the pocket penetrometer values and by resistance to deformation to hand moulding.

A Pocket Penetrometer may be used in the field or the laboratory to provide approximate assessment of unconfined compressive strength of cohesive soils. The values are recorded in kPa, as follows:

Strength	Symbol	Pocket Penetrometer Reading (kPa)
Very Soft	VS	< 25
Soft	S	25 to 50
Firm	F	50 to 100
Stiff	St	100 to 200
Very Stiff	VSt	200 to 400
Hard	H	> 400

COHESIONLESS SOILS - RELATIVE DENSITY

Relative density terms such as very loose, loose, medium dense, dense and very dense are used to describe silty and sandy material, and these are usually based on resistance to drilling penetration or the Standard Penetration Test (SPT) 'N' values. Other condition terms, such as friable, powdery or crumbly may also be used.

The Standard Penetration Test (SPT) is carried out in accordance with AS 1289 Clause 6.3.1. For completed tests the number of blows required to drive the split spoon sampler 300 mm is recorded as the N value. For incomplete tests the number of blows and the penetration beyond the seating depth of 150 mm are recorded. If the 150 mm seating penetration is not achieved the number of blows to achieve the measured penetration is recorded. SPT correlations may be subject to corrections for overburden pressure and equipment type.

Term	Symbol	Density Index	N Value (blows /0.3 m)	DCP (blows /0.1m
Very Loose	VL	0 to 15	0 to 4	0 to 1
Loose	L	15 to 35	4 to 10	1 to 2
Medium Dense	MD	35 to 65	10 to 30	2 to 5
Dense	D	65 to 85	30 to 50	5 to 10
Very Dense	VD	>85	>50	>10

COHESIONLESS SOILS - PARTICLE SIZE TERMS

Name	Subdivision	Size
Boulders		>200mm
Cobbles		63mm to 200mm
Gravel	coarse	20mm to 63mm
	medium	6mm to 20mm
	fine	2.36mm to 6mm
Sand	coarse	0.6mm to 2.36mm
	medium	0.2mm to 0.6mm
	fine	0.075mm to 0.2mm

NFGWO No Free Groundwater Observed

The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.

NFGWE No Free Groundwater Encountered

The borehole/test pit was dry soon after excavation. Inflow may have been observed had the borehole/test pit been left open for a longer period.

Explanatory Notes – Rock Description

The rock is described with strength and weathering symbols as shown below. Other features such as bedding and dip angle are given.

DRILLING/EXCAVATION METHODS

Symbol	Term
AS	Auger Screwing
EX	Excavation
HA	Hand Auger
NMLC/HMLC	Diamond Core –triple tube
NQ/HQ/PQ	Diamond Core – wireline
PC	Percussion
PCB	Poly Carbonised Diamond Bit
PT	Push Tube
RAB	Rotary Air Blast
RC	Reverse Circulation
S	Sonic drill
VB	Vibrocoring
WB	Washbore with blade
WR	Washbore with roller (tricone)

ROCK MATERIAL WEATHERING

Rock weathering is described mainly using the following abbreviations and definitions used in AS1726.

Term	Symbol	Definition
Residual soil	RS	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely weathered	XW	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
Highly weathered	HW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Distinctly weathered*	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately weathered	MW	The whole of the rock is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly weathered	SW	Rock is partially discoloured with staining or bleaching along joints, but shows little or no change of strength from fresh rock.
Fresh	FR	Rock shows no sign of decomposition of individual minerals or colour changes.

* If differentiation between highly and moderately weathered rock cannot be determined, then distinctly weathered is used which complies to terms described in Australian Standard AS1726-2017.

ROCK QUALITY

The fracture spacing is shown where applicable and the Rock Quality Designation (RQD) where:

$$\text{RQD (\%)} = \frac{\text{Sum of Axial lengths of core > 100mm long}}{\text{length of core run}}$$

ROCK STRENGTH

Rock strength is described using AS1726-2017 "Geotechnical Site Investigations" & ISRM - Commission on Standardisation of Laboratory & Field Tests, "Suggested method of determining the Uniaxial Compressive Strength of Rock materials & the Point Load Index", as follows:

Term	Symbol	Point Load Index $Is_{(50)}$ (MPa)
Very Low	VL	0.03 to 0.1
Low	L	0.1 to 0.3
Medium	M	0.3 to 1
High	H	1 to 3
Very High	VH	3 to 10
Extremely High	EH	>10

● Diametral Point Load Index test

■ Axial Point Load Index test

DEFECT SPACING/BEDDING THICKNESS

Measured at right angles to defects of same set or bedding.

The method of measurement shall be reported.

Term	Defect Spacing	Bedding
Extremely closely spaced	<6 mm 6 to 20 mm	Thinly Laminated Laminated
Very closely spaced	20 to 60 mm	Very Thin
Closely spaced	0.06 to 0.2 m	Thin
Moderately widely spaced	0.2 to 0.6 m	Medium
Widely spaced	0.6 to 2 m	Thick
Very widely spaced	>2 m	Very Thick

DEFECT DESCRIPTION

Symbol	Term	Symbol	Term
Bg	Bedding	DB	Drill Break
Pt	Parting	Se	Seam
Cn	Contact	SS	Sheared Surface
Bd	Boundary	SZ	Sheared Zone
Jt	Joint	CZ	Crushed Zone
Fo	Foliation	F	Fault
C	Cleavage	Vn	Vein

PLANARITY/ROUGHNESS

Planarity	Description	Planarity	Description
Pl	Planar	Cu	Curved
Un	Undulating	Vu	Vuggy
Ir	Irregular	Wv	Wavy
St	Stepped		
Roughness	**Description**	**Roughness**	**Description**
Sm	Smooth	Po	Polished
Ro	Rough	Sl	Slickensided

The inclination if defects are measured from the perpendicular to the core axis.

COATING OR INFILLING

Abbreviation	Description	Abbreviation	Description
Cln	Clean	Co	Coal
Cg	Coating	Cr	Crushed rock
In	infill	Fe	Limonite/ironstone
Sn	Stain	Fl	Feldspar
Vr	Veneer	Gp	Gypsum
Ca	Calcite	Mn	Manganese
Ch	Chlorite	Py	Pyrite
Cl	Clay	Qz	Quartz

Graphic Symbols – Soils and Rocks

Typical symbols for soils and rocks are as follows. Combinations of these symbols may be used to indicate mixed materials such as clayey sand.

SOIL SYMBOLS

Main components


CLAY


SILT


SAND


GRAVEL


BOULDERS / COBBLES


TOPSOIL


PEAT

Minor components


CLAYEY


SILTY


SANDY


GRAVELLY

OTHER MATERIAL SYMBOLS


FILL


BITUMEN


CONCRETE

ROCK SYMBOLS

Sedimentary Rocks


SANDSTONE


SILTSTONE


CLAYSTONE, MUDSTONE


SHALE


COAL


LIMESTONE


CONGLOMERATE

Igneous rocks


GRANITE


BASALT


UNDIFERENTIATED IGNEOUS

Metamorphic rocks


SLATE, PHYLLITE, SCHIST


GNEISS


QUARTZITE

TEST PIT ENGINEERING LOG

TEST PIT NO.

TPOR01

SHEET : 1 OF 1

Client:	**MACH Energy**	Date Commenced:	**27/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**HS**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**183.793 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297682 N 6428327 MGA94 56**

Test Pit Information | **Field Material Description**

METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY	POCKET PENETROMETER (kPa)	DCP RESULTS (BLOWS/ 100mm)	STRUCTURE AND ADDITIONAL OBSERVATIONS
		NFGWO		0.10					TOPSOIL; Silty CLAY; high plasticity, red-brown, with roots, trace coarse, angular gravel.					TOPSOIL
			183.5			B		CI-CH	Silty CLAY; medium to high plasticity, brown-pale grey, fissured, with fine to medium grained, angular gravel.	MC<PL		>600		RESIDUAL
				0.5										
				0.70					SILTSTONE; grey-white mottled brown, very low strength, extremely to highly weathered, with calcareous carbonate content.	D				WEATHERED ROCK 0.70m-1.20m: strong reaction with HCL
			183.0											
				1.0										
				1.20					SILTSTONE; pale grey-white mottled brown, very low strength, extremely to highly weathered.					
			182.5											
				1.5										
			182.0											
				2.0					As above, but very low to low strength, moderately weathered.					
			181.5											
				2.5					As above, but grey mottled brown, low strength, moderately to slightly weathered.					
			181.0											
									END OF TEST PIT AT 2.90 m					Refusal on inferred low to medium strength SILTSTONE

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

WSP Australia Pty Ltd. V00 8.30.002 WSP_LIB_7.5.GLB Log WSP NON-CORED LOG PS112915_LOGS.GPJ <<DrawingFile>> 16/04/2019 13:18 Developed by Datgel Pty Ltd



TPOR01 - 1 Depth Range: 0.00 - 2.90 m



TPOR01 - 2 Depth Range: 0.00 - 2.90 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Photo - TPOR01	DRAWN MC / DATE 29/03/2019 CHECKED HS / DATE 29/03/2019 SCALE Not To Scale / A4 PROJECT No PS112915 / FIGURE No 1/1	

WSP_LIB_7.5.GLB GrfcTbl DG PHOTO TEST PIT PHOTO 2 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 29/Mar/2019 13:29 8.30.002 Datgel CPT Tool gINT Add-In

TEST PIT ENGINEERING LOG

TEST PIT NO.

TPOR02

SHEET : 1 OF 2

Client:	**MACH Energy**	Date Commenced:	**27/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**HS**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**187.252 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297718 N 6428048 MGA94 56**

Test Pit Information | **Field Material Description**

METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	DCP RESULTS (BLOWS/ 100mm)	STRUCTURE AND ADDITIONAL OBSERVATIONS
		NFGWO	187.0	0.20					TOPSOIL; Silty CLAY; medium to high plasticity, dark grey, fissured, with roots.	D			5 10 15 20 25	TOPSOIL
						B		CI-CH	Silty CLAY; medium to high plasticity, brown, fissured, trace fine to medium grained, angular gravel. Trace rootlets.	MC<PL		>600		RESIDUAL
				0.5								>600		
			186.5	0.60				CI-CH	Silty CLAY; low to medium plasticity, pale grey, interbedded with very low to low strength, extremely weathered siltstone.			350		
												560		
												>600		
			186.0	1.0 1.0					SILTSTONE; grey mottled brown, very low strength, highly to moderately weathered.	D				WEATHERED ROCK
				1.5					As above, but mottled yellow-purple-black, very low strength, highly weathered.					
			185.5						As above, but grey, very low to low strength, moderately weathered.					
				2.0									32	
			185.0						As above, but grey mottled brown, very low to low strength, moderately weathered.					
				2.5					As above, but pale grey mottled brown, low to medium strength, moderately to slightly weathered.					
			184.5											

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPOR02

SHEET : 2 OF 2

Client:	**MACH Energy**	Date Commenced:	**27/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**HS**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**187.252 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297718 N 6428048 MGA94 56**

Test Pit Information							Field Material Description							
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	DCP RESULTS (BLOWS/ 100mm) (5 10 15 20 25)	STRUCTURE AND ADDITIONAL OBSERVATIONS
		NFGWO	184.0					SILTSTONE; grey mottled brown, very low strength, highly to moderately weathered.	D				WEATHERED ROCK
			183.5					END OF TEST PIT AT 3.40 m					Refusal on inferred low to medium strength SILTSTONE
			183.0										
			182.5										
			182.0										
			181.5										

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TPOR02 - 1 Depth Range: 0.00 - 3.40 m



TPOR02 - 2 Depth Range: 0.00 - 3.40 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Photo - TPOR02	DRAWN MC / DATE 29/03/2019 CHECKED HS / DATE 29/03/2019 SCALE Not To Scale / A4 PROJECT No PS112915 / FIGURE No 1/1	

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPOR03

SHEET : 1 OF 1

Client:	**MACH Energy**	Date Commenced:	**27/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**HS**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**174.223 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297702 N 6427765 MGA94 56**

Test Pit Information | **Field Material Description**

METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VS, VL S, L F, MD ST, D VST, VD H)	POCKET PENETROMETER (kPa)	DCP RESULTS (BLOWS/ 100mm)	STRUCTURE AND ADDITIONAL OBSERVATIONS
		NFGWO	174.0	0.10					TOPSOIL; Silty CLAY; medium to high plasticity, brown, with roots.					TOPSOIL
								CI-CH	Silty CLAY; medium to high plasticity, brown-red, trace medium to coarse grained, subangular to subrounded gravel.	MC<PL				RESIDUAL
						B						>600		
			173.5	0.5				CL	Silty CLAY; low plasticity, red-brown mottled grey, interbedded with very low to low strength, extremely to highly weathered siltstone.			>600		
				0.80					SANDSTONE; fine grained, brown, medium to high strength, slightly weathered, iron stained.					WEATHERED ROCK
									END OF TEST PIT AT 0.85 m					Refusal on inferred medium to high strength SANDSTONE
			173.0											
			172.5											
			172.0											
			171.5											

DCP RESULTS (BLOWS/ 100mm) scale: 5, 10, 15, 20, 25

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TPOR03 - 1 Depth Range: 0.00 - 0.85 m



TPOR03 - 2 Depth Range: 0.00 - 0.85 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Photo - TPOR03	DRAWN MC / DATE 29/03/2019 CHECKED HS / DATE 29/03/2019 SCALE Not To Scale / A4 PROJECT No PS112915 / FIGURE No 1/1	

WSP_LIB_7.5.GLB GrfcTbl DG PHOTO TEST PIT PHOTO 2 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 29/Mar/2019 13:29 8.30.002 Datgel CPT Tool gINT Add-In

TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL01

SHEET : 1 OF 2

Client:	**MACH Energy**	Date Commenced:	**30/1/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**30/1/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**AH/MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**142.626 m AHD**
Dimensions:	**3.00 m x 0.45 m**	Bearing:	**---**	Co-ords:	**E 298992 N 6427456 MGA94 56**

Test Pit Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWE	142.5					TOPSOIL: Silty CLAY; low plasticity, grey brown, with roots				TOPSOIL
			0.25				CL-CI	Silty CLAY; low to medium plasticity, grey-brown	MC<PL		>450	ALLUVIUM
			0.5								>450	
			142.0		B			As above, but brown				
			1.0									
			141.5									
			1.20		D		CI	Sandy CLAY; low plasticity, orange-brown, fine grained sand			>450	
			1.5(1.5				SC	Clayey SAND; fine grained, orange-brown, medium plasticity clay	D - M			
			141.0									
			2.0									
			140.5									
			2.5									
			140.0									

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

WSP Australia Pty Ltd. V00 8.30.002 WSP_LIB_7.5.GLB Log WSP NON-CORED LOG PS112915_LOGS.GPJ <<DrawingFile>> 16/04/2019 13:18 Developed by Datgel Pty Ltd

TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL01

SHEET : 2 OF 2

Client:	**MACH Energy**	Date Commenced:	**30/1/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**30/1/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**AH/MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**142.626 m AHD**
Dimensions:	**3.00 m x 0.45 m**	Bearing:	**---**	Co-ords:	**E 298992 N 6427456 MGA94 56**

Test Pit Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWE	139.5				SC	Clayey SAND; fine grained, orange-brown, medium plasticity clay	D - M			ALLUVIUM
			3.5									
			139.0									
			4.0					END OF TEST PIT AT 4.10 m Target depth				
			138.5									
			138.0									
			137.5									
			137.0									

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TPRL01 - 1 Depth Range: 0.00 - 4.10 m



TPRL01 - 2 Depth Range: 0.00 - 4.10 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Photo - TPRL01	DRAWN MC / DATE 29/03/2019 CHECKED HS / DATE 29/03/2019 SCALE Not To Scale / A4 PROJECT No PS112915 / FIGURE No 1/1	

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL02

SHEET : 1 OF 2

Client:	**MACH Energy**	Date Commenced:	**30/1/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**30/1/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**141.995 m AHD**
Dimensions:	**3.00 m x 0.45 m**	Bearing:	**---**	Co-ords:	**E 298759 N 6427448 MGA94 56**

Test Pit Information | **Field Material Description**

METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWE							TOPSOIL: Silty CLAY; low plasticity, dark grey brown, with roots				TOPSOIL
				0.25				CI	Silty CLAY; medium plasticity, dark grey brown	MC<PL			ALLUVIUM
			141.5	0.5								400	
												400	
												>450	
									As above, but brown				
						B							
			141.0	1.0						MC<PL			
			140.5	1.5									
			140.0	2.0								350	
												300	
												300	
				2.30				SC	Clayey SAND; fine grained, brown, medium plasticity clay, trace fine grained, subrounded gravel	D - M			
			139.5	2.5									
				2.70				CI	Silty CLAY; medium plasticity, dark brown, trace fine grained sand	MC=PL		350	
												350	
												400	

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

WSP Australia Pty Ltd. V00 8.30.002 WSP_LIB_7.5.GLB Log WSP NON-CORED LOG PS112915_LOGS.GPJ <<DrawingFile>> 16/04/2019 13:18 Developed by Datgel Pty Ltd

TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL02

SHEET : 2 OF 2

Client:	**MACH Energy**	Date Commenced:	**30/1/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**30/1/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**141.995 m AHD**
Dimensions:	**3.00 m x 0.45 m**	Bearing:	**---**	Co-ords:	**E 298759 N 6427448 MGA94 56**

Test Pit Information | **Field Material Description**

METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWE	141.995	0.00				SC	Clayey SAND; fine grained, brown, medium plasticity clay	D - M			ALLUVIUM
				3.30				CI	Silty CLAY; medium plasticity, dark brown	MC=PL			
			138.5	3.5									
			138.0	4.0									
			137.5	4.5					END OF TEST PIT AT 4.50 m Target depth				
			137.0										
			136.5										

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TPRL02 - 1 Depth Range: 0.00 - 4.50 m



TPRL02 - 2 Depth Range: 0.00 - 4.50 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Photo - TPRL02	DRAWN MC / DATE 29/03/2019 CHECKED HS / DATE 29/03/2019 SCALE Not To Scale / A4 PROJECT No PS112915 / FIGURE No 1/1	

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL03

SHEET : 1 OF 2

Client:	**MACH Energy**	Date Commenced:	**30/1/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**30/1/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**MC/AH**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**141.237 m AHD**
Dimensions:	**3.00 m x 0.45 m**	Bearing:	**---**	Co-ords:	**E 298552 N 6427449 MGA94 56**

Test Pit Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWE	141.0	0.20					TOPSOIL: Silty CLAY; low plasticity, dary grey, with fine to coarse grained, subrounded gravel, roots				TOPSOIL
								CI	Silty CLAY; medium plasticity, dark brown, grey, trace roots	MC<PL		>450	ALLUVIUM
			140.5	0.5		D							
			140.0	1.0					becoming brown/orange brown				
			139.5	1.5		B						>450	
			139.0	2.0		D		SC	Clayey SAND; fine grained, orange/brown, low to medium plasticity clay	D - M			
			138.5	2.5									

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

WSP Australia Pty Ltd. V00 8.30.002 WSP_LIB_7.5.GLB Log WSP NON-CORED LOG PS112915_LOGS.GPJ <<DrawingFile>> 16/04/2019 13:18 Developed by Datgel Pty Ltd

TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL03

SHEET : 2 OF 2

Client:	**MACH Energy**	Date Commenced:	**30/1/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**30/1/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**MC/AH**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**141.237 m AHD**
Dimensions:	**3.00 m x 0.45 m**	Bearing:	**---**	Co-ords:	**E 298552 N 6427449 MGA94 56**

Test Pit Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWE	138.0				SC	Clayey SAND; fine grained, orange/brown, low to medium plasticity clay	D - M			ALLUVIUM
			3.5									
			137.5									
			4.0					END OF TEST PIT AT 4.20 m Target depth				
			137.0									
			136.5									
			136.0									
			135.5									

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TPRL03 - 1 Depth Range: 0.00 - 4.20 m



TPRL03 - 2 Depth Range: 0.00 - 4.20 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Photo - TPRL03	DRAWN MC / DATE 29/03/2019 CHECKED HS / DATE 29/03/2019 SCALE Not To Scale / A4 PROJECT No PS112915 / FIGURE No 1/1	

WSP_LIB_7.5.GLB GrfcTbl DG PHOTO TEST PIT PHOTO 2 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 29/Mar/2019 13:29 8.30.002 Datgel CPT Tool gINT Add-In

TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL04

SHEET : 1 OF 2

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**140.856 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 298272 N 6427241 MGA94 56**

Test Pit Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWE	0.20					Topsoil: Silty CLAY; low to medium plasticity, dark grey, with roots.				TOPSOIL
			140.5				CH	Silty CLAY; high plasticity, dark grey, trace roots.	MC<PL		>600 >600	ALLUVIAL SOIL
			0.5		B							
			0.70				CI-CH	Silty CLAY; medium to high plasticity, brown-dark grey, trace roots.			530 530 >600	
			140.0									
			1.0									
			139.5									
			1.5		B							
			139.0									
			2.0									
			2.20				CI-CH	Silty CLAY; medium to high plasticity, brown-mottled white.			350 480 >600	
			138.5									
			2.5									
			138.0									

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

WSP Australia Pty Ltd. V00 8.30.002 WSP_LIB_7.5.GLB Log WSP NON-CORED LOG PS112915_LOGS.GPJ <<DrawingFile>> 16/04/2019 13:19 Developed by Datgel Pty Ltd

TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL04

SHEET : 2 OF 2

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**140.856 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 298272 N 6427241 MGA94 56**

Test Pit Information							Field Material Description							
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VL L MD D VD / VS S F ST VST H)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWE	137.5	3.5				CI-CH	Silty CLAY; medium to high plasticity, brown-mottled white.	MC<PL			ALLUVIAL SOIL
			137.0	3.70				CI	Silty CLAY; medium plasticity, brown, with fine to coarse grained, sub-rounded to rounded gravel.			220 300 >600	
				4.0					END OF TEST PIT AT 4.10 m Target depth				
			136.5										
			136.0										
			135.5										
			135.0										

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TPRL04 - 1 Depth Range: 0.00 - 4.10 m



TPRL04 - 2 Depth Range: 0.00 - 4.10 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Photo - TPRL04	DRAWN MC / DATE 29/03/2019 CHECKED HS / DATE 29/03/2019 SCALE Not To Scale / A4 PROJECT No PS112915 / FIGURE No 1/1	

WSP_LIB_7.5.GLB GrfcTbl DG PHOTO TEST PIT PHOTO 2 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 29/Mar/2019 13:29 8.30.002 Datgel CPT Tool gINT Add-In

TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL05

SHEET : 1 OF 2

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**140.414 m AHD**
Dimensions:	**3.00 m x 4.10 m**	Bearing:	**---**	Co-ords:	**E 298094 N 6427132 MGA94 56**

Test Pit Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VS, VL S, L F, MD ST, D VST, VD H)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWO	140.20	0.00					Topsoil: Silty CLAY; low to medium plasticity, dark grey, with roots.				TOPSOIL
			140.0	0.20		B		CI-CH	Silty CLAY; medium to high plasticity, dark grey, trace roots.	MC<PL		>600	ALLUVIAL SOIL
			139.5	0.90		B		CH	Silty CLAY; high plasticity, dark grey-black, trace rootlets.			460 >600 >600	
			138.5	1.90				CH	Silty CLAY; high plasticity, grey.				
			138.0	2.50									
			137.5										

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL05

SHEET : 2 OF 2

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**140.414 m AHD**
Dimensions:	**3.00 m x 4.10 m**	Bearing:	**---**	Co-ords:	**E 298094 N 6427132 MGA94 56**

Test Pit Information						Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWO	3.00				CI	Silty CLAY; medium plasticity, brown.	MC<PL		400 470 >600	ALLUVIAL SOIL
			137.0									
			3.5									
			136.5									
			4.0					END OF TEST PIT AT 4.10 m Target depth				
			136.0									
			135.5									
			135.0									
			134.5									

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TPRL05 - 1 Depth Range: 0.00 - 4.10 m



TPRL05 - 2 Depth Range: 0.00 - 4.10 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Photo - TPRL05	DRAWN MC / DATE 29/03/2019 CHECKED HS / DATE 29/03/2019 SCALE Not To Scale / A4 PROJECT No PS112915 / FIGURE No 1/1	

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL06

SHEET : 1 OF 2

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**140.135 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297980 N 6427118 MGA94 56**

Test Pit Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWO	140.0					Topsoil: Silty CLAY; low to medium plasticity, grey, with roots.				TOPSOIL
			0.20				CI-CH	Silty CLAY; medium to high plasticity, grey-dark grey, trace rootlets.	MC<PL		>600	ALLUVIAL SOIL
			0.5		B							
			139.5									
			1.0								>600	
			139.0									
			1.20				CL-CI	Silty CLAY; low to medium plasticity, brown.			>600	
			1.5								>600	
			138.5									
			2.0		B							
			138.0									
			2.5									
			137.5									

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL06

SHEET : 2 OF 2

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**140.135 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297980 N 6427118 MGA94 56**

Test Pit Information						Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWO	3.10 137.0		B		CL-CI	Silty CLAY; low to medium plasticity, brown.	MC<PL			ALLUVIAL SOIL
							ML	Sandy SILT; low plasticity, brown, fine grained sand.			330	
											490	
					B						540	
			3.5 136.5									
											180	
											370	
								END OF TEST PIT AT 4.00 m Target depth			580 280	
			4.0 136.0									
			135.5									
			135.0									
			134.5									

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TPRL06 - 1 Depth Range: 0.00 - 4.00 m



TPRL06 - 2 Depth Range: 0.00 - 4.00 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Photo - TPRL06	DRAWN MC / DATE 29/03/2019 CHECKED HS / DATE 29/03/2019 SCALE Not To Scale / A4 PROJECT No PS112915 / FIGURE No 1/1	

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL07

SHEET : 1 OF 2

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**140.138 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297815 N 6427151 MGA94 56**

Test Pit Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWO	140.0	0.20					Topsoil: Silty CLAY; medium plasticity, grey, with roots.				TOPSOIL
						B		CH	Silty CLAY; high plasticity, grey-brown, orange/brown, trace rootlets.	MC<PL		>600	ALLUVIAL SOIL
			139.5	0.5								>600	
				0.70				CH	Silty CLAY; high plasticity, dark grey.			>600	
				1.0								>600	
			139.0			B							
				1.5									
			138.5										
				1.80				CI-CH	Silty CLAY; medium to high plasticity, brown-grey mottled white.			400	
				2.0								580	
			138.0									>600	
				2.5									
			137.5										
				2.90		D		CI-CH	Silty CLAY; medium to high plasticity, brown mottled white.			380	Moderate reaction with HCl

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL07

SHEET : 2 OF 2

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**140.138 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297815 N 6427151 MGA94 56**

Test Pit Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VS, VL S, L F, MD ST, D VST, VD H)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWO	137.0					CI-CH	Silty CLAY; medium to high plasticity, brown mottled white.	MC<PL		470	ALLUVIAL SOIL
				3.5		D						580	
			136.5						END OF TEST PIT AT 4.00 m Target depth				
				4.0									
			136.0										
			135.5										
			135.0										
			134.5										

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TPRL07 - 1 Depth Range: 0.00 - 4.00 m



TPRL07 - 2 Depth Range: 0.00 - 4.00 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Photo - TPRL07	DRAWN MC / DATE 29/03/2019 CHECKED HS / DATE 29/03/2019 SCALE Not To Scale / A4 PROJECT No PS112915 / FIGURE No 1/1	

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL08

SHEET : 1 OF 2

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**140.334 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297800 N 6427181 MGA94 56**

Test Pit Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWO	140.0	0.10					Topsoil: Silty CLAY; medium plasticity, grey, trace coarse grained, sub-angular to rounded gravel, trace cobbles, with roots.				TOPSOIL
								CH	Silty CLAY; high plasticity, dark grey-black, trace fine grained, rounded gravel, trace rootlets.	MC<PL		>600	ALLUVIAL SOIL
			139.5	0.5		B						>600	
									As above, but trace coarse grained, rounded gravel, trace cobbles			>600	
			139.0	1.0									
				1.5									
				1.60				CH	Silty CLAY; high plasticity, brown, trace medium to coarse grained, rounded gravel, trace cobbles.			>600	
			138.5			B						>600	
				2.0									
									As above, but brown-grey, trace fine to coarse grained, sub-angular to rounded gravel, trace cobbles			>600	
			138.0										
				2.5								>600	
			137.5										

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL08

SHEET : 2 OF 2

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**140.334 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297800 N 6427181 MGA94 56**

Test Pit Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWO	137.0					CH	Silty CLAY; high plasticity, brown, trace medium to coarse grained, rounded gravel, trace cobbles.	MC<PL			ALLUVIAL SOIL
			136.5	3.30				CH	Gravelly CLAY; high plasticity, brown, fine to coarse grained, sub-rounded to rounded gravel, trace cobbles.			>600	
			136.0	3.5					END OF TEST PIT AT 3.70 m Near Refusal				
			135.5										
			135.0										
			134.5										

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TPRL08 - 1 Depth Range: 0.00 - 3.70 m



TPRL08 - 2 Depth Range: 0.00 - 3.70 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Photo - TPRL08	DRAWN MC / DATE 29/03/2019 CHECKED HS / DATE 29/03/2019 SCALE Not To Scale / A4 PROJECT No PS112915 / FIGURE No 1/1	

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL09

SHEET : 1 OF 2

Client:	**MACH Energy**	Date Commenced:	**27/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**HS**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**164.85 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297651 N 6427593 MGA94 56**

Test Pit Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
		NFGWO	164.85 / 0.10					TOPSOIL; Silty CLAY; low to medium plasticity, dark grey, with fine to medium, angular to rounded gravel and roots.	D			TOPSOIL
								SILTSTONE; pale grey mottled brown, very low strength, extremely to highly weathered, indistinct bedding.				WEATHERED ROCK
			164.5 / 0.5					As above, but pale grey mottled brown-black, very low strength, moderately weathered.				
			164.0 / 1.0					As above, but very low strength, extremely to highly weathered.				
			163.5 / 1.5					1.50m: dark brown-purple, trace carbonaceous fossils.				
			163.0 / 2.0					As above, but very low strength, highly weathered.				
			162.5 / 2.5					As above, but pale grey mottled black-brown, very low strength, highly to moderately weathered.				
			162.0					As above, but low to medium strength, moderately weathered.				

END OF TEST PIT AT 3.00 m

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL09

SHEET : 2 OF 2

Client:	**MACH Energy**	Date Commenced:	**27/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**HS**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**164.85 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297651 N 6427593 MGA94 56**

Test Pit Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
			161.5									Refusal on inferred low to medium strength SILTSTONE.
			161.0									
			160.5									
			160.0									
			159.5									
			159.0									

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TPRL09 - 1 Depth Range: 0.00 - 3.90 m



TPRL09 - 2 Depth Range: 0.00 - 3.90 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Photo - TPRL09	DRAWN MC / DATE 29/03/2019 CHECKED HS / DATE 29/03/2019 SCALE Not To Scale / A4 PROJECT No PS112915 / FIGURE No 1/1	

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL24

SHEET : 1 OF 2

Client:	**MACH Energy**	Date Commenced:	**27/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**HS**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**166.509 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297642 N 6427496 MGA94 56**

Test Pit Information | **Field Material Description**

METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
		NFGWO		0.05				GC	TOPSOIL; Gravelly CLAY; low to medium plasticity, brown, fine to coarse grained, rounded gravel, with roots.				TOPSOIL
			166.0	0.5					Clayey GRAVEL; fine to coarse grained, subrounded to rounded, medium plasticity, grey-red-brown clay, trace cobbles.	D			RESIDUAL (Weathered conglomerate)
			165.5	1.0									
				1.20				GW	Sandy GRAVEL; fine to coarse grained, subrounded to rounded, fine to coarse grained sand, with silt. Trace cobbles.	M			
			165.0	1.5									
			164.5	2.0									
			164.0	2.5									

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL24

SHEET : 2 OF 2

Client:	**MACH Energy**	Date Commenced:	**27/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**HS**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**166.509 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297642 N 6427496 MGA94 56**

Test Pit Information							Field Material Description							
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
		NFGWO	163.0	3.5				GW	Sandy GRAVEL; fine to coarse grained, subrounded to rounded, fine to coarse grained sand, with silt. Trace cobbles. As above, but pale yellow-brown.	M			RESIDUAL
			162.5	4.0					END OF TEST PIT AT 4.00 m				Near refusal on dense GRAVEL.
			162.0										
			161.5										
			161.0										

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TPRL24 - 1 Depth Range: 0.00 - 4.00 m



TPRL24 - 2 Depth Range: 0.00 - 4.00 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Photo - TPRL24	DRAWN MC / DATE 29/03/2019 CHECKED HS / DATE 29/03/2019 SCALE Not To Scale / A4 PROJECT No PS112915 / FIGURE No 1/1	

WSP_LIB_7.5.GLB GrfcTbl DG PHOTO TEST PIT PHOTO 2 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 29/Mar/2019 13:30 8.30.002 Datgel CPT Tool gINT Add-In

TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL25

SHEET : 1 OF 2

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**171.345 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297673 N 6427322 MGA94 56**

Test Pit Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VS, VL S, L F, MD ST, D VST, VD H)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWO	171.345	0.10					Topsoil: Gravelly CLAY; low plasticity, brown, fine to medium grained, sub-rounded to rounded gravel, with roots.				TOPSOIL
			171.0	0.5		B		GC	Clayey GRAVEL; fine to coarse grained, rounded to sub-rounded, low to medium plasticity clay, trace rootlets.	D			ALLUVIUM
			170.5	1.0					As above, but low plasticity clay, with fine to coarse grained sand, trace cobbles	D - M			
			170.0	1.5									
			169.5	2.0					As above, but trace calcareous content	M			Strong reaction with HCl
			169.0	2.5									
			168.5										

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TEST PIT ENGINEERING LOG

TEST PIT NO.

TPRL25

SHEET : 2 OF 2

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Test Pit Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Excavation Method:	**Backhoe**	Hole Angle:	**-90°**	Surface RL:	**171.345 m AHD**
Dimensions:	**3.00 m x 0.50 m**	Bearing:	**---**	Co-ords:	**E 297673 N 6427322 MGA94 56**

Test Pit Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
EX	Nil	NFGWO	168.0	3.5				GC	Clayey GRAVEL; fine to coarse grained, rounded to sub-rounded, low to medium plasticity clay, trace rootlets.	M			ALLUVIUM
			167.5	4.0					END OF TEST PIT AT 4.00 m Near Refusal				
			167.0										
			166.5										
			166.0										
			165.5										

This Test Pit log should be read in conjunction with WSP's accompanying explanatory notes.

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TPRL25 - 1 Depth Range: 0.00 - 4.00 m



TPRL25 - 2 Depth Range: 0.00 - 4.00 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Photo - TPRL25	DRAWN MC / DATE 29/03/2019 CHECKED HS / DATE 29/03/2019 SCALE Not To Scale / A4 PROJECT No PS112915 / FIGURE No 1/1	

WSP_LIB_7.5.GLB GrfcTbl DG PHOTO TEST PIT PHOTO 2 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 29/Mar/2019 13:30 8.30.002 Datgel CPT Tool gINT Add-In

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL01

SHEET : 1 OF 7

Client:	**MACH Energy**	Date Commenced:	**21/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**21/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**139.974 m AHD**
Borehole Diameter:	**74/110 mm**	Bearing:	**---**	Co-ords:	**E 297997 N 6427105 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	C	NFGWE	139.5	0.5				CI-CH	Silty CLAY; medium to high plasticity, dark grey, trace coarse grained, angular gravel.	MC<PL			ALLUVIAL SOIL
				0.5				CI-CH	Silty CLAY; medium to high plasticity, dark grey.				
			139.0	1.0				CH	Silty CLAY; high plasticity, dark grey, trace rootlets.			>600	80mm SPT sample recovery
					SPT 9, 18, 24 N=42	SPT							
			138.5	1.5									
			138.0	2.0									
			137.5	2.5									
WB								CI-CH	Silty CLAY; medium to high plasticity, brown.			>600	Water added to help retrieve SPT samples 150mm SPT sample recovery
					SPT 8, 10, 11 N=21	SPT							
			137.0	3.0									Water loss from 3.0m
			136.5	3.5									
			136.0	4.0				CI-CH	Silty CLAY; medium to high plasticity, brown, mottled black, grey, trace fine grained sand.			>600	200mm SPT sample recovery
					SPT 5, 9, 12 N=21	SPT							
			135.5	4.5									
			135.0										

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL01

SHEET : 2 OF 7

Client:	**MACH Energy**	Date Commenced:	**21/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**21/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**139.974 m AHD**
Borehole Diameter:	**74/110 mm**	Bearing:	**---**	Co-ords:	**E 297997 N 6427105 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS FB, S VL, F L, ST MD, VST D, H VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	C	NFGWE	134.5	5.5				CI-CH	Silty CLAY; medium to high plasticity, brown, mottled black, grey, trace fine grained sand.	MC<PL			ALLUVIAL SOIL
					SPT 3, 7, 9 N=16	SPT		CI-CH	Silty CLAY; medium to high plasticity, brown, mottled black, trace coarse grained sand.	MC=PL		230 230 260	220mm SPT sample recovery
			134.0	6.0									
			133.5	6.5									
			133.0	7.0									
					SPT 3, 3, 5 N=8	SPT		CI-CH	Silty CLAY; medium to high plasticity, brown, mottled white, trace medium to coarse grained sand.	MC>PL		190 230 130	350mm SPT sample recovery
			132.5	7.5									
			132.0	8.0									
			131.5	8.5				CI	Silty CLAY; medium plasticity, brown-grey, mottled red.			90 130 150	350mm SPT sample recovery
					SPT 2, 3, 4 N=7	SPT							
			131.0	9.0									
			130.5	9.5									9.50m: Sandy GRAVEL (fine to medium grained sub-angular to rounded gravel, medium to coarse grained sand) was observed from drilling mud return
			130.0										

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL01

SHEET : 3 OF 7

Client:	**MACH Energy**	Date Commenced:	**21/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**21/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**139.974 m AHD**
Borehole Diameter:	**74/110 mm**	Bearing:	**---**	Co-ords:	**E 297997 N 6427105 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	C	NFGWE	10.00					GP	Sandy GRAVEL; fine to coarse grained, brown, rounded, fine to coarse grained sand, trace medium to high plasticity clay.	W			ALLUVIAL SOIL 300mm SPT sample recovery
			129.5	10.5	SPT 11, 28 N=R	SPT							
			129.0	11.0									
			128.5	11.5				GP	Sandy GRAVEL; fine to coarse grained, brown, angular, fine to medium grained sand, iron staining.				Section of hole with gravels caving in and casing extended
					SPT 12, 25/120mm N=R	SPT							
			128.0	12.0									
			127.5	12.5					GRAVEL; coarse grained, with cobbles.				Coring was attempted, only gravels retrieved. Went back to RD at 13.3m
			127.0	13.0									
			13.30						GRAVEL; fine to medium grained, rounded.				
			126.5	13.5									Gravel from drilling mud return
			126.0	14.0									Possible sandstone/siltstone as observed from cutting return
			125.5	14.5	SPT 5/10mm HB N=R	SPT			REFER TO CORED BOREHOLE LOG				10mm SPT sample recovery No refusal
			125.0										

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL01

Client:	**MACH Energy**	Date Commenced:	**21/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**21/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**139.974 m AHD**
Borehole Diameter:	**74/110 mm**	Bearing:	**---**	Co-ords:	**E 297997 N 6427105 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD) / DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
					129.5 / 10.5						
					129.0 / 11.0						
					128.5 / 11.5						
					128.0 / 12.0						
					127.5 / 12.5						
					127.0 / 13.0						
					126.5 / 13.5						
					126.0 / 14.0						
					125.5 / 14.5		START CORING AT 14.50m				
NMLC	Nil		100	100			SILTSTONE; dark grey, thinly bedded	HW			14.6m: DB
								XW			14.7m: DB
								MW			14.75m: DB
								SW			14.8m: DB
			100	95	125.0						14.9m: DB

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL01

SHEET : 5 OF 7

Client:	**MACH Energy**	Date Commenced:	**21/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**21/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**139.974 m AHD**
Borehole Diameter:	**74/110 mm**	Bearing:	**---**	Co-ords:	**E 297997 N 6427105 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	Nil		100	95				SILTSTONE; dark grey, thinly bedded	SW			15.05m: DB 15.08m: DB
						15.30						15.25m: DB
					124.5	15.5		SILTSTONE; dark grey	SW			15.33m: DB
												15.72m: DB
												15.84m: DB 15.88m: DB
					124.0	16.0						16.05m: CZ, 0°, 17 mm
			93	80								16.16m: DB
												16.26m: Bg, 0 - 5°, PL - Wv, Sm
									HW			16.42m: Bg, 10°, Cu, Sm
					123.5	16.46 16.5		CORE LOSS 0.14m (16.46-16.60)				
						16.60		SILTSTONE; dark grey	MW SW			16.67m: Bg, 0°, Cu, Sm
					123.0	17.0						16.91m: Jt, 15°, Ir, Ro
						17.20			HW			17.16m: Bg, 0°, Cu, Sm
								SANDSTONE; fine to medium grained, grey, trace carbonaceous lenses	SW - FR			17.22m: DB
					122.5	17.5						
												17.68m: Jt, 20°, Ir, Ro
					122.0	18.0						
												18.14m: Jt, 50°, Pl, Ro
			100	99	121.5	18.5						
												18.87m: Jt, 15 - 20°, Pl, Ro
					121.0	19.0						
						19.44						19.44m: Jt, 45°, Pl, Sm
					120.5	19.5		Interbedded SANDSTONE and SILTSTONE; fine, grey.				19.64m: Bg, 15°, Pl, Sm
						19.75		SILTSTONE; grey, trace interbedded sandstone				19.88m: Jt, 85°, Pl, Sm
					120.0							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL01

SHEET : 6 OF 7

Client:	**MACH Energy**	Date Commenced:	**21/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**21/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**139.974 m AHD**
Borehole Diameter:	**74/110 mm**	Bearing:	**---**	Co-ords:	**E 297997 N 6427105 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS)	AVERAGE DEFECT SPACING (mm)	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	Nil		100	99	119.5	20.5		SILTSTONE; grey, trace interbedded sandstone	SW - FR	VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	<20, 20-60, 60-200, 200-600, 600-2000, >2000	20.28m: DB 20.3m: Jt, 85°, Pl, Ro 20.46m: DB
					119.0	21.0		SANDSTONE; fine grained, grey				20.72m: DB 21.06m: Bg, 0°, Pl, Ro
			100	98	118.5	21.5						
					118.0	22.0			HW SW - FR XW FR			22.18m: Bg, 0 - 5°, Un, Sm 22.25m: Bg, 0°, Ir, Ro, 15 mm, weathered siltstone 22.27m: Jt, 85°, Pl, Sm 22.32m: Se, 0°, 30 mm, Cl
					117.5	22.5						
					117.0	23.0						22.86m: Bg, 0°, Pl-St, Sm 22.9m: DB 23.06m: DB
					116.5	23.5						23.46m: DB
			100	99	116.0	24.0						24.19m: DB
					115.5	24.5						24.43m: DB 24.77m: DB
					115.0							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL01

SHEET : 7 OF 7

Client:	**MACH Energy**	Date Commenced:	**21/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**21/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**139.974 m AHD**
Borehole Diameter:	**74/110 mm**	Bearing:	**---**	Co-ords:	**E 297997 N 6427105 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	Nil		100	99	25.32			SANDSTONE; fine grained, grey	FR			25.02m: DB
					114.5	25.5		Interbedded SANDSTONE and SILTSTONE; fine, grey.				25.27m: Bg, 0°, Pl, Sm
					25.80							25.6m: Bg, 0°, Pl, Sm
					114.0	26.0		SILTSTONE; grey	HW / FR			25.85m: Bg, 0°, Pl, Sm 25.99m: Bg, 0°, Ir, Ro 26.02m: Bg, 0°, Ir, Ro
								END OF BOREHOLE AT 26.16 m Target depth				
					113.5							
					113.0							
					112.5							
					112.0							
					111.5							
					111.0							
					110.5							
					110.0							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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PointID : BHRL01 Depth Range: 14.00 - 20.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL01	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 1/3



PointID : BHRL01 Depth Range: 20.00 - 26.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL01	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 2/3



PointID : BHRL01 Depth Range: 26.00 - 26.16 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL01	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 3/3

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL02

SHEET : 1 OF 7

Client:	**MACH Energy**	Date Commenced:	**23/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**24/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**139.728 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297795 N 6427151 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	C	NFGWE	139.52	0.20					Topsoil: Silty CLAY; low plasticity, grey-brown.				TOPSOIL
			139.5					CL-CI	Silty CLAY; low to medium plasticity, brown.	MC<PL			ALLUVIAL SOIL
				0.5									
			139.0										
				1.0									
			138.5		SPT 7, 11, 15 N=26	SPT							
				1.5									
			138.0										
				2.0									
			137.5										
			2.50	2.5				CH	Silty CLAY; high plasticity, dark brown.	MC=PL			
			137.0		SPT 10, 18, 25 N=43	SPT							
WB				3.0									
			136.5										
				3.5									
			136.0										
			4.00	4.0				CI	Silty CLAY; medium plasticity, brown.				
			135.5		SPT 5, 11, 14 N=25	SPT							
				4.5									
			135.0										

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL02

SHEET : 2 OF 7

Client:	**MACH Energy**	Date Commenced:	**23/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**24/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**139.728 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297795 N 6427151 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VL L MD D VD / VS S F ST VST H)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	C	NFGWE	134.5	5.5				CI	Silty CLAY; medium plasticity, brown.	MC=PL			ALLUVIAL SOIL
			134.0	6.0	SPT 7, 12, 15 N=27	SPT		CH	Sandy CLAY; high plasticity, brown, fine grained sand.	MC>PL			
			133.5	6.5									
			133.0	7.0				CH	Silty CLAY; high plasticity, brown, trace fine grained, sub-rounded gravel.				
			132.5	7.5	SPT 6, 11, 14 N=25	SPT							
			132.0	8.0									
			131.5	8.5				SC	Gravelly Clayey SAND; fine to coarse grained, orange-brown, high plasticity clay, fine to coarse grained, sub-rounded to sub-angular gravel.	W			
			131.0	9.0	SPT 7, 9, 14 N=23	SPT			GRAVEL; fine to coarse grained, brown-orange-black, sub-rounded to sub-angular.	W			
			130.5	9.5									
			130.0										

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL02

SHEET : 3 OF 7

Client:	**MACH Energy**	Date Commenced:	**23/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**24/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**139.728 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297795 N 6427151 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	C	NFGWE	129.5	10.5	SPT 4, 16 N=R	SPT			GRAVEL; fine to coarse grained, brown-orange-black, sub-rounded to sub-angular.	W			ALLUVIAL SOIL
			129.0	11.0									
			128.5	11.5									No SPT @ 11.5m. Side wall collapsed.
			128.0	12.0									
			127.5	12.5				CH	Silty CLAY; high plasticity, pale orange brown.	MC>PL			
			127.0	12.70 / 12.73	SPT 6, 30/125mm N=R	SPT		CI	GRAVEL; fine to coarse grained, sub-rounded to sub-angular. Silty CLAY; medium plasticity, grey.	W / MC>PL			
			126.5	13.0					REFER TO CORED BOREHOLE LOG				
			126.0	13.5									
			125.5	14.0									
			125.0	14.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL02

Client:	**MACH Energy**	Date Commenced:	**23/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**24/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**139.728 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297795 N 6427151 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
					129.5			START CORING AT 13.00m				
						10.5						
					129.0							
						11.0						
					128.5							
						11.5						
					128.0							
						12.0						
					127.5							
						12.5						
					127.0							
NMLC	Nil		100	90	13 13.0			SANDSTONE; fine grained, grey	MW			13m: Core break
					13.09			SILTSTONE; grey, interbedded with dark grey carbonaceous siltstone bands	MW			13.11m: Jt, 70°, Pl, Sm
					126.5							13.25m: DB
						13.5						13.38m: DB
												13.6m: DB
					126.0							13.77m: Clay band, 10mm
					14 14.0			SILTSTONE; dark grey	HW			14.05m: DB
					125.5							14.24m: DB
									MW - HW			
					14.43							14.42m: DB
			72	39		14.5		Carbonaceous SHALE; dark grey	HW - XW			
					125.0							14.67m: Bg, 0°, Pl, Ro, Co
					14.80			COAL; black, bright, trace interbedded shale bands	SW			14.8m: Bg, 0°, Pl, Ro, Co

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL02

SHEET : 5 OF 7

Client:	**MACH Energy**	Date Commenced:	**23/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**24/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**139.728 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297795 N 6427151 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS)	AVERAGE DEFECT SPACING (mm)	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	Nil		72	39	124.5	15.00		CORE LOSS 0.57m (15.00-15.57)				
						15.5						
					124.0	15.57		SILTSTONE; grey-brown	HW			15.62m: DB
						15.59		COAL; black, bright	MW - SW			15.75m: Bg, 10°, Pl, Ro
						15.75		SILTSTONE; grey-brown	MW			15.81m: Bg, 0°, Pl, Ro
						15.81		COAL; black, interbedded dull and bright, trace clay bands	MW - SW			16m: Clay band, 30mm
					16.0							16.08m: Bg, 10°, Pl, Sm
					123.5	16.23						16.25m: DB
						16.29		Carbonaceous SILTSTONE; dark grey				16.3m: Multiple DB
								COAL; black, bright				
			100	90	16	16.5						16.48m: Bg, 10°, Pl, Sm
								Carbonaceous SILTSTONE; dark grey, with interbedded fine grained sandstone				16.56m: Bg, 10°, Pl, Sm
						16.70						16.68m: DB
					123.0			SANDSTONE; fine grained, dark grey	MW			
						16.80		SILTSTONE; grey				16.8m: DB
					17.0				MW - HW			17.18m: DB
					122.5							17.29m: DB
												17.37m: DB
					17.5							17.49m: DB
												17.56m: DB
					122.0							17.77m: DB
												17.92m: DB
					18.0							17.95m: Bg, 20°, Pl, Sm
									MW			
						18.12		SANDSTONE; fine grained, pale grey	MW - SW			18.12m: Bg, 15°, Pl, Sm
					121.5							18.23m: Jt, 85°, St, Ro
						18.32		SILTSTONE; dark grey	MW			18.32m: DB
					18.5							
						18.65		SANDSTONE; fine grained, pale grey	MW			18.65m: Bg, 10°, Pl, Ro
			100	93	121.0							
						18.86		SANDSTONE; fine grained, grey	SW - FR			
					19.0							19.05m: DB
												19.08m: DB
					120.5							19.27m: Jt, 45°, Pl, Ro
					19.5							
					120.0							

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL02

SHEET : 6 OF 7

Client:	**MACH Energy**	Date Commenced:	**23/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**24/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**139.728 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297795 N 6427151 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 5 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	Nil		100	78	119.5	20.5		SANDSTONE; fine grained, grey	SW - FR			20.5m: Bg, 10°, Pl, Ro
					119.0							20.73m: Jt, 75°, Pl, Ro
												20.85: 20.85m - 21.18m: Jt, 80°,Pl, Ro
					118.5	21.0						
					118.0	21.5						21.3m: Bg, 20°, Pl, Sm, Sn Ca
												21.66m: DB
					117.5	22.0			SW			21.7m: DB
												22m: Jt, 80°, Pl, Ro
					117.0	22.5						22.27m: Bg, 10°, Pl, Sm
						22.64		SILTSTONE; grey, interbedded with fine grained sandstone	MW - SW			22.64m: 10°, clay band (5mm)
						22.84						22.68m: DB
								SANDSTONE; fine grained, grey	SW - FR			22.84m: Bg, 10°, Pl, Ro
					116.5	23.0						23.05m: DB
												23.25m: DB
					116.0	23.5		As above, but grey / pale grey				23.34m: DB
			100	85		24						23.72m: Jt, 70°, St, Ro
					115.5	24.0		SILTSTONE; grey / pale grey	SW			24.1m: Bg, 10°, Pl, Sm, Sn Ca
												24.23m: DB
						24.30			HW			24.29m: DB
								SANDSTONE; fine grained, grey	SW			24.37m: Jt, 70°, Pl, Ro
					115.0	24.5						
												24.89m: DB
												24.93m: Bg, 5°, Pl, Ro

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL02

SHEET : 7 OF 7

Client:	**MACH Energy**	Date Commenced:	**23/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**24/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**139.728 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297795 N 6427151 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	Nil		100	85	114.5	25.5		SANDSTONE; fine grained, grey	SW			25.46m: Bg, 5°, Pl, Sm
								As above, but pale grey				25.62m: DB 25.65m: Bg, 5°, Pl, Ro, Sn Ca
					114.0	26.0						25.92m: Bg, 5°, Pl, Sm
								SILTSTONE; dark grey, interbedded with sandstone				26.03m: DB 26.04m: DB 26.11m: Bg, 5°, Pl, Sm
					113.5	26.45						
						26.5		SILTSTONE; grey	XW			26.45m: Bg, 0°, Pl, Ro 26.48m: Jt, 40°, Ir, Ro, Cl
						26.68						26.68m: Bg, 20°, Pl, Sm
			100	92	113.0			SANDSTONE; fine grained, dark grey, interbedded with siltstone	MW - SW			
						27.0						
					112.5							27.31m: DB
						27.45						
						27.5		SANDSTONE; fine grained, grey-brown				27.5m: Bg, 10°, Pl, Ro
						27.62		SANDSTONE; fine grained, dark grey, interbedded with siltstone				
					112.0							
						28.0						27.93m: DB
												28.02m: 3 x DB
						28.13		SILTSTONE; grey	XW			
					111.5	28.20		SANDSTONE; fine grained, dark grey, interbedded with siltstone	MW			28.2m: Bg, 20°, Pl, Sm
						28.5						
					111.0							28.74m: DB 28.8m: DB
						29.0		END OF BOREHOLE AT 29.00 m Target depth				
					110.5							
					110.0							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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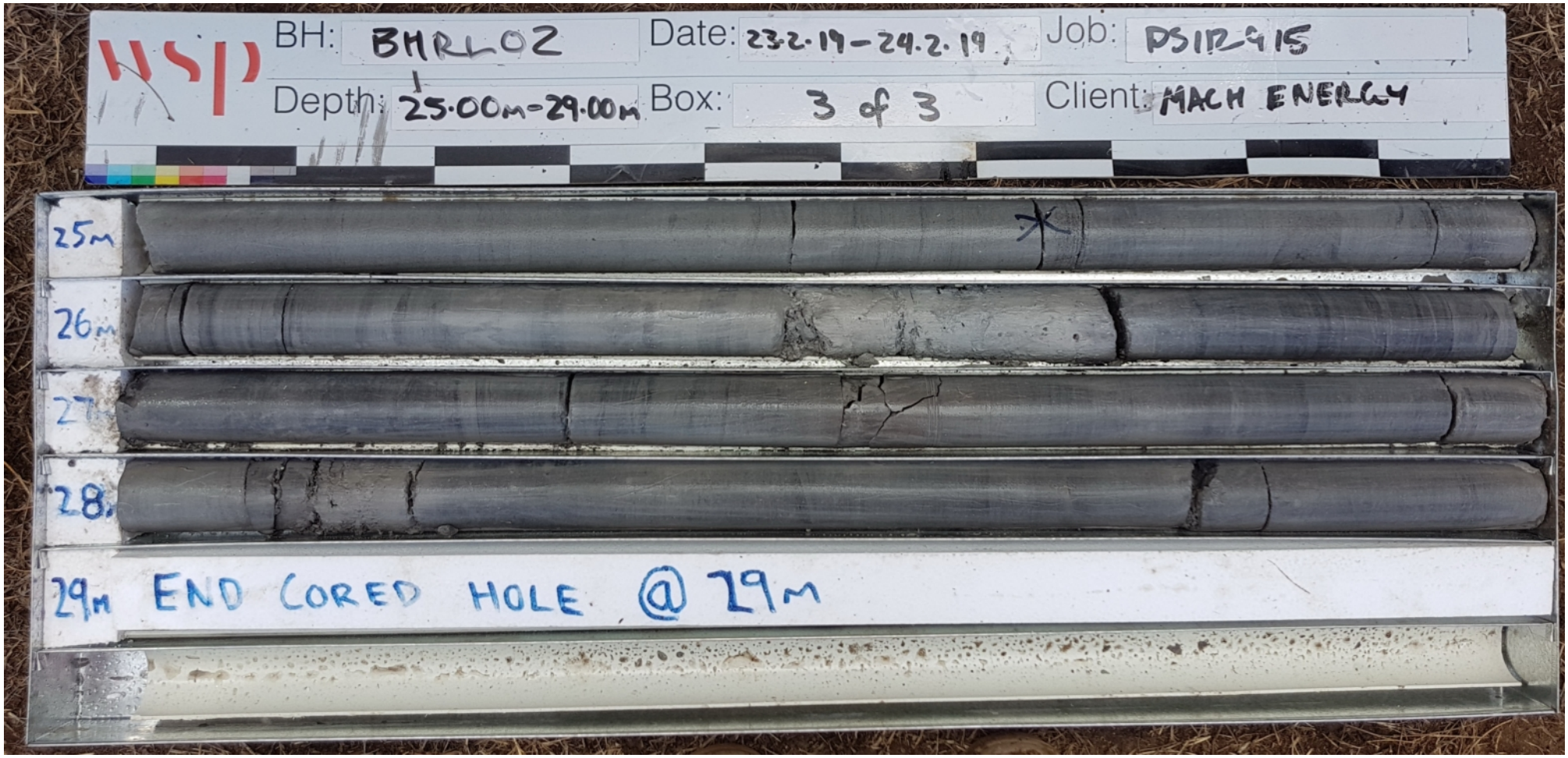
PointID : BHRL02 Depth Range: 13.00 - 19.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL02	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 1/3



PointID : BHRL02 Depth Range: 19.00 - 25.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL02	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 2/3



PointID : BHRL02 Depth Range: 25.00 - 29.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL02	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 3/3

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL03

SHEET : 1 OF 4

Client:	**MACH Energy**	Date Commenced:	**24/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**25/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**168.885 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297687 N 6427272 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VL L MD D VD / VS S F ST VST H)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	C	NFGWE	168.685	0.20					Topsoil: Silty CLAY; low plasticity, orange-brown, with roots.				TOPSOIL
			168.5	0.5				CI	Silty CLAY; medium plasticity, orange-brown, trace fine to coarse grained, sub-angular gravel, trace cobbles.	MC<PL			ALLUVIAL SOIL
			168.0	1.0									
					SPT 13, 19, 28 N=47	SPT		CI-CH	Gravelly CLAY; medium to high plasticity, orange-brown, fine to coarse grained, sub-rounded to sub-angular gravel.				
			167.5	1.5									
			167.0	2.0									
			166.5	2.5									
WB					SPT 8, 13, 15 N=28	SPT			Clayey GRAVEL; fine to coarse grained, orange-brown, rounded to sub-rounded, high plasticity clay.	W			
			166.0	3.0									
			165.5	3.5									
			165.0	4.0									
					SPT 15, 38/125mm N=R	SPT			GRAVEL; fine to coarse grained, sub-rounded to sub-angular.				
			164.5	4.5									
			164.0										

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL03

SHEET : 2 OF 4

Client:	**MACH Energy**	Date Commenced:	**24/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**25/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**168.885 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297687 N 6427272 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	C	NFGWE	163.5						GRAVEL; fine to coarse grained, sub-rounded to sub-angular.				ALLUVIAL SOIL
				5.5				GC	Clayey GRAVEL; fine to coarse grained, rounded to sub-rounded, grey-brown high plasticity clay.				
			163.0		SPT 14, 24, 40/110mm N=R	SPT							
				6.0									
			162.5										
				6.5									
			162.0										
				7.0				GC	Clayey Sandy GRAVEL; fine to coarse grained, sub-rounded to sub-angular, brown high plasticity clay, fine to coarse grained sand.				
					SPT 27, 29/125mm N=R	SPT							
			161.5	7.5									
			161.0										
				8.0									
			160.5										
				8.5									
					SPT 15, 19, 39 N=58	SPT							
			160.0										
				9.0									
			159.5										
				9.5									
			159.0										

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL03

SHEET : 3 OF 4

Client:	**MACH Energy**	Date Commenced:	**24/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**25/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**168.885 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297687 N 6427272 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	C	NFGWE	158.5	10.5	SPT 26/105mm N=R	SPT		GC	Clayey Sandy GRAVEL; fine to coarse grained, sub-rounded to sub-angular, brown high plasticity clay, fine to coarse grained sand.				ALLUVIAL SOIL
			158.0	11.0									
			157.5	11.5	SPT 24/95mm N=R	SPT		GC	Clayey Sandy GRAVEL; fine to coarse grained, sub-rounded to sub-angular, brown high plasticity clay, fine to coarse grained sand.				
			157.0	12.0									
			156.5	12.5									
			156.0	13.0	SPT 22/95mm N=R	SPT							Drill rods dropped between 13.2-14.0m, possible cavity; full water loss
		Water	155.5	13.5									
	Nil		155.0	14.0									
			154.5	14.5				CH	Gravelly Sandy CLAY; brown, sub-rounded to sub-angular, fine to coarse grained gravel, fine to coarse grained sand.	MC>PL			
			154.0		SPT 17, 29, 14/40mm N=R	SPT							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL03

SHEET : 4 OF 4

Client:	**MACH Energy**	Date Commenced:	**24/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**25/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**168.885 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297687 N 6427272 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	Nil	NFGWE	153.5 / 15.5				CH	Gravelly Sandy CLAY; brown, sub-rounded to sub-angular, fine to coarse grained gravel, fine to coarse grained sand.	MC>PL			ALLUVIAL SOIL Very soft pocket from 15.0-15.25
			153.0 / 16.0	SPT 16, 24, 9/15mm N=R	SPT		SC	Gravelly Clayey SAND; fine to coarse grained, orange-brown, sub-rounded to sub-angular, fine to coarse grained gravel, medium to high plasticity clay.	W			
			152.5 / 16.5									
			152.0 / 17.0									
			151.5 / 17.5									
			151.0 / 18.0	SPT 20/70mm N=R	SPT			END OF BOREHOLE AT 18.00 m Target depth				
			150.5									
			150.0									
			149.5									
			149.0									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL05

SHEET : 1 OF 5

Client:	**MACH Energy**	Date Commenced:	**7/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**7/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**JNA**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.227 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297684 N 6427895 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VS, VL S, L F, MD ST, D VST, VD H)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	C	NFGWE	169.0	0.20					TOPSOIL: Silty CLAY: low plasticity, pale brown.				TOPSOIL
				0.5				CL	Silty CLAY; low plasticity, red-brown	MC<PL			RESIDUAL
			168.5										
				1.0	SPT 5, 3/0mm N=R	SPT			SILTSTONE; pale yellow-brown, very low strength, highly to extremely weathered.				WEATHERED ROCK
			168.0	1.5									
			167.5										
				2.0									
			167.0										
				2.5	SPT 8/130mm N=R	SPT							
			166.5										
				3.0									
			166.0										
				3.5									
			165.5										
				4.0					REFER TO CORED BOREHOLE LOG				
			165.0										
				4.5									
			164.5										

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL05

Client:	**MACH Energy**	Date Commenced:	**7/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**7/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**JNA**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.227 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297684 N 6427895 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
					169.0	0.5						
					168.5	1.0						
					168.0	1.5						
					167.5	2.0						
					167.0	2.5						
					166.5	3.0						
					166.0	3.5						
					165.5	4.0		START CORING AT 4.00m				
NMLC	C		100	45	4.00 165.0			SILTSTONE; pale grey mottled yellow-brown.	XW			4.13m: Broken core 4.22m: DB 4.27m: Broken core 4.33m: Jt, 80°, Pl, Sm 4.4m: DB 4.43m: DB
					4.40	4.5			HW			
								SANDSTONE; fine grained, red-orange-brown.	MW			4.52m: DB x5
					164.5							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL05

SHEET : 3 OF 5

Client:	**MACH Energy**	Date Commenced:	**7/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**7/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**JNA**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.227 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297684 N 6427895 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	C		100	59	164.0	5.33		SANDSTONE; fine grained, red-orange-brown.	MW			5.1m: DB 5.18m: DB
					163.5	5.5		SILTSTONE; grey-brown.	HW			5.33m: Bg, 0 - 5°, Pl, Sm, Multiple 5.6m: Jt, 60 - 70°, Cu, Sm 5.72m: Broken core 5.9m: Bg, 0 - 5°, Pl, Sm 5.93m: Bg, 0 - 5°, Pl, Sm 6.04m: Bg, 10°, Pl, Sm, Carbonaceous stain
					163.0	6.10		SILTSTONE; grey-brown mottled brown-yellow.				6.11m: DB 6.15m: DB 6.25m: DB 6.29m: Bg, 10°, Pl, Sm 6.32m: Bg, 10°, Pl, Sm 6.35m: DB 6.49m: Broken core 6.62m: DB 6.54m: Jt, 80°, Cu, Sm 6.66m: DB 6.71m: DB 6.87m: DB 6.95m: DB 6.98m: Jt, 20°, St, Sm, Carbonaceous stain 7.25m: DB 7.55m: DB 7.85m: DB 7.93m: Jt, 80°, Pl, Sm 8.08m: Jt, 20°, Ir, Sm, Fe stained
					162.5	6.5						
					162.0	7.0						
					161.5	7.5						
					161.0	8.0						
			100	83	160.5	8.20		SILTSTONE; orange-brown mottled grey brown.				8.66m: DB
					160.0	8.94		SANDSTONE; fine grained, orange-brown.	SW			8.93m: DB 9.2m: Jt, 10°, Ir, Ro 9.33m: Clay band
					159.5	9.55		SILTSTONE; orange-brown mottled grey-brown, interbedded with fine grained sandstone.	HW			9.56m: Clay band 9.84m: Clay band 9.96m: DB

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL05

SHEET : 4 OF 5

Client:	**MACH Energy**	Date Commenced:	**7/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**7/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**JNA**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.227 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297684 N 6427895 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	C		100	83	159.0	10.5		SILTSTONE; orange-brown mottled grey-brown, interbedded with fine grained sandstone.	HW			10.1m: DB 10.3m: Jt, 15°, Ir, Ro 10.38m: Jt, 70°, Pl, Sm, Carbonaceous stain 10.52m: Jt, 80°, Pl, Sm, Carbonaceous stain 10.6m: Jt, 70°, Pl, Sm, Carbonaceous stain 10.62m: Bg, 0 - 5°, Pl, Sm 10.77m: Bg, 5°, Pl, Sm 10.96m: DB 11.1m: Jt, 80°, Pl, Sm 11.1m: Broken core
					158.5	11.0						
					158.0	1.24		SANDSTONE; fine grained, orange-brown, interbedded with siltstone.	MW			11.44m: Clay band 11.5m: Broken core
					157.5	11.5						11.73m: DB
						11.84		SANDSTONE; fine grained, grey.	SW			11.85m: DB 11.91m: Jt, 20°, Ir, Ro
						12.0						12.02m: DB
						12.14		SANDSTONE; fine grained,	MW			12.13m: DB 12.15m: DB 12.17m: Bg, 5°, Pl, Sm 12.24m: Bg, 5°, Pl, Sm
			100	72	157.0	12.5						12.5m: DB 12.61m: Bg, 10°, Cu, Sm 12.73m: Bg, 10°, Cu, Sm 12.78m: DB 12.89m: DB 12.93m: DB 13.05m: Bg, 10°, Cu, Sm 13.19m: Bg, 10°, Cu, Sm 13.4m: Bg, 10°, Pl, Sm
					156.5	13.0						
					156.0	13 13.5		SILTSTONE; grey-brown mottled brown.				13.63m: Bg, 10°, Pl, Sm 13.69m: Bg, 10°, Pl, Sm 13.85m: DB 14.05m: DB 14.11m: DB 14.11m: Jt, 70°, Ir, Ro
					155.5	14.0						
					155.0	14.25		SILTSTONE; dark grey with interbedded cabonaceous bands.				14.25m: Jt, 30°, Pl, Ro
			100	89	154.5	14.5						14.66m: Bg, 10°, Pl, Ro

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL05

SHEET : 5 OF 5

Client:	**MACH Energy**	Date Commenced:	**7/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**7/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**JNA**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.227 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297684 N 6427895 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH / 60, EH / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	C		100	89	154.0	15.19		SILTSTONE; dark grey with interbedded cabonaceous bands.	MW			15.14m: DB 15.19m: DB
								SILTSTONE; brown mottled grey brown.	HW			15.31m: Broken core 15.48m: Bg, 5°, Pl, Sm 15.58m: DB 15.65m: DB 15.69m: DB 15.82m: Bg, 10°, Pl, Sm 15.89m: Bg, 10°, St, Sm 16.01m: DB 16.09m: DB 16.28m: Bg, 10°, Pl, Sm
					153.0	16.42		SANDSTONE; fine grained, orange-brown-grey	MW			16.42m: Bg, 5°, Ir, Sm 16.8m: Bg, 5°, Pl, Ro 16.88m: Bg, 5°, Pl, Ro 17.2m: Jt, 60°, Pl, Ro
			100	100	152.0	17.30		SANDSTONE; fine grained, grey.	SW			17.69m: DB 17.85m: DB 17.96m: DB
					151.0			As above, grey brown.	MW			
								END OF BOREHOLE AT 18.37 m Target depth				

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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PointID : BHRL05 Depth Range: 4.00 - 10.00 m

TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL05	DRAWN: HS	DATE: 28/03/2019	
	CHECKED: HS	DATE: 28/03/2019	
	SCALE: Not To Scale		A4
	PROJECT No: PS112915	FIGURE No: 1/3	



PointID : BHRL05 Depth Range: 10.00 - 16.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL05	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 2/3



PointID : BHRL05 Depth Range: 16.00 - 18.37 m

TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL05	DRAWN: HS	DATE: 28/03/2019	
	CHECKED: HS	DATE: 28/03/2019	
	SCALE: Not To Scale		A4
	PROJECT No: PS112915	FIGURE No: 3/3	

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL06

SHEET : 1 OF 5

Client:	**MACH Energy**	Date Commenced:	**27/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**180.3 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297669 N 6428227 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG / GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VL L MD D VD / VS S F ST VST H)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	C	NFGWE	180.0 (0.20)				TOPSOIL: Silty CLAY; low plasticity, pale brown.				TOPSOIL
			179.5 (0.5)				Silty CLAY; medium to high plasticity, orange-brown.	MC<PL		>600	
			179.0 (1.0)	SPT 14, 29/150 N=R	SPT		SILTSTONE; pale brown.				WEATHERED ROCK
			178.5 (1.10)								
			178.0 (1.5)								
			177.5 (2.0)								
			177.0 (2.5)	SPT 30/120 N=R	SPT						
			176.5 (2.60)				SANDSTONE; fine grained, orange-brown.				
			176.0 (3.0)				REFER TO CORED BOREHOLE LOG				
			175.5 (3.5)								
			175.0 (4.0)								
			174.5 (4.5)								

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL06

SHEET : 2 OF 5

Client:	**MACH Energy**	Date Commenced:	**27/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**180.3 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297669 N 6428227 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
					180.0	0.5						
					179.5	1.0						
					179.0	1.5						
					178.5	2.0						
					178.0	2.5						
					177.5	3.0		START CORING AT 3.00m				
NMLC	C		100	80	3.00			SANDSTONE; fine grained orange-brown.	MW to HW			
					3.10			SILTSTONE; grey-brown.				
					3.25			SANDSTONE; fine grained orange-brown.				3.3m: DB
					177.0 3.30			SILTSTONE; grey-brown mottled brown.				
						3.5						
					3.60			SANDSTONE; fine grained, orange-brown.				3.6m: Broken core (DB) 3.65m: Jt, 80°, Pl, Sm 3.68m: Bg, 0°, Pl, Ro 3.71m: DB 3.76m: DB 3.81m: DB 3.87m: DB
					176.5 3.85			SILTSTONE; grey-brown mottled brown.				
						4.0						4.14m: Bg, 5°, Pl, Sm
					176.0							
					4.55	4.5						4.5m: Bg, 5°, Pl, Sl
								SILTSTONE; dark grey-brown	HW			4.61m: DB 4.72m: Jt, 60°, Ir, Ro
					175.5							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL06

SHEET : 3 OF 5

Client:	**MACH Energy**	Date Commenced:	**27/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**180.3 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297669 N 6428227 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	C		100	80	175.0	5.05						5.04m: DB
						5.10		SILTSTONE; pale grey-brown.	XW			5.06m: DB
						5.24		Carbonaceous CLAYSTONE; dark brown mottled black.				5.24m: DB
						5.40		SILTSTONE; dark grey-brown.	HW			5.4m: DB
					174.5	5.5		SANDSTONE; fine grained dark yellow brown				5.51m: Bg, 0°, Pl, Ro
												5.63m: DB
								As above but yellow-brown.	MW			5.7m: DB
					174.0	6.0		As above but pale yellow-brown.	HW			
									MW			6.18m: DB
												6.2m: DB
								As above but yellow-brown.				6.25m: DB
			100	71		6.5						6.5m: DB
												6.55m: Se, 0°, Pl, Ro, Decomposed
					173.5	6.70		SILTSTONE; grey-brown.	HW			
												6.86m: DB
						6.96						6.96m: DB
					173.0	7.0		SANDSTONE; fine grained, orange-brown.	MW			7.12m: Bg, 15°, Pl, Sm
												7.15m: DB
												7.32m: DB
						7.40		SILTSTONE; grey-brown, interbedded with fine grained sandstone.				7.41m: DB
						7.5						7.67m: Jt, 70°, Pl, Sm
					172.5	7.70		SILTSTONE; grey-brown.	MW to HW			7.79m: Bg, 15°, Pl, Sm
												7.88m: Bg, 10°, Pl, Ro
						8.0						7.93m: DB
												8.03m: DB
						8.10		SANDSTONE; fine grained grey-brown.	SW to MW			8.04m: Jt, 70°, Ir, Sm
												8.1m: DB
												8.12m: DB
					172.0							8.17m: DB
												8.24m: DB
						8.5						8.29m: Bg, 0 - 5°, Pl, Ro
												8.31m: DB
												8.41m: Jt, 30°, Cu, Ro
												8.54m: Bg, 5°, Pl, Sm
												8.7m: DB
					171.5	8.84		SANDSTONE; grey brown.	HW to XW			8.83m: Decomposed rock
			100	68		9.0						9.14m: DB
									HW			
					171.0			As above but pale grey-brown.				9.38m: DB
						9.5		As above but dark grey-brown.				9.58m: Jt, 60°, Pl, Sm
												9.66m: Jt, 70°, Pl, Sm
						9.70						
					170.5			SILTSTONE; grey-brown, interbedded with fine grained sandstone.	HW			9.83m: Bg, 5°, Pl, Sm
												9.85m: Decomposed rock

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL06

SHEET : 4 OF 5

Client:	**MACH Energy**	Date Commenced:	**27/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**180.3 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297669 N 6428227 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD) / DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	C		100	68	10.00 / 170.0		SANDSTONE; fine grained, yellow-brown.	HW			10.04m: DB 10.05m: DB 10.29m: Bg, 20°, Pl, Ro
					10.37 / 10.5		SANDSTONE; fine grained, grey-brown, interbedded with siltstone.	MW			10.35m: Clay band (20mm) 10.53m: Bg, 20°, Pl, Ro
					10.68 / 169.5		SANDSTONE; fine grained grey-brown.	SW to MW			10.65m: Bg, 20°, Pl, Ro
					11.0						
					11.05		SILTSTONE; grey-brown mottled brown.	MW			11.05m: DB
					169.0 / 1.30						11.27m: DB
			100	66			SANDSTONE; fine grained grey-brown.	MW			11.32m: DB 11.4m: DB 11.47m: DB
					11.5						
					168.5						11.74m: DB 11.82m: DB 11.83m: DB
					12.0						11.95m: DB
					12.10						12.06m: DB
					168.0		SANDSTONE; fine grained, orange-brown, interbedded with siltstone.				12.1m: DB 12.13m: Clay band (10mm) 12.27m: Clay band (10mm) 12.35m: Clay band (10mm) 12.42m: Bg, 10°, Pl, Sm
					12.5			HW			12.45m: Decomposed rock 12.56m: Decomposed rock
					167.5			MW			12.64m: Bg, 10°, Pl, Sm 12.7m: DB 12.74m: Bg, 10°, Pl, Ro 12.8m: DB
					12.85		SILTSTONE; grey-brown mottled brown.	MW to HW			12.9m: DB
					13.0						12.97m: DB 13.06m: DB
					167.0						13.16m: Bg, 10°, Pl, Ro 13.21m: Bg, 10°, Ir, Ro 13.26m: Bg, 10°, Ir, Ro 13.35m: DB
					13.5						13.46m: DB
					13.70 / 166.5		SANDSTONE; fine grained, yellow-brown.	MW			13.7m: DB 13.72m: DB
					14 14.0		SILTSTONE; yellow-brown.	MW to HW			14.11m: DB 14.2m: Jt, 40°, Pl, Ro
					166.0						14.35m: DB 14.41m: DB 14.46m: DB 14.51m: DB
			100	63	14.5 / 14.54		SANDSTONE; fine grained grey-brown.	MW			14.54m: Jt, 70 - 90°, Pl, Ro, In quartz
					14.74 / 165.5		SILTSTONE; grey-brown, interbedded with fine grained sandstone.	MW to HW			14.74m: Clay band (10mm) 14.84m: DB

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL06

SHEET : 5 OF 5

Client:	**MACH Energy**	Date Commenced:	**27/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**180.3 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297669 N 6428227 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	C		100	63	165.0	15.5		SILTSTONE; grey-brown, interbedded with fine grained sandstone.	MW to HW			15.1m: Bg, 20°, Ir, Ro 15.11m: DB 15.2m: Bg, 20°, Ir, Ro 15.26m: Bg, 10°, Pl, Ro
								As above but grey.	SW to MW			15.57m: DB
					164.5			As above but grey-brown.				15.75m: DB 15.78m: DB
						16.0		As above but grey mottled grey-brown.				16.01m: DB
					164.0							16.23m: Ironstone band
						16.5		As above but with some thin coal beds				16.64m: Coal lense
					163.5							
					16.90			COAL; black, dull.	SW to MW			16.9m: DB
					17.0							17.12m: Jt, 85°, Pl, Sm 17.18m: Jt, 70°, St, Sm
					163.0							17.27m: DB 17.35m: DB
			100	81	*17.40*			Carbonaceous SILTSTONE; dark grey mottled black.				17.4m: Decomposed rock (DB)
					17.5							17.52m: DB
					162.5				SW			17.7m: DB
						18.0						17.89m: DB
					162.0				SW to MW			18.1m: DB 18.19m: Bg, 5°, Pl, Sm
						18.5						18.32m: DB 18.45m: DB
					161.5			END OF BOREHOLE AT 18.64 m Target depth				
					161.0							
					160.5							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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PointID : BHRL06 Depth Range: 3.00 - 9.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL06	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 1/3



PointID : BHRL06 Depth Range: 9.00 - 15.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL06	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 2/3



PointID : BHRL06 Depth Range: 15.00 - 18.64 m

TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL06	DRAWN: HS	DATE: 28/03/2019	
	CHECKED: HS	DATE: 28/03/2019	
	SCALE: Not To Scale		A4
	PROJECT No: PS112915	FIGURE No: 3/3	

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL07

SHEET : 1 OF 5

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**187.466 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297664 N 6428473 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG / GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	C	NFGWE	187.0 / 0.5				TOPSOIL: Silty CLAY; low plasticity, brown, with roots.				TOPSOIL
			186.5 / 1.0				Silty CLAY; low plasticity, red-brown.	MC<PL			RESIDUAL
			1.0	SPT 13, 24, 30/60mm, N=R	SPT		As above, but pale yellow-brown			>600	
			1.21				SILTSTONE; pale yellow-brown				WEATHERED ROCK
			186.0 / 1.5								
			185.5 / 2.0								
			185.0 / 2.5								
			2.5	SPT 9/45mm, N=R	SPT		As above, but orange-brown				
			184.5 / 3.0				REFER TO CORED BOREHOLE LOG				
			184.0 / 3.5								
			183.5 / 4.0								
			183.0 / 4.5								
			182.5								

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL07

SHEET : 2 OF 5

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**187.466 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297664 N 6428473 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
					187.0	0.5						
					186.5	1.0						
					186.0	1.5						
					185.5	2.0						
					185.0	2.5						
					184.5	3.0		START CORING AT 3.00m				
NMLC	C		100	61	184.0	3.5		SANDSTONE; fine grained, orange-brown	MW			3.02m: DB 3.07m: DB 3.41m: Jt, 20°, Pl, Ro 3.64m: DB 3.74m: DB 3.76m: DB 3.88m: DB
					183.5	4.0			XW - HW			4m: Broken core (DB)
					4.07			SANDSTONE; fine grained, orange-brown, interbedded with siltstone.				4.18m: DB 4.3m: Bg, 5°, Pl, Ro 4.32m: DB 4.35m: Decomposed rock (DB)
					183.0	4.5			XW			
									HW			
					4.67			SILTSTONE; pale grey-brown.				4.66m: Broken core (DB)
					182.5							4.84m: DB 4.95m: DB

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL07

SHEET : 3 OF 5

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**187.466 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297664 N 6428473 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	C		100	51	182.0	5.5		SILTSTONE; purple-brown	XW			5.24m: Decomposed rock (DB)
						5.43		SILTSTONE; grey-orange-brown.	HW			
						5.55		becoming grey-brown.				
						5.62		becoming orange-brown.				5.72m: Bg, 10°, Pl, Sm
					181.5	6.0		As above, but grey-orange-brown.				6.13m: DB
												6.21m: DB
						6.33						6.32m: DB
								SILTSTONE; brown-grey, interbedded with fine grained sandstone.	MW			6.42m: DB
					181.0	6.5						6.52m: 5 x DBs
						6.60						6.57m: Jt, 70°, Pl, Sm
								SILTSTONE; grey-brown.	HW			6.7m: DB
												6.88m: DB
					180.5	7.0						6.97m: DB
												7.03m: DB
						7.12						7.04m: DB
								Carbonaceous SILTSTONE; brown-black.				
						7.21		SILTSTONE; grey-brown interbedded with fine grained sandstone.	HW - MW			7.21m: DB
					180.0	7.5						7.79m: DB
					179.5	8.0		SILTSTONE; grey-brown.				8.03m: DB
												8.06m: DB
									XW - HW			8.14m: Broken core (DB)
						8.43		SILTSTONE; orange-brown mottled grey, interbedded with fine grained sandstone.				
					179.0	8.5						
						8.62		SANDSTONE; fine grained, orange-grey-brown, interbedded with siltstone.	MW			8.67m: DB
												8.7m: Jt, 85°, Pl, Ro
												8.71m: DB
												8.74m: DB
												8.82m: DB
												8.86m: Jt, 75°, Pl, Ro
			100	33	178.5	8.97						8.93m: Bg, 5°, Pl, Sm
						9.0		SILTSTONE; grey-brown.				8.97m: DB
												9.02m: DB
						9.10		SANDSTONE; fine grained, orange-brown.				9.03m: DB
												9.08m: Decomposed rock (DB)
												9.2m: DB
												9.3m: DB
					178.0	9.5						9.38m: DB
												9.41m: Decomposed rock (DB)
												9.54m: DB
						9.57		SILTSTONE; grey-brown.	MW			9.6m: Jt, 60-80°, Pl-Cu, Sm
												9.71m: Jt, 50°, Cu, Sm
												9.78m: Jt, 60°, Pl, Sm
					177.5							9.96m: DB

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL07

SHEET : 4 OF 5

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**187.466 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297664 N 6428473 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 5 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	C		100	33	10.10			SILTSTONE; grey-brown.	MW			10.05m: Jt, 70-80°, Ir, Ro
								SANDSTONE; fine grained, grey-brown, interbedded with siltstone.				10.1m: DB
												10.16m: Bg, 10°, Pl, Sm
												10.24m: Bg, 0°, Pl, Sm
					177.0	10.5						10.34m: DB
												10.36m: Bg, 10°, Pl-Cu, Sm
												10.43m: Bg, 10°, Pl, Ro
			100	82	10.10	10.5		SILTSTONE; grey-brown.				10.5m: Bg, 15°, Pl, Sm
												10.52m: 3 x DB
					10.71							10.67m: Decomposed rock (30mm)
								SANDSTONE; fine grained grey-brown.				
					176.5	11.0						10.87m: DB
												10.96m: DB
												11.17m: DB
					11.21			SILTSTONE; grey-brown mottled brown.				11.2m: DB
					176.0	11.5						11.61m: DB
												11.79m: DB
									HW - MW			11.84m: DB
												11.85m: DB
					175.5	12.0						
			100	50	12.05			SILTSTONE; brown.	HW - XW			12.05m: Bg, 15°, Pl, Sm
												12.05m: Broken core (DB)
												12.15m: Decomposed rock (DB)
					175.0	12.5						12.39m: DB
												12.54m: DB
												12.66m: DB
												12.76m: Carbonaceous band
												12.8m: DB
					12.90							12.9m: Bg, 10°, Ir, Ro
					174.5	13.0		IRONSTONE; red-purple, quartz inclusions.	HW			12.95m: DB
												13.04m: DB
					13.07			SANDSTONE; fine grained, grey-brown.				13.15m: DB
					13.20			SILTSTONE; brown mottled grey-brown.				
					174.0	13.5						13.4m: Jt, 50°, Pl, Ro
												13.56m: Jt, 50°, Pl, Sm
												13.61m: DB
												13.65m: DB
					13.70							13.69m: DB
								SILTSTONE; grey mottled grey-brown, interbedded with fine grained sandstone.	MW - SW			13.72m: DB
					173.5	14.0						13.92m: Bg, 10°, Pl, Sm
												14.02m: Bg, 20°, Pl, Sm
					14.07			SANDSTONE; fine grained, grey-brown.				14.08m: DB
			100	68	173.0	14.5						14.47m: DB
												14.74m: DB
												14.88m: DB
					172.5							14.92m: DB

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL07

SHEET : 5 OF 5

Client:	**MACH Energy**	Date Commenced:	**26/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**187.466 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297664 N 6428473 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	C		100	68				SANDSTONE; fine grained, grey-brown.	MW			14.95m: DB 15.001m: 4 x DBs 15.24m: Bg, 5°, Pl, Sm
					15.41 172.0	15.5		SILTSTONE; grey-brown.				15.41m: Bg, 10°, Pl, Ro 15.42m: DB 15.58m: DB
					171.5	16.0		As above, but grey.				15.89m: DB 16.18m: DB 16.24m: DB
					171.0	16.5						16.35m: Decomposed rock (DB) 16.5m: DB 16.6m: DB 16.67m: DB 16.73m: DB
			79	49	170.5	17.0		As above, but dark grey.	SW MW SW			17.05m: DB 17.14m: DB 17.18m: Broken core (DB)
					170.0	17.5						17.48m: Bg, 50°, Ir, Sm, Vr Co 17.62m: Bg, 5°, Ir, Sm, Vr Co 17.68m: DB
					17.72 169.5	18.0		COAL; black, dull.				17.75m: DB 17.89m: Bg, 10°, Pl, Sm 17.9m: Broken core (DB) 18.01m: 5 x DB
					18.20 169.0	18.5		CORE LOSS 0.40m (18.20-18.60)				
			100	40	*18.60*			COAL; black, dull.	MW			18.6m: Broken core (DB)
					18.70			Carbonaceous SILTSTONE; dark grey.	HW			18.74m: Coal band
					18.80 *18.85*			COAL; black, dull.	HW			18.82m: Decomposed rock (DB)
					168.5			Carbonaceous SILTSTONE; dark grey.	HW			18.96m: Decomposed rock (DB)
					19 19.0			Carbonaceous SILTSTONE; dark grey.	MW			19.08m: DB
					168.0			END OF BOREHOLE AT 19.10 m Target depth				
					167.5							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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PointID : BHRL07 Depth Range: 3.00 - 9.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL07	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 1/3



PointID : BHRL07 Depth Range: 9.00 - 15.00 m

TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL07	DRAWN: HS	DATE: 28/03/2019	
	CHECKED: HS	DATE: 28/03/2019	
	SCALE: Not To Scale		A4
	PROJECT No: PS112915	FIGURE No: 2/3	



PointID : BHRL07 Depth Range: 15.00 - 19.10 m

TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL07	DRAWN: HS	DATE: 28/03/2019	
	CHECKED: HS	DATE: 28/03/2019	
	SCALE: Not To Scale		A4
	PROJECT No: PS112915	FIGURE No: 3/3	

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL08

SHEET : 1 OF 5

Client:	**MACH Energy**	Date Commenced:	**25/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**173.586 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297664 N 6428473 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG / GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	C	NFGWE	173.5				TOPSOIL: Silty CLAY; low plasticity, brown, with roots.				TOPSOIL
			0.20				Silty CLAY; low plasticity, pale red-brown.	MC<PL			RESIDUAL
			0.5 / 173.0								
			0.80				CLAY; low plasticity, pale red-brown.				
			1.0 / 172.5	SPT 9, 21, 8/25mm N=R	SPT		Silty CLAY; low to medium plasticity, pale brown.				
			1.5 / 172.0								
			2.0 / 171.5								
			2.5								
WB			171.0	SPT 22, 10/35mm N=R	SPT		SILTSTONE; yellow-brown, very low strength, extremely weathered.				WEATHERED ROCK
			3.0 / 170.5								
			3.5 / 170.0								
			4.0				REFER TO CORED BOREHOLE LOG				
			169.5								
			4.5 / 169.0								

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL08

SHEET : 2 OF 5

Client:	**MACH Energy**	Date Commenced:	**25/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**173.586 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297664 N 6428473 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
					173.5							
						0.5						
					173.0							
						1.0						
					172.5							
						1.5						
					172.0							
						2.0						
					171.5							
						2.5						
					171.0							
						3.0						
					170.5							
						3.5						
					170.0			START CORING AT 4.00m				
NMLC	C				4.00 169.5	4.0		SILTSTONE; pale orange-brown.	XW			4.06m: Clay band (10mm) 4.1m: DB
					4.21			SANDSTONE; fine grained, dark orange-brown.				4.2m: Clay band 4.2m: Decomposed rock (DB)
			100	47	4.29 169.0	4.5		SILTSTONE; pale orange-brown mottled grey.	HW - MW			4.36m: Jt, 70°, Pl, Sm 4.5m: Decomposed rock (DB) 4.53m: DB 4.54m: Jt, 50°, Pl, Sm 4.65m: DB
			100	56	4.70			SILTSTONE; orange-brown.	HW			4.71m: DB's 4.78m: DB
					4.88			SILTSTONE; grey-brown.	HW - MW			4.83m: Decomposed rock (DB)

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL08

SHEET : 3 OF 5

Client:	**MACH Energy**	Date Commenced:	**25/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**173.586 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297664 N 6428473 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	C		100	56	168.5	5.00		SANDSTONE; fine grained, orange-brown.	MW			5.15m: Bg, 20°, Pl, Sm 5.27m: Bg, 20°, Pl, Ro 5.34m: Bg, 20°, Pl, Ro, Iron stained
					168.0	5.45 5.5		SANDSTONE; fine grained, orange-brown mottled grey, interbedded with siltstone.	SW			5.45m: Bg, 20°, Pl, Ro 5.58m: DB 5.58m: Decomposed rock (DB) 5.8m: DB
					167.5	6.0			MW			5.92m: DB 5.94m: DB 6.11m: Jt, 55°, Pl, Ro 6.12m: DB 6.22m: Jt, 45°, Ir, Ro 6.26m: Decomposed rock (DB) 6.37m: DB 6.42m: DB
					167.0	6.47 6.5		SANDSTONE; fine grained, orange-brown, with quartz veins.				6.47m: DB 6.56m: DB 6.69m: DB
			100	69	166.5	6.81 6.86 7.0 7.09		SILTSTONE; orange-brown. SANDSTONE; fine grained, orange-brown. SILTSTONE; orange-brown.	HW MW			6.82m: DB 6.94m: DB 6.96m: DB 7.02m: DB 7.12m: DB
					166.0	7.22 7.42 7.5 7.58		SANDSTONE; fine grained, orange-brown. SILTSTONE; orange-brown. SANDSTONE; fine grained, orange-brown.	HW HW			7.42m: DB 7.53m: Bg, 5°, Pl, Ro 7.56m: Bg, 5°, Pl, Ro
					165.5	8.0						7.84m: DB 7.95m: DB 8m: Jt, 50°, Ir, Ro 8.13m: Bg, 10°, Pl, Sl
			100	57	165.0	8.28 8.5 8.54		SILTSTONE; orange-brown mottled grey. SILTSTONE; grey mottled brown.				8.29m: Bg, 5°, Pl, Sm 8.34m: Bg, 5°, Pl, Sm 8.38m: DB 8.53m: DB 8.56m: Jt, 60°, Pl, Sm 8.61m: Bg, 5°, Pl, Sm
					164.5	8.80 9.0		SILTSTONE; dark brown.	XW HW - MW			8.75m: Carbonaceous CLAY (decomposed) 8.9m: DB 8.93m: DB 9.03m: DB 9.14m: Bg, 5°, Pl, Sm 9.2m: DB
					164.0	9.41 9.5 9.57		SILTSTONE; grey-brown. SILTSTONE; dark grey-brown.				9.41m: DB 9.42m: Jt, 60°, Pl, Sm 9.51m: DB 9.75m: DB 9.89m: Jt, 25°, Ir, Ro

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL08

SHEET : 4 OF 5

Client:	**MACH Energy**	Date Commenced:	**25/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**173.586 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297664 N 6428473 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD) / DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	C		100	57	163.5 / 0.00		SILTSTONE; dark grey-brown.	HW - MW			10.03m: DB 10.08m: DB 10.12m: DB
					10.20		SANDSTONE; fine grained, orange-brown interbedded with siltstone.	HW			10.26m: DB 10.37m: DB 10.4m: DB 10.45m: Jt, 50°, Pl, Ro 10.47m: DB 10.52m: Bg, 0°, Pl, Sm
			100	34	10.5 / 163.0						
					10.64		SILTSTONE; orange-brown.				10.64m: DB 10.55m: Jt, 25°, Ir, Ro 10.9m: DB 10.95m: DB
					11.0 / 11.04 / 162.5		SILTSTONE; drak grey-brown.	MW			11.04m: Bg, 0°, Pl, Sm 11.19m: DB, (Decomposed rock)
					11.24		Carbonaceous SILTSTONE; black-dark brown.	HW - MW			11.35m: Carbonaceous clay
					11.42		SILTSTONE; dark grey-brown.	MW			11.49m: Jt, 30°, Pl, Sm 11.5m: Broken core (DB)
			100	72	11.5 / 162.0						11.82m: DB 11.9m: DB 11.95m: DB
					12.0 / 161.5			HW - MW			12.16m: DB
					12.20		SILTSTONE; orange-brown, interbedded with fine grained sandstone.	MW			
					12.5 / 161.0 / 12.57		SILTSTONE; grey.	HW - MW			12.71m: DB
					12.84		SANDSTONE; fine grained, orange-brown.	MW			12.83m: DB
					13 / 13.0 / 160.5 / 13.07		SILTSTONE; dark orange-brown.				13.08m: Clay band (10mm)
					13.18		SANDSTONE; fine grained, orange-brown.				13.19m: DB
							SILTSTONE; grey-brown mottled orange-brown, interbedded with fine grained sandstone.	MW			13.28m: DB 13.43m: DB
					13.5 / 160.0						
					14.0 / 14.05 / 159.5		SILTSTONE; grey-brown mottled brown.	HW to MW			13.91m: DB 13.93m: DB 14.06m: DB 14.12m: Jt, 65°, Pl, Sm 14.15m: DB
					14.31m: Coal band						
					14.5 / 14.55 / 159.0		SILTSTONE; grey mottled brown.	MW			14.39m: Bg, 10°, Pl, Sm 14.44m: DB 14.45m: Jt, 60°, Pl, Sm 14.5m: DB 14.54m: DB
			100	64	14.76		SILTSTONE; dark orange-brown mottled grey interbedded with fine grained sandstone.	XW - HW HW XW -			14.67m: Decomposed rock (DB) 14.9m: Decomposed rock (DB)

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL08

SHEET : 5 OF 5

Client:	**MACH Energy**	Date Commenced:	**25/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**173.586 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297664 N 6428473 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	C	0% Water RETURN	100	64	158.5			SILTSTONE; dark orange-brown mottled grey interbedded with fine grained sandstone.	HW HW - MW			15.1m: DB 15.18m: DB
					15.26							15.25m: Decomposed rock (DB)
					158.0			SILTSTONE; grey.	HW HW - MW			
					15.5							
					15.80			SILTSTONE; dark grey.				15.82m: DB 15.92m: Coal band
			93	78	157.5							16.13m: DB
					16.0							16.2m: Clay band (20mm)
					16.21			SILTSTONE; brown mottled grey-brown, interbedded with fine grained sandstone.	MW			
					16.44			SANDSTONE; fine to medium grained, pale brown.	HW - MW			
					16.5							16.58m: DB
					157.0							16.78m: DB
					17.0							16.96m: DB
					156.5							
					17.30			SANDSTONE; fine grained, pale brown, quartz intrusions.	HW			17.22m: Broken core (DB)
					17.40			CORE LOSS 0.14m (17.40-17.54)				
					17.5							
					17.54			SANDSTONE; fine grained, pale brown, quartz intrusions.	HW			17.54m: Decomposed rock (DB)
					156.0							
					17.68			SANDSTONE; fine to medium grained, grey.	MW - SW			17.73m: DB
								END OF BOREHOLE AT 18.00 m Target depth				
					18.0							
					155.5							
					155.0							
					154.5							
					154.0							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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PointID : BHRL08 Depth Range: 4.00 - 10.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL08	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 1/3



PointID : BHRL08 Depth Range: 10.00 - 16.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL08	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 2/3

WSP_LIB_7.5.GLB GrfcTbl DG PHOTO CORE PHOTO 1 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 28/Mar/2019 17:11 8.30.002 Datgel CPT Tool gINT Add-In



PointID : BHRL08 Depth Range: 16.00 - 18.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL08	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 3/3

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL15

SHEET : 1 OF 5

Client:	**MACH Energy**	Date Commenced:	**28/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**28/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**186.024 m AHD**
Borehole Diameter:	**74/110 mm**	Bearing:	**---**	Co-ords:	**E 297689 N 6428040 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD	C	NFGWE	186.0	0.0					Silty CLAY; medium plasticity, brown, trace medium grained, angular gravel.	MC<PL			RESIDUAL
			185.5	0.5									
			185.0	1.0	SPT 16, 26, 27/105 N=R	SPT			SILTSTONE; yellow-grey-dark brown, very low strength, extremely weathered.				WEATHERED ROCK 1.0m: 400mm SPT sample recovery
			184.5	1.5									
			184.0	2.0									
WB			183.5	2.5	SPT 11/80 N=R	SPT			SILTSTONE; pale grey, very low to low strength, highly weathered.				2.5m: 40mm SPT sample recovery; rotary drilling to 3.0m to install 88mm casing
			183.0	3.0					REFER TO CORED BOREHOLE LOG				
			182.5	3.5									
			182.0	4.0									
			181.5	4.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL15

SHEET : 2 OF 5

Client:	**MACH Energy**	Date Commenced:	**28/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**28/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**186.024 m AHD**
Borehole Diameter:	**74/110 mm**	Bearing:	**---**	Co-ords:	**E 297689 N 6428040 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
					186.0							
					185.5	0.5						
					185.0	1.0						
					184.5	1.5						
					184.0	2.0						
					183.5	2.5						
					183.0	3.0		START CORING AT 3.00m				
NMLC	C Nil		100	74				SILTSTONE; grey.	HW			3.06m: DB 3.13m: DB 3.32m: DB 3.41m: DB
					182.5	3.5		As above, but grey-brown.	HW - XW			3.52m: Decomposed rock (DB) 3.62m: Bg, 0°, Pl, Sm, Vr
									HW - MW			3.73m: DB 3.79m: Jt, 5°, Pl, Sm 3.9m: Jt, 60 - 85°, Pl, Sm
					182.0	4.0						4.03m: Bg, 0°, Pl, Sm 4.06m: Bg, 0°, Pl, Sm
								As above, but grey mottled brown.				4.18m: Bg, 0°, Pl, Sm
					4.20			SILTSTONE; grey mottled brown.	MW			4.2m: DB 4.25m: DB
			100	87	181.5	4.5						4.58m: DB 4.62m: DB 4.67m: DB 4.75m: Jt, 30°, Pl, Sm
												4.85m: Jt, 70 - 90°, Pl, Sm

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL15

SHEET : 3 OF 5

Client:	**MACH Energy**	Date Commenced:	**28/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**28/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**186.024 m AHD**
Borehole Diameter:	**74/110 mm**	Bearing:	**---**	Co-ords:	**E 297689 N 6428040 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
C			100	87	181.0			SILTSTONE; grey mottled brown.	MW			
					180.98	5.10		SILTSTONE; grey mottled brown.	MW			5.1m: DB
												5.26m: Jt, 20°, Pl, Ro
												5.46m: Decomposed rock (DB)
					180.5	5.5			HW			
									MW			
												5.76m: DB
												5.88m: DB
									HW			5.9m: DB
												5.93m: Jt, 45°, Cu, Vr
					180.0	6.0						6.03m: Jt, 90°, Pl, Vr
												6.03m: Broken Core (DB)
									MW			
												6.26m: DB
			100	87	179.5	6.5						
												6.74m: CZ, 0°, 25 mm
									HW			6.86m: Bg, 0°, Cu, Sm
												6.93m: Bg, 10°, Pl, Sm, Vr
					179.0	7.0			HW - MW			7.04m: Bg, 10°, Pl, Sm
												7.1m: DB
												7.15m: DB
									MW			7.23m: DB
					178.5	7.5						7.41m: Bg, 20°, Pl, Sm
												7.48m: Bg, 15°, Pl, Sm
												7.5m: 3 x DB
												7.59m: Bg, 5°, Pl, Sm
												7.66m: Bg, 20°, Pl, Sm
												7.74m: DB
												7.84m: DB
					178.0	8.0						7.91m: 3 x Bg, 0 - 10°, Pl, Sm
												8.1m: Jt, 55°, Pl, Sm
					177.85	8.15		SANDSTONE; fine grained, grey.	MW - SW			8.2m: DB
												8.28m: DB
												8.36m: Bg, 0°, Pl, Sm
												8.37m: Bg, 0°, Pl, Sm
					177.53	8.47						8.46m: Jt, 85°, Pl, Sm
					177.5	8.5		SILTSTONE; grey-black.				8.47m: DB
					177.41	8.59		SANDSTONE; grey.				8.55m: Jt, 80°, Pl, Sm
												8.64m: Broken Core (DB)
												8.75m: Bg, 0°, Pl, Sm
												8.82m: 4 x DB
												8.95m: Jt, 80°, Pl, Sm
			100	93	177.0	9.0						9.01m: Broken Core (DB)
									HW			9.1m: CZ, 0°, 60 mm
									MW			
												9.4m: Bg, 0°, Pl, Ro
					176.5	9.5						9.51m: DB
												9.65m: DB
					176.32	9.70		SILTSTONE; grey.				9.71m: DB
					176.22	9.80		SANDSTONE; fine grained, grey mottled brown.				9.8m: Jt, 60°, Pl, Sm, Vr
												9.89m: DB
												9.91m: DB

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL15

SHEET : 4 OF 5

Client:	**MACH Energy**	Date Commenced:	**28/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**28/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**186.024 m AHD**
Borehole Diameter:	**74/110 mm**	Bearing:	**---**	Co-ords:	**E 297689 N 6428040 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06 L 0.1 / 2 M 0.3 / 6 H 1 / 20 VH 6 / 60 EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20 20-60 60-200 200-600 600-2000 >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
C			100	93	176.0	0.00		SANDSTONE; fine grained, brown mottled grey.	HW - MW			9.96m: Jt, 60°, Pl, Sm, Sn 10.1m: DB 10.19m: DB 10.23m: Jt, 70°, Pl, Ro
					175.5	10.5						10.55m: DB 10.65m: Jt, 40 - 60°, St, Ro 10.73m: DB 10.77m: Bg, 20°, Pl, Sm
					175.0	11.0						11.19m: DB 11.23m: DB 11.27m: DB
								As above, but with clayey content brown mottled black.	MW			11.35m: Decomposed rock (DB)
					174.5	11.5			HW			
			100	88	174.0	12.0						11.8m: Decomposed rock (DB)
					173.5	12.5			MW			12.8m: Decomposed rock (DB) 12.95m: Jt, 35°, Cu, Sm
					173.0	13.0						13.25m: DB 13.4m: Jt, 45°, Pl, Sm 13.48m: Jt, 60°, Pl, Sm
					172.5	13.5						13.64m: Jt, 45°, Pl, Sm
						13.68		MUDSTONE; grey.	HW - MW			13.68m: Bg, 5°, Ir, Ro 13.73m: Jt, 20°, Pl, Sm 13.86m: Jt, 25°, Pl, Sm 13.91m: Decomposed rock (DB)
					172.0	14.0						14.03m: Jt, 40°, Pl, Sm
			100	88		14.20		Carbonaceous MUDSTONE; black mottled grey-brown.	HW			14.36m: Bg, 20°, Pl, Sm 14.38m: DB 14.48m: DB 14.63m: DB
					171.5	14.5						14.83m: Bg, 10°, Pl, Sm 14.91: 14.91m-15.03m: Jt, 75°, Pl, Sm

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL15

SHEET : 5 OF 5

Client:	**MACH Energy**	Date Commenced:	**28/2/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**28/2/19**
Borehole Location:	**See Site Plan**	Recorded By:	**CY**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**186.024 m AHD**
Borehole Diameter:	**74/110 mm**	Bearing:	**---**	Co-ords:	**E 297689 N 6428040 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
	C		100	88	171.0			Carbonaceous MUDSTONE; black mottled grey-brown.	HW - MW			
					170.5	15.5						
					15.55			SILTSTONE; brown.				15.6m: Jt, 15°, Pl, Sm
												15.8m: Bg, 0°, Pl, Sm
												15.85m: Bg, 15°, Pl, Sm
												15.94m: DB
					170.0	16.0						16.06m: Bg, 20°, Pl, Sm
												16.15m: Broken Core (DB)
												16.24m: Jt, 20°, Ir, Sm
												16.28m: Bg, 0°, Pl, Sm
					16.35			SANDSTONE; fine grained brown.	HW - MW			16.37m: DB
												16.41m: DB
					169.5	16.5						
					16.60			MUDSTONE; brown mottled grey.				16.61m: Decomposed rock (DB)
					16.85			SANDSTONE; brown, interbedded with thin siltstone.	MW			16.85m: Bg, 0 - 5°, Ir, Sm
			100	83	169.0	17.0						16.96m: Bg, 0°, Pl, Sm
												17.04m: Bg, 0°, Pl, Sm
												17.1m: DB
												17.2m: DB
												17.36m: DB
												17.41m: DB
												17.45m: DB
					168.5	17.5			MW - SW			
					17.84			CLAY; brown mottled red-grey-white.	HW			17.81m: DB
												17.93m: DB
					168.0	*18.0*		IRONSTONE; dark brown-red.	HW			17.93m: Decomposed rock (DB)
												18m: Broken Core (DB)
								END OF BOREHOLE AT 18.08 m Target depth				
					167.5							
					167.0							
					166.5							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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PointID : BHRL15 Depth Range: 3.00 - 9.00 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL15	DRAWN HS / DATE 28/03/2019 CHECKED HS / DATE 28/03/2019 SCALE Not To Scale / A4 PROJECT No PS112915 / FIGURE No 1/3	



PointID : BHRL15 Depth Range: 9.00 - 15.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL15	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 2/3



PointID : BHRL15 Depth Range: 15.00 - 18.08 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL15	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 3/3

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL16

SHEET : 1 OF 5

Client:	**MACH Energy**	Date Commenced:	**7/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**8/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**165.781 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297630 N 6427548 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	C	NFGWE	165.5	0.20					TOPSOIL; Silty CLAY; low plasicity, dark brown, with roots.				TOPSOIL
			165.0	0.5				CL	Silty gravelly CLAY; low plasticity, dark brown, fine to coarse grained, subrounded to subangular gravel.	MC<PL			ALLUVIUM
			164.5	1.0	SPT 4, 12, 23 N=35	SPT						>600	
			164.0	1.5									
			163.5	2.0									
WB	Nil			2.5	SPT 15, 30/30mm N=R	SPT			As above but medium plasticity.			>600	
			163.0	2.60				GC	Clayey sandy GRAVEL; fine to coarse grained, subrounded to subangular, fine to coarse grained, brown sand, medium plasticity clay.	W			
			162.5	3.0									
			162.0	3.5									
			161.5	4.0	SPT 10, 20, 29 N=49	SPT		GC	Clayey sandy GRAVEL; fine to coarse grained, subrounded to subangular, high plasticity, brown clay, fine to coarse grained sand.			>600	
			161.0	4.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL16

SHEET : 2 OF 5

Client:	**MACH Energy**	Date Commenced:	**7/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**8/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**165.781 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297630 N 6427548 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	Nil	NFGWE	160.5	5.5				GC	Clayey sandy GRAVEL; fine to coarse grained, subrounded to subangular, high plasticity, brown clay, fine to coarse grained sand.	W			ALLUVIUM
			160.0		SPT 6, 13, 18 N=31	SPT		SC / GW	Gravelly clayey SAND; fine to coarse grained, brown-orange, fine to coarse grained, subrounded to subangular gravel, high plasticity clay.			>600	
			159.5	6.0									
			159.0	6.5									
			158.5	7.0	SPT 12, 30/140mm N=R	SPT		CI	Sandy gravelly CLAY; medium plasticity, grey-brown, fine to coarse grained, subrounded to subangular gravel, fine to coarse grained sand.	MC>PL		>600 550 >600	
			158.0	7.5									
			157.5	8.0									
			157.0	8.5 8.60	SPT 14, 16/90mm N=R	SPT		CH	Silty CLAY; high plasticity, pale grey-brown.				
			156.5	9.0									
			156.0	9.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL16

SHEET : 3 OF 5

Client:	**MACH Energy**	Date Commenced:	**7/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**8/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**165.781 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297630 N 6427548 MGA94 56**

Borehole Information						Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	Nil C	NFGWE	10.00 / 155.5 / 10.5 / 155.0 / 11.11.0 / 154.5	SPT 11, 10/130mm N=R	SPT			SILTSTONE; pale grey-brown, low strength, highly weathered, indistinct bedding.				WEATHERED ROCK
								SANDSTONE; fine grained, pale yellow-brown, medium strength, moderately to highly weathered.				
			11.5 / 154.0 / 12.0 / 153.5 / 12.5 / 153.0 / 13.0 / 152.5 / 13.5 / 152.0 / 14.0 / 151.5 / 14.5 / 151.0					REFER TO CORED BOREHOLE LOG				

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL16

SHEET : 4 OF 5

Client:	**MACH Energy**	Date Commenced:	**7/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**8/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**165.781 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297630 N 6427548 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD) / DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
					155.5 / 10.5						
					155.0 / 11.0						
					154.5 / 11.40		START CORING AT 11.40m				
NMLC	Nil		100	100	11.5 / 154.0 / 12.0 / 153.5 / 12.5 / 153.0 / 13.0 / 152.5 / 13.5 / 152.0 / 14.0 / 151.5 / 14.34		SANDSTONE; fine grained, yellow-brown.	MW to HW			12.38m: DB 12.54m: DB 12.75m: DB 12.96m: DB 13.12m: DB 13.22m: DB 13.42m: DB 13.86m: Jt, 70°, Pl, Ro 13.95m: DB
			100	79	14.5 / 151.0		SANDSTONE; fine grained, orange-brown, massive.	XW			14.31m: Decomposed seam 14.4m: Jt, 60°, Pl, Ro 14.55m: DB 14.65m: Bg, 10°, Pl, Ro 14.82m: DB 14.94m: DB

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL16

SHEET : 5 OF 5

Client:	**MACH Energy**	Date Commenced:	**7/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**8/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**165.781 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297630 N 6427548 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6 L 0.1 / 2 M 0.3 / 6 H 1 / 20 VH 3 / 60 EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20 20-60 60-200 200-600 600-2000 >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
NMLC	Nil		100	79	150.5	15.5		SANDSTONE; fine grained, orange-brown, massive.	XW			14.98m: Jt, 20°, Pl, Ro, Sn Fe
					150.0	15.83		SANDSTONE; fine grained, yellow-brown mottled grey-brown-black, interbedded with siltstone and black coal lenses.	MW			15.72m: Bg, 10°, Pl, Sm
					16.0			SILTSTONE; grey-brown mottled brown.	HW			16.02m: Jt, 25°, Ir, Ro, Sn Fe
					149.5	16.24		As above but iron staining from 16.12 - 16.24m.				16.24m: DB
					16.5			SILTSTONE; grey-brown mottled brown.				16.49m: DB
					149.0			As above but becoming dark grey-black.				16.76m: DB 16.82m: Bg, 15°, Pl, Ro, Sn Fe
			100	13	17.0	16.95		COAL; black, interbedded dull and bright.				16.95m: Broken core (DB) 17.03m: Jt, 80°, Cu, Sm 17.08m: Jt, 80°, Pl, Sm
					148.5							17.11m: Broken core (DB)
					17.5							17.53m: DB 17.57m: DB
					148.0							17.71m: Bg, 10°, Pl, Sm
					18.0							17.81m: Jt, 80°, Pl, Sm 17.85m: Bg, 10°, Pl, Sm 17.95m: Jt, 80°, Pl, Sm 18.02m: DB
						18.03		SILTSTONE; dark grey-brown.				
						18.09		SANDSTONE; fine grained, dark grey-brown.	MW			
					147.5			END OF BOREHOLE AT 18.10 m Target depth				
					147.0							
					146.5							
					146.0							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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PointID : BHRL16 Depth Range: 11.40 - 17.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL16	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 1/2



PointID : BHRL16 Depth Range: 17.00 - 18.10 m

TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL16	DRAWN: HS	DATE: 28/03/2019	
	CHECKED: HS	DATE: 28/03/2019	
	SCALE: Not To Scale		A4
	PROJECT No: PS112915	FIGURE No: 2/2	

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL17

SHEET : 1 OF 11

Client:	**MACH Energy**	Date Commenced:	**9/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**11/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.938 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297633 N 6427394 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	C	NFGWE	169.5	0.20					TOPSOIL: Silty CLAY; low plasticity, brown with roots.				TOPSOIL
				0.5				CL	Silty CLAY; low plasticity, brown with fine to coarse grained, sub-rounded to sub-angular gravel, trace sub-rounded cobbles.	MC<PL			ALLUVIUM
			169.0	1.0 (1.0)	SPT 4, 13, 15 N=28	SPT		CL	Sandy CLAY; low plasticity, brown, fine to medium grained sand, with fine to coarse grained, sub-rounded to sub-angular gravel.			>600	
			168.5	1.5									
			168.0	2.0									
			167.5	2.5 (2.5)	SPT 3, 15, 23 N=38	SPT		CL	Gravelly Sandy CLAY; medium plasticity, brown, fine to coarse grained sand, fine to coarse grained, sub-rounded to sub-angular gravel.			>600	
WB	M		167.0	3.0									
			166.5	3.5									
			166.0	4.0	SPT 9/70mm N=R	SPT			As above but high plasticity, pale grey-brown.	MC=PL		>600 200	
			165.5	4.5									
			165.0										

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL17

SHEET : 2 OF 11

Client:	**MACH Energy**	Date Commenced:	**9/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**11/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.938 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297633 N 6427394 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VL L MD D VD / VS S F ST VST H)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	M	NFGWE	164.5	5.5	SPT 17, 28/70mm N=R	SPT		CL	Gravelly Sandy CLAY; medium plasticity, brown, fine to coarse grained sand, fine to coarse grained, sub-rounded to sub-angular gravel.	MC=PL			ALLUVIUM
									As above but grey-brown.	MC>PL		>600 350	
			164.0	6.0									
			163.5	6.5									
			163.0	7.0	SPT 2/50mm N=R	SPT			Possibly cobbles and boulders.				SPT at 7m produced no sample due to refusal on possible cobbles or boulder.
			162.5	7.5									
			162.0	8.0									
			161.5	8.5	SPT 5/50mm N=R	SPT							SPT at 8.5m produced no sample due to refusal on possible cobbles or boulder.
			161.0	9.0									
			160.5	9.5									
			160.0										

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL17

SHEET : 3 OF 11

Client:	**MACH Energy**	Date Commenced:	**9/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**11/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.938 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297633 N 6427394 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	M	NFGWE	10.00		SPT 12/80mm N=R	SPT		CL	Clayey GRAVEL; fine to coarse grained, sub-rounded to sub-angular, high plasticity, brown clay.	MC>PL			ALLUVIUM
			159.5	10.5									
			159.0	11.0									
			158.5	11.5									
			11		SPT 15, 8/10mm N=R	SPT		CL	Gravelly Sandy CLAY; high plasticity, brown, fine to coarse grained sand, fine to coarse grained, sub-rounded to sub-angular gravel.			400	
			158.0	12.0									
			157.5	12.5									
			157.0	13.0	SPT 3/20mm N=R	SPT			Possibly cobbles and boulders.				SPT at 13m produced no sample due to refusal on possible cobbles or boulder.
			156.5	13.5									
			156.0	14.0									
			155.5	14.5					VOID; Tool drop 14.5 - 16m.				Possible gas cause of void unknown.
			14										
			155.0										

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL17

SHEET : 4 OF 11

Client:	**MACH Energy**	Date Commenced:	**9/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**11/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.938 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297633 N 6427394 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	M	NFGWE	154.5 / 15.5					VOID; Tool drop 14.5 - 16m.				
			154.0 / 16.0 (16.16.0)				CL	Gravelly Sandy CLAY; high plasticity, brown, fine to coarse grained sand, fine to coarse grained, sub-rounded to sub-angular gravel.	MC>PL			
			153.5 / 16.5									
			153.0 / 17.0									
			(17.10)				CL	Sandy Gravelly CLAY; high plasticity, brown, fine to coarse grained, sub-rounded to sub-angular gravel, fine to coarse grained sand.			100	
			152.5 / 17.5	SPT 8, 5, 6 N=11	SPT						50	
			152.0 / 18.0									
			151.5 / 18.5									
			151.0 / 19.0	SPT 10/50mm N=R	SPT							SPT at 19m produced no sample due to refusal on possible cobbles or boulder.
			150.5 / 19.5									
			150.0									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL17

SHEET : 5 OF 11

Client:	**MACH Energy**	Date Commenced:	**9/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**11/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.938 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297633 N 6427394 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VL L MD D VD / VS S F ST VST H)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	M	NFGWE	149.5 / 20.5	SPT 6/50mm N=R	SPT		CL	Sandy Gravelly CLAY; high plasticity, brown, fine to coarse grained, sub-rounded to sub-angular gravel, fine to coarse grained sand.	MC>PL			SPT at 20.5m produced no sample due to refusal on possible cobbles or boulder.
			149.0 / 21.0									
			148.5 / 21.5									
								REFER TO CORED BOREHOLE LOG				
			148.0 / 22.0									
			147.5 / 22.5									
			147.0 / 23.0									
			146.5 / 23.5									
			146.0 / 24.0									
			145.5 / 24.5									
			145.0									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL17

SHEET : 6 OF 11

Client:	**MACH Energy**	Date Commenced:	**9/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**11/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.938 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297633 N 6427394 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
					149.5	20.5						
					149.0	21.0						
					148.5	21.5		START CORING AT 21.60m				
HQ	Nil		40	33	21.60			Clayey Sandy GRAVEL; fine to coarse grained, sub-angular to rounded, fine to coarse grained sand, low plasticity clay, with cobbles and boulders.				
					21.70			CORE LOSS 0.90m (21.70-22.60) CORE LOSS				
					148.0	22.0						
					147.5	22.5						
					22.60			Clayey Sandy GRAVEL; fine to coarse grained, sub-angular to rounded, fine to coarse grained sand, low plasticity clay, with cobbles and boulders.				
					147.0	23.0						
					23.10			SILTSTONE; fine grained, brown, indistinct sub-horizontal bedding.	HW to XW			23.4m: Bg, 10°, Cu, Sm, Fe stained 23.51m: Jt, 30°, Pl, Sm, Carbonaceous staining 23.72m: Bg, 10°, Pl, Sm
			100	73	146.5	23.5						
					146.0	24.0		Becoming carbonaceous SILTSTONE.				23.88m: DB
					24			COAL; black, bright and dull bands.	MW			24m: Broken core 24.1m: Jt, 80°, Pl, Sm, Broken core
			100	56	145.5	24.5						24.45m: DB 24.5m: Jt, 70°, Ir, Ro 24.6m: DB 24.65m: DB 24.65m: Jt, 85°, Pl, Sm
					145.0							24.72m: Broken core

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL17

SHEET : 7 OF 11

Client:	**MACH Energy**	Date Commenced:	**9/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**11/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.938 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297633 N 6427394 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD) / DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ	Nil		100	56	144.5 / 25.5		COAL; black, bright and dull bands.	MW			25.04m: Siltstone band
							23.32m: Siltstone band				25.32m: Siltstone band
							25.48m: Siltstone band.				25.48m: Siltstone band 25.5m: Jt, 40°, Pl, Ro
											25.72m: Bg, 10°, Cu, Sm
					25.82						25.79m: CZ
					144.0		Carbonaceous SILTSTONE; dark grey-brown, interbedded with carbonaceous bands.	HW			
					26 26.0						25.93m: Broken core
			75	44			COAL; black, bright and dull bands.	MW			26m: Broken core
											26.23m: Bg, 10°, Pl, Sm 26.13m: Broken core 26.29m: Jt, 85°, Pl, Ro
					143.5 / 26.5						26.4m: Bg, 10°, Pl, Sm 26.44m: Bg, 10°, Pl, Sm
							26.58m: Siltstone lense.				26.58m: Siltstone lense
							26.58m: Siltstone lense.				26.75m: Siltstone lense
					143.0 / 27.0						26.92m: Bg, 10°, Pl, Sm
											27m: Jt, 70°, Pl, Sm 27.06m: DB 27.1m: Broken core
					27.20						
					142.5 / 27.5		CORE LOSS 0.40m (27.20-27.60) CORE LOSS				
					27.60						
			100	69			COAL; black, bright and dull bands.	MW			27.6m: Broken core
					142.0 / 28.0						28m: Broken core
					28.14						28.14m: Bg, 10°, Pl, Ro
							SILTSTONE; fine grained, grey, indistinct sub-horizontal bedding.				
					141.5 / 28.5						28.55m: Clay band
					141.0						
					29 29.0		SANDSTONE; fine grained, grey.	SW to MW			29.1m: Jt, 30°, Pl, Ro, Carbonaceous staining
							29.00m: No ironstaining.				
			100	83	140.5 / 29.5						
					29.66		CLAY SEAM; high plasticity, grey.				29.66m: Bg, 0 - 5°, Pl, Sm
					29.74		SILTSTONE; grey mottled dark grey-black, interbedded with fine grained sandstone.	SW to MW			29.92m: Decomposed seam 29.94m: Jt, 80°, Pl, Ro
					140.0						

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL17

SHEET : 8 OF 11

Client:	**MACH Energy**	Date Commenced:	**9/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**11/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.938 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297633 N 6427394 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ	Nil		100	83	139.5	30.5		SILTSTONE; grey mottled dark grey-black, interbedded with fine grained sandstone.	SW to MW			29.96m: DB 30.07m: DB 30.3m: Bg, 10°, Pl, Sm 30.43m: Bg, 10°, Ir, Sm 30.69m: Bg, 10°, Pl, Sm 30.81m: Bg, 10°, Pl, Sm 30.92m: DB 31.22m: Jt, 20°, Ir, Ro
					139.0	31.0						
					31.33			SILTSTONE; dark grey.				
					138.5	31.5						31.52m: Bg, 0°, Pl, Ro, Carbonaceous staining 31.7m: Bg, 5°, Pl, Ro
					31.87			SANDSTONE; fine grained, grey-brown.	MW			31.89m: DB x5
					138.0	32.0		SILTSTONE; dark grey-brown.	HW			32m: Decomposed seam 32.12m: DB 32.16m: Clay band 32.27m: DB 32.35m: Bg, 5°, Pl, Sm 32.4m: Bg, 5°, Pl, Sm 32.4m: Clay band 32.45m: Bg, 0 - 5°, Pl, Sm 32.53m: Bg, 0°, Pl, Sm 32.63m: DB 32.72m: Clay band 32.8m: Decomposed seam
								32.16 - 32.23m: Clay band.				
					137.5	32.5		32.4 - 32.43m: Clay band.				
								32.72 - 32.74m: Clay band.				
			100	63	137.0	33.0						33.04m: DB 33.1m: Jt, 15°, Ir, Sm 33.14m: Decomposed seam 33.32m: Bg, 10°, Pl, Sm, Multiple 33.42m: Bg, 10°, Pl, Sm 33.45m: Bg, 10°, Pl, Sm
					136.5	*33*33.5		SILTSTONE; grey.	SW			33.53m: Bg, 10°, Pl, Sm 33.73m: DB 33.86m: DB 33.9m: Jt, 60°, Ir, Ro, Un, Py
					136.0	34.0						
					34.17			SILTSTONE; grey mottled dark grey-black, interbedded with fine grained sandstone.	MW			34.43m: Bg, 5°, Pl, Sm, Carbonaceous staining 34.76m: Bg, 10°, Pl, Sm, Carbonaceous staining 34.86m: Bg, 10°, Pl, Sm, Carbonaceous staining
					135.5	34.5						
					135.0							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL17

SHEET : 9 OF 11

Client:	**MACH Energy**	Date Commenced:	**9/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**11/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.938 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297633 N 6427394 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 5 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ	Nil		100	63	35.05			Carbonaceous SHALE; dark grey mottled	HW			35.06m: DB 35.12m: DB 35.15m: DB 35.19m: DB
									MW			35.38m: Jt, 30°, Pl, Sm 35.38m: Decomposed zone
					134.5	35.5						
					35.53			SILTSTONE; dark grey-black, interbedded with fine grained sandstone.				35.53m: Bg, 0 - 10°, Ir, Ro
												35.74m: Decomposed zone
					134.0	36.0						35.92m: DB
												36.06m: DB
												36.15m: DB
					36.22							36.21m: DB
								SANDSTONE; fine grained, grey-brown.	SW to MW			
					133.5	36.5						36.47m: DB 36.52m: Jt, 70°, Pl, Ro
			100	80	36.55			SILTSTONE; grey-brown.				
												36.77m: Bg, 10 - 20°, Pl, Sm, Carbonaceous staining 36.81m: DB
					133.0	37.0						36.91m: Jt, 10 - 20°, Wv, Sm, Carbonaceous staining 36.97m: DB 37.07m: Decomposed zone
												37.25m: Bg, 0 - 10°, Wv, Sm 37.31m: Bg, 0°, Wv, Sm
					37.39							
					132.5	37.5		SILTSTONE; grey-black, interbedded with fine grained sandstone.				37.56m: Bg, 0 - 10°, Wv, Sm
												37.84m: Bg, 10 - 20°, Wv, Sm, Carbonaceous staining
					132.0	38.0						38.01m: DB 38.12m: DB 38.17m: DB
												38.44m: Bg, 0 - 5°, Pl, Ro 38.45m: Bg, 0 - 5°, Pl, Sm
					131.5	38.5						38.75m: Jt, 20°
			100	100	38.90							
					131.0	39.0		SANDSTONE; fine grained, dark grey-brown.	SW			38.95m: DB
												39.17m: Jt, 45°, Ir, Sm, Carbonaceous staining
					39.32							39.33m: Bg, 5°, Pl, Sm
					130.5	39.44		SILTSTONE; fine grained, dark grey, indistinct bedding.	MW			39.44m: DB
					39.5			SANDSTONE; fine grained, dark grey-brown.	SW			
					130.0							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL17

SHEET : 10 OF 11

Client:	**MACH Energy**	Date Commenced:	**9/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**11/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.938 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297633 N 6427394 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD) / DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ	Nil		100	100	40.00		SILTSTONE; dark grey mottled black, interbedded with fine grained sandstone.	MW			40.08m: Bg, 5°, Pl, Sm 40.23m: Bg, 5°, Pl, Sm
					40.34		SANDSTONE; fine grained, dark grey mottled black interbedded siltstone.				
					129.5 / 40.5						
					129.0 / 41.0						40.96m: DB
					41.11		Silty SHALE; fine grained, dark grey.	MW to HW			41.11m: DB
					41.40						41.38m: DB
					128.5 / 41.5		Carbonaceous Silty SHALE; dark grey-black, with coal lenses.				41.44m: Bg, 5 - 10°, Pl, Sl, Coal band 41.48m: Coal band with calcite lenses 41.51m: DB
					41.58		COAL; black, calcite lenses, interbedded shale.	HW			41.6m: Decomposed zone
					41.69						41.66m: Decomposed zone
					41.78		CLAY; high plasticity, dark grey.	XW			
			100	78			SILTSTONE; dark grey-brown mottled black, interbedded with fine grained sandstone.	MW			
					128.0 / 42.0						42.3m: Bg, 5°, Pl, Ro, Carbonaceous staining 42.37m: Bg, 5°, Pl, Sm, Carbonaceous staining
					127.5 / 42.5						42.44m: Bg, 5°, Pl, Ro 42.47m: Jt, 10°, Ir, Ro
					42.67		CLAYSTONE; dark grey.				42.62m: Bg, 5°, Pl, Sm
					127.0 / 43.0						
					43.33		SILTSTONE; dark grey-brown mottled black, interbedded with fine grained sandstone.				43.34m: Coal band with calcite lenses
					126.5 / 43.5						43.64m: Bg, 5°, Pl, Sm
					126.0 / 44.0						44.04m: Clay lense 44.14m: Clay band
					44.27		Silty SHALE; dark grey-black.	XW			44.21m: DB 44.27m: DB 44.34m: DB
			100	64	125.5 / 44.5						
					44.57		Carbonaceous SILTSTONE; dark grey mottled black.				44.7m: Bg, 0°, Pl, Ro 44.72m: Bg, 0°, Pl, Ro 44.74m: Bg, 0°, Pl, Ro
					125.0						44.97m

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL17

SHEET : 11 OF 11

Client:	**MACH Energy**	Date Commenced:	**9/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**11/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**169.938 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297633 N 6427394 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6 L 0.1 / 2 M 0.3 / 6 H 1 / 20 VH 3 / 60 EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20 20-60 60-200 200-600 600-2000 >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ	Nil		100	64	124.5	45.22		Carbonaceous SILTSTONE; dark grey mottled black.				45.03m: Bg, 0°, Pl, Sm
						45.5		COAL; black, dull and bright bands.	HW			45.22m: Jt, 20°, Pl, Sm 45.43m: Decomposed zone 45.47m: Jt, 80°, Pl, Sm 45.65m: Clay band 45.74m: Broken core
					124.0			45.65m: Clay band. END OF BOREHOLE AT 45.90 m Target depth				
					123.5							
					123.0							
					122.5							
					122.0							
					121.5							
					121.0							
					120.5							
					120.0							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

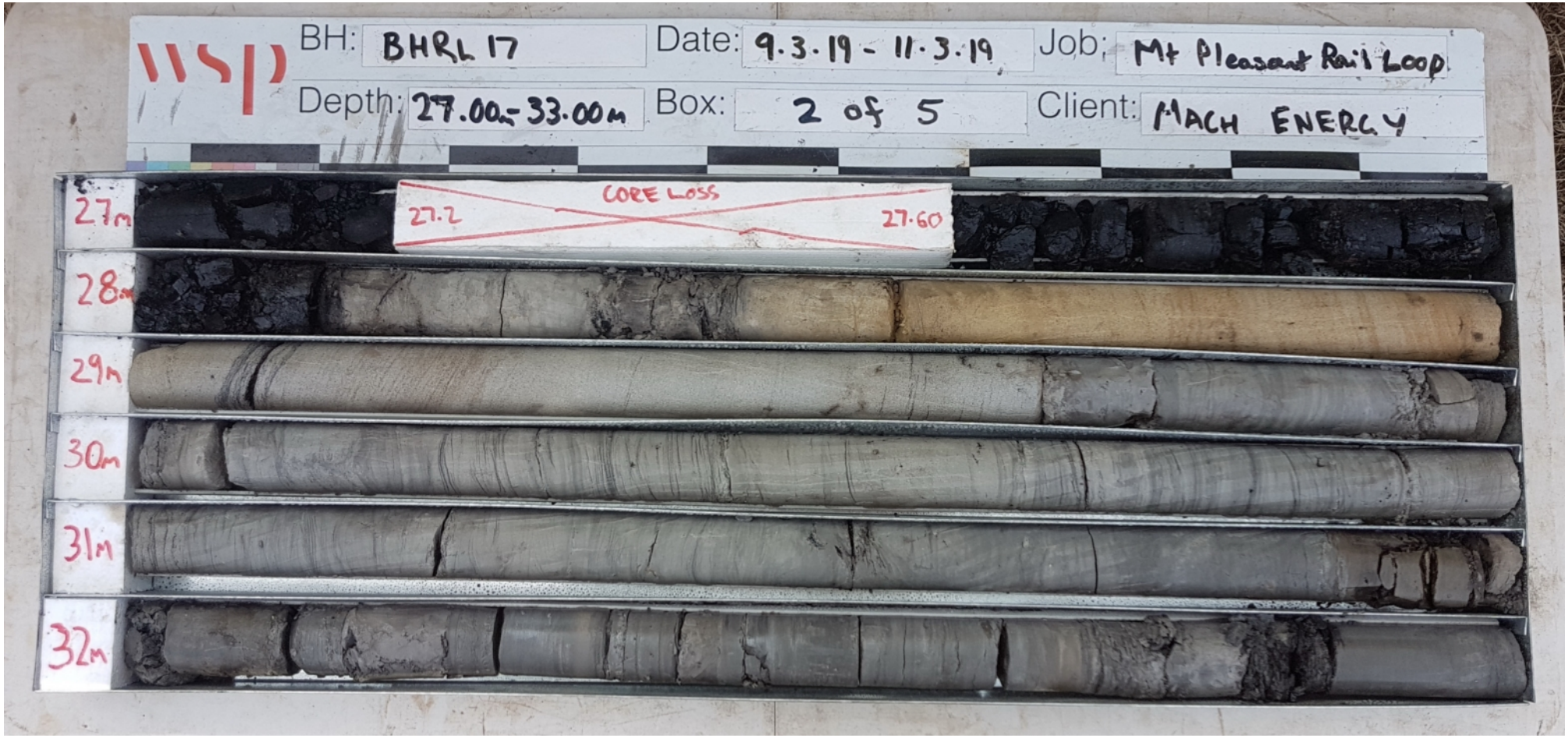
WSP Australia Pty Ltd. V00 8.30.002 WSP_LIB_7.5.GLB Log WSP CORED LOG PS112915_LOGS.GPJ <<DrawingFile>> 16/04/2019 13:24 Developed by Datgel Pty Ltd

WSP_LIB_7.5.GLB GrfcTbl DG PHOTO CORE PHOTO 1 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 28/Mar/2019 17:44 8.30.002 Datgel CPT Tool gINT Add-In



PointID : BHRL17 Depth Range: 21.60 - 27.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL17	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 1/5



PointID : BHRL17 Depth Range: 27.00 - 33.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL17	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 2/5

WSP_LIB_7.5.GLB GrfcTbl DG PHOTO CORE PHOTO 1 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 28/Mar/2019 17:45 8.30.002 Datgel CPT Tool gINT Add-In



PointID : BHRL17 Depth Range: 33.00 - 39.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL17	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 3/5



PointID : BHRL17 Depth Range: 39.00 - 45.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL17	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 4/5

WSP_LIB_7.5.GLB GrfcTbl DG PHOTO CORE PHOTO 1 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 28/Mar/2019 17:45 8.30.002 Datgel CPT Tool gINT Add-In



PointID : BHRL17 Depth Range: 45.00 - 45.90 m

TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL17	DRAWN: HS	DATE: 28/03/2019	
	CHECKED: HS	DATE: 28/03/2019	
	SCALE: Not To Scale		A4
	PROJECT No: PS112915	FIGURE No: 5/5	

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL18

SHEET : 1 OF 6

Client:	**MACH Energy**	Date Commenced:	**12/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**21/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**171.271 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297634.18 N 6427332.5 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VL L MD D VD / VS S F ST VST H)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	C	NFGWE	171.0	0.20					TOPSOIL: Silty CLAY; low plasticity, brown, with roots.				TOPSOIL
			170.5	0.5				CL	Silty Gravelly CLAY; low plasticity, brown, fine to coarse grained, sub-angular to sub-rounded gravel.	MC<PL			ALLUVIAL SOIL
			170.0	1.0	SPT 10, 19, 19/80mm N=R	SPT						>600	
			169.5	1.5									
			169.0	2.0									
WB			168.5	2.5	SPT 27, 25/70mm N=R	SPT		GC	Sandy Clayey GRAVEL; fine to coarse grained, sub-angular to sub-rounded, medium plasticity, brown clay, fine to coarse grained sand.	D		>600	
			168.0	3.0									
			167.5	3.5									
			167.0	4.0	SPT 16, 22/80mm N=R	SPT		GC	Sandy Clayey GRAVEL; fine to coarse grained, sub-angular to sub-rounded, high plasticity, brown clay, fine to coarse grained sand.	W			
			166.5	4.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL18

SHEET : 2 OF 6

Client:	**MACH Energy**	Date Commenced:	**12/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**21/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**171.271 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297634.18 N 6427332.5 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	C	NFGWE	166.0	5.5	SPT 12, 13, 21 N=34	SPT		GC	Sandy Clayey GRAVEL; fine to coarse grained, sub-angular to sub-rounded, high plasticity, brown clay, fine to coarse grained sand.	W			ALLUVIAL SOIL
			165.5										
				6.0									
			165.0										
				6.5									
			164.5										
				7.0	SPT 20, 13/30mm N=R	SPT							
			164.0										
				7.5									
			163.5										
				8.0									
			163.0										
				8.5	SPT 25, 5/20mm N=R	SPT							
			162.5										
				9.0									
			162.0										
				9.5									
			161.5										

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL18

SHEET : 3 OF 6

Client:	**MACH Energy**	Date Commenced:	**12/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**21/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**171.271 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297634.18 N 6427332.5 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	C	NFGWE	161.0 / 10.5	SPT 5/20mm N=R	SPT		GC	Sandy Clayey GRAVEL; fine to coarse grained, sub-angular to sub-rounded, high plasticity, brown clay, fine to coarse grained sand. As above, cobbles, possible boulders.	W			ALLUVIAL SOIL No sample at 10.0m due to early refusal
			160.5 / 11.0									
			160.0 / 11.5	SPT 8/30mm N=R	SPT							
			159.5 / 12.0									
			159.0 / 12.5									
			158.5 / 13.0	SPT 22, 30/150mm N=R	SPT							
			158.0 / 13.5									
			157.5 / 14.0									
			157.0 / 14.5	SPT 16/110mm N=R	SPT							
			156.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL18

SHEET : 4 OF 6

Client:	**MACH Energy**	Date Commenced:	**12/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**21/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**171.271 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297634.18 N 6427332.5 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	C	NFGWE	156.0 / 15.5				GC	Sandy Clayey GRAVEL; fine to coarse grained, sub-angular to sub-rounded, high plasticity, brown clay, fine to coarse grained sand.	W			ALLUVIAL SOIL
			155.5 / 16.0	SPT 6/20mm N=R	SPT							No sample at 16.0m due to early refusal on possible boulder
			155.0 / 16.5									
			154.5 / 17.0									
			154.0 / 17.5	SPT 12/60mm N=R	SPT							
			153.5 / 18.0									
			153.0 / 18.5									
			152.5 / 19.0	SPT 4/40mm N=R	SPT							No sample at 19.0m due to early refusal
			152.0 / 19.5									
			151.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL18

SHEET : 5 OF 6

Client:	**MACH Energy**	Date Commenced:	**12/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**21/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**171.271 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297634.18 N 6427332.5 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS FB, S VL, F L, ST MD, VST D, H VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	C	NFGWE	151.0 / 20.5	SPT 5/20mm N=R	SPT		GC	Sandy Clayey GRAVEL; fine to coarse grained, sub-angular to sub-rounded, high plasticity, brown clay, fine to coarse grained sand.	W			ALLUVIAL SOIL
			150.5 / 21.0									
			150.0 / 21.5									
			149.5 / 22.0	SPT 5/20mm N=R	SPT		CL	Sandy Gravelly CLAY; high plasticity, brown, fine to coarse grained, sub-angular to sub-rounded gravel, fine to coarse grained sand, with possible boulders.	MC>PL			
			149.0 / 22.5						W			
			148.5 / 23.0									
			148.0 / 23.5	SPT 6/60mm N=R	SPT							No sample at 23.5m due to early refusal
			147.5 / 24.0									
			147.0 / 24.5									
			146.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL18

Client:	**MACH Energy**	Date Commenced:	**12/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**21/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**171.271 m AHD**
Borehole Diameter:	**100 mm**	Bearing:	**---**	Co-ords:	**E 297634.18 N 6427332.5 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	C		146.0 / 25.5	SPT 7/70mm N=R	SPT		CL	Sandy Gravelly CLAY; high plasticity, brown, fine to coarse grained, sub-angular to sub-rounded gravel, fine to coarse grained sand, with possible boulders.	W			ALLUVIAL SOIL No sample at 25.0m due to early refusal or possible boulder
			145.5 / 26.0									
			145.0 / 26.30					VOID: tool drop 26.3-27m.				Possible gas. Cause of void unknown.
			144.5 / 26.5									
			144.0 / 27.0	SPT 6/30mm N=R				Material unknown.				No sample at 27.0m due to early refusal
			143.5 / 27.5									
			143.0 / 28.0					END OF BOREHOLE AT 28.00 m Refusal Casing and shoe sheared. Move BHRL18 1.5m SW and start BHRL18A				
			142.5									
			142.0									
			141.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL18A

SHEET : 1 OF 7

Client:	**MACH Energy**	Date Commenced:	**21/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**23/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC/JNA**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**171.271 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297660.35 N 6427333.03 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
		NFGWE	146.0 / 25.5					START BOREHOLE AT 26.00m				
WB	C		145.5 / 26 / 26.0				GC	Sandy Gravelly CLAY; high plasticity, pale brown, fine to coarse grained, sub-rounded to sub-angular gravel, fine to coarse grained sand, with cobbles and possible boulders.	MC>PL			ALLUVIAL SOIL Move BHRL18 1.5m SW No cavity encountered at 26.3m
			145.0 / 26.5									
			144.5 / 27.0									Partial water loss at 27.0m
			27.20 / 144.0	SPT 21/150mm	SPT			SILTSTONE; grey-brown, very low strength, highly weathered.				WEATHERED ROCK
			27.5 / 143.5					REFER TO CORED BOREHOLE LOG				
			28.0 / 143.0									
			28.5 / 142.5									
			29.0 / 142.0									
			29.5 / 141.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL18A

Client:	**MACH Energy**	Date Commenced:	**21/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**23/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC/JNA**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**171.271 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297660.35 N 6427333.03 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD) / DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
					146.0 / 25.5						
					145.5 / 26.0						
					145.0 / 26.5						
					144.5 / 27.0						
					144.0 / 27.40		START CORING AT 27.40m				
HQ	C		97	63	27.5		SANDSTONE; fine grained, yellow-brown, interbedded with siltstone.	MW			27.43m: DB 27.44m: DB 27.57m: DB 27.6m: Jt, 45°, Pl, Sm 27.62m: Jt, 45°, Pl, Sm 27.68m: DB 27.75m: DB
					143.5 / 27.78		SILTSTONE; grey-brown mottled orange, interbedded with fine grained, low strength sandstone, and carbonaceous lamination.				27.9m: DB 27.96m: DB
					28.0						
					143.0						28.32m: Bg, 0 - 5°, Pl, Sm 28.4m: Bg, 10°, Cu, Ro
					28.5						28.64m: Clay band 28.72m: DB
					142.5						28.94m: Clay band 28.98m: Clay band
					29 / 29.0		SANDSTONE; fine grained, orange-brown.	SW to MW			29.1m: Bg, 20°, Pl, Sm, Carbonaceous stained 29.25m: DB 29.28m: Jt, 20°, Pl, Ro 29.35m: DB
					142.0						
					29.44 / 29.5		CORE LOSS 0.35m (29.44-29.79)				
			92	79	141.5 / 29.79		SANDSTONE; fine grained, orange-brown, but with carbonaceous lamination.	SW to HW			29.81m: DB 29.88m: DB 29.9m: Jt, 20°, Pl, Ro, Carbonaceous stained

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL18A

SHEET : 3 OF 7

Client:	**MACH Energy**	Date Commenced:	**21/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**23/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC/JNA**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**171.271 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297660.35 N 6427333.03 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 5 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ	C		92	79	30.12							29.91m: Jt, 20°, Pl, Ro, Carbonaceous stained
								SILTSTONE; dark grey.	MW to HW			29.93m: DB
					141.0							29.96m: Bg, 10°, Pl, Ro
						30.5						30.02m: DB
												30.04m: Jt, 20°, Pl, Ro
												30.06m: Bg, 15°, Pl, Ro
												30.12m: DB
												30.17m
												30.26m: Clay seam
												30.36m: Jt, 30°, Pl, Sm
												30.43m: Jt x2, 30°, Pl, Sm
												30.48m: Jt, 15°, Pl, Sm
					140.5							30.66m: Decomposed seam
												30.8m: Shear zone.
						31.0						
					140.0							31.18m: DB
						31.5						31.51m: DB
												31.61m: DB
					139.5							31.71m: DB
												31.83m: DB
												31.92m: Bg, 0 - 5°, Pl, Sm
						32.0						31.93m: Bg, 0 - 5°, Pl, Sm
					139.0							
												32.37m: Bg, 10°, Cu, Sm
					32	32.5						32.42m: DB
								CORE LOSS 0.13m (32.50-32.63)				
					32.63			SILTSTONE; dark grey, distinct bedding.	HW			
					138.5							
					33	33.0		SILTSTONE; dark grey, interbedded with fine grained sandstone, and carbonaceous laminations.	MW to HW			33.05m: Ironstone band
												33.17m: DB
					138.0							
												33.37m: DB
						33.5						33.5m: DB
												33.61m: DB
			95	53								
					137.5							33.76m: DB
												33.86m: DB
						34.0						
									HW			34.15m: Jt, 20°, Pl, Sm
												34.2m: Bg, 20°, Cu, Sm, Carbonaceous stained
					137.0							34.28m: Bg, 25°, Ir, Ro, Carbonaceous stained
					34.41			COAL; black, interbedded with grey clay.				34.38m: Decomposed seam
					34	34.5						34.42m: Coal band
								SANDSTONE; fine grained, grey-brown, with iron staining.				34.51m: Bg, 5°, Ir, Ro, Iron stained
												34.53m: Bg, 5°, Ir, Ro, Iron stained
												34.62m: DB
												34.7m: Jt, 50°, Pl, Ro, Iron stained
					136.5							34.77m: Clay band
												34.91m: DB
					34.96							

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL18A

SHEET : 4 OF 7

Client:	**MACH Energy**	Date Commenced:	**21/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**23/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC/JNA**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**171.271 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297660.35 N 6427333.03 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ	C		95	53	35.10			SILTSTONE; dark grey.	HW			34.96m: Broken core
					136.0			SANDSTONE; fine grained, grey-brown, interbedded with siltstone.	FR			35.06m: Jt, 80 - 85°, Cu, Sm
					35.5							35.2m: Broken core
												35.39m: DB
					35.60							35.51m: DB
												35.53m: DB
												35.55m: DB
								SILTSTONE; dark grey, interbedded with fine grained sandstone.				35.58m: Bg, 10°, Ir, Ro
					135.5							35.72m: DB
					36.0							36.05m: Bg, 10°, Ir, Ro
					135.0							36.31m: Jt, 20°, Pl, Sm, Carbonaceous stained
					36.5							36.45m: Bg, 0 - 5°, Pl, Sm
			100	51	134.5							36.74m: Bg, 0 - 5°, Pl, Sm
					37.0							37.08m: DB
					37.17							
					134.0			SANDSTONE; fine grained, grey-brown, interbedded with siltstone.				37.4m: DB
					37.5							37.5m: Jt, 20°, Pl, Ro
					133.5							37.66m: Bg, 10°, Pl, Sm, Carbonaceous stained
												37.75m: DB
												37.84m: DB
												37.88m: Jt, 20°, Pl, Ro
												37.93m: Jt, 15°, Ir, Ro
					38.0			37.90m: Full water loss. Casing installed to 39.00m following water loss.				38.05m: DB
												38.15m: DB
					133.0							
					38.30			SILTSTONE; grey.				38.3m: Crush zone or shear zone
					38.40			SANDSTONE; fine grained, grey.				
					38.5							38.5m: DB
					132.5							38.7m: Jt, 20°, Pl, Ro
												38.71m: Jt, 70°, Pl, Ro
												38.89m: DB
					39.0							39m: DB
												39.05m: DB
			100	61	39.10							39.07m: Jt, 70°, Pl, Ro
					132.0			SILTSTONE; dark grey, carbonaceous laminations throughout.				39.32m: Clay seam
												39.4m
					39.5							39.5m: Jt, 30°, Vu, Sm
												39.56m: 30mm Clay seam
					131.5							39.68m: Jt, 20°, St, Sm
												39.93m: DB

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL18A

Client:	**MACH Energy**	Date Commenced:	**21/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**23/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC/JNA**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**171.271 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297660.35 N 6427333.03 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD) / DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 6 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ	C		100	61	40.20 / 131.0		SILTSTONE; dark grey, carbonaceous laminations throughout.	FR			39.94m: Jt x2, 80°, Pl, Ro
					40 / 40.5 / 130.5		SILTSTONE; dark grey, interbedded with fine grained, grey sandstone, carbonaceous laminations throughout.				40.54m: Bg, 5°, DB
					41.0		SILTSTONE; dark grey, carbonaceous laminations throughout.				40.8m: Jt, 20°, Un, Sm 40.92m: Jt, 20°, St, Ro 41m: DB 41.1m: Jt, 20°, St, Ro
			100	20	41.15 / 41.20 / 130.0		COAL; black. SILTSTONE; dark grey, with carbonaceous laminations.				41.38m: DB 41.4m: Bg, 5°
					41.5						
					41.65 / 41.76 / 129.5		CORE LOSS 0.11m (41.65-41.76)				
			96	60	42 / 42.0 / 129.0		SILTSTONE; dark grey, interbedded with carbonaceous lamination.	FR			41.81m: DB 41.95m: DB 41.98m: DB 42m: DB 42.1m: DB 42.13m: Bg, Pl, Sm 42.27m: DB
					42.5		SILTSTONE; dark grey, interbedded with carbonaceous lamination.				42.4m: Jt, 45°, Pl, Sm 42.48m: DB 42.48m: Jt, 80°, Pl, Sm 42.75m: Jt, 10°, Pl, Sm
					42.83 / 42.90 / 128.5		COAL; black. SILTSTONE; dark grey.				
					43 / 43.0 / 128.0		As above but interbedded with fine grained, grey, sandstone.				43m: DB 43.23m: DB 43.27m: Jt, 15°, Un, Sm
					43 / 43.5 / 127.5		SILTSTONE; grey.				43.43m: Bg, 3°, Sm 43.43m: Jt, 90°, Un, Sm 43.52m: DB 43.56m: Jt, 70°
					44 / 44.0 / 127.0		As above but dark grey.				43.97m: DB 44m: DB 44.04m: DB 44.24m: DB 44.3m: DB
					44 / 44.5		As above but black.				44.44m: DB 44.51m: DB 44.58m: DB 44.72m: DB
			72	6	126.5 / 44.80		COAL; black, interbedded with very low strength, brown siltstone.				44.8m: Jt, 20°, Pl, Sm 44.9m: Siltstone band

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL18A

SHEET : 6 OF 7

Client:	**MACH Energy**	Date Commenced:	**21/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**23/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC/JNA**
Project Number:	**PS112915**	Log Checked By:	**HS**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**171.271 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297660.35 N 6427333.03 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD) / DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH / 60, EH / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ	C		72	6	126.0		COAL; black, interbedded with very low strength, brown siltstone.	FR			45.1m: Jt, 90°, Pl, Sm 45.2m: DB, Fractured
					45.40						
					45.5		CORE LOSS 0.46m (45.40-45.86)				
					125.5						
					45.86						
					45.90		SILTSTONE; brown.	FR			45.9m: Clay seam
					46		CLAY; medium plasticity, brown.				
					46.0		COAL; black.				46m: Fractured
					46.22						
					125.0		SILTSTONE; dark grey.				
					46.30		CORE LOSS 0.15m (46.30-46.45) CORE LOSS				
					46.45						
			88	70	46.5		SANDSTONE; fine grained, grey, interbedded with grey siltstone.	FR			46.47m: DB
					124.5						46.82m: DB
					47.0						47m: DB
					124.0						47.14m: Bg, 5° 47.21m: Jt, 30°, Pl, Ro
					47						
					47.5		SILTSTONE; dark grey, carbonaceous laminations throughout.				47.52m: DB 47.59m: Jt, 30°, Pl, Sl 47.62m: Jt, 30°, Pl, Sl 47.64m: Jt, 30°, Pl, Sl 47.76m: Jt, 30°, Pl, Sl
					123.5						47.89m: DB
					48.0						48m: DB
					123.0						48.12m: Jt, 20°, Pl, Sm 48.28m: DB
					48.38						
			100	90	48.5		SANDSTONE; fine grained, pale grey to grey.				48.63m: Jt, 20°, Pl, Sl
					122.5						
					49.0						49m: DB 49.1m: Bg, 5°
					122.0						
					49.5						49.4m: DB
					121.5						49.67m: DB 49.83m: Bg, 3°

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHRL18A

Client:	**MACH Energy**	Date Commenced:	**21/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**23/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC/JNA**
Project Number:	**PS112915**	Log Checked By:	**HS**

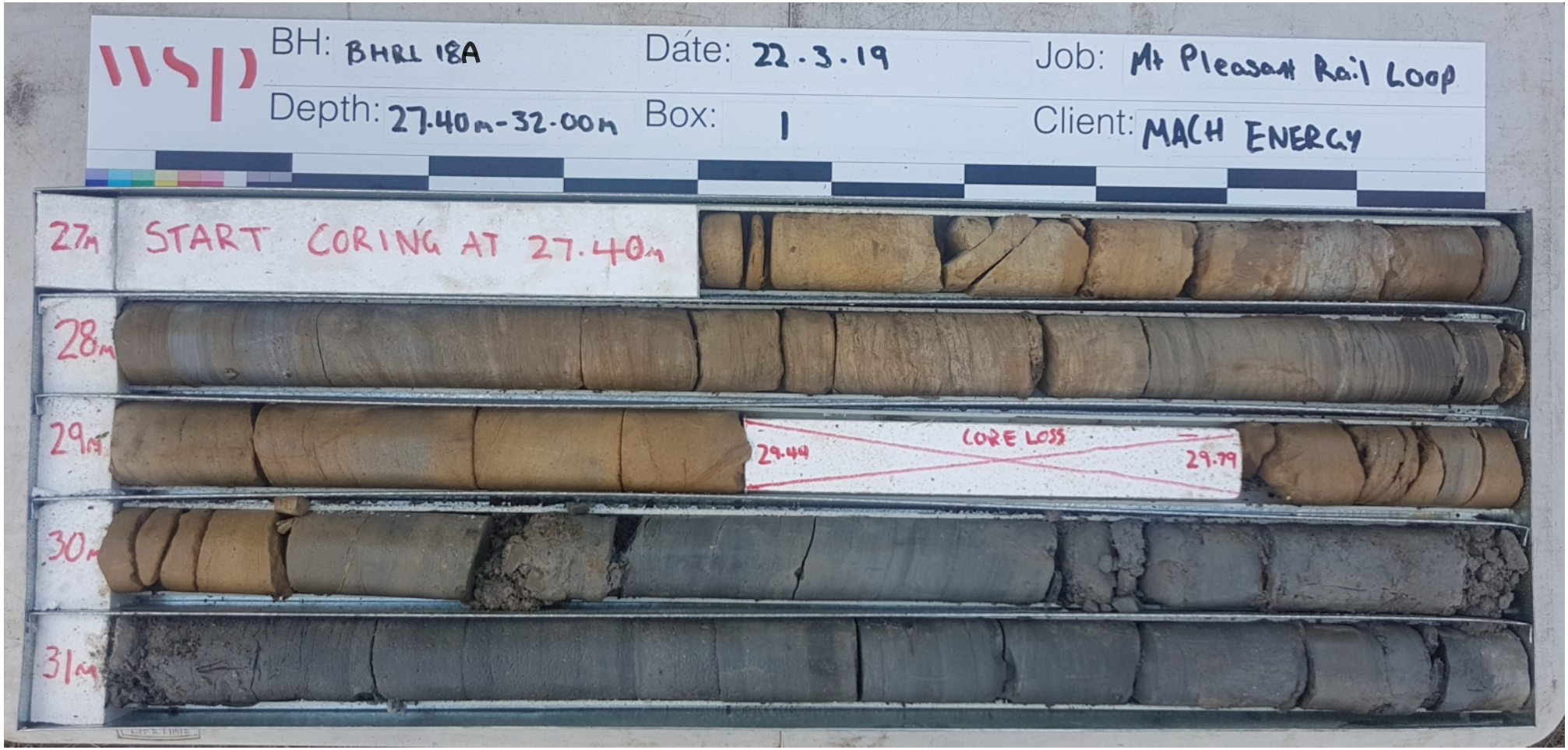
Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**171.271 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297660.35 N 6427333.03 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.06, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ	C C C C C		100	90	121.0	50.5		SANDSTONE; fine grained, pale grey to grey.	FR			50m: DB 50.28m: DB
								END OF BOREHOLE AT 50.60 m				

120.5
120.0
119.5
119.0
118.5
118.0
117.5
117.0
116.5

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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PointID : BHRL18A Depth Range: 27.40 - 32.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL18A	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 1/5



PointID : BHRL18A Depth Range: 32.00 - 37.00 m

TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL18A	DRAWN: HS	DATE: 28/03/2019	
	CHECKED: HS	DATE: 28/03/2019	
	SCALE: Not To Scale		A4
	PROJECT No: PS112915	FIGURE No: 2/5	



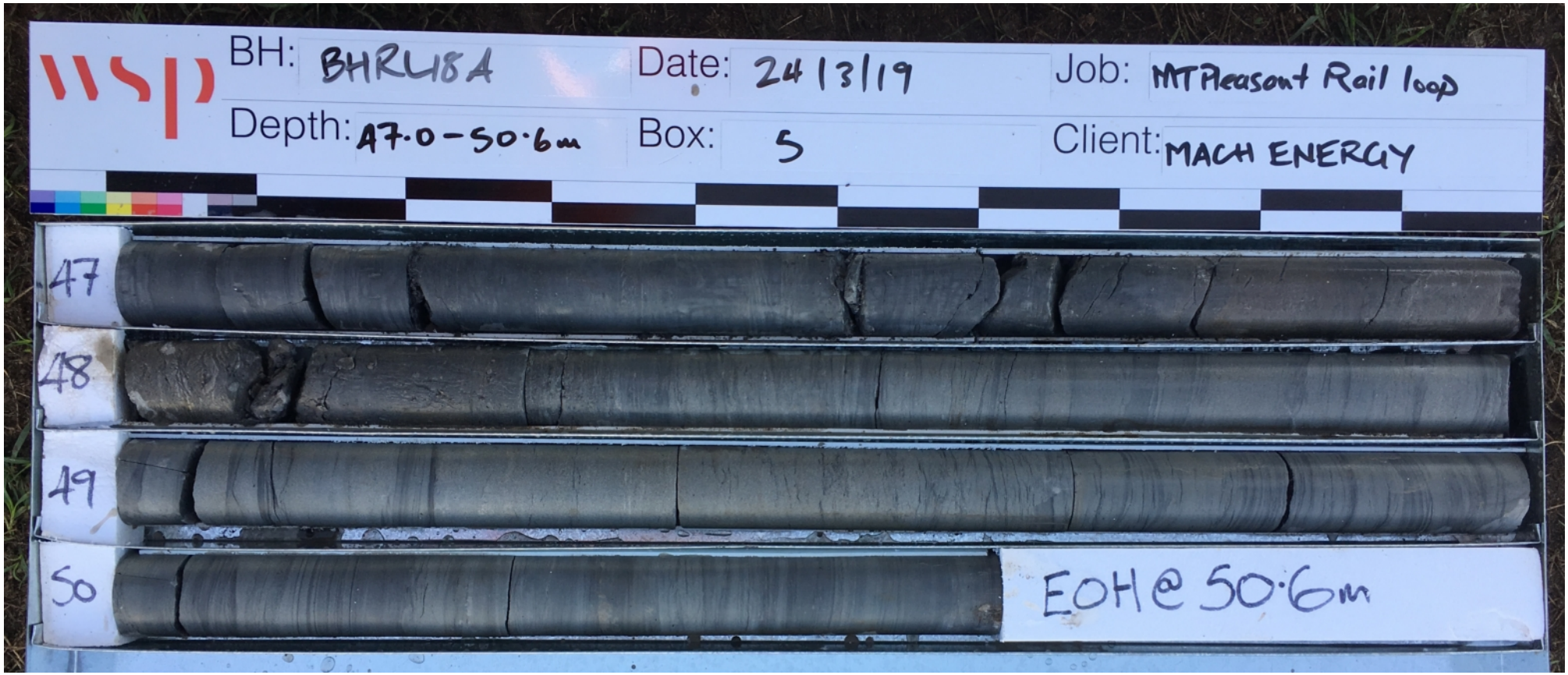
PointID : BHRL18A Depth Range: 37.00 - 42.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL18A	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 3/5



PointID : BHRL18A Depth Range: 42.00 - 47.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL18A	DRAWN: HS	DATE: 28/03/2019
		CHECKED: HS	DATE: 28/03/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 4/5



PointID : BHRL18A Depth Range: 47.00 - 50.60 m

TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHRL18A	DRAWN: HS	DATE: 28/03/2019	
	CHECKED: HS	DATE: 28/03/2019	
	SCALE: Not To Scale		A4
	PROJECT No: PS112915	FIGURE No: 5/5	

PROJECT: Mt Pleasant Rail Loop
CLIENT: MACH Energy
LOCATION: SEE SITE PLAN FOR BOREHOLE LOCATIONS
JOB NO PS112915
Tested By: MC
Date Tested: 06/02/2019 - 10/04/2019
Equipment Used: POINT LOAD TESTER
Equipment Type: Electronic / Load Cell
According to AS 4133.4.1 - 1993 Yes

Moisture Content
DRY

According to ISRM Suggest Methods

Legend;	Is (50) Mpa	Strength Class	
	0	EL	Extremely Low
	0.03	VL	Very low
	0.1	L	Low
	0.3	M	Medium
	1	H	High
	3	VH	Very High
	10	EH	Extremely High

			Diametral				Axial			
Sample Location	Sample Depth	Rock Type	Core Diameter D (mm)	Dist to End L (mm)	Point Load Strength (Is50) Dia Is(50) Mpa	Rock Strength Class	Length of section L (mm)	Core diameter W (mm)	Point Load Strength (Is50) (MPa)	Rock Strength Class
BHRL01	14.75	SILTSTONE	52	64	0.39	M	32	52	0.57	M
BHRL01	15.83	SILTSTONE	52	160	0.02	EL	43	52	0.16	L
BHRL01	16.91	SANDSTONE	52	70	0.40	M	42	52	0.67	M
BHRL01	17.7	SANDSTONE	52	305	1.49	H	39	52	2.56	H
BHRL01	18.86	SANDSTONE	52	100	2.92	H	40	52	3.71	VH
BHRL01	24.77	INT. SILTSTONE AND SANDSTONE	52	225	0.67	M	47	52	0.72	M
BHRL01	25.85	SILTSTONE	52	135	0.33	M	45	52	0.51	M
BHRL02	18.82	SANDSTONE	50	180	1.56	H	40	50	1.62	H
BHRL02	19	SANDSTONE	50	230	1.70	H	32	50	1.39	H
BHRL02	20.5	SANDSTONE	50	290	1.08	H	40	50	1.12	H
BHRL02	21.64	SANDSTONE	50	320	4.26	VH	38	50	1.68	H
BHRL02	22.64	SILTSTONE	50	200	0.66	M	35	50	0.09	VL
BHRL02	23	SANDSTONE	50	260	1.34	H	35	50	1.29	H
BHRL02	24.4	SANDSTONE	50	500	4.04	VH	47	50	6.58	VH
BHRL02	25.45	SILTSTONE	50	200	0.73	M	27	50	0.63	M
BHRL02	27.5	SANDSTONE	50	430	4.93	VH	30	50	5.41	VH
BHRL02	28.74	SANDSTONE	50	260	2.43	H	48	50	2.05	H
BHRL05	4.67	SANDSTONE	50	110	1.86	H	25	50	1.32	H
BHRL05	9	SANDSTONE	50	200	3.24	VH	30	50	2.92	H
BHRL05	10.62	SILTSTONE/SANDSTONE	50	140	0.06	VL	25	50	0.40	M
BHRL05	11.71	SILTSTONE/SANDSTONE	50	110	0.68	M	24	50	0.89	M
BHRL05	12.02	SANDSTONE	50	115	4.92	VH	27	50	7.80	VH
BHRL05	13.19	SANDSTONE/SILTSTONE	50	200	0.49	M	40	50	0.54	M
BHRL05	14.66	SILTSTONE	50	205	0.27	L	32	50	0.44	M
BHRL05	16.88	SANDSTONE	50	120	0.69	M	22	50	0.63	M
BHRL05	17.85	SANDSTONE	50	105	6.51	VH	30	50	6.88	VH
BHRL06	5.64	SANDSTONE	50	350	2.89	H	35	50	1.79	H
BHRL06	6.17	SANDSTONE	50	80	0.14	L	30	50	0.18	L
BHRL06	7.11	SANDSTONE	50	200	0.07	VL	23	50	0.55	M
BHRL06	8.29	SANDSTONE	50	120	0.50	M	21	50	0.19	L
BHRL06	10.04	SANDSTONE	50	230	1.15	H	20	50	1.22	H
BHRL06	11.74	SANDSTONE	50	85	4.88	VH	30	50	7.40	VH
BHRL06	12.63	SILTSTONE/SANDSTONE	50	100	0.07	VL	28	50	0.45	M
BHRL06	13.68	SANDSTONE	50	300	0.26	L	40	50	0.36	M
BHRL06	15.12	SILTSTONE/SANDSTONE	50	80	0.15	L	25	50	0.16	L
BHRL06	16	SILTSTONE/SANDSTONE	50	255	0.29	L	30	50	0.31	M
BHRL07	3.63	SANDSTONE	50	120	0.61	M	30	50	0.55	M

PROJECT: Mt Pleasant Rail Loop
CLIENT: MACH Energy
LOCATION: SEE SITE PLAN FOR BOREHOLE LOCATIONS
JOB NO PS112915
Tested By: MC
Date Tested: 06/02/2019 - 10/04/2019
Equipment Used: POINT LOAD TESTER
Equipment Type: Electronic / Load Cell
According to AS 4133.4.1 - 1993 Yes

Moisture Content
DRY

According to ISRM Suggest Methods

Legend;	Is (50) Mpa	Strength Class	
	0	EL	Extremely Low
	0.03	VL	Very low
	0.1	L	Low
	0.3	M	Medium
	1	H	High
	3	VH	Very High
	10	EH	Extremely High

			Diametral				Axial			
Sample Location	Sample Depth	Rock Type	Core Diameter D (mm)	Dist to End L (mm)	Point Load Strength (Is50) Dia Is(50) Mpa	Rock Strength Class	Length of section L (mm)	Core diameter W (mm)	Point Load Strength (Is50) (MPa)	Rock Strength Class
BHRL07	9.45	SANDSTONE	50	130	1.67	H	30	50	1.59	H
BHRL07	10.24	SANDSTONE	50	110	0.06	VL	25	50	0.39	M
BHRL07	11.1	SANDSTONE	50	100	0.51	M	35	50	0.27	L
BHRL07	12.9	SANDSTONE	50	90	3.02	VH	40	50	1.24	H
BHRL07	14.75	SANDSTONE	50	80	0.54	M	40	50	0.28	L
BHRL07	15.05	SANDSTONE	50	110	0.34	M	23	50	0.40	M
BHRL08	5.35	SANDSTONE	50	130	0.94	M	25	50	0.67	M
BHRL08	6.56	SANDSTONE	50	115	4.13	VH	35	50	4.12	VH
BHRL08	7.57	SANDSTONE	50	120	0.47	M	30	50	0.73	M
BHRL08	12.19	SILTSTONE/SANDSTONE	50	100	0.27	L	40	50	0.20	L
BHRL08	13.07	SANDSTONE	50	110	2.17	H	30	50	2.03	H
BHRL08	15.14	SILTSTONE	50	70	0.64	M	28	50	0.28	L
BHRL08	16.78	SANDSTONE	50	200	0.47	M	30	50	0.56	M
BHRL08	17.68	SANDSTONE	50	310	1.98	H	48	50	0.59	M
BHRL15	3.79	SILTSTONE	52	57	0.01	EL	33	52	0.01	EL
BHRL15	4.57	SILTSTONE	52	70	0.02	EL	42	52	0.06	VL
BHRL15	10.67	SANDSTONE	52	70	2.01	H	47	52	1.24	H
BHRL15	11.23	SANDSTONE	52	100	1.58	H	35	52	1.34	H
BHRL15	12.78	SANDSTONE	52	150	1.41	H	43	52	1.43	H
BHRL15	13.51	SANDSTONE	52	140	0.13	L	46	52	0.12	L
BHRL15	16.37	SANDSTONE	52	220	1.46	H	46	52	0.86	M
BHRL15	17.35	SILTSTONE	52	95	0.07	VL	52	52	0.32	M
BHRL16	12.38	SANDSTONE	50	155	0.23	L	30	50	0.21	L
BHRL16	13.22	SANDSTONE	50	200	0.19	L	37	50	0.15	L
BHRL16	16.1	IRONSTONE	50	90	0.55	M	30	50	0.81	M
BHRL16	16.6	SILTSTONE	50	200	0.06	VL	35	50	0.10	VL
BHRL17	28.55	SANDSTONE	50	430	1.45	H	35	50	1.49	H
BHRL17	29	SANDSTONE	50	90	0.67	M	32	50	0.83	M
BHRL17	30.35	SILTSTONE/SANDSTONE	50	85	0.42	M	35	50	0.42	M
BHRL17	31.232	SILTSTONE/SANDSTONE	50	100	0.44	M	23	50	0.50	M
BHRL17	33.52	SILTSTONE	50	200	0.17	L	30	50	0.60	M
BHRL17	34.76	SILTSTONE	50	95	0.20	L	23	50	0.71	M
BHRL17	35.8	SANDSTONE	50	150	0.55	M	40	50	0.31	M
BHRL17	38.75	SANDSTONE	50	200	0.75	M	35	50	1.04	H
BHRL17	39	SANDSTONE	50	170	1.42	H	35	50	1.54	H
BHRL17	40.8	SANDSTONE	50	150	0.64	M	30	50	0.88	M
BHRL17	41	SILTSTONE	50	110	0.46	M	40	50	0.27	L

PROJECT: Mt Pleasant Rail Loop
CLIENT: MACH Energy
LOCATION: SEE SITE PLAN FOR BOREHOLE LOCATIONS
JOB NO PS112915
Tested By: MC
Date Tested: 06/02/2019 - 10/04/2019
Equipment Used: POINT LOAD TESTER
Equipment Type: Electronic / Load Cell
According to AS 4133.4.1 - 1993 Yes

Moisture Content
DRY

According to ISRM Suggest Methods

Legend;	Is (50) Mpa	Strength Class	
	0	EL	Extremely Low
	0.03	VL	Very low
	0.1	L	Low
	0.3	M	Medium
	1	H	High
	3	VH	Very High
	10	EH	Extremely High

			Diametral				Axial			
Sample Location	**Sample Depth**	**Rock Type**	**Core Diameter D (mm)**	**Dist to End L (mm)**	**Point Load Strength (Is50) Dia Is(50) Mpa**	**Rock Strength Class**	**Length of section L (mm)**	**Core diameter W (mm)**	**Point Load Strength (Is50) (MPa)**	**Rock Strength Class**
BHRL18A	28	SILTSTONE/SANDSTONE	63	140	0.16	L	35	63	0.32	M
BHRL18A	29.25	SANDSTONE	63	100	0.32	M	35	63	0.43	M
BHRL18A	32.92	SILTSTONE	63	80	0.11	L	42	63	0.24	L
BHRL18A	33.59	SILTSTONE/SANDSTONE	63	140	0.42	M	30	63	0.42	M
BHRL18A	34.8	SANDSTONE	63	130	2.01	H				
BHRL18A	35.38	SANDSTONE	63	120	0.73	M	35	63	0.83	M
BHRL18A	36.74	SILTSTONE/SANDSTONE	63	255	0.32	M	40	63	0.41	M
BHRL18A	37.05	SILTSTONE	63	70	0.36	M	39	63	0.49	M
BHRL18A	38.05	SANDSTONE					45	63	0.62	M
BHRL18A	40.6	SILTSTONE	63	70	0.38	M	32	63	0.32	M
BHRL18A	41.55	SILTSTONE	63	80	0.08	VL	40	63	0.23	L
BHRL18A	42.12	SILTSTONE					41	63	0.22	L
BHRL18A	43.15	SILTSTONE					52	63	0.30	L
BHRL18A	44.26	SILTSTONE					53	63	0.19	L
BHRL18A	46.95	SANDSTONE	63	75	0.29	L	42	63	0.45	M
BHRL18A	47.1	SANDSTONE					54	63	0.39	M
BHRL18A	49.1	SANDSTONE	63	100	1.13	H	45	63	0.98	M
BHRL18A	50.1	SANDSTONE	63	100	0.65	M	45	63	1.28	H

APPENDIX C

LABORATORY CERTIFICATES

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ABN: 98 153 268 896

California Bearing Ratio Test Report

Report No: CBR:NEW19W-0646--S03
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

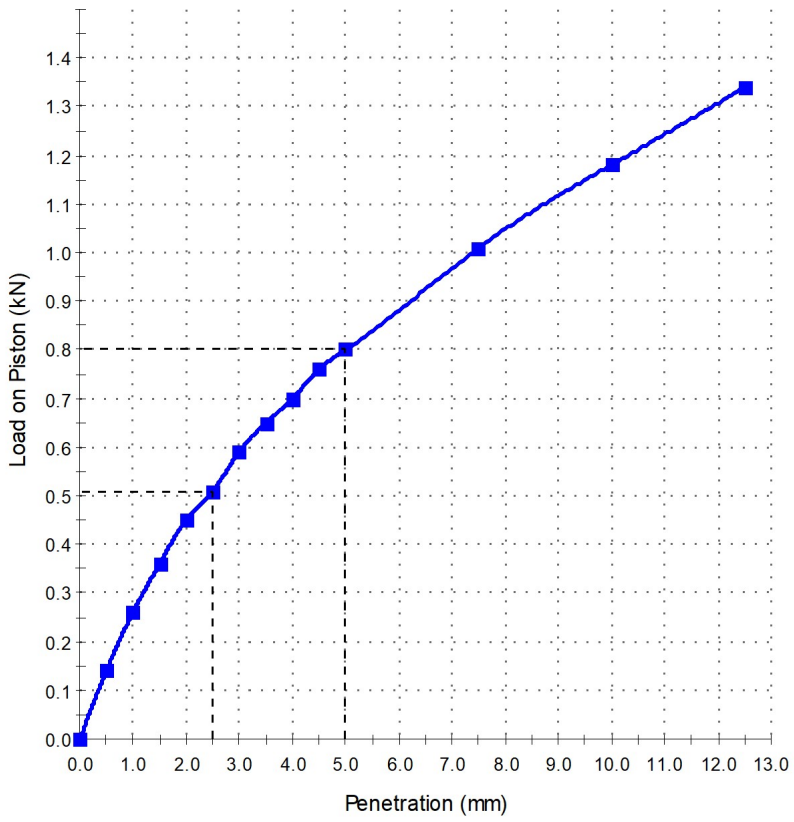
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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 19/03/2019

Sample Details

Sample ID: NEW19W-0646--S03
Test Request No.: PS112915
Date Sampled: 27/02/2019
Sampling Method: Sample submitted by client
Specification: No Specification
Source: On Site
Location: TPOR01 - (0.1 - 0.7m), Overton Road
Material: Sandy Clay
Project Location: Mt Pleasant Coal Mine, NSW

Load vs Penetration



Test Results

AS 1289.6.1.1 - 2014

CBR At 5.0mm (%):	**4.0**
Maximum Dry Density (t/m³):	1.66
Optimum Moisture Content (%):	17.5
Dry Density before Soaking (t/m³):	1.66
Density Ratio before Soaking (%):	100.0
Moisture Content before Soaking (%):	17.9
Moisture Ratio before Soaking (%):	102.0
Dry Density after Soaking (t/m³):	1.62
Density Ratio after Soaking (%):	97.5
Swell (%):	2.0
Moisture Content of Top 30mm (%):	26.9
Moisture Content of Remaining Depth (%):	21.9
Compactive Effort:	Standard
	AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Oversize Material (%):	0
CBR Moisture Content Method:	AS 1289.2.1.1
Field Moisture Content (%):	9.8
Curing Time (hrs) :	48

Comments

Method of establishing plasticity level: Liquid Limit (AS 1289.3.1.1)

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Material Test Report

Report No: MAT:NEW19W-0646--S03
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 18/03/2019

Sample Details

Sample ID: NEW19W-0646--S03
Sampling Method: Sample submitted by client
Date Sampled: 27/02/2019
Source: On Site
Material: Sandy Clay
Specification: No Specification
Project Location: Mt Pleasant Coal Mine, NSW
TRN PS112915
Sample Location: TPOR01 - (0.1 - 0.7m)
Overton Road

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	8.5	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	44	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	17	
Plasticity Index (%)	AS 1289.3.3.1	27	
Emerson Class Number	AS 1289.3.8.1	4	
Soil Description		Brown Sandy Clay	
Type of Water		Distilled	
Temperature of Water (°C)		22.0	
Moisture Content (%)	AS 1289.2.1.1	9.8	

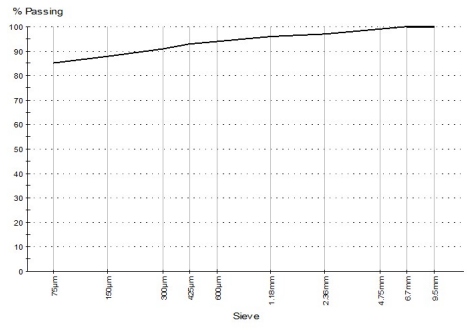
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven

Note: Sample Washed

Sieve Size	% Passing	Limits
9.5mm	100	
6.7mm	100	
4.75mm	99	
2.36mm	97	
1.18mm	96	
600µm	94	
425µm	93	
300µm	91	
150µm	88	
75µm	85	

Chart



Comments

N/A

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California Bearing Ratio Test Report

Report No: CBR:NEW19W-0646--S04
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

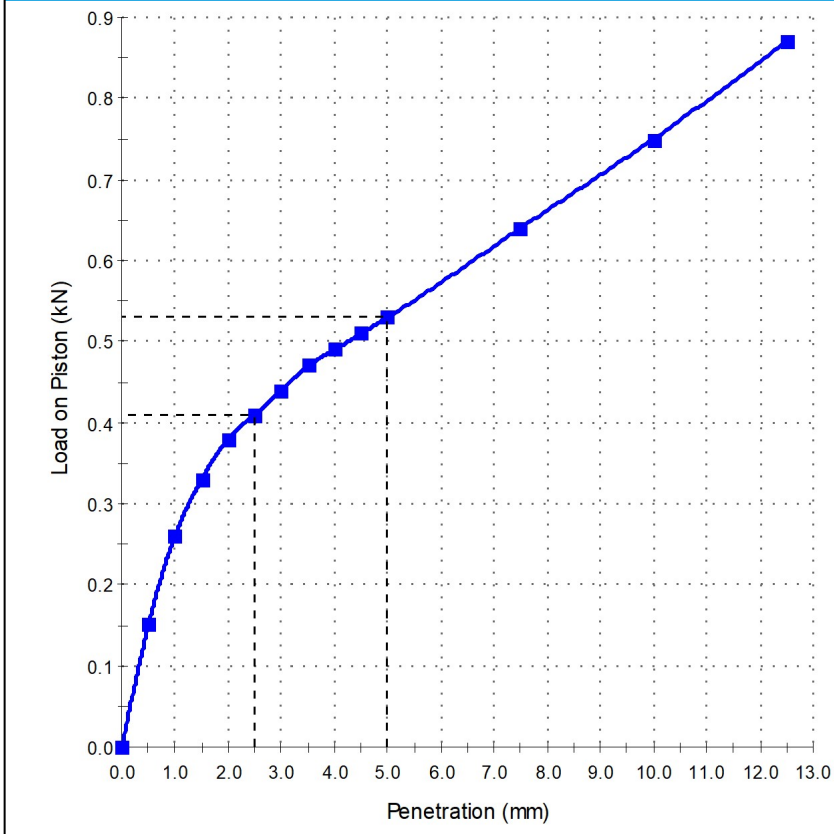
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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 19/03/2019

Sample Details

Sample ID: NEW19W-0646--S04
Test Request No.: PS112915
Date Sampled: 27/02/2019
Sampling Method: Sample submitted by client
Specification: No Specification
Source: On Site
Location: TPOR02 - (0.2 - 0.6m), Overton Road
Material: Sandy Clay
Project Location: Mt Pleasant Coal Mine, NSW

Load vs Penetration



Test Results

AS 1289.6.1.1 - 2014

CBR At 2.5mm (%):	**3.0**
Maximum Dry Density (t/m³):	1.58
Optimum Moisture Content (%):	21.0
Dry Density before Soaking (t/m³):	1.58
Density Ratio before Soaking (%):	100.0
Moisture Content before Soaking (%):	21.5
Moisture Ratio before Soaking (%):	101.5
Dry Density after Soaking (t/m³):	1.53
Density Ratio after Soaking (%):	97.0
Swell (%):	3.0
Moisture Content of Top 30mm (%):	30.5
Moisture Content of Remaining Depth (%):	23.0
Compactive Effort:	Standard
	AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Oversize Material (%):	0
CBR Moisture Content Method:	AS 1289.2.1.1
Sample Moisture Content	AS 1289.2.1.1
Field Moisture Content (%):	15.8
Curing Time (hrs) :	48

Comments

Method of establishing plasticity level: Liquid Limit (AS 1289.3.1.1)

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Material Test Report

Report No: MAT:NEW19W-0646--S04
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 20/03/2019

Sample Details

Sample ID: NEW19W-0646--S04
Sampling Method: Sample submitted by client
Date Sampled: 27/02/2019
Source: On Site
Material: Sandy Clay
Specification: No Specification
Project Location: Mt Pleasant Coal Mine, NSW
TRN PS112915
Sample Location: TPOR02 - (0.2 - 0.6m)
Overton Road

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	16.5	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	58	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	19	
Plasticity Index (%)	AS 1289.3.3.1	39	
Emerson Class Number	AS 1289.3.8.1	4	
Soil Description		Brown Sandy Clay	
Type of Water		Distilled	
Temperature of Water (°C)		22.0	
Moisture Content (%)	AS 1289.2.1.1	15.8	

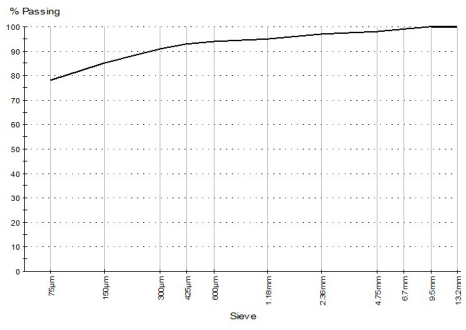
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven

Note: Sample Washed

Sieve Size	% Passing	Limits
13.2mm	100	
9.5mm	100	
6.7mm	99	
4.75mm	98	
2.36mm	97	
1.18mm	95	
600µm	94	
425µm	93	
300µm	91	
150µm	85	
75µm	78	

Chart



Comments

N/A

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California Bearing Ratio Test Report

Report No: CBR:NEW19W-0646--S05
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

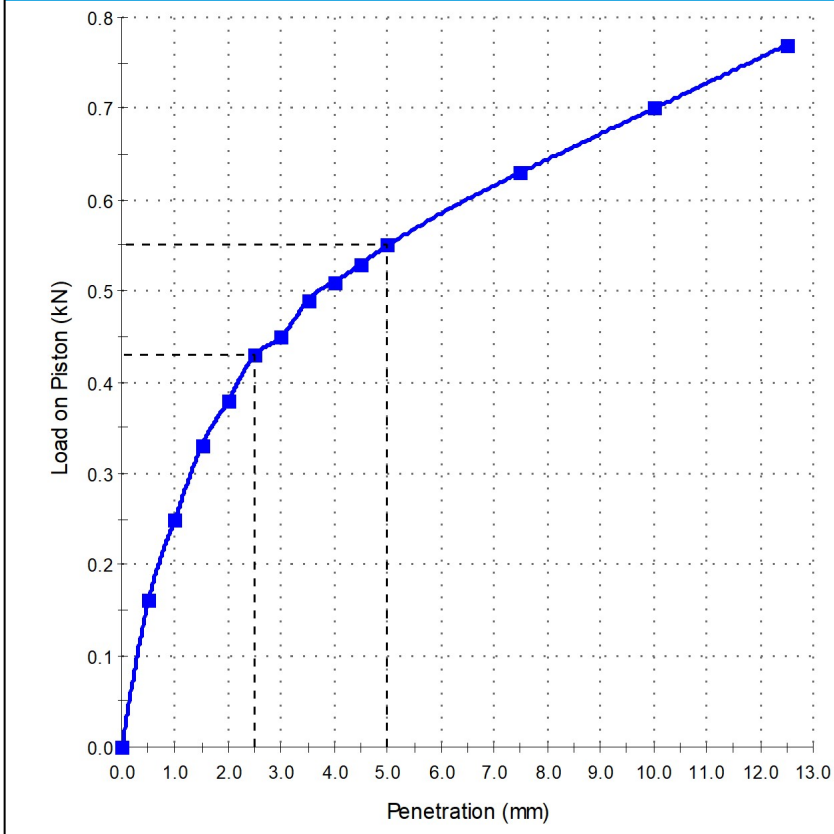
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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 19/03/2019

Sample Details

Sample ID: NEW19W-0646--S05
Test Request No.: PS112915
Date Sampled: 27/02/2019
Sampling Method: Sample submitted by client
Specification: No Specification
Source: On Site
Location: TPOR03 - (0.1 - 0.5m), Overton Road
Material: Sandy Clay
Project Location: Mt Pleasant Coal Mine, NSW

Load vs Penetration



Test Results

AS 1289.6.1.1 - 2014

CBR At 2.5mm (%):	**3.5**
Maximum Dry Density (t/m³):	1.61
Optimum Moisture Content (%):	20.5
Dry Density before Soaking (t/m³):	1.60
Density Ratio before Soaking (%):	99.5
Moisture Content before Soaking (%):	19.8
Moisture Ratio before Soaking (%):	97.5
Dry Density after Soaking (t/m³):	1.55
Density Ratio after Soaking (%):	96.0
Swell (%):	3.5
Moisture Content of Top 30mm (%):	29.3
Moisture Content of Remaining Depth (%):	24.9
Compactive Effort:	Standard
	AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Oversize Material:	Excluded
Oversize Material (%):	2
CBR Moisture Content Method:	AS 1289.2.1.1
Field Moisture Content (%):	13.7
Curing Time (hrs) :	48

Comments

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ABN: 98 153 268 896

Material Test Report

Report No: MAT:NEW19W-0646--S05
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 20/03/2019

Sample Details

Sample ID: NEW19W-0646--S05
Sampling Method: Sample submitted by client
Date Sampled: 27/02/2019
Source: On Site
Material: Sandy Clay
Specification: No Specification
Project Location: Mt Pleasant Coal Mine, NSW
TRN PS112915
Sample Location: TPOR03 - (0.1 - 0.5m)
Overton Road

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	7.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	58	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	17	
Plasticity Index (%)	AS 1289.3.3.1	41	
Moisture Content (%)	AS 1289.2.1.1	13.7	

Comments

N/A

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ABN: 98 153 268 896

California Bearing Ratio Test Report

Report No: CBR:NEW19W-0646--S06
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

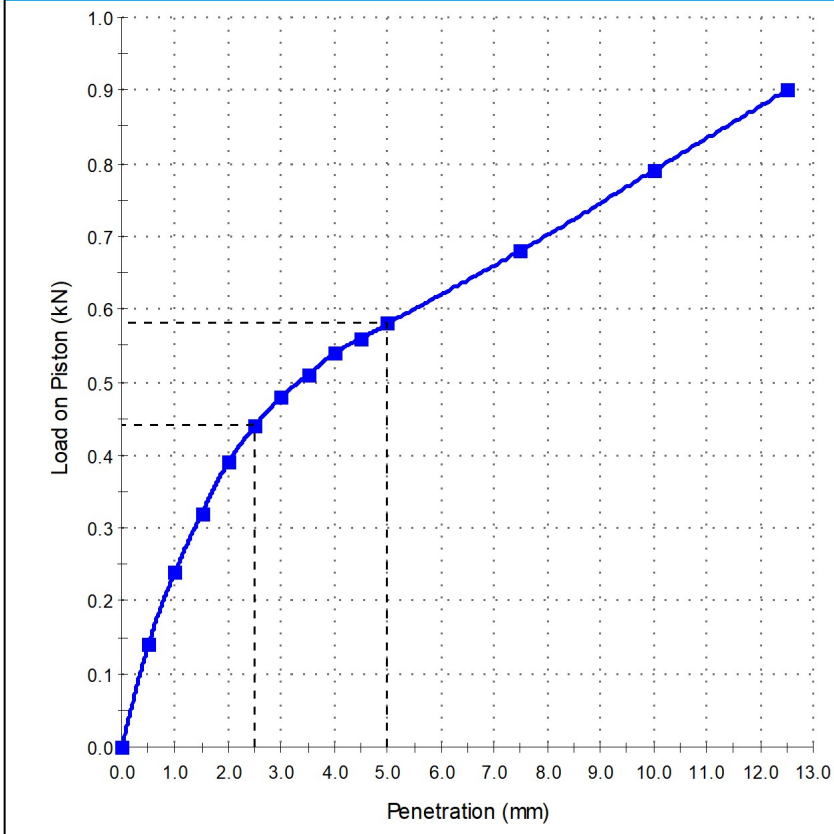
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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 19/03/2019

Sample Details

Sample ID: NEW19W-0646--S06
Test Request No.: PS112915
Date Sampled: 26/02/2019
Sampling Method: Sample submitted by client
Specification: No Specification
Source: On Site
Location: TPRL04 - (0.2 - 0.7m), Rail Loop
Material: Sandy Clay
Project Location: Mt Pleasant Coal Mine, NSW

Load vs Penetration



Test Results

AS 1289.6.1.1 - 2014

CBR At 2.5mm (%):	**3.5**
Maximum Dry Density (t/m³):	1.60
Optimum Moisture Content (%):	21.0
Dry Density before Soaking (t/m³):	1.60
Density Ratio before Soaking (%):	100.0
Moisture Content before Soaking (%):	20.7
Moisture Ratio before Soaking (%):	98.5
Dry Density after Soaking (t/m³):	1.55
Density Ratio after Soaking (%):	97.5
Swell (%):	3.0
Moisture Content of Top 30mm (%):	32.8
Moisture Content of Remaining Depth (%):	23.2
Compactive Effort:	Standard
	AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Oversize Material (%):	0
CBR Moisture Content Method:	AS 1289.2.1.1
Field Moisture Content (%):	14.0
Curing Time (hrs) :	48

Comments

Method of establishing plasticity level: Liquid Limit (AS 1289.3.1.1)

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ABN: 98 153 268 896

Material Test Report

Report No: MAT:NEW19W-0646--S06
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 18/03/2019

Sample Details

Sample ID: NEW19W-0646--S06
Sampling Method: Sample submitted by client
Date Sampled: 26/02/2019
Source: On Site
Material: Sandy Clay
Specification: No Specification
Project Location: Mt Pleasant Coal Mine, NSW
TRN PS112915
Sample Location: TPRL04 - (0.2 - 0.7m)
Rail Loop

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	13.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	41	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	16	
Plasticity Index (%)	AS 1289.3.3.1	25	
Emerson Class Number	AS 1289.3.8.1	5	
Soil Description		Brown Sandy Clay	
Type of Water		Distilled	
Temperature of Water (°C)		22.0	
Moisture Content (%)	AS 1289.2.1.1	14.0	

Comments

N/A

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California Bearing Ratio Test Report

Report No: CBR:NEW19W-0646--S07
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

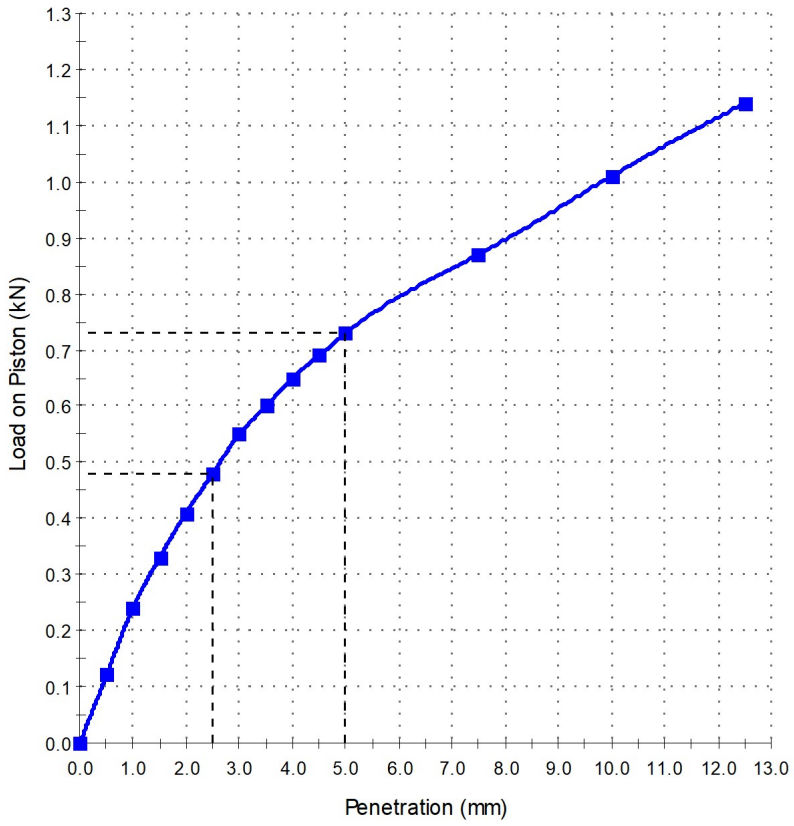
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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 19/03/2019

Sample Details

Sample ID: NEW19W-0646--S07
Test Request No.: PS112915
Date Sampled: 26/02/2019
Sampling Method: Sample submitted by client
Specification: No Specification
Source: On Site
Location: TPRL05 - (0.2 - 0.9m), Rail Loop
Material: Sandy Clay
Project Location: Mt Pleasant Coal Mine, NSW

Load vs Penetration



Test Results

AS 1289.6.1.1 - 2014

CBR At 5.0mm (%):	**3.5**
Maximum Dry Density (t/m³):	1.53
Optimum Moisture Content (%):	21.0
Dry Density before Soaking (t/m³):	1.51
Density Ratio before Soaking (%):	99.0
Moisture Content before Soaking (%):	21.6
Moisture Ratio before Soaking (%):	102.0
Dry Density after Soaking (t/m³):	1.47
Density Ratio after Soaking (%):	96.0
Swell (%):	3.0
Moisture Content of Top 30mm (%):	34.6
Moisture Content of Remaining Depth (%):	25.3
Compactive Effort:	Standard
	AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Oversize Material (%):	0
CBR Moisture Content Method:	AS 1289.2.1.1
Field Moisture Content (%):	13.1
Curing Time (hrs) :	48

Comments

Method of establishing plasticity level: Liquid Limit (AS 1289.3.1.1)

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Material Test Report

Report No: MAT:NEW19W-0646--S07
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 18/03/2019

Sample Details

Sample ID: NEW19W-0646--S07
Sampling Method: Sample submitted by client
Date Sampled: 26/02/2019
Source: On Site
Material: Sandy Clay
Specification: No Specification
Project Location: Mt Pleasant Coal Mine, NSW
TRN PS112915
Sample Location: TPRL05 - (0.2 - 0.9m)
Rail Loop

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	11.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	56	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	22	
Plasticity Index (%)	AS 1289.3.3.1	34	
Moisture Content (%)	AS 1289.2.1.1	13.1	

Comments

N/A

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California Bearing Ratio Test Report

Report No: CBR:NEW19W-0646--S08
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

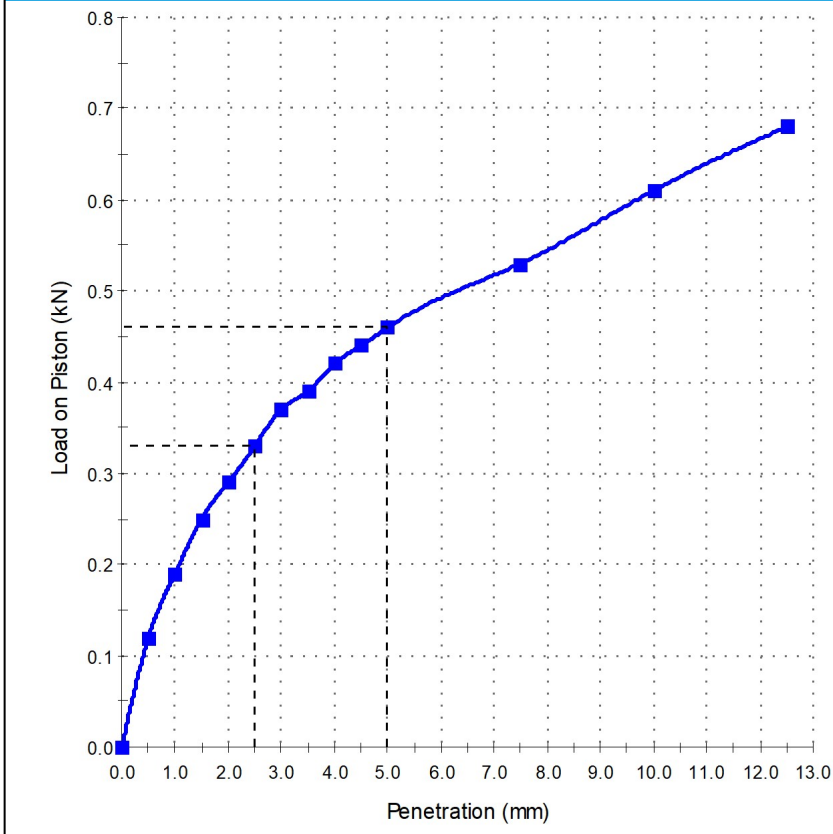
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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 19/03/2019

Sample Details

Sample ID:	NEW19W-0646--S08	**Test Request No.:**	PS112915
Date Sampled:	26/02/2019		
Sampling Method:	Sample submitted by client		
Specification:	No Specification	**Source:**	On Site
Location:	TPRL06 - (0.2 - 1.2m), Rail Loop	**Material:**	Sandy Clay
Project Location:	Mt Pleasant Coal Mine, NSW		

Load vs Penetration



Test Results

AS 1289.6.1.1 - 2014

CBR At 2.5mm (%):	**2.5**
Maximum Dry Density (t/m³):	1.55
Optimum Moisture Content (%):	21.5
Dry Density before Soaking (t/m³):	1.53
Density Ratio before Soaking (%):	99.0
Moisture Content before Soaking (%):	22.2
Moisture Ratio before Soaking (%):	102.0
Dry Density after Soaking (t/m³):	1.47
Density Ratio after Soaking (%):	95.0
Swell (%):	4.0
Moisture Content of Top 30mm (%):	33.5
Moisture Content of Remaining Depth (%):	26.7
Compactive Effort:	Standard
	AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Oversize Material (%):	0
CBR Moisture Content Method:	AS 1289.2.1.1
Field Moisture Content (%):	15.2
Curing Time (hrs) :	48

Comments

Method of establishing plasticity level: Liquid Limit (AS 1289.3.1.1)

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Material Test Report

Report No: MAT:NEW19W-0646--S08
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

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Approved Signatory: Dane Cullen
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NATA Accredited Laboratory Number: 18686
Date of Issue: 20/03/2019

Sample Details

Sample ID: NEW19W-0646--S08
Sampling Method: Sample submitted by client
Date Sampled: 26/02/2019
Source: On Site
Material: Sandy Clay
Specification: No Specification
Project Location: Mt Pleasant Coal Mine, NSW
TRN PS112915
Sample Location: TPRL06 - (0.2 - 1.2m)
Rail Loop

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	11.5	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	52	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	18	
Plasticity Index (%)	AS 1289.3.3.1	34	
Emerson Class Number	AS 1289.3.8.1	5	
Soil Description		Brown Sandy Clay	
Type of Water		Distilled	
Temperature of Water (°C)		22.0	
Moisture Content (%)	AS 1289.2.1.1	15.2	

Comments

N/A

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Material Test Report

Report No: MAT:NEW19W-0646--S09
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 18/03/2019

Sample Details

Sample ID: NEW19W-0646--S09
Sampling Method: Sample submitted by client
Date Sampled: 26/02/2019
Source: On Site
Material: Sandy Clay
Specification: No Specification
Project Location: Mt Pleasant Coal Mine, NSW
TRN PS112915
Sample Location: TPRL06 - (3.1 - 3.7m)
Rail Loop

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	5.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	25	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	15	
Plasticity Index (%)	AS 1289.3.3.1	10	
Emerson Class Number	AS 1289.3.8.1	4	
Soil Description		Brown Sandy Clay	
Type of Water		Distilled	
Temperature of Water (°C)		22.0	
Moisture Content (%)	AS 1289.2.1.1	10.1	

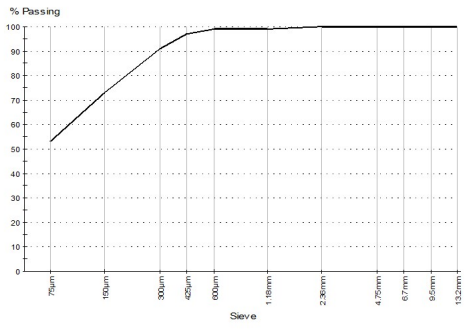
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven

Note: Sample Washed

Sieve Size	% Passing	Limits
13.2mm	100	
9.5mm	100	
6.7mm	100	
4.75mm	100	
2.36mm	100	
1.18mm	99	
600µm	99	
425µm	97	
300µm	91	
150µm	73	
75µm	53	

Chart



Comments

N/A

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Material Test Report

Report No: MAT:NEW19W-0646--S10
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 19/03/2019

Sample Details

Sample ID: NEW19W-0646--S10
Sampling Method: Sample submitted by client
Date Sampled: 26/02/2019
Source: On Site
Material: Sandy Clay
Specification: No Specification
Project Location: Mt Pleasant Coal Mine, NSW
TRN PS112915
Sample Location: TPRL07 - (0.2 - 0.7m)
Rail Loop

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	7.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	34	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	14	
Plasticity Index (%)	AS 1289.3.3.1	20	
Emerson Class Number	AS 1289.3.8.1	5	
Soil Description		Brown Sandy Clay	
Type of Water		Distilled	
Temperature of Water (°C)		22.0	
Moisture Content (%)	AS 1289.2.1.1	9.9	

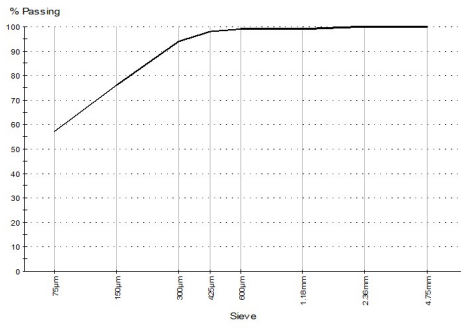
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven

Note: Sample Washed

Sieve Size	% Passing	Limits
4.75mm	100	
2.36mm	100	
1.18mm	99	
600µm	99	
425µm	98	
300µm	94	
150µm	76	
75µm	57	

Chart



Comments

N/A

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Material Test Report

Report No: MAT:NEW19W-0646--S11
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 20/03/2019

Sample Details

Sample ID: NEW19W-0646--S11
Sampling Method: Sample submitted by client
Date Sampled: 26/02/2019
Source: On Site
Material: Sandy Clay
Specification: No Specification
Project Location: Mt Pleasant Coal Mine, NSW
TRN PS112915
Sample Location: TPRL07 - (0.7 - 1.8m)
Rail Loop

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	13.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	61	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	26	
Plasticity Index (%)	AS 1289.3.3.1	35	
Moisture Content (%)	AS 1289.2.1.1	19.3	

Comments

N/A

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Material Test Report

Report No: MAT:NEW19W-0646--S12
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 19/03/2019

Sample Details

Sample ID: NEW19W-0646--S12
Sampling Method: Sample submitted by client
Date Sampled: 26/02/2019
Source: On Site
Material: Sandy Clay
Specification: No Specification
Project Location: Mt Pleasant Coal Mine, NSW
TRN PS112915
Sample Location: TPRL07 - (2.9 - 4.0m)
Rail Loop

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	10.5	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	41	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	15	
Plasticity Index (%)	AS 1289.3.3.1	26	
Moisture Content (%)	AS 1289.2.1.1	19.9	

Comments

N/A

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Material Test Report

Report No: MAT:NEW19W-0646--S13
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 19/03/2019

Sample Details

Sample ID: NEW19W-0646--S13
Sampling Method: Sample submitted by client
Date Sampled: 26/02/2019
Source: On Site
Material: Sandy Clay
Specification: No Specification
Project Location: Mt Pleasant Coal Mine, NSW
TRN PS112915
Sample Location: TPRL08 - (0.1 - 0.9m)
Rail Loop

Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	12.5	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	66	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	19	
Plasticity Index (%)	AS 1289.3.3.1	47	
Moisture Content (%)	AS 1289.2.1.1	18.2	

Comments

N/A

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ABN: 98 153 268 896

California Bearing Ratio Test Report

Report No: CBR:NEW19W-0646--S14
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

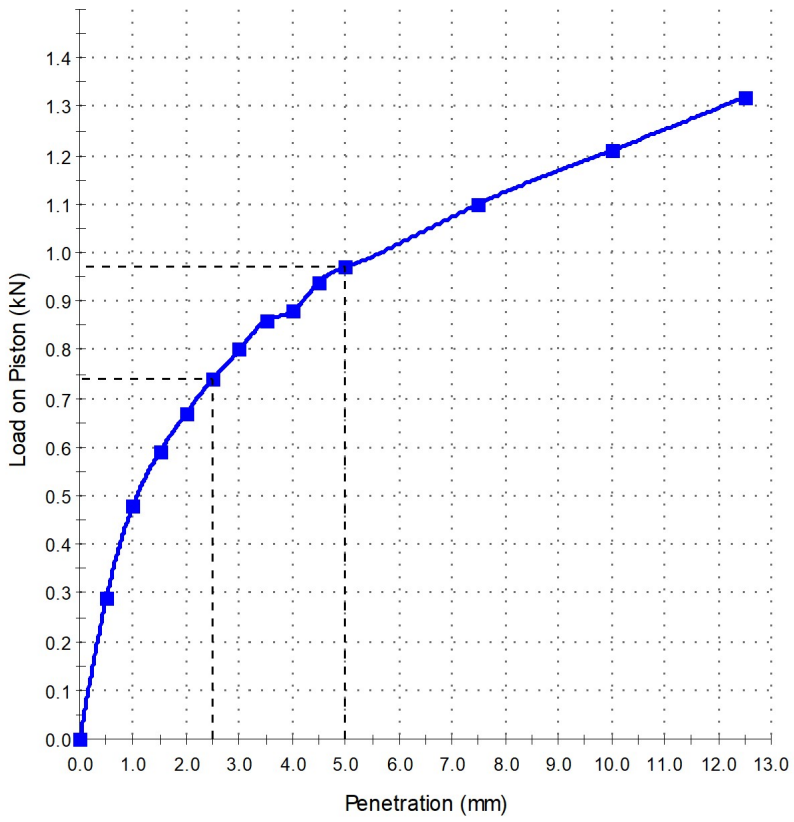
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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 19/03/2019

Sample Details

Sample ID: NEW19W-0646--S14
Test Request No.: PS112915
Date Sampled: 26/02/2019
Sampling Method: Sample submitted by client
Specification: No Specification
Source: On Site
Location: TPRL25 - (0.1 - 0.8m), Rail Loop
Material: Sandy Clay
Project Location: Mt Pleasant Coal Mine, NSW

Load vs Penetration



Test Results

AS 1289.6.1.1 - 2014

CBR At 2.5mm (%):	**6**
Maximum Dry Density (t/m³):	1.63
Optimum Moisture Content (%):	22.0
Dry Density before Soaking (t/m³):	1.64
Density Ratio before Soaking (%):	100.5
Moisture Content before Soaking (%):	21.9
Moisture Ratio before Soaking (%):	99.5
Dry Density after Soaking (t/m³):	1.62
Density Ratio after Soaking (%):	99.5
Swell (%):	1.0
Moisture Content of Top 30mm (%):	23.4
Moisture Content of Remaining Depth (%):	21.6
Compactive Effort:	Standard
	AS 1289.5.1.1
Surcharge Mass (kg):	4.50
Period of Soaking (Days):	4
Oversize Material:	Excluded
Oversize Material (%):	22
CBR Moisture Content Method:	AS 1289.2.1.1
Field Moisture Content (%):	12.4
Curing Time (hrs) :	48

Comments

Method of establishing plasticity level: Liquid Limit (AS 1289.3.1.1)

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Material Test Report

Report No: MAT:NEW19W-0646--S14
Issue No: 1

Client: WSP Australia Pty Limited
GPO Box 5394
Sydney NSW 2001

Principal:
Project No.: 13/00087
Project Name: Various Material Testing

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Approved Signatory: Dane Cullen
(Senior Geotechnician)
NATA Accredited Laboratory Number: 18686
Date of Issue: 19/03/2019

Sample Details

Sample ID: NEW19W-0646--S14
Sampling Method: Sample submitted by client
Date Sampled: 26/02/2019
Source: On Site
Material: Sandy Clay
Specification: No Specification
Project Location: Mt Pleasant Coal Mine, NSW
TRN PS112915
Sample Location: TPRL25 - (0.1 - 0.8m)
Rail Loop

Other Test Results

Description	Method	Result	Limits
Sample History	AS 1289.1.1	Air-dried	
Preparation	AS 1289.1.1	Dry Sieved	
Linear Shrinkage (%)	AS 1289.3.4.1	13.0	
Mould Length (mm)		250	
Crumbling		No	
Curling		No	
Cracking		No	
Liquid Limit (%)	AS 1289.3.1.1	66	
Method		Four Point	
Plastic Limit (%)	AS 1289.3.2.1	23	
Plasticity Index (%)	AS 1289.3.3.1	43	
Emerson Class Number	AS 1289.3.8.1	4	
Soil Description		Brown Sandy Clay	
Type of Water		Distilled	
Temperature of Water (°C)		22.0	
Moisture Content (%)	AS 1289.2.1.1	12.4	

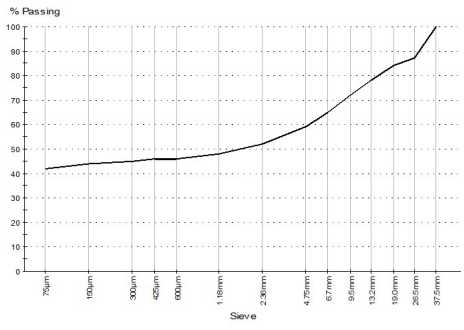
Particle Size Distribution

Method: AS 1289.3.6.1
Drying by: Oven

Note: Sample Washed

Sieve Size	% Passing	Limits
37.5mm	100	
26.5mm	87	
19.0mm	84	
13.2mm	78	
9.5mm	72	
6.7mm	65	
4.75mm	59	
2.36mm	52	
1.18mm	48	
600µm	46	
425µm	46	
300µm	45	
150µm	44	
75µm	42	

Chart



Comments

N/A

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APPENDIX D

LIMITATIONS STATEMENT

Legal

Limitations of Geotechnical Site Investigation

Scope of services

This geotechnical site assessment report (the report) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and WSP (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

Reliance on data

In preparing the report, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, WSP has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WSP will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

Geotechnical investigation

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared to meet the specific needs of individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor or even some other consulting civil engineer. This report was prepared expressly for the client and expressly for purposes indicated by the client or his representative. Use by any other persons for any purpose, or by the client for a different purpose, might result in problems. The client should not use this report for other than its intended purpose without seeking additional geotechnical advice.

This geotechnical report is based on project-specific factors

This geotechnical engineering report is based on a subsurface investigation which was designed for project-specification factors, including the nature of any development, its size and configuration, the location of any development on the site and its orientation, and the location of access roads and parking areas. Unless further geotechnical advice is obtained this geotechnical engineering report cannot be used:

- when the nature of any proposed development is changed
- when the size, configuration location or orientation of any proposed development is modified.

This geotechnical engineering report cannot be applied to an adjacent site.

Limitations of Geotechnical Site Investigation

The limitations of site investigation

In making an assessment of a site from a limited number of boreholes or test pits there is the possibility that variations may occur between test locations. Site exploration identifies specific subsurface conditions only at those points from which samples have been taken. The risk that variations will not be detected can be reduced by increasing the frequency of test locations; however this often does not result in any overall cost savings for the project. The investigation program undertaken is a professional estimate of the scope of investigation required to provide a general profile of the subsurface conditions. The data derived from the site investigation program and subsequent laboratory testing are extrapolated across the site to form an inferred geological model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite investigation the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

The borehole logs are the subjective interpretation of subsurface conditions at a particular location, made by trained personnel. The interpretation may be limited by the method of investigation, and can not always be definitive. For example, inspection of an excavation or test pit allows a greater area of the subsurface profile to be inspected than borehole investigation, however, such methods are limited by depth and site disturbance restrictions. In borehole investigation, the actual interface between materials may be more gradual or abrupt than a report indicates.

Subsurface conditions are time dependent

Subsurface conditions may be modified by changing natural forces or man-made influences. A geotechnical engineering report is based on conditions which existed at the time of subsurface exploration.

Construction operations at or adjacent to the site, and natural events such as floods, or groundwater fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept appraised of any such events, and should be consulted to determine if additional tests are necessary.

Avoid misinterpretation

A geotechnical engineer should be retained to work with other appropriate design professionals explaining relevant geotechnical findings and in reviewing the adequacy of their plans and specifications relative to geotechnical issues.

Bore/profile logs should not be separated from the engineering report

Final bore/profile logs are developed by geotechnical engineers based upon their interpretation of field logs and laboratory evaluation of field samples. Customarily, only the final bore/profile logs are included in geotechnical engineering reports. These logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings. To minimise the likelihood of bore/profile log misinterpretation, contractors should be given access to the complete geotechnical engineering report prepared or authorised for their use. Providing the best available information to contractors helps prevent costly construction problems. For further information on this matter reference should be made to ‘Guidelines for the Provision of Geotechnical Information in Construction Contracts’ published by the Institution of Engineers Australia, National Headquarters, Canberra 1987.

Geotechnical involvement during construction

During construction, excavation is frequently undertaken which exposes the actual subsurface conditions. For this reason geotechnical consultants should be retained through the construction stage, to identify variations if they are exposed and to conduct additional tests which may be required and to deal quickly with geotechnical problems if they arise.

Limitations of Geotechnical Site Investigation

Report for benefit of client

The report has been prepared for the benefit of the client and no other party. WSP assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of WSP or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

Other limitations

WSP will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.

MACH ENERGY

GEOTECHNICAL INVESTIGATION OF OVERTON COLLIERY, MT PLEASANT RAIL LOOP

FACTUAL SUMMARY REPORT

MAY 2019



Question today
Imagine tomorrow
Create for the future

Geotechnical Investigation of Overton Colliery, Mt Pleasant Rail Loop
Factual Summary Report

MACH Energy

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REV	DATE	DETAILS
A	May 2019	Final

	NAME	DATE	SIGNATURE
Prepared by:	Michael Cross	May 2019	
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Approved by:	Jamie Anderson	May 2019	

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APPENDIX C LIMITATIONS OF GEOTECHNICAL INVESTIGATION STATEMENT

1 INTRODUCTION

As requested by MACH Energy, a geotechnical investigation was undertaken to assess the condition and extent of the abandoned Overton Colliery mine workings near the proposed rail loop alignment for the Mt Pleasant Coal Mine. This factual summary report presents the results of the investigation.

Based on historical records from the Overton Colliery obtained by MACH Energy, it was expected that 3 coal seams were present (Top Seam, 2nd Seam, 3rd Seam) and that the workings were in the 2nd and 3rd seam.

Six boreholes were drilled to assess seam depths and presence of abandoned workings. The borehole locations and depths were established and located by MACH Energy.

2 SITE INFORMATION

2.1 SITE DESCRIPTION

The approximate location of the Overton Colliery site underlies the northern slope of a hill with alluvial deposits, east of Overton Road as shown in Figure 2.1. Its location is near the proposed Mt Pleasant Rail Loop.

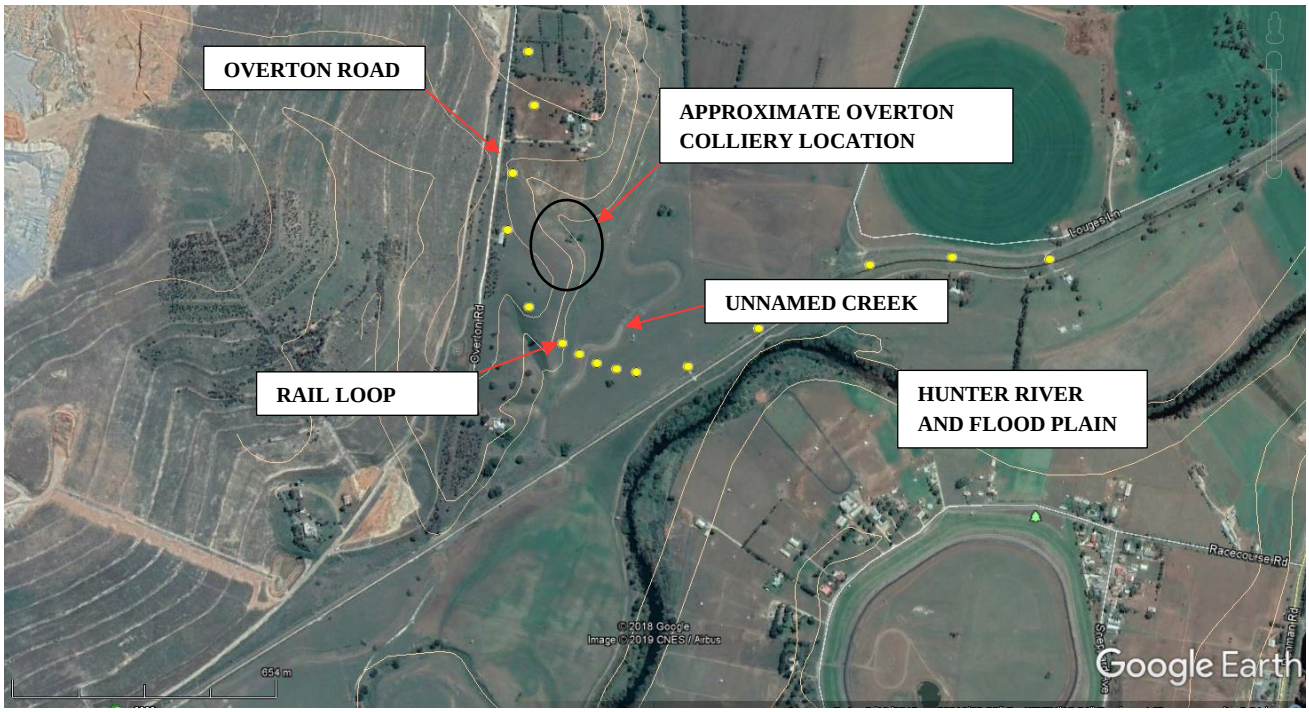


Figure 2.1 Site Location Plan Source; Google Earth and NSW Globe data

2.2 GEOLOGICAL SETTING

As shown in Figure 2.2, an extract from the 1:100,000 Hunter Coalfield Regional Geology Map, the site is located within the following geological units;

- Quaternary alluvium, comprising sand, silt and gravel associated with the Hunter River (Map symbol Qa) at lower elevations in the valley,
- Sandstone, siltstone, shale, conglomerate, and coal of the late Permian age Wittingham Coal Measures (Map symbols Pswc and Pswv, for the Saltwater Creek Formation and Vane subgroup respectively) at higher elevations to the west and underlying the alluvium.
- A number of normal faults and a thrust fault are also shown near the abandoned Overton Colliery. One fault is mapped approximately south of the location of the colliery. This fault may affect seam depths at different borehole locations.
- The dip is generally to the west at a low angle

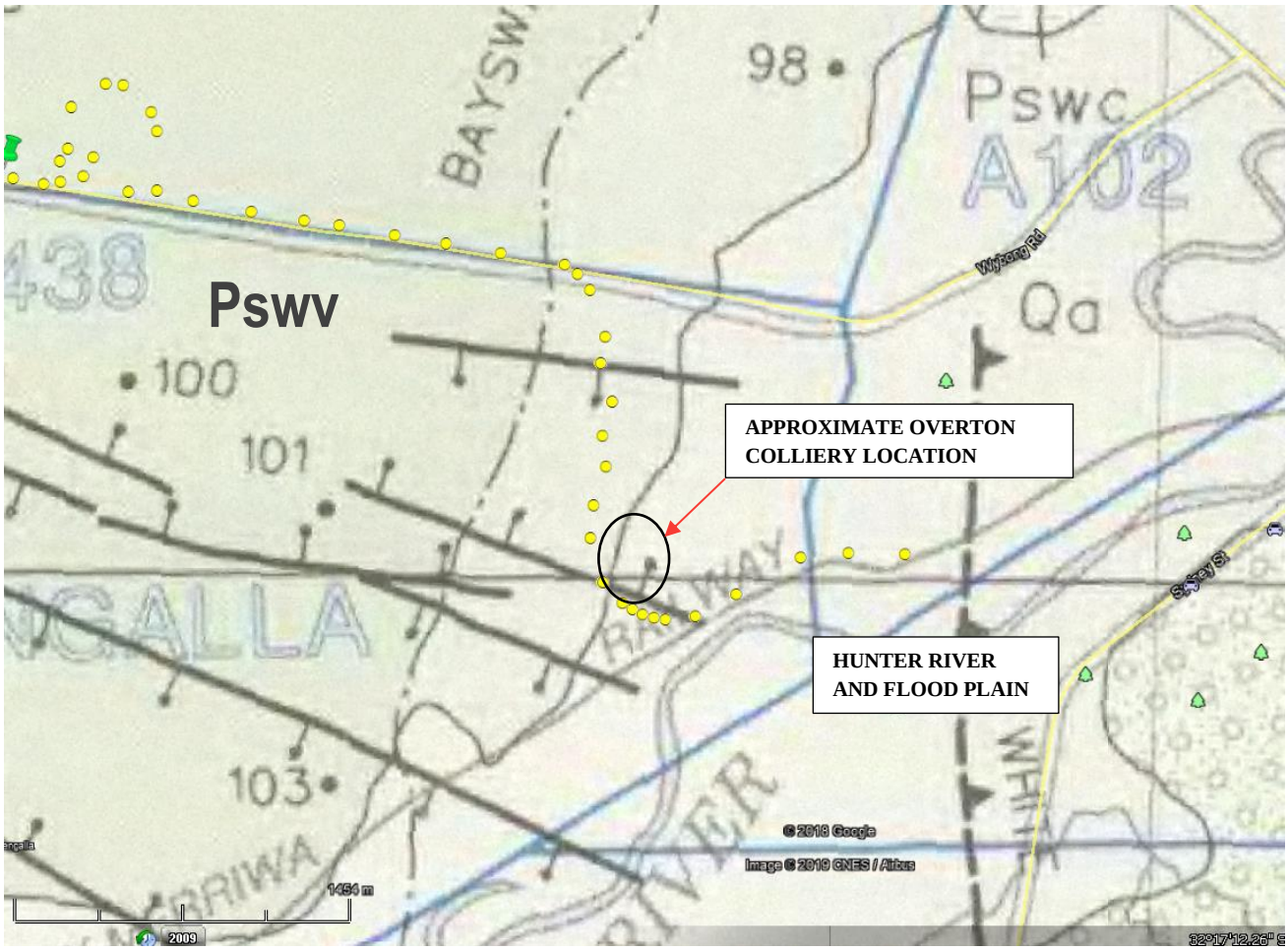
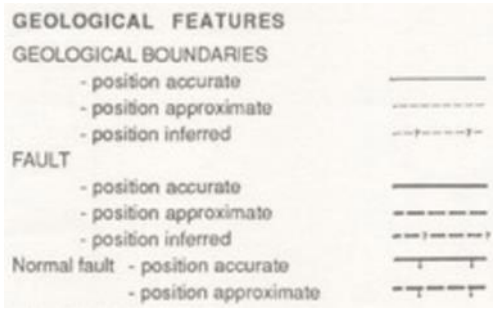


Figure 2.2 Regional geology in the area of Overton Colliery works (see legend below)

Source; 1:100,000 Hunter Coalfield Regional Geology Map, 1993



3 METHOD OF INVESTIGATION

The investigation to locate the mine workings comprised drilling 6 boreholes at the locations shown on Drawing 1 in Appendix A. The borehole locations and depths were nominated by Mach Energy based on historical survey and news records.

Borehole drilling started at BHCW03 at the toe of the slope to the north-west of the Overton Colliery entry as shown on Drawing 1 in Appendix A and progressed to other locations. Further boreholes were added by Mach Energy after the depth of the top, 2nd and 3rd seam from the previous boreholes were located.

Drilling was performed with a GD03 Scout. Soil sampling was not carried out. HQ coring was undertaken in some boreholes and rock chipping was used in others to sample the rock as indicated in Table 3.1. The rock chipping was performed initially with a blade bit, followed by a rock roller, and a PCD bit with depth. Water was used a flushing medium, with drilling additive added in BHCW01.

The fieldwork was carried out under the full-time supervision of an engineering geologist from WSP, who was responsible for recording subsurface conditions encountered, preparing engineering logs, and nominating sampling and testing locations. Gas monitoring for Hydrogen sulphide, Lower Explosive Level (LEL), Carbon Monoxide, and Oxygen was performed at the top of the borehole during the drilling using an multi gas detector meter.

Logging was undertaken in general accordance with AS1726-2017 – Geotechnical Site Investigations. The information is summarised in Table 3.1. Borehole engineering logs are included in Appendix B together with explanatory notes that describe the terms and symbols used. The rock core was boxed, photographed, point load index tested and stored on the MACH Energy site.

The soil zone in borehole BHCW06 was cased with PVC to the top of rock for future use by others. The other boreholes had plugs installed near the top of rock and the overlying portion backfilled with soil.

Table 3.1 Summary of Borehole details

INFORMATION	BHCW01	BHCW02	BHCW03	BHCW04	BHCW05	BHCW06
Total depth (m)	47.00	46.40	27.18	28.50	16.70	26.30
Drilling Method	HQ Coring	HQ Coring	HQ Coring	HQ Coring	Rock Chip	Rock Chip

4 RESULTS OF INVESTIGATION

4.1 SUBSURFACE CONDITIONS

The subsurface conditions varied with respect to the borehole location.

At the top of the slope, the boreholes encountered 0.2 m of topsoil underlain by approximately 11 m of alluvial clayey gravels. A void, which is not considered to be related to mining, was encountered from 8.3 m to 9.9 m in BHCO01. The void was underlain by residual sandy clay between 0.2 to 0.7 m thick, which was overlying rock comprising interbedded siltstone and sandstone, and the three targeted coal seams at varying depths.

At the toe of the slope, the boreholes encountered topsoil between 0.1 and 0.2 m thick, underlain by approximately 5.0 to 7.0 m of residual sandy clay, overlying rock comprising interbedded siltstone and sandstone and the three coal seams at varying depths.

Voids, as indicated by tools drops, were encountered at 3 borehole locations as summarised in Table 4.1 and shown on the logs. Drilling water loss was also observed at these locations.

Gas monitoring carried out during drilling detected carbon monoxide in multiple boreholes in concentrations up to 332 ppm.

Table 4.1 Summary of voids encountered by Boreholes

BOREHOLE	VOID DEPTHS (m)	
BHCW03	-	24.70-27.10
BHCW04	-	26.15-28.50
BHCW06	13.20-15.50	25.50-26.30

4.2 GROUNDWATER

Groundwater was not encountered in the soil zone. Water loss during drilling occurred when the boreholes encountered mine workings and in BHCW01 after encountering a void in the soil zone and in the underlying rock. Casing was advanced when this occurred to allow drilling to continue.

It is noted that drilling fluids were used for coring and may influence groundwater water level readings.

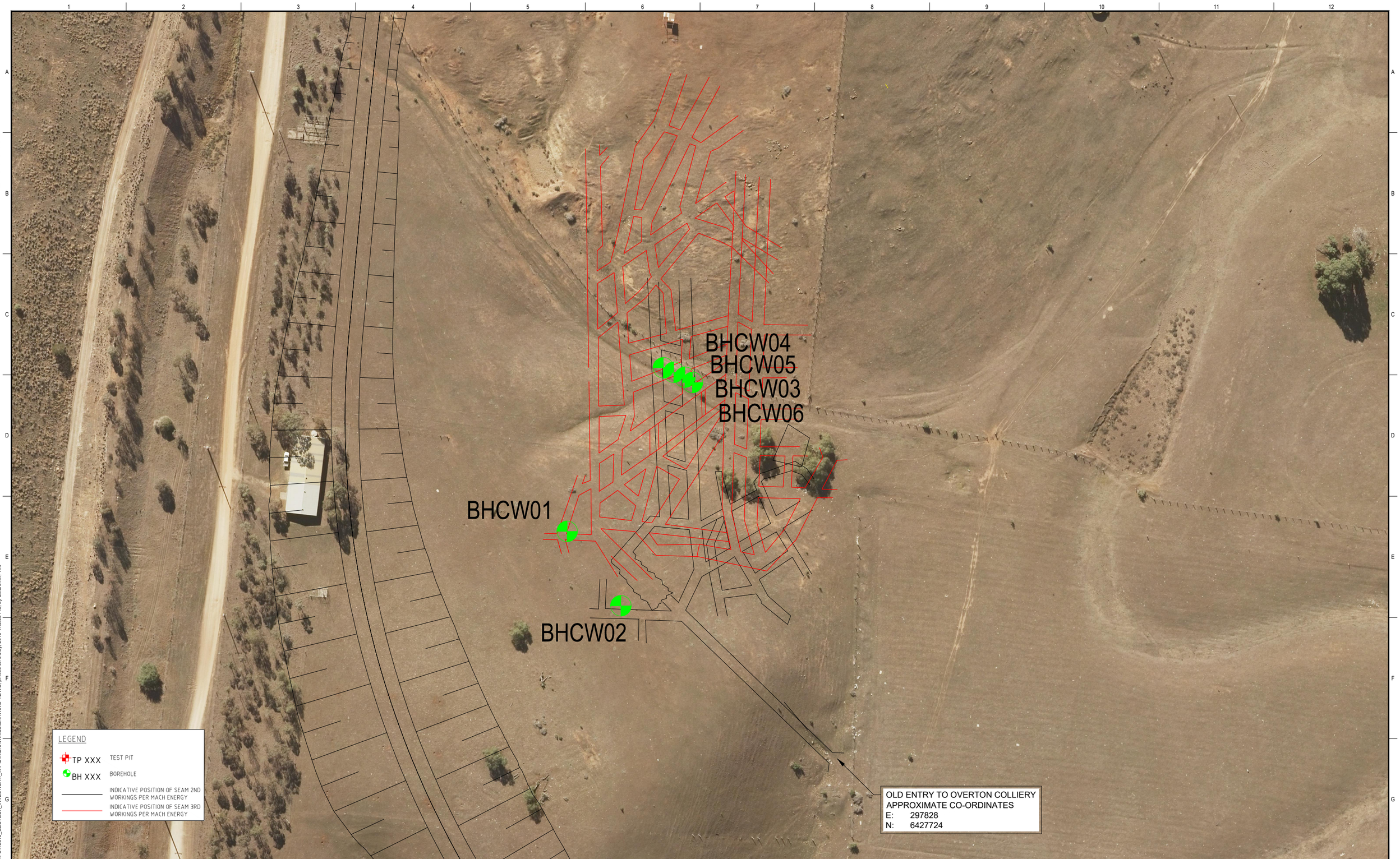
5 LIMITATIONS

This report should be read in conjunction with the 'Limitations of Geotechnical Site Investigation' contained in Appendix C, which provides important information regarding geotechnical investigations and assessments.

If during site works, the subsurface, including groundwater, conditions are found to be significantly different from those anticipated based on this investigation, then we recommend that you immediately contact this office.

APPENDIX A

SITE LOCATION PLANS



DRAWING-1

File name:\\CORP.PBWAN.NET\NZ\PROJECTS\PS112915_GEOTECH_INVESTIGA4_WIP\BIM\DRAWINGS\DRAWING-1.DWG, printed on 3 May, 2019 4:45:38 PM, by Chiarentin, Tim

REV	DATE	BY	DESCRIPTION	CHK	APPD
A	02.05.19	T.C		D.K	J.A

REFERENCE COORDINATION DRAWINGS

DESCRIPTION	DRAWING NO.	REV	CHK

SURVEY DATUM

HORIZONTAL DATUM: VERTICAL DATUM:

SCALES

0 5 10 20

Full Size 1:750 (A1)
SCALE (m)

A1 ORIGINAL
DO NOT SCALE THIS DRAWING

APPROVED

SIGNED:

DATE: RPEQ:

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CLIENT: MACHEnergy

PROJECT: GEOTECHNICAL INVESTIGATION OF OVERTON COLLIERY - MT PLEASANT RAIL LOOP

TITLE: BOREHOLE AND TEST PITS FOR OVERTON COLLIERY

DRAWING STATUS:

DESIGNED:	CHECKED:	APPROVED:
M.CROSS	D.KNOTT	J.ANDERSON
PROJECT No:	DRAWN:	DATE:
MP002	T.CHIARENTIN	02.05.19

DRAWING No: DRAWING - 1 REV: A

APPENDIX B

ENGINEERING LOGS, CORE PHOTOS AND POINT LOAD RESULTS

Explanatory Notes – Soil Description

In engineering terms, soil includes every type of uncemented or partially cemented inorganic material found in the ground. In practice, if the material can be remoulded by hand in its field condition or in water, it is described as a soil. The dominant soil constituent is given in CAPITAL LETTERS, with secondary textures in lower case. The dominant feature is assessed from the Unified Soil Classification System (USCS) and a soil symbol is used to define a soil layer as follows:

SUPPORT

C Casing
M Drill mud
Nil No support

FIELD TEST

DM Dilatometer test
HB Hammer bounce
OT Other test (eg. plate load test)
PE Permeability test
PM Pressuremeter test
PP Pocket penetrometer
SPT Standard penetration test
DCP Dynamic cone penetrometer test
SV Shear vane test

SAMPLE

B Bulk disturbed sample
D Disturbed sample
PT Push tube
SPT SPT sample
U50 Undisturbed sample in 50 mm diameter tube
U75 Undisturbed sample in 75 mm diameter tube

UNIFIED SOIL CLASSIFICATION

The appropriate symbols are selected on the result of visual examination, field tests and available laboratory tests, such as: sieve analysis, liquid limit and plasticity index.

USC Symbol	Description
GW	Well graded gravel
GP	Poorly graded gravel
GM	Silty gravel
GC	Clayey gravel
SW	Well graded sand
SP	Poorly graded sand
SM	Silty sand
SC	Clayey sand
ML	Silt of low plasticity
CL	Clay of low plasticity
OL	Organic soil of low plasticity
CI	Clay of medium or intermediate plasticity
MH	Silt of high plasticity
CH	Clay of high plasticity
OH	Organic soil of high plasticity
Pt	Peaty Soil

MOISTURE CONDITION

Dry - Cohesive soils are friable or powdery
Cohesionless soil grains are free-running

Moist - Soil feels cool, darkened in colour
Cohesive soils can be moulded
Cohesionless soil grains tend to adhere

Wet - Cohesive soils usually weakened
Free water forms on hands when handling

For cohesive soils, the following codes may also be used:

>PL Moisture content greater than the Plastic Limit.
~PL Moisture content near the Plastic Limit.
<PL Moisture content less than the Plastic Limit.

WATER SYMBOLS AND DEFINITIONS

Partial water loss Water inflow

Complete water loss

Water level at date shown

COHESIVE SOILS - CONSISTENCY

The consistency of a cohesive soil is defined by descriptive terminology such as very soft, soft, firm, stiff, very stiff and hard. These terms are assessed by the shear strength of the soil as observed visually, by the pocket penetrometer values and by resistance to deformation to hand moulding.

A Pocket Penetrometer may be used in the field or the laboratory to provide approximate assessment of unconfined compressive strength of cohesive soils. The values are recorded in kPa, as follows:

Strength	Symbol	Pocket Penetrometer Reading (kPa)
Very Soft	VS	< 25
Soft	S	25 to 50
Firm	F	50 to 100
Stiff	St	100 to 200
Very Stiff	VSt	200 to 400
Hard	H	> 400

COHESIONLESS SOILS - RELATIVE DENSITY

Relative density terms such as very loose, loose, medium dense, dense and very dense are used to describe silty and sandy material, and these are usually based on resistance to drilling penetration or the Standard Penetration Test (SPT) 'N' values. Other condition terms, such as friable, powdery or crumbly may also be used.

The Standard Penetration Test (SPT) is carried out in accordance with AS 1289 Clause 6.3.1. For completed tests the number of blows required to drive the split spoon sampler 300 mm is recorded as the N value. For incomplete tests the number of blows and the penetration beyond the seating depth of 150 mm are recorded. If the 150 mm seating penetration is not achieved the number of blows to achieve the measured penetration is recorded. SPT correlations may be subject to corrections for overburden pressure and equipment type.

Term	Symbol	Density Index	N Value (blows /0.3 m)	DCP (blows /0.1m
Very Loose	VL	0 to 15	0 to 4	0 to 1
Loose	L	15 to 35	4 to 10	1 to 2
Medium Dense	MD	35 to 65	10 to 30	2 to 5
Dense	D	65 to 85	30 to 50	5 to 10
Very Dense	VD	>85	>50	>10

COHESIONLESS SOILS - PARTICLE SIZE TERMS

Name	Subdivision	Size
Boulders		>200mm
Cobbles		63mm to 200mm
Gravel	coarse	20mm to 63mm
	medium	6mm to 20mm
	fine	2.36mm to 6mm
Sand	coarse	0.6mm to 2.36mm
	medium	0.2mm to 0.6mm
	fine	0.075mm to 0.2mm

NFGWO No Free Groundwater Observed

The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.

NFGWE No Free Groundwater Encountered

The borehole/test pit was dry soon after excavation. Inflow may have been observed had the borehole/test pit been left open for a longer period.

Explanatory Notes – Rock Description

The rock is described with strength and weathering symbols as shown below. Other features such as bedding and dip angle are given.

DRILLING/EXCAVATION METHODS

Symbol	Term
AS	Auger Screwing
EX	Excavation
HA	Hand Auger
NMLC/HMLC	Diamond Core –triple tube
NQ/HQ/PQ	Diamond Core – wireline
PC	Percussion
PCB	Poly Carbonised Diamond Bit
PT	Push Tube
RAB	Rotary Air Blast
RC	Reverse Circulation
S	Sonic drill
VB	Vibrocoring
WB	Washbore with blade
WR	Washbore with roller (tricone)

ROCK MATERIAL WEATHERING

Rock weathering is described mainly using the following abbreviations and definitions used in AS1726.

Term	Symbol	Definition
Residual soil	RS	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely weathered	XW	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
Highly weathered	HW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Distinctly weathered*	DW	Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately weathered	MW	The whole of the rock is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly weathered	SW	Rock is partially discoloured with staining or bleaching along joints, but shows little or no change of strength from fresh rock.
Fresh	FR	Rock shows no sign of decomposition of individual minerals or colour changes.

* If differentiation between highly and moderately weathered rock cannot be determined, then distinctly weathered is used which complies to terms described in Australian Standard AS1726-2017.

ROCK QUALITY

The fracture spacing is shown where applicable and the Rock Quality Designation (RQD) where:

$$\text{RQD (\%)} = \frac{\text{Sum of Axial lengths of core > 100mm long}}{\text{length of core run}}$$

ROCK STRENGTH

Rock strength is described using AS1726-2017 "Geotechnical Site Investigations" & ISRM - Commission on Standardisation of Laboratory & Field Tests, "Suggested method of determining the Uniaxial Compressive Strength of Rock materials & the Point Load Index", as follows:

Term	Symbol	Point Load Index $Is_{(50)}$ (MPa)
Very Low	VL	0.03 to 0.1
Low	L	0.1 to 0.3
Medium	M	0.3 to 1
High	H	1 to 3
Very High	VH	3 to 10
Extremely High	EH	>10

● Diametral Point Load Index test

■ Axial Point Load Index test

DEFECT SPACING/BEDDING THICKNESS

Measured at right angles to defects of same set or bedding.

The method of measurement shall be reported.

Term	Defect Spacing	Bedding
Extremely closely spaced	<6 mm 6 to 20 mm	Thinly Laminated Laminated
Very closely spaced	20 to 60 mm	Very Thin
Closely spaced	0.06 to 0.2 m	Thin
Moderately widely spaced	0.2 to 0.6 m	Medium
Widely spaced	0.6 to 2 m	Thick
Very widely spaced	>2 m	Very Thick

DEFECT DESCRIPTION

Symbol	Term	Symbol	Term
Bg	Bedding	DB	Drill Break
Pt	Parting	Se	Seam
Cn	Contact	SS	Sheared Surface
Bd	Boundary	SZ	Sheared Zone
Jt	Joint	CZ	Crushed Zone
Fo	Foliation	F	Fault
C	Cleavage	Vn	Vein

PLANARITY/ROUGHNESS

Planarity	Description	Planarity	Description
Pl	Planar	Cu	Curved
Un	Undulating	Vu	Vuggy
Ir	Irregular	Wv	Wavy
St	Stepped		
Roughness	**Description**	**Roughness**	**Description**
Sm	Smooth	Po	Polished
Ro	Rough	Sl	Slickensided

The inclination if defects are measured from the perpendicular to the core axis.

COATING OR INFILLING

Abbreviation	Description	Abbreviation	Description
Cln	Clean	Co	Coal
Cg	Coating	Cr	Crushed rock
In	infill	Fe	Limonite/ironstone
Sn	Stain	Fl	Feldspar
Vr	Veneer	Gp	Gypsum
Ca	Calcite	Mn	Manganese
Ch	Chlorite	Py	Pyrite
Cl	Clay	Qz	Quartz

Graphic Symbols – Soils and Rocks

Typical symbols for soils and rocks are as follows. Combinations of these symbols may be used to indicate mixed materials such as clayey sand.

SOIL SYMBOLS

Main components


CLAY


SILT


SAND


GRAVEL


BOULDERS / COBBLES


TOPSOIL


PEAT

Minor components


CLAYEY


SILTY


SANDY


GRAVELLY

OTHER MATERIAL SYMBOLS


FILL


BITUMEN


CONCRETE

ROCK SYMBOLS

Sedimentary Rocks


SANDSTONE


SILTSTONE


CLAYSTONE, MUDSTONE


SHALE


COAL


LIMESTONE


CONGLOMERATE

Igneous rocks


GRANITE


BASALT


UNDIFERENTIATED IGNEOUS

Metamorphic rocks


SLATE, PHYLLITE, SCHIST


GNEISS


QUARTZITE

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW01

SHEET : 1 OF 11

Client:	**MACH Energy**	Date Commenced:	**7/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**9/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**162.728 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297725.683 N 6427413.423 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	C	NFGWE	162.5	0.20					TOPSOIL; Silty CLAY; low plasticity, brown, with fine to coarse grained, subrounded to subangular gravel and roots.				TOPSOIL
				0.5				CI / GM	Silty gravelly CLAY; medium plasticity, brown, fine to coarse grained, subrounded to subangular gravel, trace cobbles.	MC<PL			ALLUVIUM
			162.0	1.0									
			161.5	1.5									
			161.0	2.0									
				2.00				GC	Clayey GRAVEL; fine to coarse grained, subrounded to subangular, medium plasticity, brown clay, with cobbles.	D			
			160.5	2.5									
WR			160.0	2.90				SW / SP	Gravelly SAND; fine to coarse grained, orange-brown-black, fine to coarse grained, subrounded to subangular gravel.	W			
				3.0									
			159.5	3.5									
			159.0	4.00									
				4.0				GC	Sandy clayey GRAVEL; fine to coarse grained, subrounded to subangular, fine to coarse grained sand, high plasticity, grey-brown clay.				
			158.5	4.5									
			158.0										

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW01

Client:	**MACH Energy**	Date Commenced:	**7/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**9/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**162.728 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297725.683 N 6427413.423 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WR		NFGWE	157.5	5.5				GC	Sandy clayey GRAVEL; fine to coarse grained, subrounded to subangular, fine to coarse grained sand, high plasticity, grey-brown clay.	W			ALLUVIUM
			157.0										
			156.72	6.0				GC	Clayey sandy GRAVEL; fine to coarse grained, subrounded to subangular, high plasticity, grey-brown-pale brown clay, fine to coarse grained sand, trace cobbles.				
			156.5	6.5									
			156.0	7.0									
			155.5	7.5									
			155.0	8.0									
			154.5										
			154.43	8.30					VOID; TOOL DROP				
			154.0	8.5									
			153.5	9.0									
			153.0	9.5									
			152.83	9.90				GC		W			

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW01

SHEET : 3 OF 11

Client:	**MACH Energy**	Date Commenced:	**7/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**9/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**162.728 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297725.683 N 6427413.423 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WR WR	C	NFGWE	152.5 10.5 152.0 11.0				GC	Sandy clayey GRAVEL; fine to coarse grained, subrounded to subangular, fine to coarse grained sand, high plasticity grey-brown clay.	W			
			11.10 151.5				CH	Sandy CLAY; high plasticity, yellow-brown, fine to coarse grained sand.	MC>PL			RESIDUAL
			11.30 11 11.5					SANDSTONE; fine grained, yellow-brown, very low strength, highly weathered.				WEATHERED ROCK
								CONGLOMERATE; fine to coarse grained, subrounded to subangular, grey silty-sand matrix, very low strength, extremely weathered.				
			11.70 151.0					SANDSTONE; fine grained, yellow-brown, low strength, highly weathered.				11.70m: Start Rock Chipping
			12.0 150.5 12 12.5					SILTSTONE; pale yellow-brown, very low strength, highly weathered.				
			12.70 150.0					SANDSTONE; fine grained, yellow-brown, low strength, highly weathered, interbedded with siltstone.				
			13.0 149.5 13.5 149.0 14 14.0					SILTSTONE; grey-brown, low strength, highly weathered.				
BB	C		148.5 14.5 148.0									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW01

SHEET : 4 OF 11

Client:	**MACH Energy**	Date Commenced:	**7/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**9/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**162.728 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297725.683 N 6427413.423 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
BB	C	NFGWE	147.5	15.5					SILTSTONE; grey-brown, low strength, highly weathered.				
			147.0	16.0					SILTSTONE; grey-brown, low strength, moderately weathered, interbedded with fine grained sandstone.				
			146.5	16.5									
			146.0	17.0									
PCD			145.5	17.5									
PCD	C		145.0	18.0									
			144.5	18.5									
			144.0	19.0					19.00m: As above, with carbonaceous laminations.				
			143.5	19.5									
			143.0										

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW01

SHEET : 5 OF 11

Client:	**MACH Energy**	Date Commenced:	**7/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**9/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**162.728 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297725.683 N 6427413.423 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
PCD	C	NFGWE	142.5 / 20.5					SILTSTONE; grey-brown, low strength, moderately weathered, interbedded with fine grained sandstone.				
			142.0 / 21.0									
			141.5 / 21.5									
			141.0 / 22.0									
			140.5 / 22.5					REFER TO CORED BOREHOLE LOG				
			140.0 / 23.0									
			139.5 / 23.5									
			139.0 / 24.0									
			138.5 / 24.5									
			138.0									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW01

SHEET : 6 OF 11

Client:	**MACH Energy**	Date Commenced:	**7/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**9/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**162.728 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297725.683 N 6427413.423 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
					142.5							
						20.5						
					142.0							
						21.0						
					141.5							
						21.5						
					141.0							
						22.0		START CORING AT 22.00m				
HQ					140.5	22.0		SANDSTONE; fine grained, grey.	SW			22.11m: 2 x DB
						22.30		SILTSTONE; grey.	MW			
						22.5						
						22.56		CLAY; high plasticity, grey.	MW			22.56m: Clay Band
			100	56	140.0	22.59		SANDSTONE; fine grained, grey, interbedded with siltstone and carbonaceous lamintations.	HW SW			22.65m: 3 x DB 22.97m: Bg, 20°, Ir, Sm, Carbonaceous Sn 23.07m: Bg, 10°, Ir, Ro, Carbonaceous Sn 23.12m: Clay Band 23.13m: Broken Core (DB) 23.15m: Clay Band
					139.5	23.0						
						23.5						23.21m: 8 x DB
						23.67		COAL; black, dull.				23.65m: Bg, 5°, Pl, Ro, Carbonaceous Sn 23.67m: Broken Core (DB)
					139.0	23.73		SILTSTONE; grey, interbedded with fine grained sandstone.				23.81m: Bg, 10°, Ir, Ro 23.85m: 2 x DB
			90	45		24.0						
					138.5	24.20		SANDSTONE; fine grained, grey-brown, interbedded with siltstone.				24.34m: Broken Core (DB)
						24.38		CORE LOSS 0.30m (24.38-24.68) CORE LOSS				
						24.5						
					138.0	24.68		SANDSTONE; fine grained, grey-brown, interbedded with siltstone and carbonaceous laminations.	MW			24.73m: Jt, 70°, Ir, Ro 24.81m: 2 x DB 24.97m: Bg, 5°, Pl, Sm

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW01

SHEET : 7 OF 11

Client:	**MACH Energy**	Date Commenced:	**7/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**9/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**162.728 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297725.683 N 6427413.423 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ			90	45	25.10				MW			25.02m: Jt, 70°, Pl, Sm, 3 x DB 25.02m: 3 x DB
					137.5			SILTSTONE; dark grey-brown.				25.2m: Jt, 70°, Pl, Sm
					25.39							25.39m: Clay Band
					25.44			CLAY; high plasticity, dark grey-brown.				25.47m: DB
					25.5			SILTSTONE; dark grey-brown.	MW			25.47m: Jt, 75°, Pl, Sm
					25.54							25.54m: Clay Band
					25.58			CLAY; high plasticity, dark grey-brown.	MW			25.65m: DB
					137.0			SILTSTONE; dark grey-brown.				25.65m: Jt, 80°, Pl, Sm
					25.75							25.7m: Clay Band
								SILTSTONE; grey-brown mottled dark grey, interbedded with fine grained sandstone and carbonaceous laminations.	HW			25.74m: Clay Band 25.85m: Clay Band 25.88m: Clay Band 25.88m: Jt, 70°, Wv, Sm
					26.0							26.02m: Jt, 90°, Pl, Sm 26.03m: Jt, 30°, Pl, Sm 26.04m: Jt, 20°, Pl, Sm
					26.17							26.09m: DB
					136.5	26.21		CLAY; high plasticity, grey-brown.				26.17m: Clay Band
								SILTSTONE; grey-brown mottled dark grey, interbedded with fine grained sandstone and carbonaceous laminations.	HW - MW			26.25m: 2 x DB 26.36m: Decomposed Rock
HQ	C				26	26.5		CORE LOSS 0.13m (26.51-26.64) CORE LOSS				
			78	70	26.64							
					136.0	26.71		SILTSTONE; grey-brown mottled dark grey, interbedded with fine grained sandstone and carbonaceous laminations.	HW - MW			26.7m: Decomposed Rock
								SILTSTONE; dark grey-brown, with carbonaceous laminations.				26.94m: DB
					27.0							
			100	77	135.5							27.1m: 5 x DB
					27.5							
					135.0							27.66m: Bg, 10°, Cu, Sm 27.74m: DB 27.78m: Bg, 10°, Pl, Ro, Carbonaceous Sn
					27.80			COAL; black, bright.				27.81m: Broken Core (DB)
					27.95							
			100	0	28.0			SILTSTONE; pale-brown.	XW			
					28.05			COAL; black, bright.	MW			28.05m: Bg, 5°, Pl, Ro 28.08m: Bg, 5°, Pl, Ro 28.05m: Jt, 85°, Pl, Ro 28.13m: Bg, 5°, Pl, Ro 28.16m: 2 x DB 28.25m: Bg, 5°, Ir, Ro 28.27m: Bg, 5°, Ir, Ro
					134.5							
					28.38			CLAY; high plasticity, pale-brown.				28.31m: DB
			100	33	28.5							28.35m: Bg, 5°, Pl, Ro
					28.55			COAL; black.	XW			28.38m: Clay Band 28.52m: Broken Core (DB)
					28.58			CLAY; high plasticity, pale-brown.				28.55m: Clay Band
					28.68							28.58m: Broken Core (DB)
					134.0			COAL; black, laminations of high plasticity, black clay.	HW - XW			28.68m: Bg, 5°, Pl, Ro 28.7m: 2 x DB
								SILTSTONE; grey-brown.				28.81m: Decomposed Rock
					29.0							28.9m: Decomposed Rock
			100	46								
					133.5	29.24		SILTSTONE; grey, interbedded with fine grained sandstone.	MW - SW			
					29.5							29.06m: 4 x DB
			100	88	133.0							29.89m: Bg, 5°, Cu, Sm 29.97m: DB

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW01

Client:	**MACH Energy**	Date Commenced:	**7/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**9/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**162.728 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297725.683 N 6427413.423 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
					132.5	30.17		SILTSTONE; grey, interbedded with fine grained sandstone.	MW - SW			30.12m: Se
								SANDSTONE; fine grained, grey, interbedded with siltstone and carbonaceous laminations.	SW			30.32m: DB
					132.0	30.5						30.71m: DB
					131.5	31.0						30.93m: Bg, 10°, Pl, Sm 31.03m: DB 31.12m: Se
			100	88	131.0	31.5						31.32m: DB
					130.5	32.0						31.64m: Bg, 5 - 10°, Wv, Sm
						32.32		SILTSTONE; grey, interbedded with fine grained sandstone and carbonaceous laminations.				31.98m: DB 32.2m: DB 32.28m: Bg, 10°, Cu, Sm, Carbonaceous Sn
					130.0	32.5						32.5m: 3 x DB
						32.73		SANDSTONE; fine grained, grey.				32.73m: Jt, 85°, Pl, Ro 32.94m: Bg, 10°, Pl, Sm 32.94m: Jt, 50°, Pl, Ro
					129.5	33.0						
			94	46		33.30		SANDSTONE; fine grained, grey, interbedded with siltstone and carbonaceous laminations.				33.08m: 4 x DB
					129.0	33.5						
						33.57		SILTSTONE; dark grey.	MW			33.67m: Bg, 5°, Pl, Sm 33.74m: Bg, 5°, Cu, Sm
						33.93		COAL; black, dull.	MW - HW			33.84m: Se 33.93m: Broken Core (DB) 34.18m: Clay Band
					128.5	34.0						
						34.28		CORE LOSS 0.11m (34.28-34.39) CORE LOSS				
						34.39		COAL; black, dull.	MW - HW			34.39m: Broken Core (DB)
			80	0	128.0	34.5						34.58m: Bg, 10°, Pl, Sm 34.63m: DB 34.64m: Jt, 50°, Ir, Sm 34.69m: Jt, 60°, Pl, Sm 34.71m: Broken Core (DB)
						34.79		CORE LOSS 0.10m (34.79-34.89) CORE LOSS				
			100	62		34.89		COAL; black, dull to bright.				

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW01

SHEET : 9 OF 11

Client:	**MACH Energy**	Date Commenced:	**7/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**9/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**162.728 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297725.683 N 6427413.423 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
			100	62	127.5	35.09		COAL; black, dull to bright.	MW - HW			34.89m: Broken Core (DB)
								SILTSTONE; grey				35.06m: Clay Band
					127.0	35.5			SW			
						35.70		SANDSTONE; fine grained, grey-brown, with carbonaceous laminations.				35.11m: 6 x DB
			100	96	126.5	36.0						
					126.0	36.5						
					125.5	37.0						
					125.0	37.5						37.15m: 5 x DB
						37.71		SANDSTONE; fine to medium grained, grey-brown.				
					124.5	38.0						
					124.0	38.5						38.03m: 6 x DB
			100	85	123.5	39.0						
						39.31		SANDSTONE; fine grained, grey with carbonaceous laminations.				
					123.0	39.5						
						39.67		SANDSTONE; fine grained, grey.				39.76m: DB
												39.88m: DB
												39.68m: Jt, 70 - 90°, Wv, Ro

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW01

SHEET : 10 OF 11

Client:	**MACH Energy**	Date Commenced:	**7/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**9/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**162.728 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297725.683 N 6427413.423 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
			100	85	122.5	40.5		SANDSTONE; fine grained, grey.	SW			40.09m: 7 x DB
					122.0	40.78		SANDSTONE; fine grained, grey, interbedded with siltstone and carbonaceous laminations.				
					121.5	41.0						41.33m: Bg, 10°, Pl, Ro
					121.0	41.5						41.43m: DB 41.45m: DB 41.5m: DB
					120.5	42.0						41.82m: DB
			100	100	120.0	42.57		SANDSTONE; fine grained, grey.				42.93m: Bg, 5°, Pl, Sm
					119.5	43.0		SILTSTONE; grey, interbedded with fine grained sandstone.				43.45m: DB
					119.0	43.5						43.85m: Bg, 5°, Pl, Sm
					118.5	44.0						43.98m: DB 44.11m: Bg, 5°, Pl, Sm
					118.0	44.5						44.4m: Bg, 5°, Pl, Sm
			100	100		44.74		SILTSTONE; grey-dark grey.	SW - MW			44.51m: 3 x DB 44.88m: Bg, 5°, Pl, Sm

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW01

SHEET : 11 OF 11

Client:	**MACH Energy**	Date Commenced:	**7/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**9/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**162.728 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297725.683 N 6427413.423 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
			100	100	117.5	5.21		SILTSTONE; grey-dark grey.	MW			45.04m: DB
									HW			45.12m: Bg, 5°, Pl, Sm
								COAL; black, bright to dull.	HW			45.23m: Se
			100	0	45.5							45.25m: Jt, 85°, Pl, Sm
					117.0							45.25m: Broken Core (DB)
			44	0		45.91						
					46.0			CORE LOSS 0.22m (45.91-46.13) CORE LOSS				
			85	0		46.13		COAL; black, dull.	HW - MW			46.13m: Jt, 85°, Pl, Sm
					116.5							46.17m: 4 x DB
						46.30		SILTSTONE; pale brown.	XW			
						46.40		COAL; black, dull.	HW			
					46.5							46.4m: Broken Core (DB)
						46.60						46.61m: DB
						46.65		SILTSTONE; pale brown.				46.61m: Clay Band
			100	38	116.0			COAL; black, dull to bright.				46.65m: DB
												46.71m: Broken Core (DB)
						46.85		SANDSTONE; fine grained, dark grey-brown, interbedded with siltstone, carbonaceous.	MW			
					47.0							46.97m: Jt, 30°, Pl, Sm
								END OF BOREHOLE AT 47.00 m Target depth				
					115.5							
					115.0							
					114.5							
					114.0							
					113.5							
					113.0							

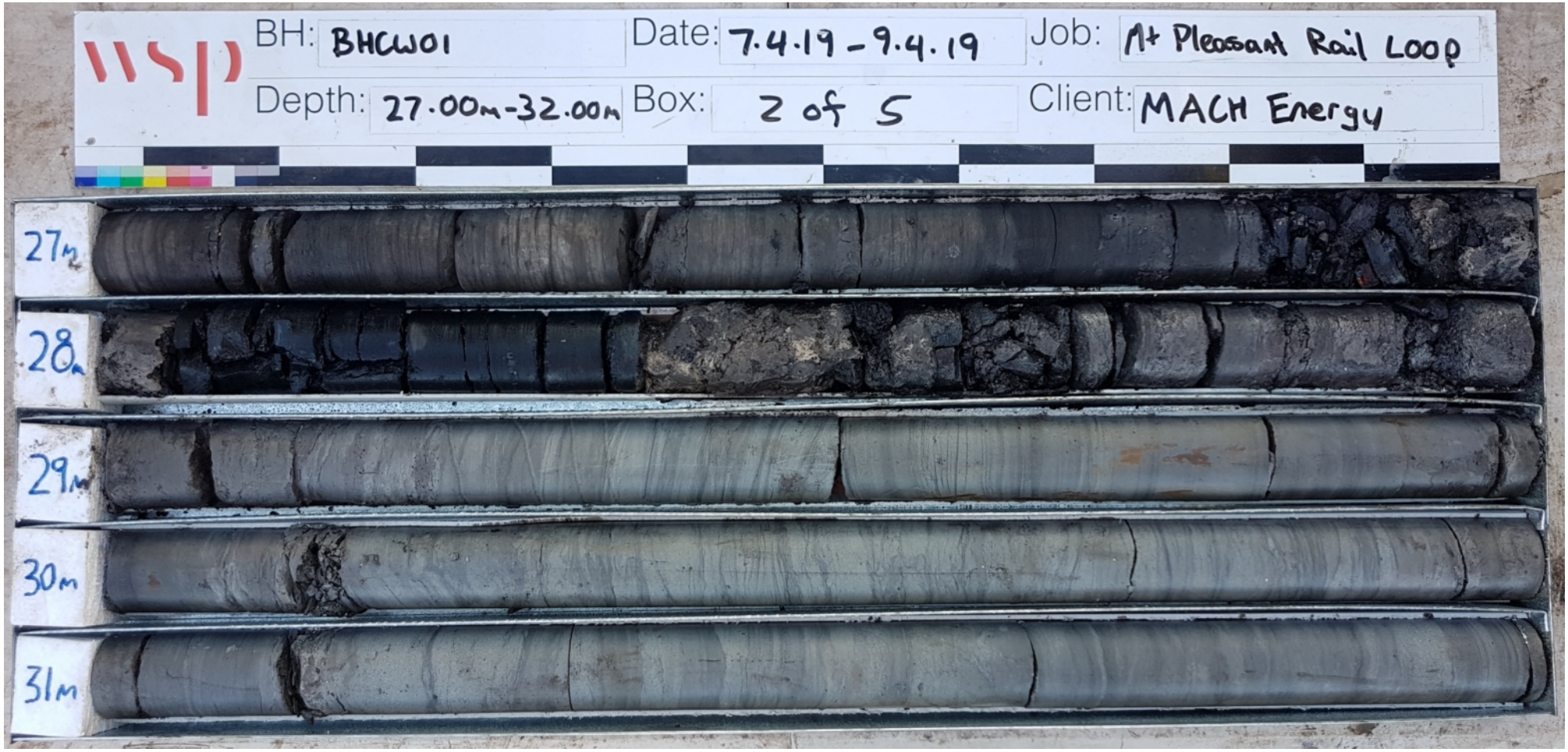
This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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PointID : BHCW01 Depth Range: 22.00 - 27.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW01	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 1/5



PointID : BHCW01 Depth Range: 27.00 - 32.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW01	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 2/5

WSP_LIB_7.5.GLB GrfcTbl DG PHOTO CORE PHOTO 1 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 15/Apr/2019 17:32 8.30.002 Datgel CPT Tool gINT Add-In



PointID : BHCW01 Depth Range: 32.00 - 37.00 m

TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW01	DRAWN: MC	DATE: 15/04/2019	
	CHECKED: AH	DATE: 15/04/2019	
	SCALE: Not To Scale		A4
	PROJECT No: PS112915	FIGURE No: 3/5	

WSP_LIB_7.5.GLB GrfcTbl DG PHOTO CORE PHOTO 1 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 15/Apr/2019 17:32 8.30.002 Datgel CPT Tool gINT Add-In



PointID : BHCW01 Depth Range: 37.00 - 42.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW01	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 4/5



PointID : BHCW01 Depth Range: 42.00 - 47.00 m

TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW01	DRAWN: MC	DATE: 15/04/2019	
	CHECKED: AH	DATE: 15/04/2019	
	SCALE: Not To Scale		A4
	PROJECT No: PS112915	FIGURE No: 5/5	

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW02

SHEET : 1 OF 11

Client:	**MACH Energy**	Date Commenced:	**5/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**6/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**163.041 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297746.48 N 6427384.567 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST / FB VL L MD D VD H)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	C	NFGWE	163.0	0.20					TOPSOIL: Silty CLAY; low plasticity, brown, with fine to coarse, sub-rounded to sub-angular gravel, with roots.				TOPSOIL
			162.5	0.5				GC	Silty Gravelly CLAY; medium plasticity, brown, fine to coarse, sub-rounded to sub-angular gravel.	MC<PL			ALLUVIAL SOIL
			162.0	1.0									
			161.5	1.5									
			161.0	2.0									
				2.30				GC	Clayey GRAVEL; fine to coarse, sub-rounded to sub-angular, medium plasticity, grey-brown clay, trace cobbles.	D			
WB			160.5	2.5									
			160.0	3.0 3.0					Gravelly SAND; fine to coarse grained, orange-brown-black, fine to coarse, sub-rounded to sub-angular gravel.	W			
			159.5	3.5									
			159.0	4.0									
			158.5	4.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW02

Client:	**MACH Energy**	Date Commenced:	**5/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**6/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**163.041 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297746.48 N 6427384.567 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	C	NFGWE	158.00	0.00				GC	Sandy Clayey GRAVEL; fine to coarse, sub-rounded to sub-angular, fine to coarse grained sand, high plasticity grey-brown clay.	W			ALLUVIAL SOIL
			157.5	5.5									
			157.0	6.0									
			156.5	6.5									
			156.00	7.00 7.0				GC	Clayey Sandy GRAVEL; fine to coarse, sub-rounded to sub-angular, high plasticity, brown clay, fine to coarse grained sand, with cobbles, trace boulders.				
			155.5	7.5									
			155.0	8.0									
			154.5	8.5									
			154.0	9.0									
			153.5	9.5									

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW02

SHEET : 3 OF 11

Client:	**MACH Energy**	Date Commenced:	**5/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**6/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**163.041 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297746.48 N 6427384.567 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB	C	NFGWE	153.0				GC	Clayey Sandy GRAVEL; fine to coarse, sub-rounded to sub-angular, high plasticity, brown clay, fine to coarse grained sand, with cobbles, trace boulders.	W			ALLUVIAL SOIL
			10 10.5 152.5				GC	Gravelly Sandy CLAY; high plasticity, brown, fine to coarse, sub-rounded to sub-angular gravel, fine to coarse grained sand, trace cobbles.	MC>PL			
			152.0 11.0									
			11 11.5 151.5				CH	Sandy CLAY; high plasticity yellow-brown, fine grained sand.				RESIDUAL
			151.0 12.0									
			12.30					SANDSTONE; fine grained, yellow-brown, very low strength, extremely weathered.				WEATHERED ROCK
			150.5 12.5									
			150.0 13.0									
			149.5 13.5									
			13.80									
BB	Adv C		149.0 14.0					SILTSTONE; grey-brown, low strength, highly weathered, interbedded with sandstone.				START ROCK CHIPPING
			148.5 14.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW02

Client:	**MACH Energy**	Date Commenced:	**5/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**6/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**163.041 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297746.48 N 6427384.567 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
BB	Adv C	NFGWE	148.0					SILTSTONE; grey-brown, low strength, highly weathered, interbedded with sandstone.				
			147.5 15.5									
			147.0 16.0									
			146.5 16.5									
			16.80					SANDSTONE; fine grained, orange-brown, medium strength, moderately weathered.				
			146.0 17.0									
			17.40					SILTSTONE; grey-brown, low strength, moderately to highly weathered, interbedded with sandstone.				
PCD			145.5 17.5									
			18 145.0 18.0					SILTSTONE; grey, low strength, highly weathered, with carbonaceous laminations.				
			144.5 18.5									
			19 144.0 19.0					SILTSTONE; grey, low strength, moderately weathered, interbedded with fine grained sandstone, interbedded with carbonaceous laminations.				
			143.5 19.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW02

SHEET : 5 OF 11

Client:	**MACH Energy**	Date Commenced:	**5/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**6/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**163.041 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297746.48 N 6427384.567 MGA94 56**

Borehole Information						Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
PCD	Adv C	NFGWE	143.0					SILTSTONE; grey, low strength, moderately weathered, interbedded with fine grained sandstone, interbedded with carbonaceous laminations.				
			20.40									
			142.5 20.5					SANDSTONE; fine grained, grey, low strength, moderately weathered, interbedded with siltstone, interbedded with carbonaceous laminations.				
			142.0 21.0									
			141.5 21.5									
			141.0 22.0									
			140.5 22.5									
			22.70					COAL; black.				
								REFER TO CORED BOREHOLE LOG				
			140.0 23.0									
			139.5 23.5									
			139.0 24.0									
			138.5 24.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW02

SHEET : 6 OF 11

Client:	**MACH Energy**	Date Commenced:	**5/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**6/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**163.041 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297746.48 N 6427384.567 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6 L 0.1 / 2 M 0.3 / 6 H 1 / 20 VH 3 / 60 EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20 20-60 60-200 200-600 600-2000 >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
					143.0							
					142.5	20.5						
					142.0	21.0						
					141.5	21.5						
					141.0	22.0						
					140.5	22.5						
					22.80			START CORING AT 22.80m				
HQ			100	64	140.0	23.0		SILTSTONE; grey-dark grey, interbedded with fine grained sandstone, interbedded with carboncaceous laminations.	MW to SW			22.92m: DB 23.23m: Bg, 10°, Pl, Sm, Carbonaceous Sn 23.26m: DB 23.32m: Bg, 0 - 5°, Pl, Sm 23.38m: DB 23.62m: Bg, 0 - 5°, Pl, Sm 23.9m: Bg, 5°, St, Sm, Carbonaceous Sn 24.02m: DB 24.03m: DB 24.23m: Bg, 5°, Pl, Sm 24.32m: DB 24.39m: DB 24.44m: Bg, 5°, Pl, Sm, Carbonaceous Sn 24.55m: Bg, 10°, Pl, Sm, Carbonaceous Sn 24.61m: DB 24.7m: DB 24.73m: Bg, 10°, Pl, Sm 24.78m: DB 24.74m: Jt, 80°, Pl, Sm 24.88m: Bg, 10°, Pl, Sm
					139.5	23.5						
			100	58	139.0	24.0						
					138.5	24.5						
					24.88			SILTSTONE; grey-dark grey, interbedded with carboncaceous laminations.				

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW02

SHEET : 7 OF 11

Client:	**MACH Energy**	Date Commenced:	**5/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**6/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**163.041 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297746.48 N 6427384.567 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ			100	58	138.0			SILTSTONE; grey-dark grey, interbedded with carboncaceous laminations.	MW to SW			25.07m: DB 25.2m: DB 25.38m: Bg, 0 - 5°, Pl, Sm
					137.5	25.5						
												25.8m: DB
					137.0	26.0		Carbonaceous SILTSTONE; dark brown-black.	SW			
						26.22						26.16m: Broken core (DB)
						26.26		COAL; black, bright.				
						26.29		SILTSTONE; pale brown.	HW			26.28m: Broken core (DB)
								COAL; black, dull to bright.				26.4m: Jt, 85°, Pl, Sm
					136.5	26.5		SILTSTONE; pale brown.				
						26.62		COAL; black, bright.	MW			26.61m: Jt, 85°, Pl, Sm
												26.72m: Broken core (DB)
						26.85		SILTSTONE; drak grey, interbedded with carbonaceous laminations.	HW			26.88m: Jt, 20°, Pl, Sm
			71	23	136.0	27.0						26.94m: Decomposed Rock (DB)
												27.1m: DB
												27.3m: Decomposed Rock (DB)
												27.4m: DB
						27						27.46m: DB
					135.5	27.5		CORE LOSS 0.40m (27.50-27.90)				
						27.90						
			100	94	135.0	28.0		SILTSTONE; grey-dark grey, interbedded with fine grained sandstone, with some carboncaceous laminations.	MW			27.9m: Broken core (DB)
									SW			28.14m: DB
												28.22m: Bg, 10°, Pl, Ro
					134.5	28.5						28.61m: Jt, 30°, Pl, Sm
												28.87m: DB
					134.0	29.0						29.04m: DB
												29.23m: Bg, 10°, Ir, Sm
												29.4m: DB
					133.5	29.5						29.54m: DB
			100	39								29.69m: Bg, 10°, Ir, Sm, Carbonaceous Sn
												29.72m: DB
												29.91m: Bg, 10°, Pl, Sm, Carbonaceous Sn
												29.93m: Bg, 10°, Pl, Sm, Carbonaceous Sn

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW02

Client:	**MACH Energy**	Date Commenced:	**5/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**6/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**163.041 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297746.48 N 6427384.567 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ			100	39	133.0	0.00		SANDSTONE; fine grained, grey-brown, interbedded with carbonaceous laminations.	SW			29.95m: Decomposed Rock (DB) 30m: Jt, 70°, Pl, Sm 30.09m: DB 30.14m: DB 30.16m: DB 30.22m: DB 30.32m: DB 30.35m: Broken core (DB)
					132.5	30.5						
						30.55		SILTSTONE; grey.	HW			30.55m: DB
						30.67		SANDSTONE; fine grained, grey, interbedded with carbonaceous laminations.	SW			30.64m: Decomposed Rock (DB) 30.68m: Jt, 80°, Pl, Ro
			100	91	132.0	31.0						30.96m: DB 31.24m: Bg, 10°, Ir, Ro
					131.5	31.5						31.54m: Bg, 10°, Ir, Ro, Carbonaceous Sn 31.67m: DB 31.69m: Bg, 10°, Ir, Sm, Carbonaceous Sn 31.76m: Bg, 5°, Ir, Sm
					131.0	32.0						
						32.31		SILTSTONE; grey.				32.32m: Bg, 10°, Cu, Sm 32.44m: DB 32.58m: Clay band
					130.5	32.5						
						32.68		COAL; black, bright and dull bands.	SW			32.68m: Broken core (DB) 32.8m: Jt, 85°, Pl, Sm 33.05m: Broken core (DB)
					130.0	33.0						
						33.11						
						33.15		SILTSTONE; pale brown.	MW			33.2m: DB
			100	60	129.5	33.5		COAL; black, bright and dull bands.	SW			33.3m: DB 33.3m: Jt, 85 - 90°, Pl, Sm 33.32m: Broken core (DB) 33.49m: DB 33.62m: DB
						33.78		SANDSTONE; fine grained, grey, interbedded with siltstone.	SW			33.91m: DB
					129.0	34.0						34.16m: DB
					128.5	34.5						34.44m: Bg, 15°, Pl, Sm 34.82m: Jt, 60°, St, Ro

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW02

SHEET : 9 OF 11

Client:	**MACH Energy**	Date Commenced:	**5/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**6/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**163.041 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297746.48 N 6427384.567 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ			100	60	128.0	35.00		SANDSTONE; fine grained, grey.	SW			35.15m: DB 35.17m: DB 35.27m: DB
					127.5	35.5						35.5m: Jt, 70°, Pl, Ro
			100	100	127.0	36.0						36.08m: DB
					126.5	36.5						
					126.0	37.0						
					125.5	37.5						
					125.0	38.0						
					124.5	38.5						38.42m: Jt, 40°, Pl, Ro 38.57m: DB
			100	100	124.0	39.0						39.1m: DB
					123.5	39.5		39.50m - As above but with carbonaceous laminations.				39.5m: DB 39.68m: DB 39.89m: DB

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW02

SHEET : 10 OF 11

Client:	**MACH Energy**	Date Commenced:	**5/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**6/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**163.041 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297746.48 N 6427384.567 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ			100	100	123.0			SANDSTONE; fine grained, grey.	SW			40.08m: DB
					122.5	40.5						40.37m: DB
					122.0	41.0						40.55m: DB
					41	41.5						
					121.5			SILTSTONE; grey-dark grey, interbedded with fine grained sandstone, interbedded with carboncaceous laminations.				41.55m: DB
					121.0	42.0						41.77m: Bg, 5°, Pl, Sm
					42.46							
			89	57	120.5	42.5		SILTSTONE; dark grey, interbedded with carbonaceous bands.	SW			42.53m: DB 42.57m: Bg, 5°, Pl, Sm, Carbonaceous Sn
					120.0	43.0						42.68m: DB 42.87m: DB
					119.5	43.5						43.14m: DB 43.27m: DB 43.43m: Coal band
					43.57			COAL; black, bright and dull bands.				43.58m: DB 43.64m: DB 43.66m: DB 43.72m: DB 43.8m: DB 43.6m: Jt, 85°, Pl, Sm 43.84m: Broken core (DB)
					119.0	44.0						44.03m: DB 44.12m: Bg, 5°, Pl, Sm
					44.18			CORE LOSS 0.73m (44.18-44.91)				
			78	57	118.5	44.5						
					44.91							44.91m: Broken core (DB)
					44.96			SILTSTONE; pale brown.	SW			

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW02

SHEET : 11 OF 11

Client:	**MACH Energy**	Date Commenced:	**5/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**6/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**163.041 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297746.48 N 6427384.567 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ			78	57	118.0			COAL; black, bright and dull bands.	SW			45.01m: Bg, 5°, Pl, Sm
												45.1m: DB
												45.13m: Broken core (DB)
					45.21							
					45.27			SILTSTONE; pale brown.				45.27m: Bg, 0°, Pl, Sm
								COAL; black, bright and dull bands.				45.27m: Jt, 85°, Pl, Sm
					45.37							45.32m: Broken core (DB)
								SANDSTONE; fine grained, grey-brown-dark grey, interbedded with siltstone.				
					117.5	45.5						
								45.70m - As above but pale grey.				45.68m: Bg, 10°, Pl, Ro, Carbonaceous Sn
												45.68m: Broken core (DB)
												45.79m: Bg, 10°, Pl, Ro
												45.94m: DB
					117.0	46.0						45.96m: DB
												46.12m: DB
												46.34m: Clay band
								END OF BOREHOLE AT 46.40 m Target depth				
					116.5							
					116.0							
					115.5							
					115.0							
					114.5							
					114.0							
					113.5							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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WSP_LIB_7.5.GLB GrfcTbl DG PHOTO CORE PHOTO 1 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 15/Apr/2019 17:47 8.30.002 Datgel CPT Tool gINT Add-In



PointID : BHCW02 Depth Range: 22.80 - 27.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW02	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 1/5



PointID : BHCW02 Depth Range: 27.00 - 32.00 m

TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW02	DRAWN: MC	DATE: 15/04/2019	
	CHECKED: AH	DATE: 15/04/2019	
	SCALE: Not To Scale		A4
	PROJECT No: PS112915	FIGURE No: 2/5	

WSP_LIB_7.5.GLB GrfcTbl DG PHOTO CORE PHOTO 1 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 15/Apr/2019 17:47 8.30.002 Datgel CPT Tool gINT Add-In



PointID : BHCW02 Depth Range: 32.00 - 37.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW02	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 3/5



PointID : BHCW02 Depth Range: 37.00 - 42.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW02	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 4/5

WSP_LIB_7.5.GLB GrfcTbl DG PHOTO CORE PHOTO 1 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 15/Apr/2019 17:48 8.30.002 Datgel CPT Tool gINT Add-In



PointID : BHCW02 Depth Range: 42.00 - 46.40 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW02	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 5/5

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW03

SHEET : 1 OF 7

Client:	**MACH Energy**	Date Commenced:	**24/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/5/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC/JNA**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**148.299 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297761.9 N 6427489.125 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	C	NFGWE	148.0	0.10					TOPSOIL: Silty CLAY; low plasticity, brown, with fine grained sand, with fine to coarse grained, angular gravel.				TOPSOIL
									Gravelly SAND; fine grained, light brown, fine to medium grained, angular gravel.	D			RESIDUAL
			147.5	0.5									
			147.0	1.0 1.0	SPT 4, 11, 15 N=26	SPT			Sandy CLAY; medium plasticity, dark brown, fine grained sand, with fine to medium grained, angular gravel.	MC<PL		>600 >600	
			146.5	1.5									
			146.0	2.0									
			145.5	2.5	SPT 6, 16, 17 N=33	SPT						>600 >600	
WR			145.0	3.0								>600	
			144.5	3.5									
			144.0	4.0	SPT 7, 13, 20 N=33	SPT							
			143.5	4.40 4.5					SILTSTONE; extremely weathered, extremely low strength, brown-grey.				WEATHERED ROCK

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW03

Client:	**MACH Energy**	Date Commenced:	**24/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/5/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC/JNA**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**148.299 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297761.9 N 6427489.125 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WR		NFGWE	143.0 / 5.5					SILTSTONE; extremely weathered, extremely low strength, brown-grey.	MC<PL			WEATHERED ROCK
			142.5 / 6.0					REFER TO CORED BOREHOLE LOG				
			142.0 / 6.5									
			141.5 / 7.0									
			141.0 / 7.5									
			140.5 / 8.0									
			140.0 / 8.5									
			139.5 / 9.0									
			139.0 / 9.5									
			138.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW03

SHEET : 3 OF 7

Client:	**MACH Energy**	Date Commenced:	**24/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/5/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC/JNA**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**148.299 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297761.9 N 6427489.125 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
					143.0	5.5		START CORING AT 5.60m				
HQ						5.60		SILTSTONE; brown mottled orange-grey.	XW			5.6m: Decomposed rock (DB)
					142.5	6.0						6.12m: Jt, 80°, Ir, Sm 6.2m: Bg, 5°, Pl, Sm 6.22m: Jt, 50°, Pl, Sm 6.32m: Jt, 50°, Pl, Sm
					142.0	6.5						6.41m: Jt, 80°, Pl, Sm 6.42m: DB 6.45m: DB 6.51m: DB 6.59m: Decomposed rock (DB)
			100	32	141.5	7.0		7.0m - As above but becoming dark brown.				6.8m: Jt, 60°, Pl, Sm 6.84m: Decomposed rock (DB)
					141.0	7.5						7.16m: DB 7.24m: Bg, 15°, Pl, Sm 7.3m: DB 7.32m: Jt, 60°, Pl, Sm 7.34m: DB
						7.53		COAL; black, interbedded with pale red-brown siltstone.				
					140.5	7.80		COAL; black.				7.8m: Bg, 5°, Pl, Sm 7.83m: Jt, 70°, Pl, Sm 7.86m: Decomposed rock (DB)
						8.0						
						8.20		SILTSTONE; brown mottled pale brown.				8.2m: Bg, 5°, Pl, Sm
					140.0	8.30		CORE LOSS 0.30m (8.30-8.60)				
			86	49		8.5						
						8.60		SILTSTONE; dark brown.				8.6m: Decomposed rock (DB)
					139.5	9.0						8.85m: Broken core (DB) 9.1m: Bg, 25°, Pl, Sm
						9.19		SILTSTONE; grey-brown, interbedded with fine grained sandstone.	HW			9.18m: Jt, 50°, Pl, Sm
					139.0	9.5						9.29m: DB 9.35m: DB
					138.5							9.62m: Jt, 80°, Pl, Ro, Iron stained 9.65m: DB

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW03

SHEET : 4 OF 7

Client:	**MACH Energy**	Date Commenced:	**24/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/5/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC/JNA**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**148.299 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297761.9 N 6427489.125 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ			86	49	10.00 10.08 10.26 138.0 10.40			SILTSTONE; pale brown. SILTSTONE; grey, interbedded with fine grained sandstone. SILTSTONE; grey.	XW MW HW to XW			10m: with soil-like properties 10.31m: DB 10.33m: Jt, 30°, Pl, Sm 10.35m: DB
			79	72	10.5 10.67 137.5 10.85 11.0 137.0 11.5			CORE LOSS 0.27m (10.40-10.67) SILTSTONE; grey. SANDSTONE; fine grained, grey, with carbonaceous laminations.	MW SW			10.74m: DB 10.76m: DB 10.78m: Bg, 10°, Pl, Sm, Carbonaceous staining 10.82m: Broken core (DB) 11.24m: Bg, 25°, Pl, Ro 11.49m: Clay band (5mm) 11.51m: DB 11.55m: DB 11.61m: DB 11.7m: DB 11.79m: DB 11.86m: DB 11.87m: Jt, 60°, Pl, Ro 11.9m: DB
			100	84	136.5 12.0 136.0 12.5 135.5 13.0 135.0 13.5 134.5 14.0 14.14 134.0 14.5			SILTSTONE; grey.				12.21m: DB 12.3m: DB 12.36m: DB 12.67m: DB 12.84m: Bg, 0 - 5°, Pl, Ro 13.18m: DB 13.25m: DB 13.3m: DB 13.68m: DB 13.87m: DB 13.98m: DB 14.08m: DB 14.14m: Clay band (10mm) 14.48m: DB 14.59m: DB
			79	0	14.70 133.5 14.93 14.97			CORE LOSS 0.23m (14.70-14.93) SILTSTONE; grey.	SW			14.98m: DB

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW03

SHEET : 5 OF 7

Client:	**MACH Energy**	Date Commenced:	**24/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/5/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC/JNA**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**148.299 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297761.9 N 6427489.125 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS)	AVERAGE DEFECT SPACING (mm)	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ			79	0	133.05	15.30		COAL; black.	to MW HW			14.93m: Broken core (DB)
					133.00	15.34		SILTSTONE; grey-brown.	MW			
					132.85	15.5		COAL; black.				15.34m: Broken core (DB)
			100	100	132.51	15.80		SILTSTONE; grey-brown, interbedded with fine grained sandstone, with carbonaceous laminations.	SW to MW			16.03m: DB
					132.0	16.0						16.64m: DB
					131.5	16.5						
					131.0	17.0						
					130.82	17.17		SANDSTONE; fine grained, grey-brown, with carbonaceous laminations.	SW			17.51m: DB
					130.5	17.5						17.64m: DB
			100	96	130.0	18.0						18.03m: DB
					129.5	18.5						18.15m: DB
					129.0	19.0						18.68m: DB
					128.5	19.5						18.77m: DB
												18.95m: Bg, 0°, Pl, Sm, Carbonaceous staining
												19.46m: DB
												19.89m: Bg, 0°, Pl, Sm

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW03

SHEET : 6 OF 7

Client:	**MACH Energy**	Date Commenced:	**24/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/5/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC/JNA**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**148.299 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297761.9 N 6427489.125 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ			100	96	128.0	20.5		SANDSTONE; fine grained, grey-brown, with carbonaceous laminations.	SW			20.53m: DB
						20.60						20.6m: DB
					127.5			SANDSTONE; fine grained, grey-brown, interbedded with siltstone, with carbonaceous laminations.				20.93m: DB
						21.0						21.08m: Bg, 5°, Pl, Ro, Carbonaceous staining
					127.0							21.13m: Bg, 5°, Pl, Ro, Carbonaceous staining
												21.23m: DB
						21.5		SILTSTONE; grey-dark grey, interbedded with fine grained sandstone, with carbonaceous laminations.				
			100	100	126.5							21.67m: Bg, 10°, Pl, Ro
						22.0						22.06m: DB
					126.0							
						22.5						22.52m: Bg, 15°, Pl, Sm
					125.5							22.76m: Bg, 10°, Pl, Ro, Carbonaceous staining
						23.0						22.95m: DB
												23.15m: DB
					125.0							23.26m: DB
						23.5						23.5m: DB
												23.58m: Bg, 0°, Pl, Ro
												23.62m: DB
					124.5							
						24.0						23.87m: DB
			37	27	124.0							
						24.5			MW			24.4m: DB
												24.42m: Broken core (DB)
						24.70		VOID (OLD MINE WORKINGS)				
					123.5							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW03

SHEET : 7 OF 7

Client:	**MACH Energy**	Date Commenced:	**24/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**26/5/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC/JNA**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**148.299 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297761.9 N 6427489.125 MGA94 56**

Borehole Information							Field Material Description					
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6 L 0.1 / 2 M 0.3 / 6 H 1 / 20 VH 3 / 60 EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20 20-60 60-200 200-600 600-2000 >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
HQ			37	73	123.0	25.5		VOID (OLD MINE WORKINGS)				
					122.5	26.0						
					122.0	26.5						
			14	0	121.5	27.0						
						27.10		SILTSTONE; grey-brown.	MW - SW			27.1m: Broken core (DB)
					121.0			END OF BOREHOLE AT 27.18 m Target depth				
					120.5							
					120.0							
					119.5							
					119.0							
					118.5							

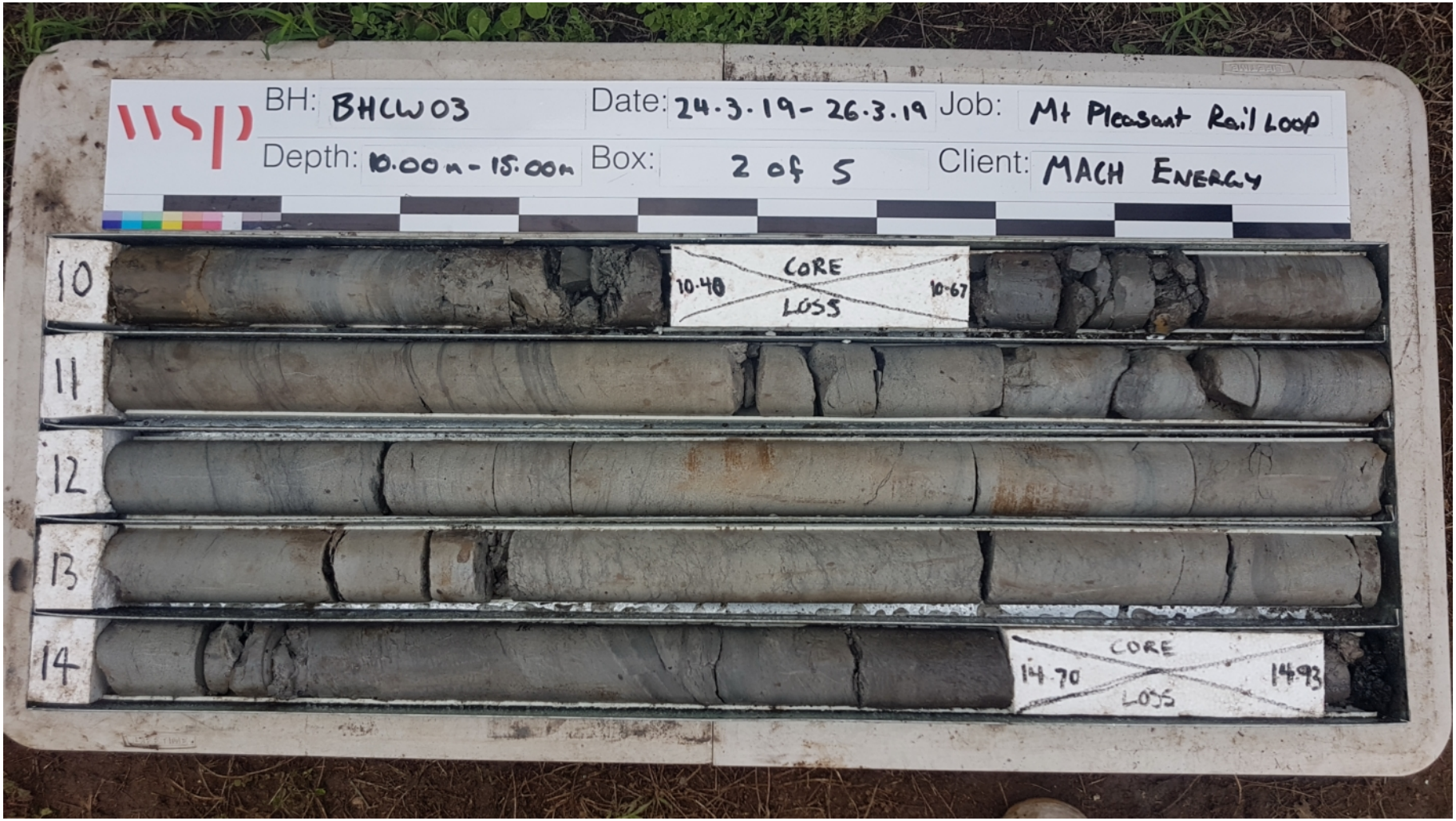
This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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PointID : BHCW03 Depth Range: 5.60 - 10.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW03	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 1/5



PointID : BHCW03 Depth Range: 10.00 - 15.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW03	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 2/5



PointID : BHCW03 Depth Range: 15.00 - 20.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW03	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 3/5



PointID : BHCW03 Depth Range: 20.00 - 25.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW03	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 4/5

WSP_LIB_7.5.GLB GrfcTbl DG PHOTO CORE PHOTO 1 PER PAGE PS112915_LOGS.GPJ <<DrawingFile>> 15/Apr/2019 17:48 8.30.002 Datgel CPT Tool gINT Add-In



PointID : BHCW03 Depth Range: 25.00 - 27.18 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW03	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 5/5

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW04

SHEET : 1 OF 7

Client:	**MACH Energy**	Date Commenced:	**26/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**149.004 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297763 N 6427477 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	C	NFGWE	148.80	0.20					TOPSOIL; Silty CLAY; low plasticity, brown with fine to medium grained, angular gravel and roots.				TOPSOIL
			148.5	0.5				CL	Gravelly sandy CLAY; low plasticity, brown, fine to coarse grained, angular to sub-angular gravel, fine grained sand.	MC<PL			RESIDUAL
			148.0	1.0	SPT 15, 17, 20 N=37	SPT						>600	
			147.5	1.5									
			147.0	2.0									
WB			146.5	2.5	SPT 11, 12, 16 N=28	SPT		CI	Gravelly sandy CLAY; medium plasticity, brown, fine to coarse grained, angular to sub-angular gravel, fine grained sand.			>600 >600	
			146.0	3.0									
			145.5	3.5									
			145.0	4.0	SPT 9, 15, 16 N=31	SPT		CI-CH	Sandy gravelly CLAY; medium to high plasticity, orange-brown, fine to coarse grained, angular gravel, fine grained sand.	MC>PL		280 300 250	
			144.5	4.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW04

Client:	**MACH Energy**	Date Commenced:	**26/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**149.004 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297763 N 6427477 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB		NFGWE						CI-CH	Sandy gravelly CLAY; medium to high plasticity, orange-brown, fine to coarse grained, angular gravel, fine grained sand.	MC>PL			RESIDUAL
	C		143.5	5.5	SPT 25/100mm N=R	SPT			SILTSTONE; grey-brown, very low strength, extremely weathered.				WEATHERED ROCK
									REFER TO CORED BOREHOLE LOG				
			143.0	6.0									
			142.5	6.5									
			142.0	7.0									
			141.5	7.5									
			141.0	8.0									
			140.5	8.5									
			140.0	9.0									
			139.5	9.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW04

SHEET : 3 OF 7

Client:	**MACH Energy**	Date Commenced:	**26/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**149.004 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297763 N 6427477 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
					143.5	5.5		START CORING AT 5.60m				
HQ	Nil					5.60		SILTSTONE; orange-brown, grey.	HW			5.6m: Broken core/Clay
									MW			5.81m: Jt, 60°, Ir, Sm
												5.91m: DB
												5.92m: Jt, 60°, Ir, Sm
												5.97m: Bg, 5°, Pl, Sm
					143.0	6.0						6.04m: Se, Cl
						6.04		Carbonaceous CLAYSTONE; black, high plasticity clay.	HW			
						6.10		SILTSTONE; grey-brown-orange interbedded with fine grained sandstone and carbonaceous laminations.				
					142.5	6.5						6.45m: Clay band
						6.81		SILTSTONE; grey-brown, with carbonaceous laminations.				6.81m: Clay band
												6.92m: Decomposed rock (DB)
			100	63	142.0	7.0						7.05m: Jt, 80°, Pl, Sm, Sn Fe
												7.12m: Bg, 5°, Pl, Sm, Sn Fe
												7.28m: DB
												7.3m: Clay band
								7.40m: As above, but mottled orange-brown.				7.45m: DB
					141.5	7.5						7.49m: DB
												7.52m: Bg, 10°, Pl, Sm
						7.59		SILTSTONE; dark brown/grey, high plasticity clay.				7.67m: DB
						7.72		SILTSTONE; orange-grey-brown.				
												7.87m: DB
												7.96m: DB
					141.0	8.0						8.01m: Jt, 80°, Pl, Sm, Sn Fe
												8.02m: Bg, 10°, Ir, Sm, Sn Fe
						8.11		Carbonaceous SILTSTONE; dark grey-black.				8.15m: Jt, 75°, Pl, Sm
								8.37m: As above, but brown mottled black with high plasticity clay	XW			8.37m: Carbonaceous clay band
					140.5	8.5						
						8.53		Carbonaceous SILTSTONE; dark grey.	HW			8.53m: Broken core (DB)
												8.9m: Bg, 20°, Pl, Sm
					140.0	9.0		Clayey COAL; black, pale brown clay lenses.	XW			9m: Decomposed rock
			90	37		9.17		COAL; black.	HW			9.26m: Clay band
												9.36m: DB
												9.41m: DB
					139.5	9.5						9.46m: DB
						9.55		CLAY; high plasticity, pale brown.				
						9.61		COAL; black.	HW			9.62m: Jt, 80°, Pl, Sm
												9.7m: Broken core (DB)
						9.85		CORE LOSS 0.15m (9.85-10.00)				

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW04

SHEET : 4 OF 7

Client:	**MACH Energy**	Date Commenced:	**26/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**149.004 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297763 N 6427477 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
			100	61	10.00			SILTSTONE; dark grey, interbedded with carbonaceous lenses.	HW - XW			10.09m: DB 10.13m: Decomposed rock (DB) 10.22m: Decomposed rock (DB) 10.32m: Bg, 15°, Pl, Ro 10.35m: Bg, 15°, Pl, Ro 10.39m: DB 10.4m: Clay band
					10.42			SILTSTONE; grey, interbedded with fine grained sandstone.	SW			
					138.5	10.5						10.78m: DB
					138.0	11.0						10.97m: DB 11.04m: Bg, Pl, Sm, Carbonaceous Stain 11.15m: Bg, 10°, Cu, Sm, Carbonaceous Stain 11.18m: DB
					11.37			SILTSTONE; grey.	MW			11.37m: Bg, 20°, Pl, Sm, Carbonaceous Stain 11.43m: DB
					137.5	11.5						11.5m: Jt, 80°, Pl, Sm 11.56m: DB
					11.60			SANDSTONE; fine grained, grey-brown interbedded with siltstone and carbonaceous laminations.	SW			11.65m: DB
									HW			11.83m: DB 11.85m: Decomposed rock
					137.0	12.0			SW			12.05m: DB
									XW			12.12m: Se, Cl
									SW			
			100	62								12.35m: Bg, 20°, Pl, Ro 12.38m: Broken core (DB)
					136.5	12.5						12.51m: DB 12.63m: Bg, 10°, Pl, Ro
												12.79m: Bg, 30°, Ir, Ro 12.86m: DB
					136.0	13.0						12.97m: DB 13.07m: Bg, 5°, Pl, Sm, Carbonaceous Stain 13.08m: Clay band 13.16m: DB 13.19m: DB 13.26m: DB 13.34m: Jt, 45°, Pl, Ro
					135.5	13.5						13.47m: DB
					135.0	14.0						14.09m: DB 14.15m: DB
					134.5	14.5						14.57m: DB
			100	84								14.69m: DB

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW04

SHEET : 5 OF 7

Client:	**MACH Energy**	Date Commenced:	**26/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**149.004 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297763 N 6427477 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
			100	84	133.5	15.5		SANDSTONE; fine grained, grey-brown interbedded with siltstone and carbonaceous laminations.	SW			15.05m: Bg, 25°, Wv, Ro
												15.71m: DB
					15.82			SILTSTONE; grey.	SW			15.83m: Bg, 5°, Pl, Sm
					133.0	16.0						16.08m: Clay band
												16.21m: Bg, 10°, Pl, Sm
					16.30			COAL; black, dull to bright.				16.27m: Clay band
												16.33m: Jt, 80°, Pl, Sm
												16.41m: Bg, 5°, Pl, Sm
					132.5	16.5		CORE LOSS 0.20m (16.50-16.70)				16.46m: DB
					16.70			COAL; black, bright.	SW			16.7m: Broken core (DB)
												16.72m: Jt, 60°, St, Sm
			82	30								16.92m: Bg, 5°, Pl, Sm
												16.94m: Bg, 5°, Pl, Sm
					132.0	17.0						17m: Broken core (DB)
					17.15							
					17.20			SILTSTONE; pale brown.				17.18m: Broken core (DB)
					17.23			COAL; black, bright.				17.29m: DB
								SILTSTONE; grey, interbedded with fine grained sandstone and carbonaceous laminations.				
					131.5	17.5						17.56m: Bg, 10°, Pl, Ro
												17.57m: DB
												17.6m: Bg, 10°, Pl, Ro
					131.0	18.0						
												18.45m: Jt, 70°, Pl, Sm
			100	100	130.5	18.5						18.7m: Jt, 55°, Pl, Sm
												18.95m: DB
					130.0	19.0						
					19.07			SANDSTONE; fine grained grey, trace carbonaceous laminations.				
					129.5	19.5						19.69m: DB

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW04

SHEET : 6 OF 7

Client:	**MACH Energy**	Date Commenced:	**26/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**149.004 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297763 N 6427477 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
			100	100	128.5	20.5		SANDSTONE; fine grained grey, trace carbonaceous laminations.	SW			20.66m: Jt, 30°, Pl, Sm 20.72m: DB
		Partial WL			128.0	21.0						21m: Bg, 30°, Pl, Sm, Carbonaceous Stain 21.13m: Bg, 30°, Pl, Sm, Carbonaceous Stain
					127.5	21.5						21.6m: DB
			100	88	127.0	22.0						22.1m: Jt, 70°, Pl, Ro 22.23m: DB
					126.5	22.5						22.56m: DB
					22.94							22.82m: Bg, 20°, Pl-Cu, Ro
					126.0	23.0		SANDSTONE; fine-grained, grey with carbonaceous laminations.				22.94m: Jt, 80°, Pl, Ro 23m: Bg, 20°, Pl, Ro 23.13m: Bg, 20°, Pl, Ro 23.2m: Bg, 20°, Cu, Ro
					125.5	23.5						23.35m: DB 23.5m: DB 23.54m: DB
		Partial WL			125.0	24.0						23.67m: DB 23.68m: DB 23.7m: DB 23.85m: Bg, 5°, Pl, Ro, Carbonaceous Stain 24.15m: DB 24.23m: DB
			82	94	24.34			SILTSTONE; grey, interbedded with fine grained sandstone and carbonaceous laminations.				24.41m: DB
					124.5	24.5						24.59m: DB 24.88m: DB

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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CORED BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW04

SHEET : 7 OF 7

Client:	**MACH Energy**	Date Commenced:	**26/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**27/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**149.004 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297763 N 6427477 MGA94 56**

Borehole Information							Field Material Description				
METHOD	SUPPORT	WATER	TOTAL CORE RECOVERY (TCR)	RQD	RL (m AHD)	DEPTH (m)	GRAPHIC LOG	SOIL/ROCK MATERIAL FIELD DESCRIPTION	WEATHERING	INFERRED STRENGTH MPa ($Is_{(50)}$/UCS) VL 0.03 / 0.6, L 0.1 / 2, M 0.3 / 6, H 1 / 20, VH 3 / 60, EH 10 / 200	AVERAGE DEFECT SPACING (mm) <20, 20-60, 60-200, 200-600, 600-2000, >2000	STRUCTURE AND ADDITIONAL OBSERVATIONS
			82	77	123.5	25.5		SILTSTONE; grey, interbedded with fine grained sandstone and carbonaceous laminations.	SW			25.24m: Bg, 5°, Pl, Sm 25.45m: DB 25.56m: Bg, 5°, Pl, Sm 25.65m: Bg, 10°, Pl, Sm 25.81m: DB 25.91m: DB 26.02m: DB 26.05m: DB 26.09m: DB
		Full WL			123.0	26.0						
						26.15		VOID (OLD MINE WORKING)				
					122.5	26.5						
					122.0	27.0						
			0	0	121.5	27.5						
					121.0	28.0						
					120.5	28.5		END OF BOREHOLE AT 28.50 m Target depth				
					120.0							
					119.5							

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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PointID : BHCW04 Depth Range: 5.60 - 10.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW04	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 1/5



PointID : BHCW04 Depth Range: 10.00 - 15.00 m

wsp	TITLE MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW04	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 2/5



PointID : BHCW04 Depth Range: 15.00 - 20.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW04	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 3/5



PointID : BHCW04 Depth Range: 20.00 - 25.00 m

	TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW04	DRAWN: MC	DATE: 15/04/2019
		CHECKED: AH	DATE: 15/04/2019
		SCALE: Not To Scale	A4
		PROJECT No: PS112915	FIGURE No: 4/5

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PointID : BHCW04 Depth Range: 25.00 - 28.50 m

TITLE: MACH Energy Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine Core Photo - BHCW04	DRAWN: MC	DATE: 15/04/2019	
	CHECKED: AH	DATE: 15/04/2019	
	SCALE: Not To Scale		A4
	PROJECT No: PS112915	FIGURE No: 5/5	

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW05

SHEET : 1 OF 4

Client:	**MACH Energy**	Date Commenced:	**27/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**28/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**148.649 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297767 N 6427475 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	C	NFGWE	148.5	0.20					TOPSOIL; Silty CLAY; low plasticity, brown, with fine to coarse grained, angular gravel and roots.				TOPSOIL
			148.0	0.5				CL	Gravelly sandy CLAY; low plasticity, brown, fine to coarse grained, angular gravel, fine grained sand.	MC<PL			RESIDUAL
			147.5	1.0	SPT 11, 17, 17 N=34	SPT						>600	
			147.0	1.5									
			146.5	2.0									
WB			146.0	2.5	SPT 8, 18, 14 N=32	SPT		CI	Gravelly sandy CLAY; medium plasticity, brown, fine to coarse grained, angular gravel, fine to coarse grained sand.			>600 >600	
			145.5	3.0									
			145.0	3.5									
			144.5	4.0	SPT 12, 20, 17 N=37	SPT		GC	Clayey sandy GRAVEL; fine to coarse grained, angular to sub-angular, medium plasticity, brown clay, fine to coarse grained sand.	W			
			144.0	4.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW05

Client:	**MACH Energy**	Date Commenced:	**27/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**28/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**148.649 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297767 N 6427475 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
WB		NFGWE	143.5					GC	Clayey sandy GRAVEL; fine to coarse grained, angular to sub-angular, medium plasticity, brown clay, fine to coarse grained sand.	W			RESIDUAL
				5.5	SPT 8/70mm N=R	SPT							No sample at 5.5m due to inferred gravel.
			143.0										
				6.0									
			142.5										
				6.5									
			142.0										
				7.0									
				7.00					SILTSTONE; brown, low strength, extremely weathered.				WEATHERED ROCK
				7.10									
BB	C		141.5		SPT 11, 18, 30 N=48	SPT			SILTSTONE; grey-brown, very low strength, highly weathered.				Start rock chipping borehole from 7.10m
				7.5									
			141.0										
				8.0									
			140.5										
				8.5									
			140.0										
				8.80					COAL; black.				
				9.0									
			139.5	9.15					CLAY; high plasticity, pale brown.				
				9.25					COAL; black.				
				9.5									
				9.60									
			139.0						SILTSTONE; grey-brown, low strength, moderately weathered.				

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW05

Client:	**MACH Energy**	Date Commenced:	**27/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**28/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**148.649 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297767 N 6427475 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
BB	C	NFGWE	138.5 / 10.5					SILTSTONE; grey-brown, low strength, moderately weathered.				
			138.0 / 11.0									
			137.5 / 11.5									
PCB			11 / 137.0					SANDSTONE; fine grained, grey, low to medium strength, moderately weathered, interbedded with siltstone.				
			12.0 / 136.5									
			12.30 / 12.5					SILTSTONE; grey, low strength, moderately to highly weathered, interbedded with fine grained sandstone.				
			136.0 / 13.0									
			135.5 / 13.5									
			135.0 / 14.0									
			134.5 / 14.5									
			134.0									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW05

SHEET : 4 OF 4

Client:	**MACH Energy**	Date Commenced:	**27/3/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**28/3/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**148.649 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297767 N 6427475 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
PCB		NFGWE	133.5 15.5 15.60 133.0 16.0 16.05 132.5 16.5 132.0					SILTSTONE; grey, low strength, moderately to highly weathered, interbedded with fine grained sandstone. COAL; black. SILTSTONE; grey-brown, low strength, moderately to highly weathered. COAL; black.				
			131.5 131.0 130.5 130.0 129.5 129.0					END OF BOREHOLE AT 16.70 m Target depth				

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW06

SHEET : 1 OF 6

Client:	**MACH Energy**	Date Commenced:	**4/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**4/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**147.997 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297774.262 N 6427471.126 MGA94 56**

Borehole Information | **Field Material Description**

METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
AS	C	NFGWE		0.20					TOPSOIL; Silty CLAY; low plasticity, brown, fine to coarse, angular gravel.				TOPSOIL
			147.5	0.5				GC	Gravelly Sandy CLAY; medium plasticity, brown, fine to coarse, angular to sub-angular gravel, fine to coarse grained sand.	MC<PL			RESIDUAL
			147.0	1.0									
			146.5	1.5									
			146.0	2.0									
WB			145.5	2.5									
			145.0	3.0									
			144.5	3.5									
BB			144.0	4.0									
			143.5	4.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW06

Client:	**MACH Energy**	Date Commenced:	**4/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**4/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**147.997 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297774.262 N 6427471.126 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VS, VL S, L F, MD ST, D VST, VD H)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
BB	C	NFGWE	5.00					SILTSTONE; grey-brown, very low strength, extremely weathered.				WEATHERED ROCK
			142.5 5.5									
	Adv C		5.60					SILTSTONE; grey-brown, low strength, highly weathered.				5.60m - START ROCK CHIPPING
			142.0 6.0									
			141.5 6.5					SILTSTONE; grey-brown-orange, low strength, moderately to highly weathered, interbedded with fine grained sandstone.				
			141.0 7.0									
			140.5 7.5									
			7.80					COAL; black.				
			140.0 8.0									
			8.10				CH	CLAY; highly plasticity, pale brown.				
			8.15					COAL; black.				
			139.5 8.5									
			8.60					SILTSTONE; dark brown, very low strength, highly weathered.				
			139.0 9.0									
			138.5 9.5					9.80m - as above but grey.				

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW06

SHEET : 3 OF 6

Client:	**MACH Energy**	Date Commenced:	**4/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**4/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**147.997 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297774.262 N 6427471.126 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (FB VS VL S L F ST MD VST D H VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
BB	Adv C	NFGWE	137.5 / 10.5					SILTSTONE; dark brown, very low strength, highly weathered.				
			137.0 11.0					SILTSTONE; grey, low strength, moderately weathered, interbedded with fine grained sandstone.				
			136.5 / 11.5					SANDSTONE; fine grained, grey, low to medium strength, moderately weathered, interbedded with siltstone.				
			136.0 12.0									
			135.5 12.5									
			135.0 13.0									
			13.20					VOID (OLD MINE WORKINGS)				
			134.5 13.5									
			134.0 14.0									
			133.5 14.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

WSP Australia Pty Ltd. V00 8.30.002 WSP_LIB_7.5.GLB Log WSP NON-CORED LOG PS112915_LOGS.GPJ <<DrawingFile>> 16/04/2019 09:34 Developed by Datgel Pty Ltd

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW06

Client:	**MACH Energy**	Date Commenced:	**4/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**4/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**147.997 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297774.262 N 6427471.126 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
BB	Adv C	NFGWE	132.5 15.5					VOID (OLD MINE WORKINGS)				
	Adv C		132.0 16.0					SANDSTONE; fine grained, grey, medium strength, moderately weathered, interbedded with siltstone.				
			131.5 16.5									
			131.0 17.0									
			130.5 17.5									
			130.0 18.0					SANDSTONE; fine grained, grey, medium to high strength, slightly to moderately weathered				
			129.5 18.5									
			129.0 19.0									
			128.5 19.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

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BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW06

SHEET : 5 OF 6

Client:	**MACH Energy**	Date Commenced:	**4/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**4/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**147.997 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297774.262 N 6427471.126 MGA94 56**

Borehole Information						Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD) / DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
BB	Adv C	NFGWE	20.00					SANDSTONE; fine grained, grey, high strength, slightly to moderately weathered.				
			127.5 20.5									
			127.0 21.0									
			126.5 21.5									
			126.0 22.0					SANDSTONE; fine grained, grey, medium strength, moderately weathered, interbedded with siltstone and carbonaceous laminations.				
			125.5 22.5									
			125.0 23.0									
			124.5 23.5									
			124.0 24.0									
			24.20					SILTSTONE grey, low to medium strength, moderately to highly weathered, interbedded with fine grained sandstone and carbonaceous laminations.				
			123.5 24.5									

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

WSP Australia Pty Ltd. V00 8.30.002 WSP_LIB_7.5.GLB Log WSP NON-CORED LOG PS112915_LOGS.GPJ <<DrawingFile>> 16/04/2019 09:34 Developed by Datgel Pty Ltd

BOREHOLE ENGINEERING LOG

BOREHOLE NO.

BHCW06

SHEET : 6 OF 6

Client:	**MACH Energy**	Date Commenced:	**4/4/19**
Project:	**Geotechnical investigation for proposed Rail Loop, Mt Pleasant Coal Mine**	Date Completed:	**4/4/19**
Borehole Location:	**See Site Plan**	Recorded By:	**MC**
Project Number:	**PS112915**	Log Checked By:	**AH**

Drill Model/Mounting:	**GD03 Scout/ Truck**	Hole Angle:	**-90°**	Surface RL:	**147.997 m AHD**
Borehole Diameter:	**125 mm**	Bearing:	**---**	Co-ords:	**E 297774.262 N 6427471.126 MGA94 56**

Borehole Information							Field Material Description						
METHOD	SUPPORT	WATER	RL (m AHD)	DEPTH (m)	FIELD TEST	SAMPLE	GRAPHIC LOG	GROUP SYMBOL	SOIL/ROCK MATERIAL FIELD DESCRIPTION	MOISTURE	RELATIVE DENSITY / CONSISTENCY (VS S F ST VST H / FB VL L MD D VD)	POCKET PENETROMETER (kPa)	STRUCTURE AND ADDITIONAL OBSERVATIONS
BB	Adv C	NFGWE	122.5	25.5					SILTSTONE grey, low to medium strength, moderately to highly weathered, interbedded with fine grained sandstone and carbonaceous laminations.				
		FULL WL							VOID (OLD MINE WORKINGS)				
			122.0	26.0									
									END OF BOREHOLE AT 26.30 m Target depth				
			121.5										
			121.0										
			120.5										
			120.0										
			119.5										
			119.0										
			118.5										

This Borehole log should be read in conjunction with WSP's accompanying explanatory notes.

WSP Australia Pty Ltd. V00 8.30.002 WSP_LIB_7.5.GLB Log WSP NON-CORED LOG PS112915_LOGS.GPJ <<DrawingFile>> 16/04/2019 09:34 Developed by Datgel Pty Ltd

PROJECT: Mt Pleasant Rail Loop
CLIENT: MACH Energy
LOCATION: SEE SITE PLAN FOR BOREHOLE LOCATIONS
JOB NO PS112915
Tested By: MC
Date Tested: 06/02/2019 - 10/04/2019
Equipment Used: POINT LOAD TESTER
Equipment Type: Electronic / Load Cell
According to AS 4133.4.1 - 1993 Yes

Moisture Content DRY

According to ISRM Suggest Methods

Legend;	Is (50) Mpa	Strength Class
	0	EL Extremely Low
	0.03	VL Very low
	0.1	L Low
	0.3	M Medium
	1	H High
	3	VH Very High
	10	EH Extremely High

			Diametral				Axial			
Sample Location	Sample Depth	Rock Type	Core Diameter D (mm)	Dist to End L (mm)	Point Load Strength (Is50) Dia Is(50) Mpa	Rock Strength Class	Length of section L (mm)	Core diameter W (mm)	Point Load Strength (Is50) (MPa)	Rock Strength Class
BHCW01	22	SANDSTONE	63	110	4.49	VH	35	63	6.72	VH
BHCW01	23	SANDSTONE/SILTSTONE	63	80	0.34	M	25	63	0.46	M
BHCW01	29.5	SILTSTONE/SANDSTONE	63	290	0.30	M	35	63	0.31	M
BHCW01	30.71	SANDSTONE/SILTSTONE	63	230	0.44	M	40	63	0.59	M
BHCW01	31.32	SANDSTONE/SILTSTONE	63	320	0.38	M	35	63	0.63	M
BHCW01	32.66	SANDSTONE/SILTSTONE	63	80	0.52	M	40	63	0.72	M
BHCW01	33.08	SANDSTONE	63	210	2.51	H	45	63	4.61	VH
BHCW01	35.9	SANDSTONE/SILTSTONE	63	100	0.67	M	40	63	0.74	M
BHCW01	36.74	SANDSTONE	63	260	1.03	H	40	63	1.27	H
BHCW01	37.85	SANDSTONE	63	150	6.84	VH	40	63	4.50	VH
BHCW01	38.47	SANDSTONE	63	200	0.94	M	30	63	1.21	H
BHCW01	39	SANDSTONE	63	310	1.07	H	33	63	1.31	H
BHCW01	40.53	SANDSTONE	63	150	1.68	H	30	63	5.50	VH
BHCW01	41.53	SANDSTONE	63	285	1.36	H	40	63	1.50	H
BHCW01	42	SANDSTONE	63	280	1.41	H	30	63	1.93	H
BHCW02	28.87	SILTSTONE/SANDSTONE	63	120	0.57	M	35	63	0.43	M
BHCW02	29.26	SILTSTONE/SANDSTONE	63	130	0.40	M	27	63	0.33	M
BHCW02	30.22	SANDSTONE	63	90	1.18	H	30	63	1.92	H
BHCW02	31.76	SANDSTONE/SILTSTONE	63	210	0.50	M	35	63	0.58	M
BHCW02	33.78	SANDSTONE/SILTSTONE	63	120	0.30	L	25	63	0.47	M
BHCW02	34.85	SANDSTONE	63	160	0.68	M	35	63	0.84	M
BHCW02	36	SANDSTONE	63	90	1.01	H	25	63	0.81	M
BHCW02	38.41	SANDSTONE	63	120	4.02	VH	37	63	4.30	VH
BHCW02	39	SANDSTONE	63	110	2.73	H	28	63	3.18	VH
BHCW02	40.54	SANDSTONE/SILTSTONE	63	450	0.52	M	45	63	1.12	H
BHCW02	41	SANDSTONE/SILTSTONE	63	120	0.82	M	39	63	1.18	H
BHCW02	45.37	SANDSTONE/SILTSTONE	63	310	0.41	M	27	63	0.52	M
BHCW02	46	SANDSTONE/SILTSTONE	63	110	0.32	M	30	63	0.42	M
BHCW03	10.85	SANDSTONE/SILTSTONE	63	140	0.32	M	30	63	0.42	M
BHCW03	11.9	SANDSTONE	63	100	0.51	M	34	63	0.53	M
BHCW03	12.67	SANDSTONE	63	167	0.23	L	40	63	0.61	M
BHCW03	13	SANDSTONE	63	170	0.66	M	32	63	0.62	M
BHCW03	15.76	SILTSTONE	63	220	0.27	L	30	63	0.39	M
BHCW03	16.31	SILTSTONE	63	330	0.13	L	30	63	0.26	L
BHCW03	17.5	SANDSTONE	63	150	0.73	M	34	63	0.80	M
BHCW03	18.77	SANDSTONE	63	170	0.84	M	30	63	0.97	M
BHCW03	19	SANDSTONE	63	167	0.78	M	30	63	0.80	M
BHCW03	20	SANDSTONE	63	165	1.16	H	32	63	1.37	H
BHCW03	21.13	SANDSTONE	63	100	0.63	M	32	63	0.94	M
BHCW03	23.16	SILTSTONE/SANDSTONE	63	110	0.81	M				
BHCW04	11.18	SILTSTONE/SANDSTONE	63	180	0.18	L	35	63	0.23	L
BHCW04	12.86	SANDSTONE	63	110	2.74	H	37	63	4.10	VH
BHCW04	13.46	SANDSTONE/SILTSTONE	63	240	0.32	M	35	63	0.24	L
BHCW04	14.57	SANDSTONE/SILTSTONE	63	120	0.22	L	35	63	0.49	M
BHCW04	15.7	SANDSTONE/SILTSTONE	63	120	0.34	M	38	63	0.35	M
BHCW04	17.3	SANDSTONE	63	145	0.39	M	30	63	0.40	M
BHCW04	18.71	SANDSTONE/SILTSTONE	63	250	0.34	M	30	63	0.23	L
BHCW04	19.7	SANDSTONE	63	300	0.34	M	30	63	1.03	H
BHCW04	20.73	SANDSTONE	63	230	1.72	H	30	63	1.84	H
BHCW04	21	SANDSTONE	63	120	2.79	H	30	63	4.76	VH
BHCW04	22.24	SANDSTONE	63	140	4.67	VH	30	63	5.69	VH
BHCW04	23.7	SANDSTONE/SILTSTONE	63	140	0.46	M	30	63	0.54	M
BHCW04	24	SILTSTONE/SANDSTONE	63	150	0.53	M	30	63	0.44	M
BHCW04	25	SANDSTONE/SILTSTONE	63	245	0.46	M	36	63	0.58	M

APPENDIX C

LIMITATIONS OF GEOTECHNICAL INVESTIGATION STATEMENT

Legal

Limitations of Geotechnical Site Investigation

Scope of services

This geotechnical site assessment report (the report) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and WSP (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

Reliance on data

In preparing the report, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, WSP has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WSP will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

Geotechnical investigation

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared to meet the specific needs of individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor or even some other consulting civil engineer. This report was prepared expressly for the client and expressly for purposes indicated by the client or his representative. Use by any other persons for any purpose, or by the client for a different purpose, might result in problems. The client should not use this report for other than its intended purpose without seeking additional geotechnical advice.

This geotechnical report is based on project-specific factors

This geotechnical engineering report is based on a subsurface investigation which was designed for project-specification factors, including the nature of any development, its size and configuration, the location of any development on the site and its orientation, and the location of access roads and parking areas. Unless further geotechnical advice is obtained this geotechnical engineering report cannot be used:

- when the nature of any proposed development is changed
- when the size, configuration location or orientation of any proposed development is modified.

This geotechnical engineering report cannot be applied to an adjacent site.

Limitations of Geotechnical Site Investigation

The limitations of site investigation

In making an assessment of a site from a limited number of boreholes or test pits there is the possibility that variations may occur between test locations. Site exploration identifies specific subsurface conditions only at those points from which samples have been taken. The risk that variations will not be detected can be reduced by increasing the frequency of test locations; however this often does not result in any overall cost savings for the project. The investigation program undertaken is a professional estimate of the scope of investigation required to provide a general profile of the subsurface conditions. The data derived from the site investigation program and subsequent laboratory testing are extrapolated across the site to form an inferred geological model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite investigation the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

The borehole logs are the subjective interpretation of subsurface conditions at a particular location, made by trained personnel. The interpretation may be limited by the method of investigation, and can not always be definitive. For example, inspection of an excavation or test pit allows a greater area of the subsurface profile to be inspected than borehole investigation, however, such methods are limited by depth and site disturbance restrictions. In borehole investigation, the actual interface between materials may be more gradual or abrupt than a report indicates.

Subsurface conditions are time dependent

Subsurface conditions may be modified by changing natural forces or man-made influences. A geotechnical engineering report is based on conditions which existed at the time of subsurface exploration.

Construction operations at or adjacent to the site, and natural events such as floods, or groundwater fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept appraised of any such events, and should be consulted to determine if additional tests are necessary.

Avoid misinterpretation

A geotechnical engineer should be retained to work with other appropriate design professionals explaining relevant geotechnical findings and in reviewing the adequacy of their plans and specifications relative to geotechnical issues.

Bore/profile logs should not be separated from the engineering report

Final bore/profile logs are developed by geotechnical engineers based upon their interpretation of field logs and laboratory evaluation of field samples. Customarily, only the final bore/profile logs are included in geotechnical engineering reports. These logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings. To minimise the likelihood of bore/profile log misinterpretation, contractors should be given access to the complete geotechnical engineering report prepared or authorised for their use. Providing the best available information to contractors helps prevent costly construction problems. For further information on this matter reference should be made to ‘Guidelines for the Provision of Geotechnical Information in Construction Contracts’ published by the Institution of Engineers Australia, National Headquarters, Canberra 1987.

Geotechnical involvement during construction

During construction, excavation is frequently undertaken which exposes the actual subsurface conditions. For this reason geotechnical consultants should be retained through the construction stage, to identify variations if they are exposed and to conduct additional tests which may be required and to deal quickly with geotechnical problems if they arise.

Limitations of Geotechnical Site Investigation

Report for benefit of client

The report has been prepared for the benefit of the client and no other party. WSP assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of WSP or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

Other limitations

WSP will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.