GROUNDED EXPERTISE

Report on Geotechnical Investigation

Proposed Hotel and Apartments

402 Macquarie Street, Liverpool NSW

Prepared for The Grand Liverpool Pty Ltd

Project 228571.00

24 June 2024

Douglas Partners Pty Ltd
ABN 75 053 980 117
douglaspartners.com.au
96 Hermitage Road, West Ryde, NSW 2114
(02) 9809 0666

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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.

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Douglas Partners acknowledges Australia's First Peoples as the Traditional Owners of the Land and Sea on which we operate. We pay our respects to Elders past and present and to all Aboriginal and Torres Strait Islander peoples across the many communities in which we live, visit and work. We recognise and respect their ongoing cultural and spiritual connection to Country.

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402 Macquarie Street, Liverpool NSW

1. Introduction

This report prepared by Douglas Partners Pty Ltd (Douglas) presents the results of a geotechnical investigation undertaken for a proposed development at 402 Macquarie Street, Liverpool NSW (the site). The investigation was commissioned by The Grand Liverpool Pty Ltd and was undertaken in accordance with Douglas' proposal 225857.00.P.001.Rev1 dated 17 April 2024.

It is understood that the proposed hotel and residential apartment development includes 30-storeys and six levels of basement. For the western part of the site, it is understood that the existing shoring wall and anchors are proposed to be reused, with the excavation extending a further three basements (~12 m) by vertical cuts. The eastern part of the site will need new shoring piles and the entire shoring system will require new temporary anchors.

The aim of the investigation was to assess the subsurface soil and groundwater conditions across the site in order to provide detailed geotechnical information to inform the development application, design and construction.

The investigation included the drilling of six boreholes, imaging of the open boreholes using an acoustic televiewer, water pressure (packer) testing within the open boreholes, installation of three groundwater monitoring wells, water sampling for offsite disposal and permeability (rising head) tests in the wells. The details of the field work are presented in this report, together with comments and recommendations related to the development.

This report must be read in conjunction with all appendices including the notes provided in Appendix A.

Douglas also recently undertook assessments of the existing shoring wall on the western part of the site, through numerical modelling (report Ref. 228571.00.R.002.Rev0) and downhole magnetic gradiometry to investigate the as-built pile toe level (report Ref. 22857.00.R.003.Rev0).

2. Site Description, History and Previous Investigation

It is understood that in late 2017 / early 2018 that the western two thirds of the site was subject to construction activities for a development that did not proceed. Three basement levels were excavated vertically and are supported by soldier piles with shotcrete infill panels and two rows of temporary tie-back anchors. The toe of the piled shoring wall appears to extend around 1.8-2.0 m below the third basement level (refer to Douglas report 22857.00.R.003.Rev0). This shoring wall was understood to have been designed to support a building which was previously located on the eastern part of the site. The eastern part of the site is now vacant, with the previous building(s) demolished in 2019.

Geotechnical investigations by others were conducted on the western two thirds of the site, which included ten cored boreholes drilled from the original ground surface and during excavation works. The boreholes were taken to maximum depths of 9 m to 12 m. Some groundwater monitoring wells were installed, with water levels measured at around 4-6 m depth below the existing ground surface.

3. Desktop Study

3.1 Geology

The Geological Survey of NSW Seamless Geology Web Map indicates that the site is underlain by Bringelly Shale. Bringelly Shale is a formation of sedimentary rocks which consist of claystone-siltstone (70%), laminite and sandstone (25%), coal and carbonaceous claystone (3%) and tuff (2%) (William and Airey 2004). Bringelly Shale is known to deteriorate if fresh material is exposed to repeated wetting and drying cycles.

Residual soils that originate from weathered Bringelly Shale are known to exhibit moderate to high shrink / swell behaviour (i.e. reactive), which is a result of mineral composition in combination with changes in the soil moisture content.

3.2 Hydrogeology

Based on the site's geology a fractured aquifer system is likely located within the secondary permeability of the Bringelly Shale.

Four registered groundwater wells are located within about 600 m of the site, however, no standing water level is shown recorded on the WaterNSW record sheets for these wells.

The Georges River is located over 600 m to the east/south-east of the site.

4. Field Work

The field work was undertaken in May 2024 and the methods and results are described in the following sections.

4.1 Boreholes

Six boreholes were drilled by truck and track mounted rigs using solid flight augers and rotary (wash-boring) through soils and then HQ wireline coring through the rock to obtain core samples. Standard penetration tests were undertaken at regular intervals within the soil profile.

Four boreholes were drilled in the east of the site (BH301, BH302, BH303 and BH304) and two were drilled in the lower western part of the site (BH405 and BH406).

Borehole locations are shown on Drawing 1 in Appendix B. Borehole coordinates and levels were surveyed using a differential GPS receiver, typically accurate to ±0.1 m.

The results of the boreholes are attached in Appendix C. Descriptive notes which should be read in conjunction with the borehole logs are attached in Appendix A.

The interpreted geological profile encountered from the four boreholes in the higher eastern part of the site can be summarised as follows:

- **FILL:** gravel to 0.15 m depth in BH301 and BH302, forming the driveway access pad.
- **Residual CLAY:** Generally firm to stiff, becoming very stiff to hard below about 0.5 – 1.0 m depth.
- **BRINGELLY SHALE:** Typically siltstone with beds of sandstone, and interbedded/ interlaminated siltstone and sandstone. In detail:
  - Very low to low strength siltstone below about 1.1 – 1.7 m depth.
  - Medium strength siltstone below about 2.9 – 5.0 m depth.
  - Beds of high to very high strength sandstone and high strength siltstone below about 7.5 – 12.8 m.
  - High strength interbedded/interlaminated siltstone/sandstone below about 19.0 m depth to the base of the boreholes at 22.1 – 28.1 m.

The interpreted geological profile encountered from the two boreholes in the lower western part of the site can be summarised as follows:

- **BRINGELLY SHALE:** Typically siltstone with beds of sandstone, and interbedded/ interlaminated siltstone and sandstone. In detail:
  - Medium or medium to high strength siltstone at the surface.
  - High to very high strength sandstone below about 8.1 m.
  - High strength interbedded/interlaminated siltstone/sandstone below about 10.2 – 12.8 m to the base of the boreholes at 14.1 – 20.1 m.

No free groundwater was measured in the boreholes whilst auger drilling and the use of water precluded the measurement of water levels during rotary wash boring or HQ coring.

4.2 Acoustic Televiewer

Acoustic televiewer (ATV) logging was undertaken in each drilled borehole. ATV logging takes an image of the drilled borehole using high-resolution sound waves. The device is inserted into the base of the hole and takes measurements as the device is raised. The acoustic image can then be interpreted and provide information on defects within the rock, oriented to magnetic north. Douglas engaged a subcontractor to undertake the ATV logging.

Individual ATV Interpreted Features Reports are attached in Appendix E.

Douglas then processed the interpreted data as a single data set using the program DIPS, to identify any joint 'sets' and to statistically assess the risk of rock wedges forming on the four sides of the proposed excavation. The assessment indicates that the south-west excavation face (Carey Street) has a higher probability of wedge failures than the remaining other three faces.

The results from the DIPS analysis are included in Appendix E.

4.3 Groundwater Monitoring

Groundwater monitoring wells were installed within boreholes BH301, BH304 and BH405 at the completion of drilling and ATV imaging. Within the holes, Class 18 machine slotted PVC pipe was installed to the base of the holes and surrounded with filter gravel. The top 2-4 m of the well was unslotted and was sealed against the borehole walls using bentonite. Well installation logs are attached in Appendix C.

The remaining three boreholes (BH302, BH303 and BH406) were left open and the water level measured on 24 May in these holes and the wells, approximately 2.5 – 3 weeks after the wells were installed. BH303 had collapsed and no water measurement could be obtained on this date. Before the packer test (see Section 4.4.1) in borehole BH303, groundwater was measured at 9.7 m depth on 3 May 2024 (the borehole had been drilled to completion depth of 24.15 m the previous day).

Automatic loggers were installed within each well taking readings every 1-2 hours so that long term data can be collected at a future date.

The results of water level measurements in the wells and open boreholes are summarised in Table 1.

Table 1: Monitoring wells overview

Well / Borehole	Surface (RL, m AHD)	Well Screen		Measured Water Level on 24 May 2024 (RL, m AHD)
		Section Length (RL, m AHD)	Lithology	
BH301	27.3	23.15 to -0.85	Siltstone, Sandstone	18.1
BH302	27.9	N/A	N/A	17.7
BH303	27.6	N/A	N/A	17.9*
BH304	27.5	23.36 to 5.36	Siltstone, Sandstone	16.6
BH405	18.7	16.60 to 4.60	Siltstone, Sandstone	16.7
BH406	18.9	N/A	N/A	16.4

Note: * water measurement on 3 May 2024 after hole was drilled on 2 May 2024 and prior to packer testing

4.4 Permeability Testing

4.4.1 Packer Testing

Packer testing was conducted in boreholes BH301, BH302 and BH303 to assess the Lugeon value of the rock mass within the hole length tested. The testing was in accordance with industry standard test procedures. Testing was carried out by the Field Engineers using equipment supplied by the drilling contractor. Prior to testing the boreholes were thoroughly flushed with clean water.

The packer tests were undertaken in each borehole within the siltstone and sandstone bedrock, with the top of the tested section at around 9 – 14 m depth and the bottom of the tested section at around 24 – 28 m (base of the drilled borehole). The testing procedure involved the use of a single hydraulic packer system to systematically test the hole section in a down stage manner. The water was delivered to the packer through the in-place HQ rods with an internal diameter of 76 mm. The rate of water flow out of the sealed off section of the borehole was measured using a flow meter, and cross checked with volume flows from a calibrated drum. Typically, the flow was measured over 15-minute intervals at three different pressures, firstly in ascending order followed by descending order. The maximum pressure used did not exceed the vertical rock pressure at the test section depth (calculated using an assumed average density of rock of 22 kN/m^3).

The results were interpreted using both Houlsby and Burgess methods. Houlsby's method involves selecting a representative Lugeon value based on the interpreted flow pattern. Burgess' method involves using a line of best fit through the measured data, projecting that line through the origin and calculating the Lugeon value based on the estimated water loss at 1,000 kPa.

The packer test records are presented in Appendix D, with the assessed Lugeon value and approximate permeability of the tested section presented in Table 2.

Table 2: Summary of Packer Tests

Borehole	Packer Test Section Length in Borehole (m)	Assessed Lugeon Value (l/m/min)		Interpreted Hydraulic Permeability Range (m/sec)
		Houlsby	Burgess	
BH301	8.70 – 28.15	2	3	1.5 – 2.7 x10^{-7}
BH302	9.50 – 25.30	0.4	0.5	4.1 – 8.0 x10^{-8}
BH303	14.00 – 24.15	<0.1	<0.1	3.6 – 6.5 x10^{-9}

4.4.2 Rising and Falling Head Tests

Rising and/or Falling head permeability tests were undertaken in the monitoring wells whereby a 'slug' was either inserted into or extracted from the water column to cause the water level to either rise or fall as a result (BH304 and BH405) or the water within the wells was pumped out and the rate of water recharge was measured (BH301). Measurements were then taken as the water level returned to its original level. The data was measured using an automated logger suspended towards the base of the well, taking measurements every second.

Rising and falling head records and analysis sheets are attached in Appendix D. The results sheets include the interpreted hydraulic conductivity of the rock mass using the methods of Hvorslev (1951). The results of the rising and falling head tests are summarised in Table 3.

Table 3: Summary of Rising and Falling Head Tests

Well	Interpreted Hydraulic Permeability (Hvorslev) (m/sec)		
	Pumped Rising Head	Slug Rising Head	Slug Falling Head
BH301	9.4×10^{-8}	-	-
BH304	2.8×10^{-6}	1.1×10^{-5}	1.1×10^{-5}
BH405	1.3×10^{-6}	1.1×10^{-6}	1.0×10^{-6}

5. Laboratory Testing

5.1 Rock

Over 110 rock point load index tests ($Is_{(50)}$) were carried out on the recovered rock core at regular intervals. The results are shown on the respective borehole logs and are graphically presented in Figure 1.

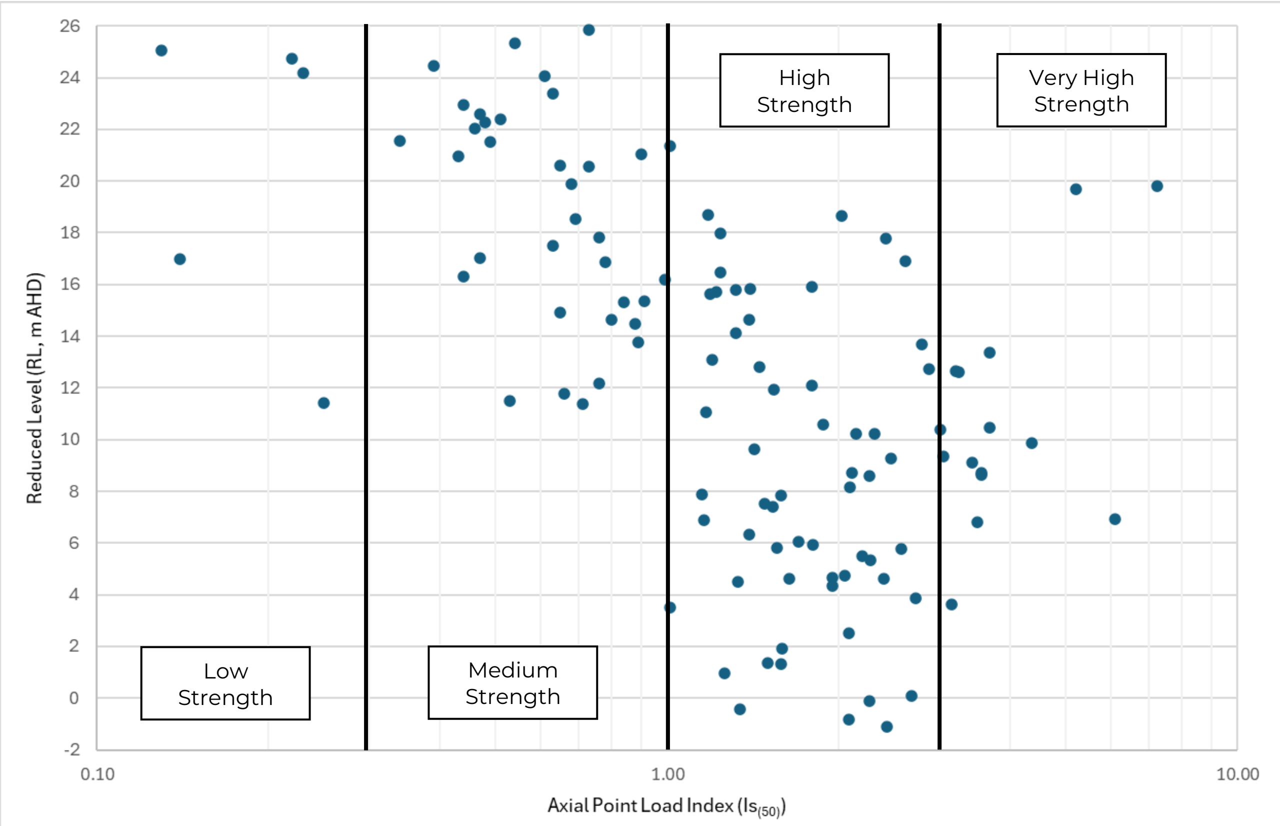

Figure 1: Point Load Index Results

5.2 Water

Samples of groundwater from the three installed monitoring wells were tested for a range of contaminants. The laboratory reports are included in Appendix F. These results will be discussed in the dewatering management plan that Douglas will be preparing (report 228571.00.R.004).

6. Geotechnical Model

Interpreted geotechnical cross-sections through the site, are shown on Drawings 2 and 3 in Appendix B. These sections include the current boreholes and the previous boreholes drilled by others. Strata Units have been interpreted on these sections, with the rock classified in accordance with the procedures given in Pells et al (2019), which uses a combination of rock strength, fracture spacing and allowable defects to divide the rock into five classes.

The geotechnical model for the site is summarised in Table 4.

Table 4: Geotechnical Model

Strata	Level to top of Strata (m, AHD)					
	BH301	BH302	BH303	BH304	BH405	BH406
Fill	27.3	27.9	-	-	-	-
Clay st	27.2	27.8	27.6	27.5	-	-
Clay vst-h	26.6	26.9	27.0	27.0	-	-
Siltstone VL-L	26.1	26.2	26.5	26.4	-	-
Siltstone M	24.5	22.9	24.2	22.7	-	-
Sandstone H-VH	19.8	19.5	20.1	14.7	-	-
Siltstone M	19.1	18.9	18.6	-	18.7	18.9
Sandstone H-VH	14.0	12.9	13.5	-	-	-
Siltstone M	12.0	11.9	11.6	11.9	-	-
Sandstone H-VH	11.1	10.9	10.6	11.0	10.9	10.7
Siltstone/Sandstone H	8.8	8.7	8.3	8.5	8.5	6.1
End of hole	*-0.8*	*2.6*	*3.5*	*5.4*	*4.6*	*-1.2*

NOTE: st = stiff, vst = very stiff, h = hard, VL = very low strength, L = low strength, M = medium strength, H = high strength, VH = very high strength

Groundwater was encountered between RL 15.7 m and RL 17.9 m, typically being at a higher level in the east of the site and a lower level in the west of the site. The groundwater table is therefore expected to be some 6 m to 10 m above the bulk excavation level.

7. Proposed Development

The proposed development consists of a hotel and residential apartment building of 30-storeys and six levels of basement. The basement excavation will extend to depths of around 19 m in the higher eastern part of the site and to about 10 m below the current excavation level in the lower western part of the site.

For the lower western part of the site, it is understood that the existing shoring wall is proposed to be reused, with the excavation extending below this wall using vertical cuts in the rock. The eastern part of the site will need new shoring piles and the entire shoring system will require new temporary anchors.

Details on the specific column working loads have not been confirmed but given the building height they will be relatively high.

8. Comments

8.1 Basement Excavation Support

The proposed excavation will extend to about 19 m depth in the higher eastern part of the site and to about 10 m below the current excavation level in the lower western part of the site. The excavation is proposed to extend up to site boundaries and will therefore need to be cut vertically. The vertical excavation will require both temporary and permanent lateral support to provide stability to surrounding structures and property.

For the lower western part of the site, existing shoring is already installed. This shoring wall consists of 600 mm diameter soldier piles at 2.0 m spacing (centre to centre), restrained by two rows of temporary tie back anchors. Douglas investigated the toe level of the piles (Report Ref. 22857.00.R.003.Rev0), with the results of that investigation indicating that the toe level is at about RL 17.0 m. This puts the toe of the piles within siltstone of medium strength, some 3 m to 6 m above high to very high strength sandstone/siltstone and about 7 m to 9 m above the proposed bulk excavation level. Douglas proposes that the western part of the site be excavated vertically below the existing shoring wall following the detailed methodology presented in Section 8.1.2. The basement structure will need to be designed to support the vertical rock face and the existing shoring wall in the long term.

It is understood that for the higher eastern part of the site that a new shoring wall is to be installed, consisting of soldier piles with shotcrete infill panels temporarily restrained by tie-back anchors during construction and the basement floor slabs in the long term.

8.1.1 Surrounding Properties and Structures

The neighbouring properties to the south and south-east (No. 1 and No. 5 Charles Street) do not appear to have any basements. However, the neighbouring property to the east (No. 170 Terminus Street) is understood to have two basement levels. An investigation should be undertaken to determine the nature and condition of the foundations and their loads. The proposed shoring system may need to be modified to ensure support to this adjacent building, depending on the findings of the investigation. This could include major underpinning, anchors or leaving a permanent rock bench if adverse conditions are encountered. It is assumed that the permanent structure will support the shored section of the excavation in the long-term.

Macquarie Street and Carey Street border the site to the north and west, respectively. Macquarie Street is a NSW state asset and as such approvals will need to be sought from Transport for NSW (TfNSW). Reference should be made to TfNSW Geotechnology Technical Direction (GTD) 2020/001 with regards to excavation adjacent to Transport for NSW Infrastructure.

Douglas notes that the existing shoring in the western part of the site does contain three inclinometers, which would have been installed for the purposes of monitoring lateral movement of the shoring wall adjacent to Macquarie Street. If it has not commenced already, it is suggested that survey monitoring of the shoring wall and inclinometer readings in the existing inclinometers should commence with minimal delay. The existing inclinometers may not extend to below the proposed basement and will therefore provide limited value for future excavations but can be used to assess current stability until new works commence.

8.1.2 New Shoring Wall

The new shoring wall should be designed and constructed similar to the existing wall in the lower western part of the site. The wall should therefore consist of around 600 mm diameter soldier piles at approximate 2.0 m spacings, with shotcrete infill panels and temporarily restrained by three to four rows of tie-back anchors. Due to the potential for unstable wedges to form in the Bringelly Shale rock, the shoring piles should be extended to below the bulk excavation level. If the shoring piles are to terminate above the bulk level, then the toe of each pile will need a Bolt/anchor and the vertical rock cuts beneath should be supported as per the methodology set out in Section 8.1.2.

The shoring wall will need to be designed to support earth pressures (refer to Section 8.1.4), the building to the east (No. 170 Terminus Street) and surcharge loads (e.g. Macquarie Street). The design should also consider the possibility that unfavourable joints in the Bringelly Shale rock will daylight near the base of the excavation, leading to wedges of rock which need to be supported by the temporary and permanent retaining structures (refer to Section 8.1.5).

8.1.1 Existing Shoring Wall

The existing shoring wall in the west of the site is proposed to be retained and incorporated into the new shoring system.

The temporary 'tie back 'anchors in this shoring wall do not appear to have been installed with any form of corrosion protection. As such, the integrity of the anchors is presently unknown.

Douglas highly recommends that the existing anchors be ignored as part of the new shoring system design. Douglas would not be able to verify the capacity of the anchors to sustain load even if restressing or 'lift off' testing was undertaken. Therefore, new anchors will need to be installed prior to any excavation below the current level of RL 18.9 m. It is also recommended that a 'toe' anchor be installed before any excavation extends below RL 17.5 m depth.

The shoring wall itself was likely designed to be incorporated into the final structure and thus would have adequate cover to reinforcement steel. The structural engineer should comment on re-use of the existing shoring piles.

8.1.2 Vertical Cuts (Hit and Miss Panels)

In the western part of the site, vertical excavation is proposed beneath the existing shoring wall. Douglas recommends that vertical cuts in the siltstone/sandstone be undertaken in a 'hit and miss' underpinning panel sequence under close supervision by an experienced geotechnical engineer or engineering geologist.

The hit and miss vertical faces will need to be supported by shotcrete and mesh and any unfavourable rock defects (e.g. wedges) restrained by temporary anchors/bolts.

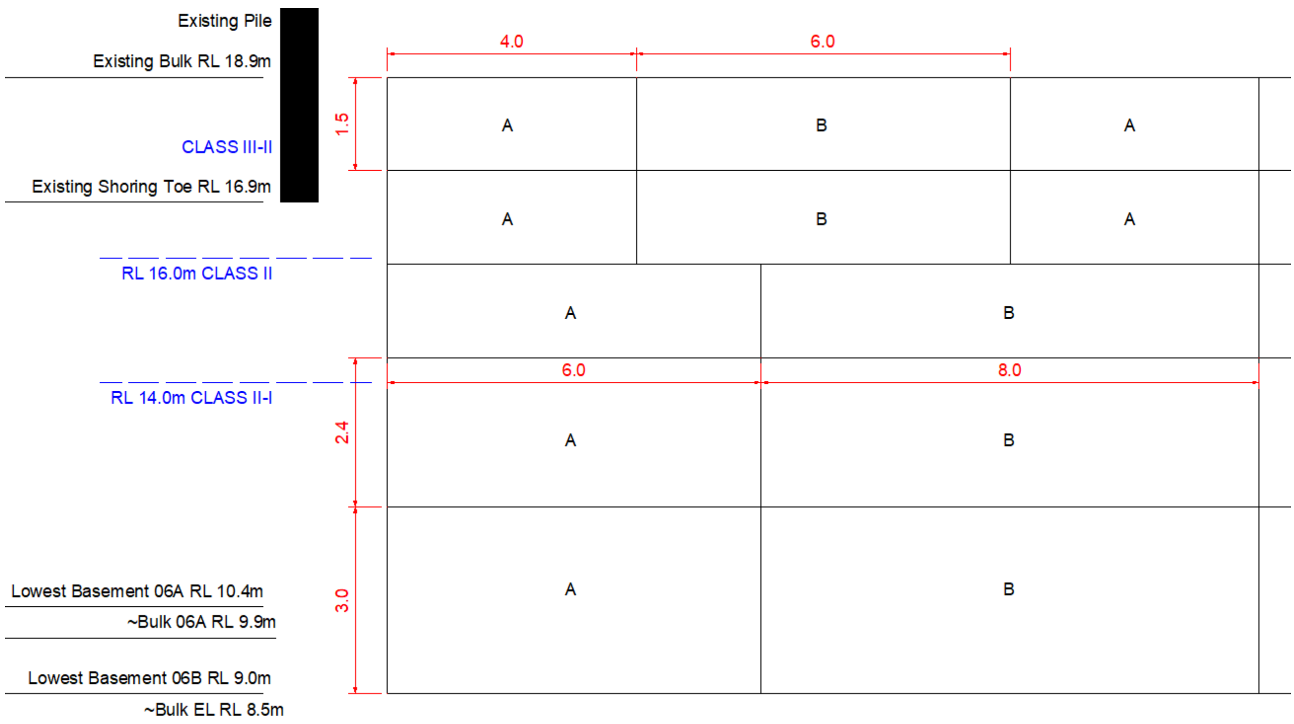

Figure 2: Preliminary 'Hit and Miss' Panel Sequence (Elevation)

The following preliminary excavation and construction sequence is recommended to reduce the geotechnical risks associated with underpinning the shoring wall. Refer to Figure 2 for the proposed hit and miss panel arrangement.

- Step 1.1: Excavate the <u>first</u> row of 'A' panels, which are to be 1.5 m in height and 4.0 m wide. This will result in an excavation level of about RL 17.4 m. **Hold Point – geotechnical engineer to inspect the exposed rock face between the shoring piles.**
- Step 1.2: Construct shotcrete infill panels, with mesh tied into the piles.
- Step 1.3: Locally excavate in front of one pile at a time (about 0.5 m of excavation) and install the toe anchor/bolt in each pile.
- Step 1.4: Excavate the first row of 'B' panels, which are to be 1.5 m in height and 6.0 m wide. This will result in an excavation level of about RL 17.4 m. **Hold Point – geotechnical engineer to inspect the exposed rock face between the shoring piles.**

- Step 1.5 Place drainage strips and construct shotcrete infill panels, with mesh tied into the piles.
- Step 1.6: Locally excavate in front of one pile at a time (about 0.5 m of excavation) and install the toe anchor/bolt in each pile.
- Step 2.1: Excavation the second row of 'A' panels, which are 1.5 m high and 4.0 m wide. This will result in an excavation level of about RL 15.9 m and will now be below the toe of the shoring piles. **Hold Point – geotechnical engineer to inspect the exposed rock face and mark out locations of anchors/bolts.**
- Step 2.2: Drill anchor holes, install bolts/anchors (refer to Section 8.1.4 on rock wedge design). Place drainage strips, mesh and construct shotcrete panels. Tension bolts/anchors.
- Step 2.3: Excavation the second row of 'B' panels, which are 1.5 m high and 4.0 m wide. **Hold Point – geotechnical engineer to inspect the exposed rock face and mark out locations of anchors/bolts.**
- Step 2.4: Drill anchor holes, install bolts/anchors. Place drainage strips, mesh and construct shotcrete panels. Tension bolts/anchors.
- Step 3.1: Excavate the third row of 'A' panels, which are 1.5 m high but can now be wider at 6.0 m width, as it is expected that more competent Class II rock will now be exposed. This will result in an excavation level of about RL 14.4 m. **Hold Point – geotechnical engineer to inspect the exposed rock face and mark out locations of anchors/bolts.**
- Step 3.2: Drill anchor holes, install bolts/anchors. Place drainage strips, mesh and construct shotcrete panels. Tension bolts/anchors.
- Step 3.3: Excavate the third row of 'B' panels, which are 1.5 m high and 8.0 m wide. **Hold Point – geotechnical engineer to inspect the exposed rock face and mark out locations of anchors/bolts.**
- Step 3.4: Drill anchor holes, install bolts/anchors. Place drainage strips, mesh and construct shotcrete panels. Tension bolts/anchors.
- Step 4.1: Excavate the fourth row of 'A' panels, which are now 2.4 m high and 6.0 m wide, as it is expected that more competent Class II-I rock will now be exposed. This will result in an excavation level of about RL 12.0 m. **Hold Point – geotechnical engineer to inspect the exposed rock face and mark out locations of anchors/bolts.**
- Step 4.2: Drill anchor holes, install bolts/anchors. Place drainage strips, mesh and construct shotcrete panels. Tension bolts/anchors.
- Step 4.3: Excavate the fourth row of 'B' panels, which are 2.4 m high and 8.0 m wide. **Hold Point – geotechnical engineer to inspect the exposed rock face and mark out locations of anchors/bolts.**
- Step 4.4: Drill anchor holes, install bolts/anchors. Place drainage strips, mesh and construct shotcrete panels. Tension bolts/anchors.
- Step 5.1: Excavate the fifth and final row of 'A' panels, which are 3.0 m high and 6.0 m wide. This will result in an excavation level of about RL 9.0 m. **Hold Point – geotechnical engineer to inspect the exposed rock face and mark out locations of anchors/bolts.**
- Step 5.2: Drill anchor holes, install bolts/anchors. Place drainage strips, mesh and construct shotcrete panels. Tension bolts/anchors.

- Step 5.3: Excavation the fourth row of 'B' panels, which are 3.0 m high and 8.0 m wide. **Hold Point – geotechnical engineer to inspect the exposed rock face and mark out locations of anchors/bolts.**
- Step 5.4: Drill anchor holes, install bolts/anchors. Place drainage strips, mesh and construct shotcrete panels. Tension bolts/anchors.

Note: If the shotcrete panels are being constructed without restraint from the bolts/anchors under tension, then the panels will need to have 'footings' that extend down to the rock at the current excavation level, otherwise the shotcrete panel will slide off the rock face.

As part of the underpinning methodology, the structural engineer needs to:

- Nominate the required thickness and mesh for the shotcrete panels.
- Nominate the structural connection details of the new shotcrete panels into the piles.
- Nominate the connection details of the anchors/bolts and mesh.
- Consider the bearing pressure that the anchor plates will impose on the concrete piles (e.g. chisel out a flat area for the anchor plate).
- Consider that the anchor plate needs to be placed perpendicular to the strands and therefore may need to specify a purposely made chair for this.

Identifying adverse joints in the rock is critical to this methodology. This approach is suggested only on the basis that Douglas Partners is engaged to carry out inspection and mapping of the joints at the HOLD POINTS nominated above. Douglas would take no responsibility for work and inspections carried out by the contractor and their geotechnical consultant as there is no control on the experience of the geotechnical consultant inspecting the rock and jointing.

It is important to note that the above methodology is preliminary and is a recommendation for the civil contractor to adopt for the vertical excavation beneath the existing shoring piles.

The methodology should not be used as part of a specification, without review and agreement by Douglas as the preliminary methodology has been written as advice and opinion rather than instructions for construction.

8.1.3 Earth Pressure Design

Preliminary design for lateral earth pressures for a multi-anchored wall system may be based on a uniform rectangular earth pressure distribution. A uniform lateral earth pressure could be adopted for the retaining wall of 4H kPa (H = Height (m) to be retained from surface to the top of medium to high or high strength rock or 6H (where lateral movements are to be reduced, such as to the neighbour to the east at No. 170 Terminus Street). Additional lateral pressures due to surcharge loadings behind the wall and hydrostatic pressures (as appropriate) should be allowed for within the structural design.

Shoring will also need to be designed to support earth pressures and surcharge loads. The final or detailed design of retaining walls are normally undertaken using interactive computer programs such as WALLAP or PLAXIS, which can take due regard of soil-structure interaction during the progressive stages of wall construction, anchoring and bulk excavation. Plaxis or similar is suggested for this site so that ground movements behind the wall can also be assessed.

Alternatively, design for lateral earth pressures may be based on the parameters given in Table 5. For situations where only minor lateral movements are acceptable, such as the support of sensitive structures or services, an increased pressure based on "at-rest" conditions should be adopted, depending on the level of restraint required. A uniform pressure of 10 kPa should be adopted for the support of low to medium strength or stronger rock between soldier piles and/or anchors to account for minor wedges that may become mobilised.

Table 5: Recommended Design Parameters for Shoring Design

Material	Unit Weight (kN/m^3)	Earth Pressure Coefficient		Effective Cohesion c' (kPa)	Effective Friction Angle (Degrees)
		Active (K_a)	At Rest (K_o)		
FILL	20	0.35	0.6	1	30
Residual CLAY	21	0.3	0.5	5	27
Very Low to Low Strength SILTSTONE	23	0.2	0.25	20	30
Medium Strength SILTSTONE	24	10 kPa uniform	10 kPa uniform	50	33
High Strength SILTSTONE	24	0*	0*	100	36
High to Very Vigh Strength SANDSTONE	24	0*	0*	300	45

Note: * Subject to jointing assessment by experienced Geotechnical Engineer/Engineering Geologist

All surcharge loads should be allowed for in the shoring design including building footings, inclined slopes behind the wall, traffic and construction related activities.

Shoring walls should be designed for full hydrostatic pressures unless drainage of the ground behind impermeable walls can be provided. Drainage could comprise 150 mm wide strip drains pinned to the face at 1 m to 2 m centres behind shotcrete in-fill panels.

8.1.4 **Rock Wedge Design**

Based on the DIPS analysis of the rock defects identified from the ATV logging in the boreholes (Section 4.2), Douglas recommends that the design of temporary and permanent support consider the possibility that 55 degree joints (above horizontal) in the Bringelly Shale rock will daylight near the base of the shoring wall leading to wedges of rock which need to be supported by the temporary and permanent retaining structures.

The support system would typically comprise anchors spaced at 2 m to 3 m centres over the rock face, through the shoring piles (where they exist) or directly onto the rock face with face plates. These anchors should have their bond lengths formed in rock behind a line projected up at 55 degrees from the base of the shoring.

As a guide, it is suggested that the anchor capacity (working load) of the support system should be designed for an anchor force per unit width of $4.2\ H^2$ (kN), where H is the height of the excavation in metres. This approximation of the anchor force required to support a 55-degree wedge is based on an anchor inclination of 10 degrees below horizontal, an average bulk weight of 23 kN/m^3, and friction angle of 30 degrees (with zero cohesion) along the failure plane. Given that there is a very low probability that a joint would run the full length and height of the excavation it suggested that this aspect of the design may be carried out for a factor of safety of 1.0.

For steeper anchors, the anchor capacity would need to be increased as per Table 6.

Table 6: Increased Capacity Requirement for Steeper Anchors

Angle of Installation (below horizontal)	Required Percentage Increase in Capacity
10°	0%
20°	14%
30°	27%

Inspection of the cut faces during the excavation phase should be carried out by an experienced Engineering Geologist or Geotechnical Engineer to check the adequacy of the design. The mapping of all actual joints and faults will also allow the re-calculation of the horizontal force required to restrain the actual joint wedges present for final support design, for the permanent basement structure. Obviously this approach to permanent support design will require considerable interaction between the Structural and Geotechnical Engineers.

8.1.5 Ground Anchors

The design of temporary and permanent ground anchors for the support of excavations and/or shoring systems may be carried out on the basis of the maximum allowable bond stresses given in Table 7.

Table 7: Allowable Bond Stresses for Rock Anchor Design

Material Description	Maximum Allowable Bond Stress (kPa)	Maximum Ultimate Bond Stress (kPa)
Medium Strength SILTSTONE	400	800
High Strength SILTSTONE	500	1000
High to Very Vigh Strength SANDSTONE	1000	2000

The parameters given in Table 10 assume that the drilled holes are clean and adequately flushed. The anchors should be bonded behind a line drawn up at 55 degrees from the base of the shoring, and "lift-off" tests should be carried out to confirm the anchor capacities. It is suggested that ground anchors should be proof loaded to 125% of the design working load and locked-off at no higher than 80% of the working load.

It is anticipated that the building will support the basement excavation over the long term and therefore the ground anchors are expected to be temporary only. The use of permanent anchors would require careful attention to corrosion protection including full column grouting and the use of an internal corrugated sheathing over the full length of the anchor. A detailed specification would need to be prepared for the installation and stressing of permanent anchors.

8.1.6 Passive Resistance

Passive resistance for shoring piles founded below the base of the bulk excavation (including allowance for services or footings) may be based on an ultimate passive restraint value of 8,000 kPa for high or high to very high strength siltstone or sandstone. This ultimate value will need to incorporate a factor of safety to limit the wall movement that is required to mobilise the full passive resistance. The top 0.5 m of the socket should be ignored due to possible disturbance (e.g. over-excavation) and tolerance effects. The passive restraint adopted in the design must not exceed the shear capacity of the pile.

8.2 Stress Relief

Locked in stresses are present in the rock and during excavation these stresses will be released, which will result in lateral movement of the rock. These lateral movements may cause cracking of adjacent buildings and the potential movement of roads. They may also cause increases in the loads on anchors.

Based on previous experience, lateral movements of the edge of the excavation in the order of 0.5 to 1 mm per metre depth of rock excavation can be expected. For the proposed excavation to 19 m depth (about 10-12 m of rock of medium strength or greater), movement due to stress relief could be up to about 12 mm. Maximum movement will occur towards the centre of the boundaries.

Consideration should be given to the locations of internal columns, connections with perimeter walls and other design issues, so that the potential stress relief movements as a result of construction or do not affect the building, or the neighbouring building to the east (No. 170 Terminus Street).

8.3 Site Preparation and Earthworks

8.3.1 Excavaton Conditions

It is anticipated that excavation for the basement will require the removal of shallow filling, mostly clayey soils and bedrock ranging in strength from very low to very high strength.

Excavation of soil and very low to low strength rock should be achievable using conventional earthmoving equipment. It is anticipated that excavation of medium to very high strength rock will require heavy ripping with a large bulldozer, together with the use of hydraulic rock breakers for effective removal of this material. Productivity in slightly fractured and unbroken, high and very strength rock may be very low. Excavation contractors can inspect rock core at the Douglas office and should make their own assessment of productivity and equipment required.

The detailed excavation for footings, services and lift pits below the bulk level will generally require the use of a rotary rock saw, grinder, or hydraulic rock hammers.

Rock saws or grinders may also need to be used to reduce vibrations near adjacent structures to reduce the potential for causing damage to such structures.

8.3.2 Dilapidation Surveys and Monitoring

Dilapidation surveys should be carried out on surrounding buildings and pavements that may be affected by the basement construction. The dilapidation surveys should be undertaken before the commencement of any excavation work in order to document any existing defects so that any claims for damage due to construction related activities can be accurately assessed.

In accordance with TfNSW GTD 2020/001, monitoring of the excavation during construction will be required. This should be undertaken through survey targets on the shoring wall capping beam (both new and old walls) and at about 5 m and 10 m below the capping beam. The targets should be spaced along the walls at a spacing of no greater than 10 m. Furthermore, at least three inclinometers will need to be installed along the Macquarie Street frontage to monitor wall movements from the ground level to below the bulk level. Inclinometers are typically installed within shoring piles (where they are founded below the bulk level) or within boreholes (drilled in footpath adjacent to where the existing shoring wall is located.

8.3.3 Vibrations

During excavation, it will be necessary to use appropriate methods and equipment to keep ground vibrations at adjacent buildings and structures within acceptable limits. The level of acceptable vibration is dependent on various factors including the type of building structure, its structural condition, the frequency range of vibrations produced by the construction equipment, the natural frequency of the building and the vibration transmitting medium.

Ground vibration can be strongly perceptible to humans at levels above 2.5 mm/s component peak particle velocity (PPVi). This is generally much lower than the vibration levels required to cause structural damage to buildings. The Australian Standard AS2670.2-1990 *"Evaluation of human exposure to whole-body vibrations – continuous and shock induced vibrations in buildings (1-80 Hz)"* indicates an acceptable day time limit of 8 mm/s component PPVi for human comfort.

Based on the experience of DP and reference to AS2670, it is suggested that a maximum component PPVi of 8 mm/sec (applicable at the foundation level of existing buildings) be employed at this site to reduce the risk of causing architectural damage to surrounding buildings.

As the magnitude of vibration transmission is site specific, it is recommended that a vibration trial be undertaken at the commencement of rock excavation. The trial may indicate that smaller or different types of excavation equipment should be used for bulk (or detailed) excavation purposes.

8.3.4 Disposal of Excavated Material

All excavated materials will need to be disposed of in accordance with the provisions of the current legislation and guidelines including the *Waste Classification Guidelines* (EPA, 2014). This includes filling and natural materials that may be removed from the site. Accordingly, environmental testing will need to be carried out to classify spoil prior to transport from the site.

8.4 Foundations

The bulk excavation level is expected to expose high and high to very high strength interbedded siltstone and sandstone. The higher Basement B06A level (RL 10.4 m) could expose a thin layer of medium strength siltstone. It is recommended that all pad footings supporting the structure be founded on rock of similar strength, thus if medium strength siltstone is exposed in the base of a pad footing, the footing should be deepened until at least high strength siltstone/sandstone is encountered.

Footings should be founded below a 45 degree line from any adjacent excavations. If footings are to be founded near the edge of vertical cuts in competent high strength sandstone then this will need to be assessed on a case by case basis and the bearing pressure should be reduced to say 2000 kPa. If adverse joints are found below the footing then underpinning may be required.

Recommended maximum pressures for the various rock strata are presented in Table 8. For piles required to resist uplift forces, shaft adhesion values for uplift (tension) may be taken as being equal to 70% of the values for compression.

Table 8: Recommended Design Parameters for Foundation Design

Strata	Maximum Allowable Pressure		Maximum Ultimate Pressure	
	End Bearing (kPa)	Shaft Adhesion (Compression) (kPa)	End Bearing (kPa)	Shaft Adhesion (Compression) (kPa)
High and high to very high strength siltstone/sandstone	8,000	600	80,000	1000

Foundations proportioned on the basis of the allowable bearing pressures in Table 8 would be expected to experience total settlements of less than 1% of the footing width under the applied working load, with differential settlements between adjacent columns expected to be less than half of this value.

All footings/piles should be inspected by a geotechnical engineer to confirm that foundation conditions are suitable for the design parameters. Spoon testing should be carried out in at least one third of pad footings which are designed for an allowable end bearing pressure of 3500 kPa or greater. Spoon testing generally involves drilling a 50 mm diameter hole below the base of the footing, to a depth of 1.5 times the footing width, followed by testing to check for the presence of weak/clay bands. If weak seams are detected then footings may need to be taken deeper to reach better foundation material.

8.5 Groundwater

Groundwater has been measured within the monitoring wells on the site at levels of between RL 16.4 m and RL 18.1 m. The proposed basement levels of RL 9.0 – 10.4 m will extend many metres below the water levels measured. Water seepage should be expected through joints and bedding planes within the rock mass.

The Packer testing in the three boreholes and the rising/falling head tests in BH301 indicated hydraulic conductivities of the rock strata of between 1.5 x 10^{-7} m/sec to 6.5 x 10^{-9} m/sec which is relatively low permeability and would typically be associated with relatively minor inflows. The rising and falling head tests in BH304 and BH405 indicated hydraulic conductivities of the rock strata of between 1.1 x 10^{-5} m/sec to 1.1 x 10^{-6} m/sec m/sec, which is relatively high permeability (for the Class III-I rock) and could be associated with higher localised inflows. With reference to Pells (2019), the mass hydraulic conductivity of Class III to Class I sandstone/siltstone typically ranges between about 5 x 10^{-7} to 1 x 10^{-8} m/sec.

Numerical modelling will be required to assess likely inflow volumes to the basement. The inflow volume will inform basement design which should consider serviceability and long-term groundwater management. Douglas is undertaking groundwater modelling for the proposed basement excavation, the results of which will be reported in the future.

From a geotechnical point of view, it is considered that a drained basement is feasible without any significant impact to surrounding groundwater systems or property. This will be subject to review and approval from Council and relevant authorities. Typically if predicted inflows are less than 3ML/year then there is an exemption against a Water Access License and it is generally more acceptable to WaterNSW/DPE to approve a drained basement. If inflows are more than 3 ML/year then a Water Access License with water share allocation is required. It is still possible to get a drained basement approved for more than 3 ML/year, but it can be more difficult.

For this site and given the size/depth of the basement it is likely that inflows will be more than 3 ML/year, particularly if the higher permeability values obtained from some tests are considered. Possibly grouting could be used to control inflows if required but this can be difficult.

If a drained basement slab is not permitted, or it is preferred to eliminate issues associated with long term removal of groundwater, then a water-tight 'tanked' basement will be required for the permanent basement structure. A tanked basement would need to be designed to resist uplift forces associated with hydrostatic groundwater pressures which will be significant for this site.

Disposal of any water off site will need to be in accordance with council and EPA regulations. The water chemistry testing (Section 5.2) was undertaken for the purposes of informing offsite disposal of water.

9. References

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Pells, P., Mostyn, G., Bertuzzi, R. and Wong, P. (2019). "Classification of Sandstone and Shales in the Sydney Region: A Forty Year Review." Australian Geomechanics: Journal and News of the Australian Geomechanics Society 54(2):

Pells, P. (1999). “State of practice for the design of socketed piles in rock.” Proceedings of the 8th Australia New Zealand Conference on Geomechanics: Consolidating Knowledge.

William, E. and D. Airey (2004). "Index Properties and the Engineering Behaviour of Bringelly Shale " Australian Geomechanics 39.

10. Limitations

Douglas Partners Pty Ltd (Douglas) has prepared this report for this project at 402 Macquarie Street, Liverpool NSW in accordance with Douglas' proposal 225857.00.P.001.Rev1 dated 17 April 2024, and acceptance received from Ian Jordan from The Grand Liverpool Pty Ltd. The work was carried out under Douglas' Engagement Terms. This report is provided for the exclusive use of The Grand Liverpool Pty Ltd 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 sites, 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 Douglas, does so entirely at its own risk and without recourse to Douglas for any loss or damage. In preparing this report Douglas 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 Douglas' field testing has been completed.

Douglas' advice is based upon the conditions encountered during this current and previous investigations. The accuracy of the advice provided by Douglas 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.

The assessment of atypical safety hazards arising from this advice is restricted to the geotechnical and groundwater components set out in this report and based on known project conditions and stated design advice and assumptions. While some recommendations for safe controls may be provided, detailed ‘safety in design’ assessment is outside the current scope of this report and requires additional project data and assessment.

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. Douglas 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 Douglas. This is because this report has been written as advice and opinion rather than instructions for construction.

This report provides specialist advice only and no part of it is considered a Regulated Design under the Design and Building Practitioner Act 2020 (NSW).

The scope of 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 fill 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 fill may contain contaminants and hazardous building materials.

Appendix A

About this Report

Explanatory Notes – Drill & Excavation Logs

About this Report

November 2023

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.

continued next page

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.

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EXPLANATORY NOTES - DRILL & EXCAVATION LOGS

GENERAL

Information obtained from site investigations is recorded on log sheets. The “Cored Drill Hole Log” presents data from an operation where a core barrel has been used to recover material - commonly rock. The “Non-Core Drill Hole - Geological Log” presents data from an operation where coring has not been used and information is based on a combination of regular sampling and insitu testing. The material penetrated in non-core drilling is commonly soil but may include rock. The “Excavation - Geological Log” presents data and drawings from exposures of soil and rock resulting from excavation of pits, trenches, etc.

The heading of the log sheets contains information on Project Identification, Hole or Pit Identification, Location and Elevation. The main section of the logs contains information on methods and conditions, material substance description and structure presented as a series of columns in relation to depth below the ground surface which is plotted on the left side of the log sheet. The common depth scale is 8m per drill log sheet and about 3-5m for excavation logs sheets.

As far as is practicable the data contained on the log sheets is factual. Some interpretation is inevitable in the identification of material boundaries in areas of partial sampling, the location of areas of core loss, description and classification of material, estimation of strength and identification of drilling induced fractures. Material description and classifications are based on SAA Site Investigation Code AS 1726 - 2017 with some modifications as defined below.

These notes contain an explanation of the terms and abbreviations commonly used on the log sheets.

DRILLING

Drilling & Casing

NDD	Non-destructive digging
AD/V	Auger Drilling with V-Bit
AD/T	Auger Drilling with TC Bit
WB	Wash-bore drilling
RR	Rock Roller
NMLC	NMLC core barrel
NQ	NQ core barrel
HMLC	HMLC core barrel
HQ	HQ core barrel

Drilling Fluid/Water

The drilling fluid used is identified and loss of return to the surface estimated as a percentage

Drilling Penetration/Drill Depth

Core lifts are identified by a line and depth with core loss per run as a percentage. Ease of penetration in non-core drilling is abbreviated as follows:

VE	Very Easy
E	Easy
F	Firm
H	Hard
VH	Very Hard

Groundwater Levels

Level taken during or immediately after drilling

Samples/Tests

D	Disturbed
U	Undisturbed
C	Core Sample
SPT	Standard Penetration Test
N	Result of SPT (* sample taken)
VS	Vane Shear Test
IMP	Borehole Impression Test
PBT	Plate Bearing Test
PZ	Piezometer Installation
HP	Hand Penetrometer

EXCAVATION LOGS

Explanatory notes are provided at the bottom of drill log sheets. Information about the origin, geology and pedology may be entered in the “Structure and other Observations” column. The depth of the base of excavation (for the logged section) at the appropriate depth in the “Material Description” column. Refusal of excavation plant is noted should it occur. A sketch of the exposure may be added.

MATERIAL DESCRIPTION - SOIL

Classification Symbol - In accordance with the Unified Classification System (AS 1726-2017, Tables 9 and 10)

Material Description - In accordance with AS 1726-2017, Section 6.1

Moisture Condition

D	Dry, looks and feels dry
M	Moist, feels cool, darkened in colour.
W	Wet, free water forms when handling.

Consistency - In accordance with AS 1726-2017, Table 11:

	Description	Su	HP
VS	Very Soft	≤ 12kPa	< 25kPa
S	Soft	12 - 25 kPa	25 - 50 kPa
F	Firm	25 - 50 kPa	50 - 100 kPa
St	Stiff	50 - 100 kPa	100 - 200 kPa
VSt	Very Stiff	100 - 200 kPa	200 - 400 kPa
H	Hard	≥ 200 kPa	≥ 400 kPa

Strength figures quoted are the approximate range of Unconfined Compressive Strength for each class.

Density Index (%) is estimated or is based on SPT results. Approximate N Value correlation is shown in right column

	Description	Density Index	SPT Value
VL	Very Loose	< 15%	0 – 4
L	Loose	15 – 35%	4 – 10
MD	Medium Dense	35 – 65%	10 – 30
D	Dense	65 – 85%	30 – 50
VD	Very Dense	> 85%	> 50

MATERIAL DESCRIPTION - ROCK

Material Description

Identification of rock type, composition and texture based on visual features in accordance with AS 1726-2017, Section 6.2.

Core Loss

Is shown at the bottom of the run unless otherwise indicated

Description	Spacing (mm)
Thinly Laminated	< 6
Laminated	6 - 20
Very Thinly Bedded	20 - 60
Thinly Bedded	60 -200
Medium Bedded	200 - 600
Thickly Bedded	600 - 2000
Very Thickly Bedded	> 2000

Weathering - No distinction is made between weathering and alteration. Weathering classification assists in identification but does not imply engineering properties – differs from AS1726-2017 where the distinction is made in Table 20/21.

F	**Fresh**	Rock substance unaffected by weathering
SW	**Slightly Weathered**	Rock substance partly stained or discoloured. Colour and texture of fresh rock recognisable.
MW	**Moderately Weathered**	Staining or discolouration extends throughout rock substance. Fresh rock colour not recognisable.
HW	**Highly Weathered**	Stained or discoloured throughout. Signs of chemical or physical alteration. Rock texture retained.
XW	**Extremely Weathered**	Rock texture evident but material has soil properties and can be remoulded.
RS	**Residual Soil**	Mass structure and material texture and fabric of original rock are no longer visible.

Strength - The following terms are used to described rock strength:

	Rock Strength Class	PL Strength Index, Is(50) (MPa)	UCS (MPa)
VL	Very Low	0.03 - 0.1	0.6 – 2
L	Low	0.1 - 0.3	2 – 6
M	Medium	0.3 - 1.0	6 – 20
H	High	1.0 - 3.0	20 – 60
VH	Very High	3.0 - 10.0	60 – 200
EH	Extremely high	≥ 10.0	>200

Strengths are estimated from UCS tests where possible and supported by Point Load Index Testing of representative samples. Test results are plotted on the graphical estimated strength by using:

○ Diametral Point Load Test

● Axial Point Load Test

Where the estimated strength log covers more than one range it indicates the rock strength varies between the limits shown.

MATERIALS STRUCTURE/FRACTURES

ROCK

Natural Fracture Spacing - A plot of average fracture spacing excluding defects known or suspected to be due to drilling, core boxing or testing. Closed or cemented joints, drilling breaks and handling breaks are not included in the Natural Fracture Spacing.

Additional Data - Description of individual defects by type, orientation, in-filling, shape and roughness in accordance with AS 1726-2017, Table 22.

Type	BP	Bedding Parting
	JT	Joint
	SS	Shear Seam
	SZ	Shear Zone >100mm
	CS	Crushed Seam
	IS	Infilled Seam
	XS	XW Seam
	VN	Vein
	FL	Foliation
	CL	Cleavage

Orientation - angle relative to the plane normal to the core axis.

Infilling	St	Stained
	Vn	Veneer
	Ct	Coating > 1mm
	CN	Clean
	X	Carbonaceous
	Clay	Clay
	KT	Chlorite
	CA	Calcite
	Fe	Iron Oxide
	Qz	Quartz
	MS	Secondary Mineral
	MU	Unidentified Mineral
Shape	PR	Planar
	CU	Curved
	UN	Undulating
	ST	Stepped
	IR	Irregular
	DIS	Discontinuous
Roughness	POL	Polished
	SL	Slickensides
	S	Smooth
	RF	Rough
	VR	Very Rough

SOIL

Structures - Fissuring and other defects are described in accordance with AS 1726-2017, Table 13, using the terminology for rock defects.

Origin - Where practicable an assessment is provided of the probable origin of the soil, eg fill, topsoil, alluvium, colluvium, residual soil.

Appendix B

Drawings

REV	DESCRIPTION/COMMENT	DATE	DRAWN BY
0	INITIAL ISSUE	18.06.2024	EC

SCALE: 0 5 10 15 20 m
1:400 @ A3

Douglas PARTNERS
OFFICE: SYDNEY
96-98 Hermitage Rd, West Ryde NSW 2114
(02)9809 0666

CLIENT:
The Grand Liverpool Pty Ltd

NOTE:
1: Basemap from Metromap (Dated 25.03.2024)

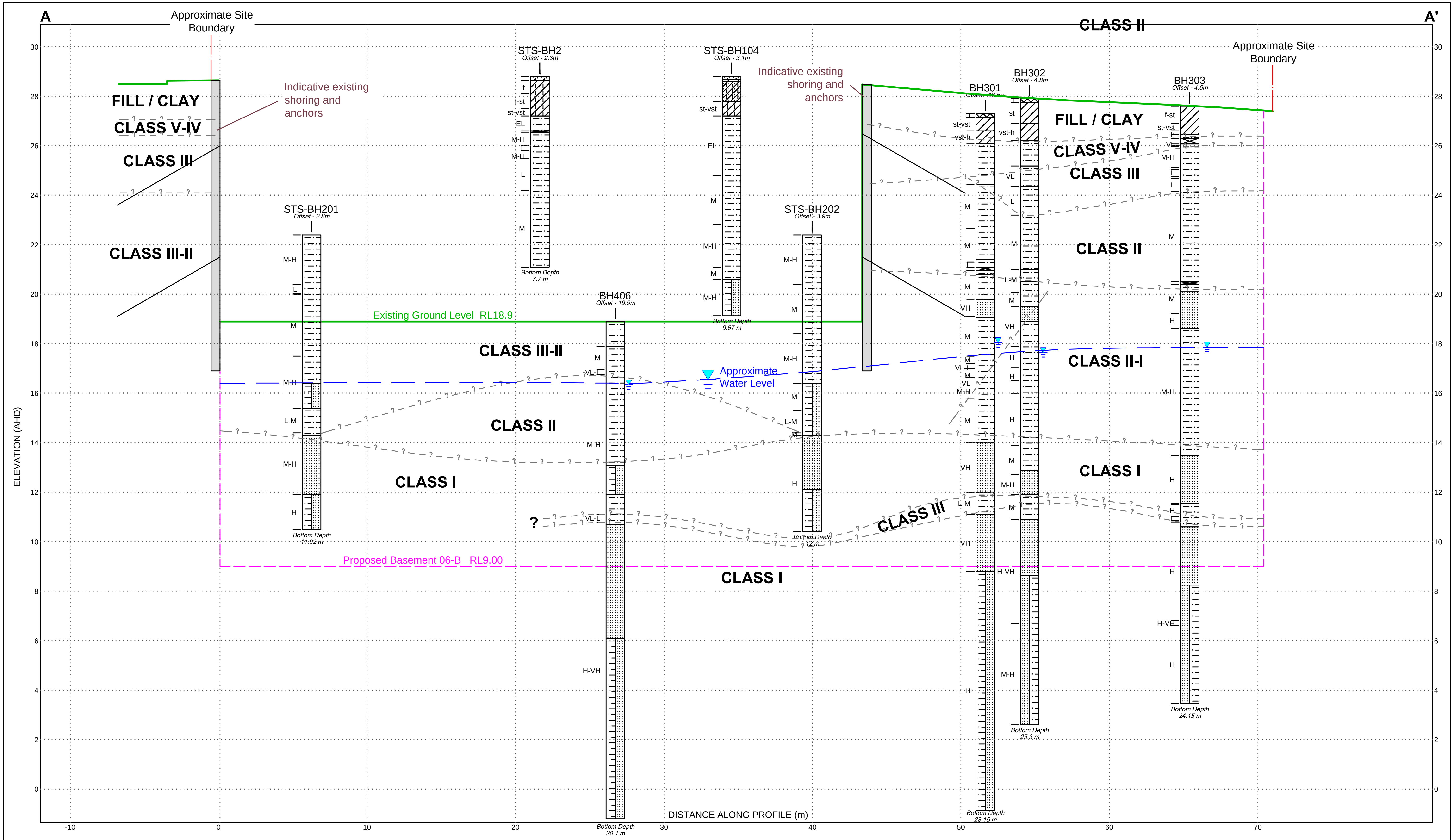
COORDINATE REFERENCE SYSTEM: GDA2020 / MGA zone 56

PROJECT NAME:
Proposed Hotel and Apartments

PROJECT ADRESS:
402 Macquarie Street, Liverpool

DRAWING TITLE:
TEST LOCATION PLAN

PROJECT NO: **228571.00**
DRAWING NO: **1**
REVISION: **0**



LEGEND

- Core Loss
- Clay
- Clayey Sand
- Concrete
- Fill
- Sandstone
- Sandy Silty Clay
- Siltstone
- Silty Clay

NOTE:

1. Subsurface conditions are accurate at borehole locations. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only. Should be read in conjunction with detailed logs.

ROCK STRENGTH
EL - Extremely low
VL - Very low
L - Low
M - Medium
H - High

SOIL STRENGTH/CONSISTENCY
f - Firm
st - Stiff
vst - Very stiff
h - Hard
l - Loose
md - Medium dense
d - Dense
vd - Very dense

TESTS / OTHER
N - Standard penetration test value
Water level
Inferred Geological boundary

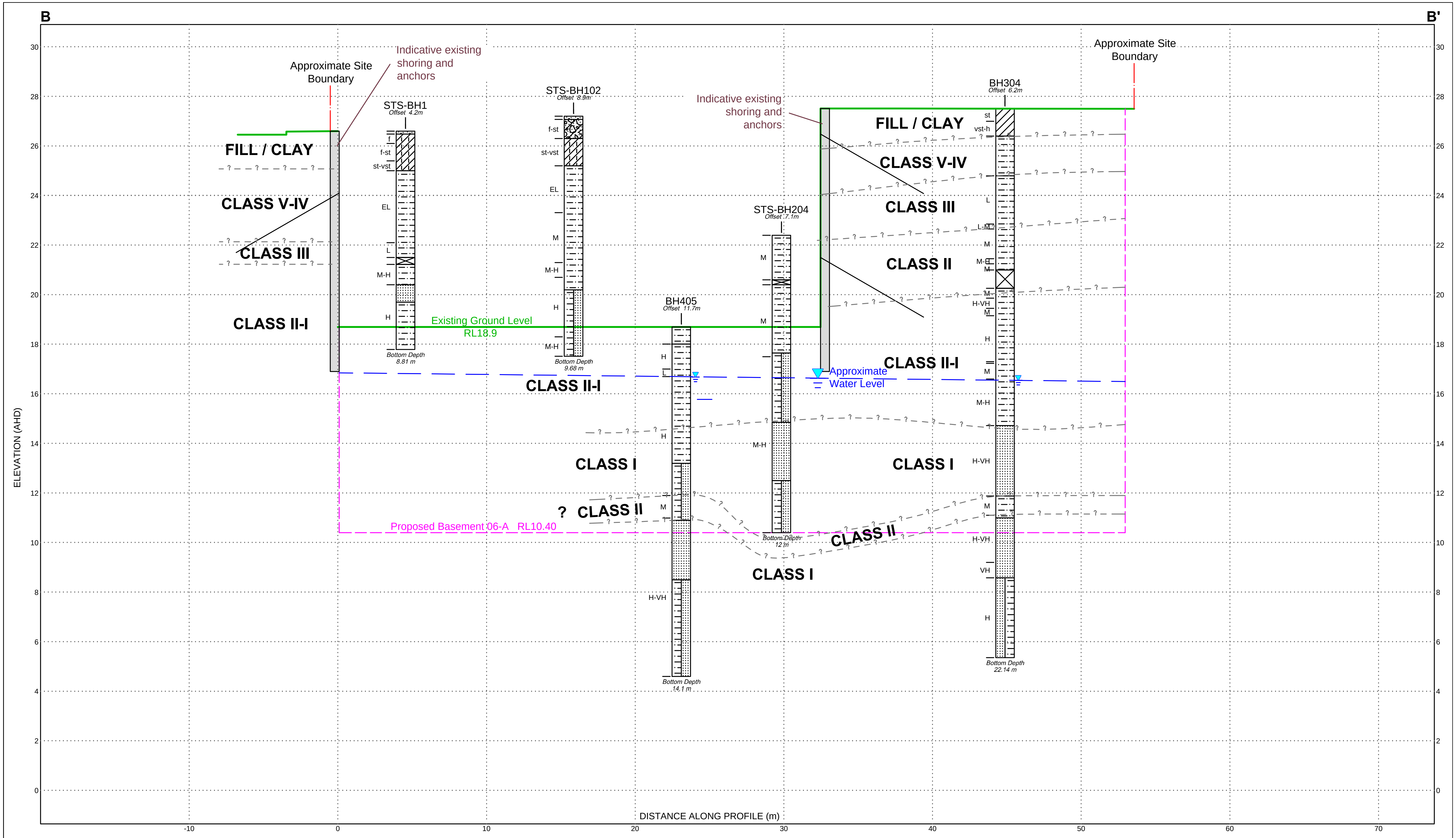
0 5
Horizontal Scale (metres)
Vertical Exaggeration = 1.7

Douglas PARTNERS GROUNDED EXPERTISE

CLIENT: The Grand Liverpool Pty Ltd	
OFFICE: Sydney	DRAWN BY: LJH
SCALE: 1:250 (H) 1:150 (V) @ A3	DATE: 21/05/2024

TITLE: **Interpreted Geotechncial Cross Section A-A'**
Geotechnical Investigation
402 Macquarie Street, Liverpool

PROJECT No:	228571.00
DRAWING No:	2
REVISION:	0



LEGEND

Core Loss	Fill
Clay	Sandstone
Clayey Sand	Sandy Silty Clay
Concrete	Siltstone
Silty Clay	

NOTE:

1. Subsurface conditions are accurate at borehole locations. Variations in subsurface conditions may occur between borehole locations. Interpreted strata boundaries are approximate and should be used as a guide only.
2. Summary logs only. Should be read in conjunction with detailed logs.

ROCK STRENGTH
EL - Extremely low
VL - Very low
L - Low
M - Medium
H - High

SOIL STRENGTH/CONSISTENCY
f - Firm
st - Stiff
vst - Very stiff
h - Hard
l - Loose
md - Medium dense
d - Dense
vd - Very dense

TESTS / OTHER
N - Standard penetration test value
- Water level
- ? - Inferred Geological boundary

0 5
Horizontal Scale (metres)
Vertical Exaggeration = 1.7

Douglas PARTNERS GROUNDED EXPERTISE

CLIENT: The Grand Liverpool Pty Ltd		TITLE: Interpreted Geotechncial Cross Section B-B' Geotechnical Investigation 402 Macquarie Street, Liverpool	PROJECT No: 228571.00
OFFICE: Sydney	DRAWN BY: LJH		DRAWING No: 3
SCALE: 1:250 (H) 1:150 (V) @ A3	DATE: 21/05/2024		REVISION: 0

Appendix C

Borehole Logs

NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH301
FILE / JOB NO : 228571.00
SHEET : 1 OF 5

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307710.5, N: 6243912.0 (56 MGA2020) SURFACE ELEVATION : 27.30 (AHD) ANGLE FROM HORIZONTAL : 90°
RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM
DATE STARTED : 6/5/24 DATE COMPLETED : 7/5/24 DATE LOGGED : 6/5/24 LOGGED BY : SI CHECKED BY : LJH

DRILLING & CASING	WATER LOSS	DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m) RL (m AHD)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
AD/T (0.0–2.5 m); HW Casing (0.0–2.85 m)		E	Not Observed		0.0 / 27.3 – 0.15m			FILL: GRAVEL: grey, coarse gravel, aggregate		L	FILL
		E			0.15m – 0.70m		CH	CLAY: high plasticity, pale grey-brown	w~PL	St to VSt	RESIDUAL SOIL
		F			0.70m – 1.20m (1.0 / 26.3)		CL	CLAY: pale grey, (shaly clay)	w<PL	VSt to H	
WB (2.5–2.85 m)		H			1.20m – 2.85m (2.0 / 25.3)			SILTSTONE: pale grey, apparently very low to low strength			ROCK
					2.85m			Continued as Cored Drill Hole			

Depth scale: 3.0 / 24.3; 4.0 / 23.3; 5.0 / 22.3; 6.0 / 21.3; 7.0 / 20.3; 8.0 / 19.3

See Explanatory Notes for details of abbreviations & basis of descriptions.

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH301
FILE / JOB NO : 228571.00
SHEET : 2 OF 5

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307710.5, N: 6243912.0 (56 MGA2020) SURFACE ELEVATION : 27.30 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM

DATE STARTED : 6/5/24 DATE COMPLETED : 7/5/24 DATE LOGGED : 6/5/24 LOGGED BY : SI CHECKED BY : LJH

CASING DIAMETER : HW BARREL (Length) : BIT : BIT CONDITION :

DRILLING & CASING	WATER LOSS	(CORE LOSS RUN %) DRILL DEPTH	RQD (%)	SAMPLES & FIELD TESTS	DEPTH (m) / RL (m AHD)	DESCRIPTION ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering	ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, apparent dip, infilling or coating, shape, roughness, thickness, other, [true dip, dip direction]
					0.0 / 27.3			
					1.0 / 26.3			
					2.0 / 25.3			
					2.85m	START CORING AT 2.85m		
HQ3		0% LOSS	98	Is(50) a=0.39	3.0 / 24.3	SILTSTONE: grey and brown, 10-20% fine grained, pale grey sandstone laminations, bedding at 0-5°	MW	3.20: BP 0° Fe fragmented 10mm 3.35: JT 30° UN RF fragmented 10mm
		4.15		Is(50) a=0.63	4.0 / 23.3			
		0% LOSS	95				SW	4.60: JT 25° Fe UN RF
				Is(50) a=0.51	5.0 / 22.3			5.06: BP 0° Fe fragmented 20mm
		5.85		Is(50) a=0.49	5.90m	SILTSTONE: dark grey, carbonaceous		5.86-6.20: JT 85° PR RF fragmented 6.00-6.20: X shale
		5% LOSS	82		6.0 / 21.3			
					6.20m	CORE LOSS 0.15m (6.20-6.35)		
					6.35m	SILTSTONE: as above	SW	6.45: JT 80° partially tight
				Is(50) a=0.65	6.50m	SILTSTONE: pale grey and grey	F	6.60: JT 35° tight 6.90: BP 5° Clay VNR
					7.0 / 20.3			7.30: JT 50° tight
				Is(50) a=5.2	7.50m	SANDSTONE: fine grained, pale grey, 0-10% dark grey siltstone laminations		7.71: BP 10° Fe
					8.0 / 19.3			

ESTIMATED STRENGTH Is(50) ● - Axial ○ - Diametral: VL 0.1, L 0.3, M 1, H 3, VH 10, EH

NATURAL FRACTURE (mm): 20, 40, 100, 300, 1000

CORE

Douglas PARTNERS

RMS LIB 40.3.14 - NEW LOGO.GLB Log RTA CORED DRILL HOLE 4 228571.00 LOGS.GPJ <<DrawingFile>> 30/May/2024 11:24 10.02.00.04 Datgel Tools

CORED DRILL HOLE LOG

HOLE NO : BH301
FILE / JOB NO : 228571.00
SHEET : 3 OF 5

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307710.5, N: 6243912.0 (56 MGA2020) SURFACE ELEVATION : 27.30 (AHD) ANGLE FROM HORIZONTAL : 90°
RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM
DATE STARTED : 6/5/24 DATE COMPLETED : 7/5/24 DATE LOGGED : 6/5/24 LOGGED BY : SI CHECKED BY : LJH
CASING DIAMETER : HW BARREL (Length) : BIT : BIT CONDITION :

Drilling & Casing	Water Loss	Core Loss (Run %) / Drill Depth	RQD (%)	Samples & Field Tests	Depth (m) / RL (m AHD)	Description	Weathering	Additional Data
HQ3		5% LOSS	82		8.0 / 19.3	SANDSTONE: fine grained, pale grey, 0-10% dark grey siltstone laminations *(continued)*	F	
					8.25m	SILTSTONE: grey, 0-10% pale grey, fine grained sandstone laminations, bedding at 0-5°		
		8.60						
		0% LOSS	93	Is(50) a=0.69			F	
					9.0 / 18.3			9.05: JT 35° CN PR RF
								9.50: JT 45° PR S SL
	24/05/24			Is(50) a=0.63				
					10.0 / 17.3		HW	10.10-10.15: Decomposed Seam
							F	10.25: JT 45° PR S SL
								10.65: BP 0° horizontal sheared zone, fragmented 10mm
				Is(50) a=1.24				
					11.0 / 16.3			
		11.50						
		0% LOSS	100				F	
				Is(50) a=0.91	12.0 / 15.3			
				Is(50) a=0.88				
					13.0 / 14.3			
					13.30m	SANDSTONE: fine grained, pale grey, 0-20% grey and dark grey siltstone laminations, bedding at 0-5°		
				Is(50) a=3.67	14.0 / 13.3			
		14.35						
		0% LOSS	92					
				Is(50) a=3.21				
					15.0 / 12.3			
					15.30m	SILTSTONE: dark grey	SW	15.40-15.45: fragmented
								15.65: JT 45° tight
								15.30-16.05: X shale
								15.70: JT 45° S SL, sheared zone 10mm
				Is(50) a=0.25	16.0 / 11.3			15.80: JT 20° PR S fragmented 10mm

Estimated Strength Is(50): ● - Axial, ○ - Diametral; VL -0.1, L -0.3, M -1, H -3, VH -10, EH
Natural Fracture (mm): 20, 40, 100, 300, 1000

Additional data: (joints, partings, seams, zones, etc) Description, apparent dip, infilling or coating, shape, roughness, thickness, other, [true dip, dip direction]

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH301
FILE / JOB NO : 228571.00
SHEET : 4 OF 5

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307710.5, N: 6243912.0 (56 MGA2020) SURFACE ELEVATION : 27.30 (AHD) ANGLE FROM HORIZONTAL : 90°
RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM
DATE STARTED : 6/5/24 DATE COMPLETED : 7/5/24 DATE LOGGED : 6/5/24 LOGGED BY : SI CHECKED BY : LJH
CASING DIAMETER : HW BARREL (Length) : BIT : BIT CONDITION :

DRILLING & CASING	CORE LOSS (RUN %) / DRILL DEPTH	RQD (%)	SAMPLES & FIELD TESTS	DEPTH (m) / RL (m AHD)	DESCRIPTION	Weathering	ADDITIONAL DATA
HQ3	0% LOSS	92		16.0 / 11.3	SILTSTONE: dark grey *(continued)* (to 16.20m)	SW	15.96-16.00: fragmented; 16.05: JT 30° X CT PR S 1mm; 16.12-16.15: fragmented
			Is(50) a=3.68	17.0 / 10.3	SANDSTONE: fine grained, pale grey and grey (16.20m to 18.50m)	F	
	17.32						
	0% LOSS	100	Is(50) a=3.05	18.0 / 9.3			
			Is(50) a=2.26	19.0 / 8.3	INTERBEDDED AND INTERLAMINATED SILTSTONE AND SANDSTONE: 50-60% grey to dark grey siltstone, 40-50% pale grey, fine grained sandstone, bedding at 0-5° (from 18.50m)		
			Is(50) a=1.53	20.0 / 7.3			
	20.30						
	0% LOSS	97					20.55: BP 5° MU
			Is(50) a=1.39	21.0 / 6.3			21.50-21.70: JT 70° CN UN RF
			Is(50) a=2.27	22.0 / 5.3			22.51: BP 5° MU
			Is(50) a=2.4	23.0 / 4.3			22.83-23.15: JT 80° CN UN RF; 23.23: BP 0° MU 5mm
	23.30						
	0% LOSS	100	Is(50) a=1.01	24.0 / 3.3			

ESTIMATED STRENGTH Is(50): ● - Axial, O - Diametral; VL 0.1 L 0.3 M 1 H 3 VH 10 EH
NATURAL FRACTURE (mm): 20 40 100 300 1000

Douglas PARTNERS

CORED DRILL HOLE LOG

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307710.5, N: 6243912.0 (56 MGA2020) SURFACE ELEVATION : 27.30 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM

DATE STARTED : 6/5/24 DATE COMPLETED : 7/5/24 DATE LOGGED : 6/5/24 LOGGED BY : SI CHECKED BY : LJH

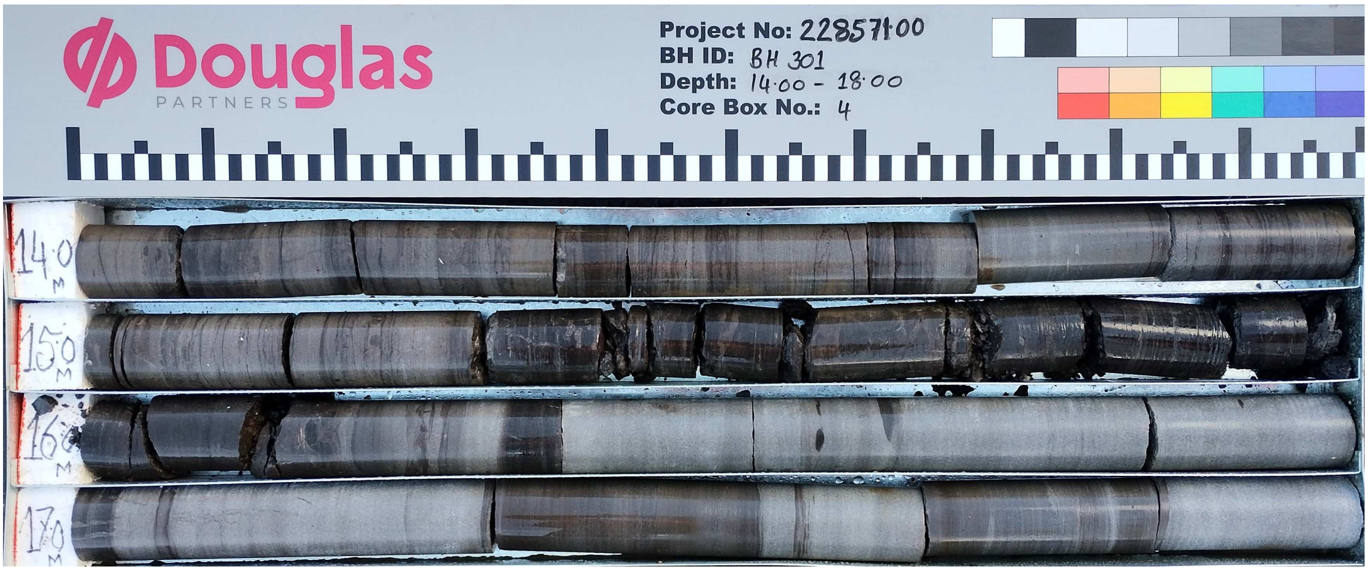
CASING DIAMETER : HW BARREL (Length) : BIT : BIT CONDITION :

DRILLING					MATERIAL				FRACTURES		
PROGRESS: DRILLING & CASING	WATER LOSS	(CORE LOSS RUN %) DRILL DEPTH	RQD (%)	SAMPLES & FIELD TESTS	DEPTH (m) RL (m AHD)	DESCRIPTION ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering	ESTIMATED STRENGTH Is(50) ● - Axial O - Diametral (VL -0.1 L -0.3 M -1 H -3 VH -10 EH)	NATURAL FRACTURE (mm) (20 40 100 300 1000)	CORE	ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, apparent dip, infilling or coating, shape, roughness, thickness, other, [true dip, dip direction]
HQ3		0% LOSS	100		24.0 / 3.3	INTERBEDDED AND INTERLAMINATED SILTSTONE AND SANDSTONE: 50-60% grey to dark grey siltstone, 40-50% pale grey, fine grained sandstone, bedding at 0-5° *(continued)*	F				
				Is(50) a=2.08	25.0 / 2.3						
				Is(50) a=1.5	26.0 / 1.3						
		26.35									
		0% LOSS	100	Is(50) a=1.26							
					27.0 / 0.3						27.15: JT 50° CN UN RF
				Is(50) a=1.34							27.75: JT 45° CN PR RF
		28.15		Is(50) a=2.08	28.0 / -0.7	28.15m					
						BOREHOLE BH301 TERMINATED AT 28.15 m Target depth					
					29.0 / -1.7						
					30.0 / -2.7						
					31.0 / -3.7						
					32.0 / -4.7						


Douglas
PARTNERS
Project No: 22857100
BH ID: BH301
Depth: 2·85 - 6·00m
Core Box No.: 1
LIVERPOOL BH301 START: 2·85m 6/5/2024
22857100
3·0 M
4·0 M
5·0 M

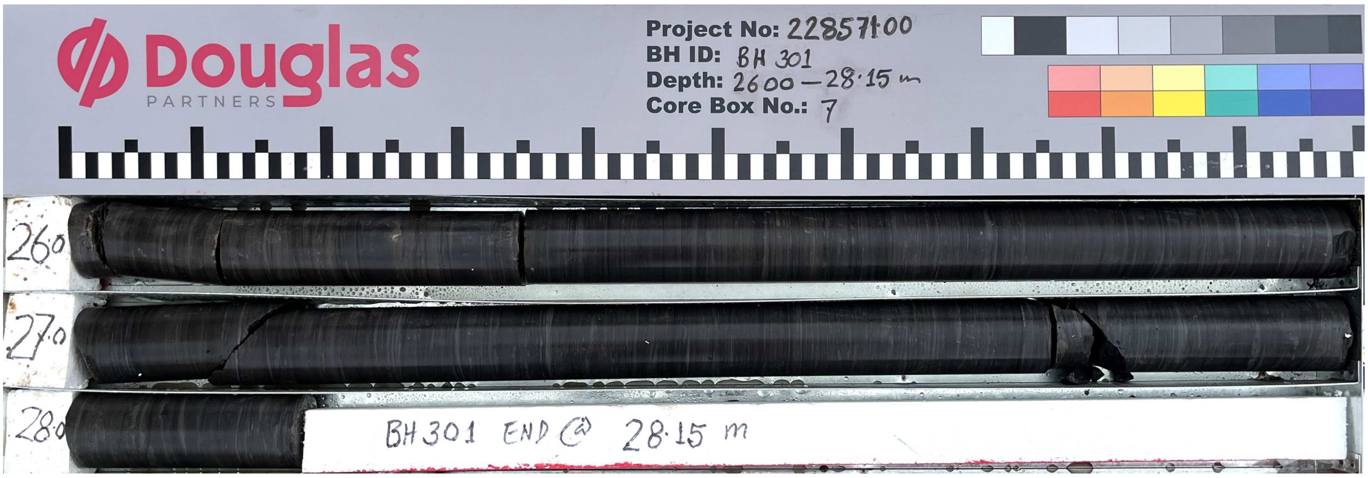

Douglas
PARTNERS
Project No: 22857100
BH ID: BH301
Depth: 6·00 -10·00m
Core Box No.: 2


Douglas
PARTNERS
Project No: 22857100
BH ID: BH301
Depth: 10·00 -14·00m
Core Box No.: 3
10·0 M
11·0 M
12·0 M
13·0 M


Douglas
PARTNERS
Project No: 22857100
BH ID: BH 301
Depth: 14·00 - 18·00
Core Box No.: 4
14·0 M
15·0 M
16·0 M
17·0 M


Douglas
PARTNERS
Project No: 22857100
BH ID: BH 301
Depth: 18·00 - 22·00 m
Core Box No.: 5
18·0 M
19·0 M
20·0 M
21·0 M


Douglas
PARTNERS
Project No: 22857100
BH ID: BH 301
Depth: 22·00 — 26·00 m
Core Box No.: 6
22·0 M
23·0 M
24·0 M
25·0 M


Douglas
PARTNERS
Project No: 22857100
BH ID: BH 301
Depth: 2600 — 28·15 m
Core Box No.: 7
26.0
27.0
28.0
BH301 END @ 28·15 m

NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH302
FILE / JOB NO : 228571.00
SHEET : 1 OF 5

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307707.6, N: 6243923.8 (56 MGA2020) SURFACE ELEVATION : 27.90 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM

DATE STARTED : 8/5/24 DATE COMPLETED : 9/5/24 DATE LOGGED : 8/5/24 LOGGED BY : SI CHECKED BY : LJH

DRILLING & CASING	WATER LOSS	DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m) / RL (m AHD)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION (Soil Type, Colour, Plasticity or Particle Characteristic, Secondary and Minor Components)	MOISTURE CONDITION	CONSISTENCY / RELATIVE DENSITY	STRUCTURE & Other Observations
AD/T; HW Casing		E	Not Observed		0.0 / 27.9			0.15m FILL: GRAVEL: coarse gravel		L	FILL 0.00: aggregate
							CH	1.00m CLAY: high plasticity, pale grey-brown	w~PL	St	RESIDUAL SOIL
		F		1.00m SPT 4, 8, 12 N=20 1.45m	1.0 / 26.9		CL	1.70m CLAY: low plasticity, pale grey	w<PL	VSt to H	
WB		H		2.50m SPT 20/150mm N=R 2.65m	2.0 / 25.9			2.72m SILTSTONE: grey-brown, apparently very low to low strength			ROCK
					3.0 / 24.9			Continued as Cored Drill Hole			
					4.0 / 23.9						
					5.0 / 22.9						
					6.0 / 21.9						
					7.0 / 20.9						
					8.0 / 19.9						

See Explanatory Notes for details of abbreviations & basis of descriptions.

RMS LIB 40.3.14 - NEW LOGO.GLB Log RTA NON-CORE DRILL HOLE 2 228571.00 LOGS.GPJ <<DrawingFile>> 30/May/2024 11:26 10.02.00.04 Datgel Tools

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH302
FILE / JOB NO : 228571.00
SHEET : 2 OF 5

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307707.6, N: 6243923.8 (56 MGA2020) SURFACE ELEVATION : 27.90 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM

DATE STARTED : 8/5/24 DATE COMPLETED : 9/5/24 DATE LOGGED : 8/5/24 LOGGED BY : SI CHECKED BY : LJH

CASING DIAMETER : HW BARREL (Length) : BIT : BIT CONDITION :

Depth (m)	RL (m AHD)	Description	Weathering	Core loss / Drill depth	RQD (%)
0.0–2.72	27.9	START CORING AT 2.72m			
2.72		SILTSTONE: pale grey-brown	HW	0% LOSS (to 3.00)	0
3.00	24.9 (3.0)			0% LOSS (to 5.65)	60
3.55		SILTSTONE: grey and grey-brown, 0-10% pale grey, fine grained sandstone laminations, bedding at 0-5°	MW, HW, MW, HW, MW, HW, MW, SW		
5.65				0% LOSS	80
6.90		SILTSTONE: dark grey, carbonaceous			
7.40		SILTSTONE: pale grey and grey			

Drilling & casing: HQ3

Depth scale: 0.0 (27.9), 1.0 (26.9), 2.0 (25.9), 3.0 (24.9), 4.0 (23.9), 5.0 (22.9), 6.0 (21.9), 7.0 (20.9), 8.0 (19.9)

ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, apparent dip, infilling or coating, shape, roughness, thickness, other, [true dip, dip direction]

- 2.72-3.55: Clay fragmented
- 3.80: JT 45° tight
- 3.85-3.95: Fe fragmented
- 4.20-4.29: Clay fragmented
- 4.70-4.73: Decomposed Seam
- 4.78-4.87: JT 65° UN RF fragmented 50mm
- 5.12: JT 60° CN PR S
- 5.30: JT 45° tight
- 5.50: JT 45° CN PR S
- 6.60: BP 5° Fe fragmented 10mm
- 6.71: JT 30° Fe healed
- 6.96-7.10: JT2 SN ST RF 45 and 80°
- 7.10-7.22: fragmented
- 7.30: JT 70° tight
- 7.70-7.83: CS

RMS LIB 40.3.14 - NEW LOGO.GLB Log RTA CORED DRILL HOLE 4 228571.00 LOGS.GPJ <<DrawingFile>> 30/May/2024 11:24 10.02.00.04 Datgel Tools

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH302
FILE / JOB NO : 228571.00
SHEET : 3 OF 5

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307707.6, N: 6243923.8 (56 MGA2020) SURFACE ELEVATION : 27.90 (AHD) ANGLE FROM HORIZONTAL : 90°
RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM
DATE STARTED : 8/5/24 DATE COMPLETED : 9/5/24 DATE LOGGED : 8/5/24 LOGGED BY : SI CHECKED BY : LJH
CASING DIAMETER : HW BARREL (Length) : BIT : BIT CONDITION :

DRILLING: PROGRESS (DRILLING & CASING / WATER LOSS)	CORE LOSS (RUN %) / DRILL DEPTH	RQD (%)	DEPTH (m) / RL (m AHD)	MATERIAL: DESCRIPTION	Weathering	FRACTURES: ADDITIONAL DATA
HQ3	0% LOSS	80	8.0 / 19.9	SILTSTONE: pale grey and grey *(continued)*	SW	8.35: JT 30-80° Fe CU healed
	8.40			8.40m		
	0% LOSS	98		SANDSTONE: fine grained, pale grey, 10% dark grey siltstone laminations, indistinct bedding at 0-10°	F	
			9.0 / 18.9	9.00m SILTSTONE: grey, 20% pale grey, fine grained sandstone laminations, distinct and indistinct bedding at 0-5°		9.02: JT 40° tight
						9.85-9.88: fragmented
			10.0 / 17.9			
24/05/24 (water level)						10.88-10.92: CS
			11.0 / 16.9			
	11.20					
	0% LOSS	90			HW	11.18-11.28: JT 70° CN UN S
						11.38: JT 50° S SL, fragmented 50mm, Shear Zone
					SW	11.65-11.68: CS
						11.72: BP 5° fragmented 5mm
			12.0 / 15.9		F	
			13.0 / 14.9			
	14.20		14.0 / 13.9			
	0% LOSS	96				
			15.0 / 12.9	15.02m SANDSTONE: fine grained, pale grey to grey, 10-20% dark grey siltstone laminations, bedding at 0-5°		
			16.0 / 11.9	16.00m		

Estimated strength Is(50): ● - Axial, O - Diametral; VL 0.1, L 0.3, M 1, H 3, VH 10, EH
Natural fracture (mm): 20, 40, 100, 300, 1000

CORED DRILL HOLE LOG

HOLE NO : BH302
FILE / JOB NO : 228571.00
SHEET : 4 OF 5

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307707.6, N: 6243923.8 (56 MGA2020) SURFACE ELEVATION : 27.90 (AHD) ANGLE FROM HORIZONTAL : 90°
RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM
DATE STARTED : 8/5/24 DATE COMPLETED : 9/5/24 DATE LOGGED : 8/5/24 LOGGED BY : SI CHECKED BY : LJH
CASING DIAMETER : HW BARREL (Length) : BIT : BIT CONDITION :

DRILLING: PROGRESS (DRILLING & CASING, WATER LOSS), (CORE LOSS RUN %) DRILL DEPTH, RQD (%), SAMPLES & FIELD TESTS, DEPTH (m) RL (m AHD)
MATERIAL: GRAPHIC LOG, DESCRIPTION ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable), Weathering, ESTIMATED STRENGTH Is(50) (● - Axial, ○ - Diametral; VL -0.1 L -0.3 M -1 H -3 VH -10 EH)
FRACTURES: NATURAL FRACTURE (mm) (20 40 100 300 1000), CORE, ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, apparent dip, infilling or coating, shape, roughness, thickness, other, [true dip, dip direction]

Drilling method: HQ3

Depth (m)	RL (m AHD)
16.0	11.9
17.0	10.9
18.0	9.9
19.0	8.9
20.0	7.9
21.0	6.9
22.0	5.9
23.0	4.9
24.0	3.9

Core loss (run %)	Drill depth	RQD (%)
0% LOSS	17.25	96
0% LOSS	20.25	100
0% LOSS	23.25	100

Depth	Description	Weathering
16.0–17.00m	SILTSTONE: dark grey and grey, 0-10% pale grey, fine grained sandstone laminations, bedding at 0-5°	F
17.00m–19.25m	SANDSTONE: fine grained, pale grey, 0-20% grey siltstone laminations, bedding at 0-5°	
19.25m–24.0	INTERBEDDED AND INTERLAMINATED SILTSTONE AND SANDSTONE: 50% grey to dark grey siltstone, 50% pale grey, fine grained sandstone, bedding at 0-5°	

Additional data:
- 16.03-16.05: X fragmented, shale
- 16.65: JT 20° CA PR S X Shale
- 19.92: JT 80° CN PR RF
- 20.75-21.00: JT 45-80° CN CU RF
- 21.30-21.40: JT4 45-80° ST tight
- 21.90: JT 70° tight
- 23.45: JT 45° CN PR S

RMS LIB 40.3.14 - NEW LOGO.GLB Log RTA CORED DRILL HOLE 4 228571.00 LOGS.GPJ <<DrawingFile>> 30/May/2024 11:24 10.02.00.04 Datgel Tools

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH302
FILE / JOB NO : 228571.00
SHEET : 5 OF 5

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307707.6, N: 6243923.8 (56 MGA2020) SURFACE ELEVATION : 27.90 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM

DATE STARTED : 8/5/24 DATE COMPLETED : 9/5/24 DATE LOGGED : 8/5/24 LOGGED BY : SI CHECKED BY : LJH

CASING DIAMETER : HW BARREL (Length) : BIT : BIT CONDITION :

DRILLING: Progress – Drilling & Casing	Water Loss	Core Loss (Core Run %) / Drill Depth	RQD (%)	Samples & Field Tests	Depth (m) / RL (m AHD)	Graphic Log	Description (Rock type: grain size, colour, structure (texture, fabric, mineral composition, hardness, alteration, cementation, etc as applicable))	Weathering	Estimated Strength Is(50) (● Axial, ○ Diametral) VL L M H VH EH	Natural Fracture (mm) 20 40 100 300 1000	Core	Additional Data (joints, partings, seams, zones, etc) Description, apparent dip, infilling or coating, shape, roughness, thickness, other, [true dip, dip direction]
HQ3					24.0 / 3.9 – 25.0 / 2.9		INTERBEDDED AND INTERLAMINATED SILTSTONE AND SANDSTONE: 50% grey to dark grey siltstone, 50% pale grey, fine grained sandstone, bedding at 0-5° *(continued)*	F				
					25.30m		BOREHOLE BH302 TERMINATED AT 25.30 m Target depth					

Depth scale: 26.0 (1.9), 27.0 (0.9), 28.0 (-0.1), 29.0 (-1.1), 30.0 (-2.1), 31.0 (-3.1), 32.0 (-4.1)


Douglas
PARTNERS
Project No: 22857100
BH ID: BH 302
Depth: 2·72 - 6·00 m
Core Box No.: 1
LIVERPOOL 22857100. BH 302 8/5/2024
Start: 2·72 m
3·0 M
4·0 M
5·0 M


Douglas
PARTNERS
Project No: 22857100
BH ID: BH 302
Depth: 6·00 - 10·00 m
Core Box No.: 2
6·0 M
7·0 M
8·0 M
9·0 M


Douglas
PARTNERS
Project No: 22857100
BH ID: BH 302
Depth: 10·00 - 14·00m
Core Box No.: 3
10·0
11·0
12·0
13·0


Douglas
PARTNERS
Project No: 22857100
BH ID: BH 302
Depth: 14·00 - 18·00m
Core Box No.: 4
14·0m
15·0m
16·0m
17·0m


Douglas
PARTNERS
Project No: 22857100
BH ID: BH 302
Depth: 18.00 -22.00m
Core Box No.: 5
18.0 M
19.0
20.0
21.0


Douglas
PARTNERS
Project No: 22857100
BH ID: BH 302
Depth: 2200 -25.30m
Core Box No.: 7
22.0 M
23.0 M
24.0 M
25.0 M

NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH303
FILE / JOB NO : 228571.00
SHEET : 1 OF 5

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307717.0, N: 6243929.1 (56 MGA2020) SURFACE ELEVATION : 27.60 (AHD) ANGLE FROM HORIZONTAL : 90°
RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM
DATE STARTED : 2/5/24 DATE COMPLETED : 2/5/24 DATE LOGGED : 2/5/24 LOGGED BY : RT CHECKED BY : LJH

DRILLING & CASING	WATER LOSS	DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m) / RL (m AHD)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
AD/T; HW Casing		E	Not Observed		0.0 / 27.6		CI	Silty CLAY: medium plasticity, red-brown and pale grey, trace fine to medium ironstone gravel	w<PL	F to St	RESIDUAL SOIL
		F		1.00m SPT 13, 25/150mm HB N*=R 1.30m	1.0 / 26.6					St to VSt	1.00: SPT Recovery: 0.3 m
					1.15m					H	
WB		H			1.30m			SILTSTONE: orange-brown, grey, apparently very low strength			ROCK
								Continued as Cored Drill Hole			

Depth scale: 2.0 / 25.6; 3.0 / 24.6; 4.0 / 23.6; 5.0 / 22.6; 6.0 / 21.6; 7.0 / 20.6; 8.0 / 19.6

See Explanatory Notes for details of abbreviations & basis of descriptions.

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH303
FILE / JOB NO : 228571.00
SHEET : 2 OF 5

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307717.0, N: 6243929.1 (56 MGA2020) SURFACE ELEVATION : 27.60 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM

DATE STARTED : 2/5/24 DATE COMPLETED : 2/5/24 DATE LOGGED : 2/5/24 LOGGED BY : RT CHECKED BY : LJH

CASING DIAMETER : HW BARREL (Length) : 3.00 m BIT : 5 Step face BIT CONDITION : Good

DRILLING

Drill depth (m)	Core loss (run %)	RQD (%)	Water loss
1.30–2.48	19% LOSS	59	0-5%
2.48–5.09	0% LOSS	86	0-5%
5.09–7.10	0% LOSS	100	0-5%
7.10–	5% LOSS	95	0-5%

Samples & Field Tests

Test	Value
Is(50)	a=0.73
Is(50)	a=0.54
Is(50)	a=0.13
Is(50)	a=0.61
Is(50)	a=0.44
Is(50)	a=0.46
Is(50)	a=0.43
Is(50)	a=0.73
Is(50)	a=0.68

Depth (m) / RL (m AHD): 0.0 / 27.6; 1.0 / 26.6; 2.0 / 25.6; 3.0 / 24.6; 4.0 / 23.6; 5.0 / 22.6; 6.0 / 21.6; 7.0 / 20.6; 8.0 / 19.6

MATERIAL

DESCRIPTION
ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)

Depth	Description	Weathering
1.30m	START CORING AT 1.30m	
1.30–1.53m	CORE LOSS 0.23m (1.30-1.53)	
1.53m	SILTSTONE: orange-brown, grey to dark grey, 0-20% pale grey, fine grained sandstone laminations, bedding at 0-5°	HW, XW, MW, SW, XW, MW, SW, F
7.10m	7.00-7.10m: carbonaceous, dark grey	
7.10–7.20m	CORE LOSS 0.10m (7.10-7.20)	
7.20m	SILTSTONE: as above	F
7.50m	SANDSTONE: fine grained, pale grey, 0-30% dark grey siltstone laminations, bedding at 0-5°	

ESTIMATED STRENGTH Is(50): ● - Axial, O - Diametral; VL 0.1 L 0.3 M 1 H 3 VH 10 EH

FRACTURES

NATURAL FRACTURE (mm): 20, 40, 100, 300, 1000

ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, apparent dip, infilling or coating, shape, roughness, thickness, other, [true dip, dip direction]

- 1.58-1.63: CS =50mm
- 1.66: BP 5° CN PR RF
- 1.72: JT 90° Fe SN PR S (1.69-1.74) discontinuous
- 1.89: JT 20° CN PR RF
- 2.04: BP 0° CN PR S
- 2.25: JT 20° CN CU RF
- 2.42: JT 45-90° CN IR RF (2.34-2.48)
- 2.48-2.55: CS =70mm
- 2.66: JT 30° Clay FILLED =20mm
- 2.81: IS Clay =10mm
- 2.85-2.91: XS =60mm
- 3.08: IS Clay =20mm
- 3.17: IS Clay =10mm
- 3.44: BP 0° CN PR S
- 3.92: JT 45° CN PR S
- 3.96: JT 15° CN PR S
- 4.10: BP 0° CN PR RF
- 4.17: JT 45° CN PR S
- 4.36: BP 5° CN PR S
- 4.52: JT 45-90° Fe SN CU S (4.41-4.62)
- 5.57: BP 0° Fe SN PR S
- 5.89: JT 60° CN PR S
- 6.45: BP 0° CN PR S
- 6.78: BP 0° CN PR S
- 6.94: JT 60-90° IR tight
- 7.75: BP 0° CN PR RF

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH303
FILE / JOB NO : 228571.00

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307717.0, N: 6243929.1 (56 MGA2020) SURFACE ELEVATION : 27.60 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM

DATE STARTED : 2/5/24 DATE COMPLETED : 2/5/24 DATE LOGGED : 2/5/24 LOGGED BY : RT CHECKED BY : LJH

CASING DIAMETER : HW BARREL (Length) : 3.00 m BIT : 5 Step face BIT CONDITION : Good

DRILLING | MATERIAL | FRACTURES

PROGRESS: DRILLING & CASING; WATER LOSS | (CORE LOSS RUN %) DRILL DEPTH | RQD (%) | SAMPLES & FIELD TESTS | DEPTH (m) RL (m AHD) | GRAPHIC LOG | DESCRIPTION ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable) | Weathering | ESTIMATED STRENGTH Is(50) ● - Axial O - Diametral; VL -0.1 L -0.3 M -1 H -3 VH -10 EH | NATURAL FRACTURE (mm) 20 40 100 300 1000 | CORE | ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, apparent dip, infilling or coating, shape, roughness, thickness, other, [true dip, dip direction]

Depth (m)	RL (m AHD)	Drill depth / Core loss	RQD (%)	Samples & field tests	Description	Weathering	Additional data
8.0	19.6	5% LOSS	95		SANDSTONE: fine grained, pale grey, 0-30% dark grey siltstone laminations, bedding at 0-5° *(continued)*	F	8.37: BP 0° Fe SN PR S
8.97m				Is(50) a=2.02	SILTSTONE: grey to dark grey, 0-10% pale grey, fine grained sandstone laminations, bedding at 0-5°		
9.0	18.6	9.15; 0% LOSS	100	Is(50) a=0.76			
10.0	17.6			Is(50) a=2.62			10.06: JT 20-30° tight
11.0	16.6			Is(50) a=0.44; Is(50) a=1.32			11.21: JT 45° CN PR S; 11.43: JT 45° CN PR S
12.0	15.6	12.10; 0% LOSS	98	Is(50) a=0.8			12.46: BP 0° CN PR RF
13.0	14.6			Is(50) a=0.89			
14.0	13.6						
14.12m				Is(50) a=1.45	SANDSTONE: fine grained, pale grey, 5-15% dark grey siltstone laminations, distinct and indistinct bedding at 0-5°		14.51: JT 15° CN PR RF; 14.57: BP 5° CN PR S
15.0	12.6	15.00; 0% LOSS	96	Is(50) a=1.54			
16.0	11.6						

Water loss: 0-5%; water level 03/05/24

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH303
FILE / JOB NO : 228571.00

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307717.0, N: 6243929.1 (56 MGA2020) SURFACE ELEVATION : 27.60 (AHD) ANGLE FROM HORIZONTAL : 90°
RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM
DATE STARTED : 2/5/24 DATE COMPLETED : 2/5/24 DATE LOGGED : 2/5/24 LOGGED BY : RT CHECKED BY : LJH
CASING DIAMETER : HW BARREL (Length) : 3.00 m BIT : 5 Step face BIT CONDITION : Good

DRILLING | MATERIAL | FRACTURES

Drill depth	Core loss (run %)	RQD (%)	Samples & field tests	Depth (m)	RL (m AHD)	Description	Weathering	Additional data
	0% LOSS	96		16.0	11.6	16.06m SILTSTONE: dark grey	XW / F	16.05-16.10: XS X =50mm; 16.24: BP 0-5° X VNR PR RF; 16.42: BP 0-5° X VNR PR RF
			Is(50) a=1.17			16.60-16.75m: carbonaceous	XW / F	16.74: BP 0° CN PR RF; 16.75-16.80: XS X =50mm
				17.0	10.6	17.00m SANDSTONE: fine grained, pale grey and grey, bedding at 0-5°		
18.00	0% LOSS	100	Is(50) a=1.42	18.0	9.6			18.63: JT 15° CN PR S
			Is(50) a=2.11	19.0	8.6			
						19.35m INTERBEDDED AND INTERLAMINATED SILTSTONE AND SANDSTONE: 50-60% pale grey, fine grained sandstone, 40-50% dark grey siltstone, bedding at 0-15°		19.38: JT 20° CN PR S
			Is(50) a=1.15	20.0	7.6			
			Is(50) a=3.5					
21.06	0% LOSS	100		21.0	6.6			
			Is(50) a=1.56	22.0	5.6			
			Is(50) a=1.64; Is(50) a=1.33	23.0	4.6			
			Is(50) a=2.73	24.0	3.6			

Water loss: 0-5%

Column headings: PROGRESS (DRILLING & CASING, WATER LOSS); (CORE LOSS RUN %) DRILL DEPTH; RQD (%); SAMPLES & FIELD TESTS; DEPTH (m) RL (m AHD); GRAPHIC LOG; DESCRIPTION ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable); Weathering; ESTIMATED STRENGTH Is(50) ● - Axial ○ - Diametral (VL -0.1 L -0.3 M -1 H -3 VH -10 EH); NATURAL FRACTURE (mm) (20 40 100 300 1000); CORE; ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, apparent dip, infilling or coating, shape, roughness, thickness, other, [true dip, dip direction]

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH303
FILE / JOB NO : 228571.00
SHEET : 5 OF 5

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307717.0, N: 6243929.1 (56 MGA2020) SURFACE ELEVATION : 27.60 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM

DATE STARTED : 2/5/24 DATE COMPLETED : 2/5/24 DATE LOGGED : 2/5/24 LOGGED BY : RT CHECKED BY : LJH

CASING DIAMETER : HW BARREL (Length) : 3.00 m BIT : 5 Step face BIT CONDITION : Good

DRILLING & CASING	WATER LOSS	(CORE LOSS RUN %) DRILL DEPTH	RQD (%)	SAMPLES & FIELD TESTS	DEPTH (m) RL (m AHD)	GRAPHIC LOG	DESCRIPTION ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering	ESTIMATED STRENGTH Is(50) ● - Axial ○ - Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	NATURAL FRACTURE (mm) (20, 40, 100, 300, 1000)	CORE	ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, apparent dip, infilling or coating, shape, roughness, thickness, other, [true dip, dip direction]
	▼	24.15	100		24.0 / 3.6		24.15m	F				
							BOREHOLE BH303 TERMINATED AT 24.15 m Target depth					
					25.0 / 2.6							
					26.0 / 1.6							
					27.0 / 0.6							
					28.0 / -0.4							
					29.0 / -1.4							
					30.0 / -2.4							
					31.0 / -3.4							
					32.0 / -4.4							

RMS LIB 40.3.14 - NEW LOGO.GLB Log RTA CORED DRILL HOLE 4 228571.00 LOGS.GPJ <<DrawingFile>> 30/May/2024 11:24 10.02.00.04 Datgel Tools

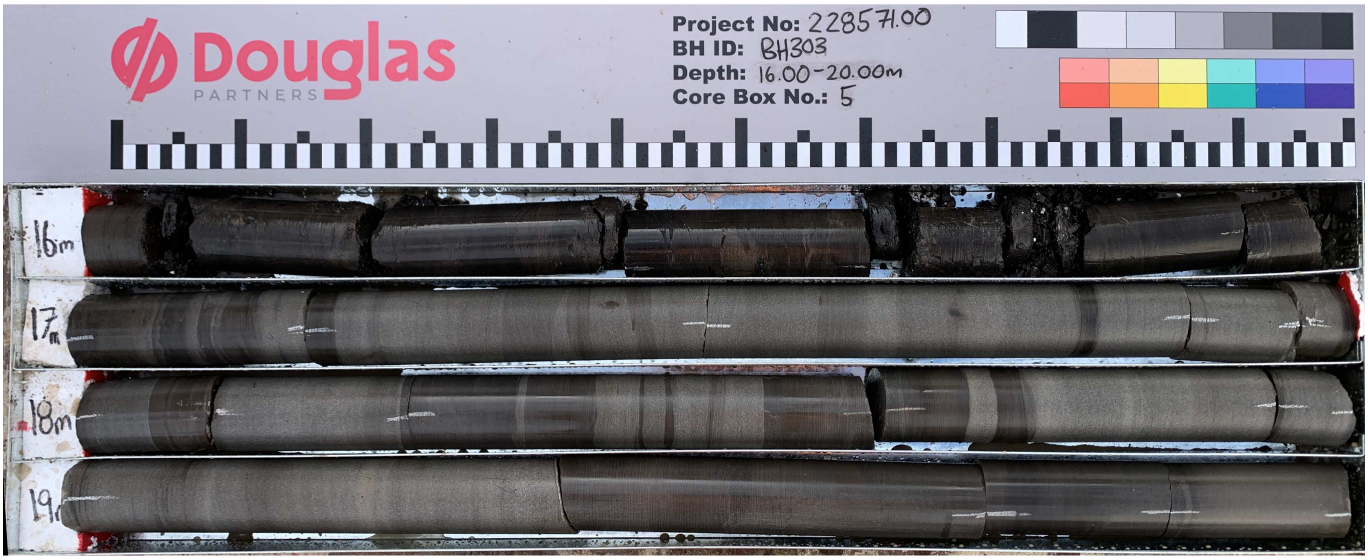
Douglas PARTNERS


Douglas
PARTNERS
Project No: 22857100
BH ID: BH303
Depth: 1.30 - 4.00m
Core Box No.: 1
22857100 LIVERPOOL BH303 02/05/24 START CORING: 1.30m
1m
1.30
CORE LOSS
1.53
2m
3m


Douglas
PARTNERS
Project No: 22857100
BH ID: BH303
Depth: 4.00 - 8.00m
Core Box No.: 2
4m
5m
6m
7m
CORE LOSS


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH303
Depth: 8.00 - 12.00m
Core Box No.: 3
8m
9m
10m
11m


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH303
Depth: 12.00 - 16.00m
Core Box No.: 4
12m
13m
14m
15m


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH303
Depth: 16.00-20.00m
Core Box No.: 5
16m
17m
18m
19m


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH303
Depth: 20.00-24.00m
Core Box No.: 6
20m
21m
22m
23m


Douglas
PARTNERS
Project No: 22857.00
BH ID: BH303
Depth: 24.00 - 24.15m
Core Box No.: 7
24m
END OF HOLE: 24.15m

NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH304
FILE / JOB NO : 228571.00
SHEET : 1 OF 4

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307724.6, N: 6243906.7 (56 MGA2020) SURFACE ELEVATION : 27.50 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM

DATE STARTED : 30/4/24 DATE COMPLETED : 1/5/24 DATE LOGGED : 1/5/24 LOGGED BY : RT CHECKED BY : LJH

DRILLING: PROGRESS – DRILLING & CASING	DRILLING: PROGRESS – WATER LOSS	DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m) / RL (m AHD)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil Type, Colour, Plasticity or Particle Characteristic; Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
AD/T (0.0–2.50m); HW Casing (0.0–2.70m)		E-F	Not Observed	0.10m; 0.10m D 0.40m; D 0.50m; 0.90m D 1.00m	0.0 / 27.5		CI	Silty CLAY: medium plasticity, red-brown, trace fine to medium ironstone gravel	w<PL	St	RESIDUAL SOIL
								0.5m: becoming orange-brown	w<PL to w~PL	VSt - H	
				1.00m SPT 12/100mm HB N*=R 1.10m	1.0 / 26.5			(to 1.10m)			1.00: SPT Recovery: 0.1 m
		H		1.40m D 1.50m				SILTSTONE: pale brown, grey, apparently very low to low strength			ROCK
					2.0 / 25.5						
WB (2.50–2.70m)				2.50m SPT 25/130mm HB N*=R 2.63m				(to 2.70m)			2.50: SPT Recovery: 0.13 m
					3.0 / 24.5			Continued as Cored Drill Hole			
					4.0 / 23.5						
					5.0 / 22.5						
					6.0 / 21.5						
					7.0 / 20.5						
					8.0 / 19.5						

See Explanatory Notes for details of abbreviations & basis of descriptions.

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH304
FILE / JOB NO : 228571.00
SHEET : 2 OF 4

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307724.6, N: 6243906.7 (56 MGA2020) SURFACE ELEVATION : 27.50 (AHD) ANGLE FROM HORIZONTAL : 90°
RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM
DATE STARTED : 30/4/24 DATE COMPLETED : 1/5/24 DATE LOGGED : 1/5/24 LOGGED BY : RT CHECKED BY : LJH
CASING DIAMETER : HW BARREL (Length) : 3.00 m BIT : 5 Step face BIT CONDITION : Good

Columns: DRILLING — PROGRESS (DRILLING & CASING, WATER LOSS), (CORE LOSS / RUN %) DRILL DEPTH, RQD (%), SAMPLES & FIELD TESTS, DEPTH (m) RL (m AHD); MATERIAL — GRAPHIC LOG, DESCRIPTION (ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)), Weathering, ESTIMATED STRENGTH Is(50) (● - Axial, O - Diametral; VL -0.1 L -0.3 M -1 H -3 VH -10 EH); FRACTURES — NATURAL FRACTURE (mm) (20 40 100 300 1000), CORE, ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, apparent dip, infilling or coating, shape, roughness, thickness, other, [true dip, dip direction]

Depth scale: 0.0 (27.5), 1.0 (26.5), 2.0 (25.5), 3.0 (24.5), 4.0 (23.5), 5.0 (22.5), 6.0 (21.5), 7.0 (20.5), 8.0 (19.5)

Drilling & casing: HQ3 (2.70–8.00 m)
Water loss: 0-5% (2.70–5.60 m); 40-60% (5.60–8.00 m)

Drill depth / Core loss (run %)	RQD (%)	Samples & field tests
0% LOSS (to 3.15)	80	Is(50) a=0.22
0% LOSS (3.15–6.00)	85	Is(50) a=0.23; Is(50) a=0.47; Is(50) a=0.48
0% LOSS (6.00–6.50)	86	Is(50) a=0.34; Is(50) a=1.01
85% LOSS (6.50–7.35)	10	Is(50) a=0.9
0% LOSS (7.35–7.59)	100	
0% LOSS (7.59–7.83)	100	Is(50) a=7.23
0% (7.83–)	88	

Depth	Description
2.70m	START CORING AT 2.70m
2.70–6.50m	SILTSTONE: orange-brown, grey to dark grey, 0-20% pale grey, fine grained sandstone laminations, bedding at 0-5°
6.50–7.24m	CORE LOSS 0.74m (6.50-7.24) *Core loss and extensive drilling breaks above due to issue with core barrel and drill bit - bit replaced below 7.24m.*
7.24m–	SILTSTONE: grey to dark grey, 0-10% pale grey, fine grained sandstone laminations, bedding at 0-5° 7.64-8.05m: pale grey, fine grained sandstone bed

Additional data:

- 2.80: BP 0° Fe SN PR S
- 2.89: JT 20° Fe SN UN RF
- 3.27: BP 0° Fe SN PR RF
- 3.32: BP 0° Clay VNR PR S
- 3.66: JT 20° CN PR S
- 3.82: JT 45° CN PR S
- 3.91: JT 45° CN IR RF
- 4.21: BP 0° Fe SN PR S
- 4.45: JT 45° tight
- 4.54: JT 30° CN PR S
- 5.41: BP 0° CN PR S
- 5.65: JT 70° CN PR S (5.53-5.78)
- 5.96: BP 0° X VNR PR RF
- 6.07: BP 0° CN PR S
- 7.28: BP 0° CN PR RF
- 7.62: JT 45° CN PR RF
- 7.93: JT 80° Fe SN PR RF

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH304
FILE / JOB NO : 228571.00

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307724.6, N: 6243906.7 (56 MGA2020)   SURFACE ELEVATION : 27.50 (AHD)   ANGLE FROM HORIZONTAL : 90°
RIG TYPE : Hydrapower Scout MOUNTING : Truck   CONTRACTOR : Ground Test   DRILLER : GM
DATE STARTED : 30/4/24   DATE COMPLETED : 1/5/24   DATE LOGGED : 1/5/24   LOGGED BY : RT   CHECKED BY : LJH
CASING DIAMETER : HW   BARREL (Length) : 3.00 m   BIT : 5 Step face   BIT CONDITION : Good

DRILLING

Drilling & Casing: HQ3

Drill depth (m)	Core loss (Run %)	RQD (%)
– 8.49	LOSS 0% LOSS	88
8.49 – 8.84	0% LOSS	100
8.84 – 9.05	0% LOSS	100
9.05 – 10.69	0% LOSS	95
10.69 – 11.23	0% LOSS	100
11.23 – 11.48	0% LOSS	100
11.48 – 12.20	0% LOSS	100
12.20 – 15.07	0% LOSS	100
15.07 –	0% LOSS	100

Samples & Field Tests: Is(50) a=1.18; Is(50) a=2.42; Is(50) a=0.78; Is(50) a=1.22; Is(50) a=0.84; Is(50) a=1.39; Is(50) a=2.8; Is(50) a=3.24; Is(50) a=0.66

Depth (m) / RL (m AHD): 8.0 / 19.5; 9.0 / 18.5; 10.0 / 17.5; 11.0 / 16.5; 12.0 / 15.5; 13.0 / 14.5; 14.0 / 13.5; 15.0 / 12.5; 16.0 / 11.5

MATERIAL

Depth (m)	Description
– 12.78	SILTSTONE: grey to dark grey, 0-10% pale grey, fine grained sandstone laminations, bedding at 0-5° *(continued)*
12.78 – 15.62	SANDSTONE: fine grained, pale grey, 10-20% dark grey siltstone laminations, bedding at 0-5°
15.62 –	SILTSTONE: grey to dark grey, 0-5% pale grey, fine grained sandstone laminations, bedding at 0-5°

Estimated Strength Is(50): ● - Axial, O - Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)

FRACTURES

Natural Fracture (mm): 20, 40, 100, 300, 1000

Additional Data (joints, partings, seams, zones, etc) Description, apparent dip, infilling or coating, shape, roughness, thickness, other, [true dip, dip direction]:

- 8.16: BP 15° CN PR RF
- 8.24: BP 0° CN PR S
- 9.07: BP 0° CN PR S
- 10.20-10.27: XS =70mm
- 10.50: IS 0° Clay =20mm
- 12.68: JT 45° CN UN S
- 14.34: JT 45° CN PR RF
- 14.56: BP 0° CN PR S
- 15.61: BP 0° CN PR RF
- 15.71: BP 5° CN PR RF
- 15.92: JT 30° CN PR RF

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH304
FILE / JOB NO : 228571.00
SHEET : 4 OF 4

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307724.6, N: 6243906.7 (56 MGA2020) SURFACE ELEVATION : 27.50 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test DRILLER : GM

DATE STARTED : 30/4/24 DATE COMPLETED : 1/5/24 DATE LOGGED : 1/5/24 LOGGED BY : RT CHECKED BY : LJH

CASING DIAMETER : HW BARREL (Length) : 3.00 m BIT : 5 Step face BIT CONDITION : Good

Drilling & Casing	Water Loss	Core Loss (Run %) / Drill Depth	RQD (%)	Samples & Field Tests	Depth (m) / RL (m AHD)	Description	Additional Data
HQ3	0-10%	0% LOSS	100		16.0 / 11.5	SILTSTONE: grey to dark grey, 0-5% pale grey, fine grained sandstone laminations, bedding at 0-5° *(continued)*	16.36: BP 5° X VNR PR RF
					16.50m	SANDSTONE: fine grained, pale grey, 0-20% dark grey siltstone laminations, bedding at 0-5°,	
				Is(50) a=1.88	17.0 / 10.5		
				Is(50) a=2.31			
				Is(50) a=4.36			17.62: BP 0° Clay VNR PR S
		18.00					
		0% LOSS	100		18.0 / 9.5		
				Is(50) a=3.55	18.92m	INTERBEDDED AND INTERLAMINATED SILTSTONE AND SANDSTONE: 60-70% grey and pale grey, fine grained sandstone, 30-40% dark grey siltstone, bedding at 0-5°	
					19.0 / 8.5		
				Is(50) a=1.58			
					20.0 / 7.5		
				Is(50) a=1.16			
		21.00					
		0% LOSS	100		21.0 / 6.5		
				Is(50) a=2.57			
		22.14			22.0 / 5.5		
					22.14m	BOREHOLE BH304 TERMINATED AT 22.14 m Target depth	
					23.0 / 4.5		
					24.0 / 3.5		

Estimated Strength Is(50): ● - Axial, O - Diametral; VL 0.1 L 0.3 M 1 H 3 VH 10 EH

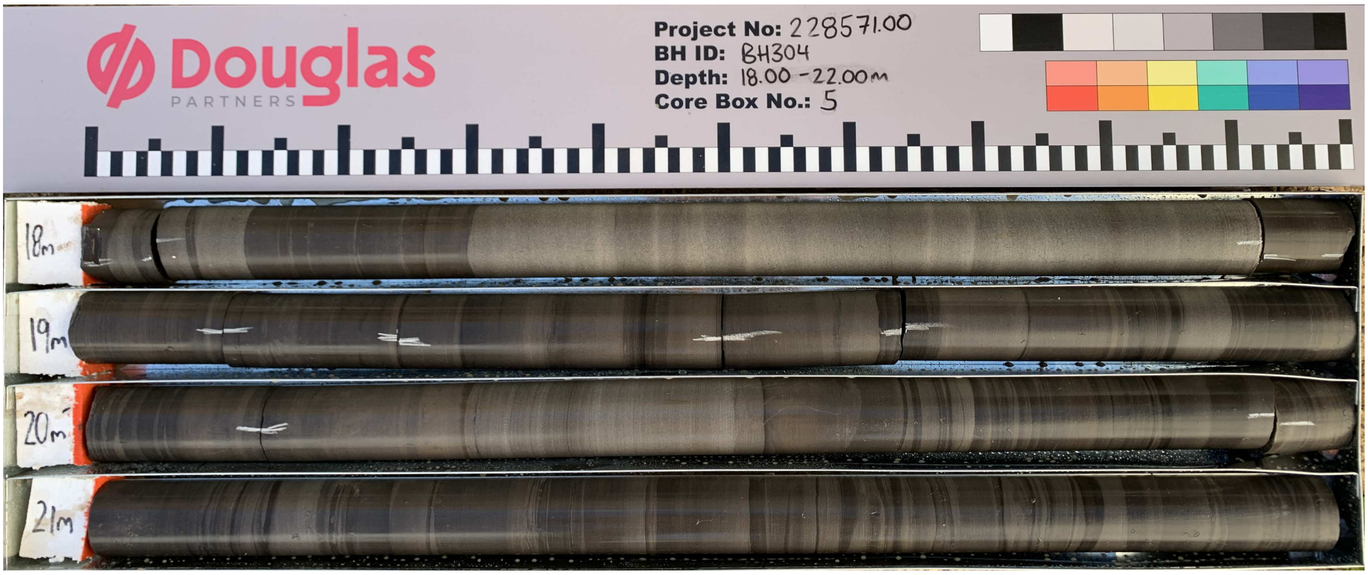
Natural Fracture (mm): 20 40 100 300 1000

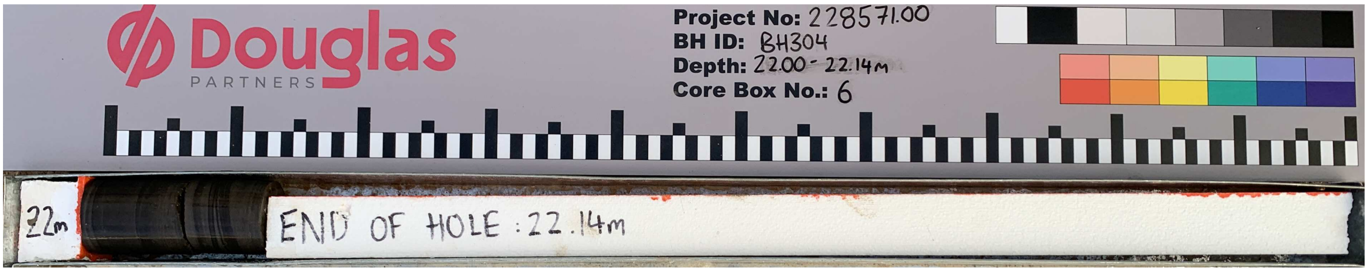

Douglas
PARTNERS
Project No: 228571.00
BH ID: BH304
Depth: 2.70-6.00m
Core Box No.: 1
228571.00 LIVERPOOL 30/4/24 START CORING: 2.70m →
3m
4m
5m


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH304
Depth: 6.00-10.00m
Core Box No.: 2
6m
6.50
CORE LOSS
7m
7.24
8m
9m


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH304
Depth: 10.00-14.00m
Core Box No.: 3
10m
11m
12m
13m


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH304
Depth: 14.00-18.00m
Core Box No.: 4
14m
15m
16m
17m


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH304
Depth: 18.00 - 22.00m
Core Box No.: 5
18m
19m
20m
21m


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH304
Depth: 22.00 - 22.14m
Core Box No.: 6
22m
END OF HOLE : 22.14m

NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH405
FILE / JOB NO : 228571.00
SHEET : 1 OF 3

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307704.7, N: 6243896.0 (56 MGA2020) SURFACE ELEVATION : 18.70 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hanjin DB8 MOUNTING : Track CONTRACTOR : Rockwell DRILLER :

DATE STARTED : 1/5/24 DATE COMPLETED : 2/5/24 DATE LOGGED : 1/5/24 LOGGED BY : AS CHECKED BY : LJH

DRILLING						MATERIAL					
PROGRESS: DRILLING & CASING	PROGRESS: WATER LOSS	DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m) RL (m AHD)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
AD/T, HW Casing		H	Not Observed		0.0 (18.7) – 0.69m			SILTSTONE: dark grey, apparently medium strength; slightly weathered to fresh			ROCK
					0.69			Continued as Cored Drill Hole			
					1.0 (17.7)						
					2.0 (16.7)						
					3.0 (15.7)						
					4.0 (14.7)						
					5.0 (13.7)						
					6.0 (12.7)						
					7.0 (11.7)						
					8.0 (10.7)						

See Explanatory Notes for details of abbreviations & basis of descriptions.

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH405
FILE / JOB NO : 228571.00
SHEET : 2 OF 3

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307704.7, N: 6243896.0 (56 MGA2020) SURFACE ELEVATION : 18.70 (AHD) ANGLE FROM HORIZONTAL : 90°
RIG TYPE : Hanjin DB8 MOUNTING : Track CONTRACTOR : Rockwell DRILLER :
DATE STARTED : 1/5/24 DATE COMPLETED : 2/5/24 DATE LOGGED : 1/5/24 LOGGED BY : AS CHECKED BY : LJH
CASING DIAMETER : HW BARREL (Length) : BIT : BIT CONDITION :

Depth (m)	RL (m AHD)	Drilling & Casing	Water Loss	Core Loss (Run %) / Drill Depth	RQD (%)	Samples & Field Tests	Description	Weathering	Additional Data (Fractures)
0.0	18.7								
0.69		HQ3	0-5%				START CORING AT 0.69m		
0.69–5.50				0% LOSS	100	Is(50) a=1.24	SILTSTONE: dark grey, 0-10% pale grey, fine grained sandstone laminations, bedding at 0-5°, with interbedded sandstone bands	F	
1.0	17.7								
~1.7						Is(50) a=0.14	1.70-2.00m: pale grey		
1.95									1.95: BP 10° Clay FILLED PR RF 5mm
2.0	16.7								
2.27									2.27: BP 5° PR RF
2.36									2.36: JT 30° CN PR S
~2.9			24/05/24			Is(50) a=1.4			
3.0	15.7			3.08					
3.08				0% LOSS	100	Is(50) a=1.19			
3.32									3.32: BP 5° MU CT PR S
4.0	14.7								
~4.5						Is(50) a=1.32			4.53: BP 5° Clay CT PR S
5.0	13.7								
5.50–7.80							INTERBEDDED AND INTERLAMINATED SILTSTONE AND SANDSTONE: 40-80% dark grey siltstone, 20-60% pale grey, fine grained sandstone, bedding at 0-5°		
5.61									5.61: BP 10° X VNR PR S
~5.95						Is(50) a=2.88			
6.0	12.7			6.08					
6.08				0% LOSS	100				
6.40									6.40: JT 70° MU PR healed
6.57						Is(50) a=1.79			6.57: BP 5° X VNR PR S
7.0	11.7								
~7.2						Is(50) a=0.53			
7.43									7.43: JT 20° CN PR RF
7.80–8.0							SANDSTONE: fine grained, pale grey, 0-20% dark grey siltstone laminations, bedding at 0-5°,		
8.0	10.7								

RMS LIB 40.3.14 - NEW LOGO.GLB Log RTA CORED DRILL HOLE 4 228571.00 LOGS.GPJ <<DrawingFile>> 30/May/2024 11:24 10.02.00.04 Datgel Tools

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH405
FILE / JOB NO : 228571.00
SHEET : 3 OF 3

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307704.7, N: 6243896.0 (56 MGA2020) SURFACE ELEVATION : 18.70 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hanjin DB8 MOUNTING : Track CONTRACTOR : Rockwell DRILLER :

DATE STARTED : 1/5/24 DATE COMPLETED : 2/5/24 DATE LOGGED : 1/5/24 LOGGED BY : AS CHECKED BY : LJH

CASING DIAMETER : HW BARREL (Length) : BIT : BIT CONDITION :

DRILLING						MATERIAL				FRACTURES		
PROGRESS: DRILLING & CASING	WATER LOSS	(CORE LOSS RUN %) DRILL DEPTH	RQD (%)	SAMPLES & FIELD TESTS	DEPTH (m) RL (m AHD)	GRAPHIC LOG	DESCRIPTION ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)	Weathering	ESTIMATED STRENGTH Is(50) ● - Axial O - Diametral (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	NATURAL FRACTURE (mm) (20, 40, 100, 300, 1000)	CORE	ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, apparent dip, infilling or coating, shape, roughness, thickness, other, [true dip, dip direction]
HQ3	0-5%	0% LOSS	100		8.0 / 10.7		SANDSTONE: fine grained, pale grey, 0-20% dark grey siltstone laminations, bedding at 0-5°, *(continued)*	F				
				Is(50) a=3.01								
		9.07			9.0 / 9.7							
		0% LOSS	100									9.30: BP 0° CN PR S
				Is(50) a=2.47								9.42: BP 0° CN PR S
				Is(50) a=3.55	10.0 / 8.7							
							10.20m INTERBEDDED AND INTERLAMINATED SILTSTONE AND SANDSTONE: 60-80% dark grey siltstone, 20-40% pale grey, fine grained sandstone, bedding at 0-5°					10.52: JT 20° CN PR S
					11.0 / 7.7							
				Is(50) a=1.48								11.35: JT 40° CN PR RF
		12.06			12.0 / 6.7							
		0% LOSS	100									
				Is(50) a=1.7								
					13.0 / 5.7							
		14.10		Is(50) a=2.05 Is(50) a=1.95	14.0 / 4.7		14.10m					
							BOREHOLE BH405 TERMINATED AT 14.10 m Target depth					
					15.0 / 3.7							
					16.0 / 2.7							

RMS LIB 40.3.14 - NEW LOGO.GLB Log RTA CORED DRILL HOLE 4 228571.00 LOGS.GPJ <<DrawingFile>> 30/May/2024 11:24 10.02.00.04 Datgel Tools

Douglas PARTNERS


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH405
Depth: 0.69m to 4.00m
Core Box No.: 1 of 4
228571.00 BH405 START: 0.69m (LIVERPOOL)
1
2
3


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH405
Depth: 4.00m to 8.00m
Core Box No.: 2 of 4
4
5
6
7


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH405
Depth: 8.00m to 12.00m
Core Box No.: 3 of 4
8
9
10
11


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH405
Depth: 12.00m to 14.10m
Core Box No.: 4 of 4
12
13
14
EOH 14.10m

NON-CORE DRILL HOLE - GEOLOGICAL LOG

HOLE NO : BH406
FILE / JOB NO : 228571.00
SHEET : 1 OF 4

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307696.8, N: 6243896.9 (56 MGA2020) SURFACE ELEVATION : 18.90 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hanjin DB8 MOUNTING : Track CONTRACTOR : Rockwell DRILLER :

DATE STARTED : 30/4/24 DATE COMPLETED : 1/5/24 DATE LOGGED : 30/4/24 LOGGED BY : AS CHECKED BY : LJH

DRILLING						MATERIAL					
PROGRESS: DRILLING & CASING	PROGRESS: WATER LOSS	DRILLING PENETRATION	GROUND WATER LEVELS	SAMPLES & FIELD TESTS	DEPTH (m) RL (m AHD)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION Soil Type, Colour, Plasticity or Particle Characteristic Secondary and Minor Components	MOISTURE CONDITION	CONSISTENCY RELATIVE DENSITY	STRUCTURE & Other Observations
AD/T HW Casing		H	Not Observed		0.0 18.9			SILTSTONE: dark grey, apparently medium strength 1.00m			ROCK
					1.0 17.9			Continued as Cored Drill Hole			
					2.0 16.9						
					3.0 15.9						
					4.0 14.9						
					5.0 13.9						
					6.0 12.9						
					7.0 11.9						
					8.0 10.9						

See Explanatory Notes for details of abbreviations & basis of descriptions.

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH406
FILE / JOB NO : 228571.00
SHEET : 2 OF 4

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307696.8, N: 6243896.9 (56 MGA2020) SURFACE ELEVATION : 18.90 (AHD) ANGLE FROM HORIZONTAL : 90°
RIG TYPE : Hanjin DB8 MOUNTING : Track CONTRACTOR : Rockwell DRILLER :
DATE STARTED : 30/4/24 DATE COMPLETED : 1/5/24 DATE LOGGED : 30/4/24 LOGGED BY : AS CHECKED BY : LJH
CASING DIAMETER : HW BARREL (Length) : BIT : BIT CONDITION :

Depth (m) / RL (m AHD)	Drilling & Casing	Water Loss	Core Loss (Run %) / Drill Depth	RQD (%)	Samples & Field Tests	Description	Weathering	Additional Data
0.0 / 18.9								
1.00 / 17.9	HQ3	0-5%	0% LOSS	96		1.00m START CORING AT 1.00m SILTSTONE: dark grey, 0-10% pale grey, fine grained sandstone laminations, bedding at 0-5°, with interbedded sandstone bands	F	
								1.67: BP 5° Clay FILLED PR RF 10mm
					Is(50) a=0.47			1.88: BP 10° Clay VNR PR RF
1.90						1.90-2.40m: pale grey	SW	
2.09 / 16.8			2.09 0% LOSS	100			F	2.15: JT 45° Clay VNR PR S
								2.40: JT 15° CN PR RF
		24/05/24 (water level)			Is(50) a=0.99			
3.0 / 15.9			3.10 0% LOSS	99	Is(50) a=1.79			
								3.76: BP 5° Clay FILLED PR S 10mm
4.0 / 14.9					Is(50) a=0.65			
								5.55: BP 5° PR S
5.80								5.77: BP 5° PR S
					Is(50) a=1.2	5.80m INTERBEDDED AND INTERLAMINATED SILTSTONE AND SANDSTONE: 50-70% pale grey, fine grained sandstone, 30-50% dark grey siltstone, bedding at 0-5°		
6.0 / 12.9			6.10 0% LOSS	100				6.33: BP 5° Clay PR S
					Is(50) a=0.76			
7.0 / 11.9						7.00m SILTSTONE: dark grey		
					Is(50) a=0.71			7.47: BP 5° Clay CT PR RF 7.48: JT 10° CN PR RF
						7.65-8.10m: crushed zone	SW - F	7.71: JT 30° Clay CT PR RF 7.81: JT 45° Clay CT PR RF 7.93: JT 45° Clay CT PR RF
8.0 / 10.9								

Estimated Strength Is(50): ● - Axial, O - Diametral; VL 0.1, L 0.3, M 1, H 3, VH 10, EH
Natural Fracture (mm): 20, 40, 100, 300, 1000

RMS LIB 40.3.14 - NEW LOGO.GLB Log RTA CORED DRILL HOLE 4 228571.00 LOGS.GPJ <<DrawingFile>> 30/May/2024 11:24 10.02.00.04 Datgel Tools

Douglas PARTNERS

CORED DRILL HOLE LOG

HOLE NO : BH406
FILE / JOB NO : 228571.00
SHEET : 3 OF 4

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307696.8, N: 6243896.9 (56 MGA2020)	SURFACE ELEVATION : 18.90 (AHD)	ANGLE FROM HORIZONTAL : 90°
RIG TYPE : Hanjin DB8	MOUNTING : Track	CONTRACTOR : Rockwell
DRILLER :		
DATE STARTED : 30/4/24	DATE COMPLETED : 1/5/24	DATE LOGGED : 30/4/24
LOGGED BY : AS	CHECKED BY : LJH	
CASING DIAMETER : HW	BARREL (Length) :	BIT :
BIT CONDITION :		

DRILLING: PROGRESS (DRILLING & CASING, WATER LOSS), (CORE LOSS RUN %) DRILL DEPTH, RQD (%), SAMPLES & FIELD TESTS, DEPTH (m) RL (m AHD)
MATERIAL: GRAPHIC LOG, DESCRIPTION (ROCK TYPE : Grain size, Colour, Structure (texture, fabric, mineral composition, hardness alteration, cementation, etc as applicable)), Weathering, ESTIMATED STRENGTH Is(50) (● - Axial, O - Diametral; VL 0.1, L 0.3, M 1, H 3, VH 10, EH)
FRACTURES: NATURAL FRACTURE (mm) (20, 40, 100, 300, 1000), CORE, ADDITIONAL DATA (joints, partings, seams, zones, etc) Description, apparent dip, infilling or coating, shape, roughness, thickness, other, [true dip, dip direction]

Drilling: HQ3; Water loss: 0-5%

Drill depth (m)	Core loss (run %)	RQD (%)
8.0–9.05	0% LOSS	100
9.05–12.10	0% LOSS	97
12.10–15.10	0% LOSS	100
15.10–	0% LOSS	99

Depth (m)	RL (m AHD)
8.0	10.9
9.0	9.9
10.0	8.9
11.0	7.9
12.0	6.9
13.0	5.9
14.0	4.9
15.0	3.9
16.0	2.9

Description

SILTSTONE: dark grey *(continued)*

8.20m
SANDSTONE: fine grained, pale grey, 0-40% dark grey siltstone interbeds, bedding at 0-5°,

12.80m
INTERBEDDED AND INTERLAMINATED SILTSTONE AND SANDSTONE: 60-80% dark grey siltstone, 20-40% pale grey, fine grained sandstone, bedding at 0-5°

Weathering: F

Samples & field tests

Is(50) a=2.14
Is(50) a=3.42
Is(50) a=2.09
Is(50) a=6.09
Is(50) a=1.8
Is(50) a=2.2
Is(50) a=1.95
Is(50) a=3.15

Additional data

8.09: JT 45° Clay CT PR RF
9.32: BP 0° CN PR S
9.58: BP 0° CN PR S
10.20: JT 70° MU PR RF
10.30: JT 60° MU healed
12.96: BP 5° X VNR PR S
15.27: BP 5° X VNR PR S

CORED DRILL HOLE LOG

HOLE NO : BH406
FILE / JOB NO : 228571.00
SHEET : 4 OF 4

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307696.8, N: 6243896.9 (56 MGA2020) SURFACE ELEVATION : 18.90 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hanjin DB8 MOUNTING : Track CONTRACTOR : Rockwell DRILLER :

DATE STARTED : 30/4/24 DATE COMPLETED : 1/5/24 DATE LOGGED : 30/4/24 LOGGED BY : AS CHECKED BY : LJH

CASING DIAMETER : HW BARREL (Length) : BIT : BIT CONDITION :

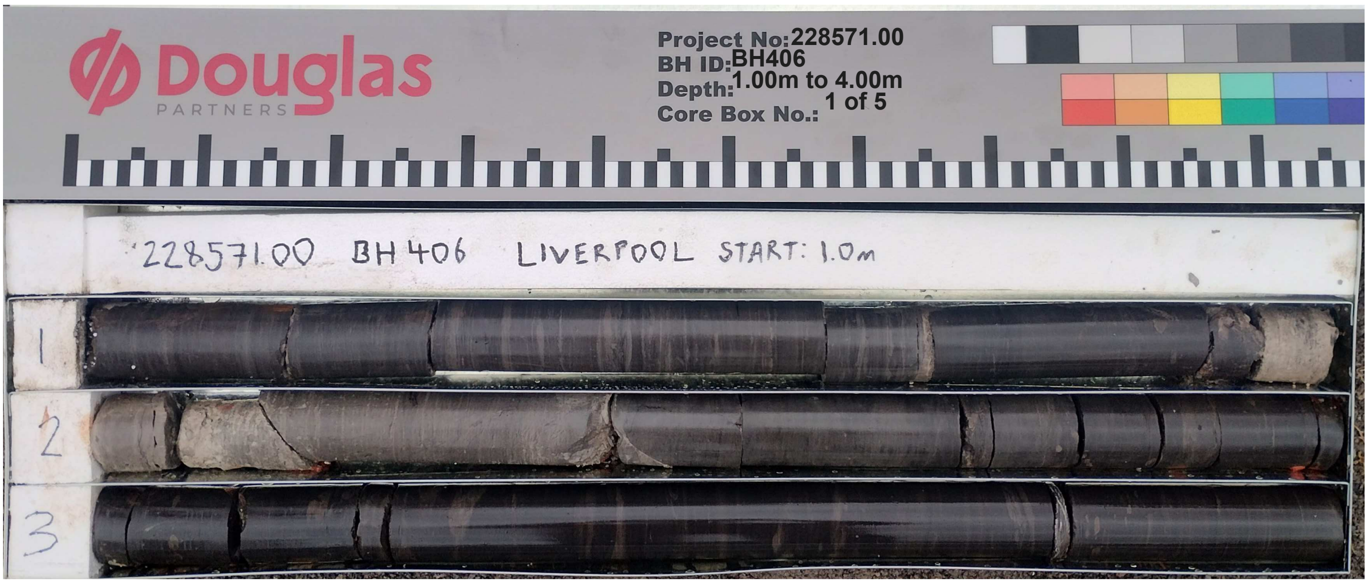
Drilling & Casing	Water Loss	Core Loss (Core Run %) / Drill Depth	RQD (%)	Samples & Field Tests	Depth (m) / RL (m AHD)	Description	Weathering	Estimated Strength Is(50)	Additional Data
HQ3	0-5%	0% LOSS	99		16.0 / 2.9	INTERBEDDED AND INTERLAMINATED SILTSTONE AND SANDSTONE: 60-80% dark grey siltstone, 20-40% pale grey, fine grained sandstone, bedding at 0-5° *(continued)*	F		16.23: BP 5° CN PR S
				Is(50) a=1.59	17.0 / 1.9				
				Is(50) a=1.58					
		18.10			18.0 / 0.9				
		0% LOSS	100						
				Is(50) a=2.68					
				Is(50) a=2.26	19.0 / -0.1				
		20.10		Is(50) a=2.43	20.0 / -1.1	20.10m			
						BOREHOLE BH406 TERMINATED AT 20.10 m Target depth			
					21.0 / -2.1				
					22.0 / -3.1				
					23.0 / -4.1				
					24.0 / -5.1				

Estimated strength legend: ● - Axial; ○ - Diametral. Scale: VL 0.1 L 0.3 M 1 H 3 VH 10 EH

Natural Fracture (mm): 20 40 100 300 1000

RMS LIB 40.3.14 - NEW LOGO.GLB Log RTA CORED DRILL HOLE 4 228571.00 LOGS.GPJ <<DrawingFile>> 30/May/2024 11:24 10.02.00.04 Datgel Tools

Douglas PARTNERS


Douglas
PARTNERS
Project No:228571.00
BH ID:BH406
Depth:1.00m to 4.00m
Core Box No.: 1 of 5
228571.00 BH 406 LIVERPOOL START: 1.0m
1
2
3


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH406
Depth: 4.00m to 8.00m
Core Box No.: 2 of 5
4
5
6
7


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH406
Depth: 8.00m to 12.00m
Core Box No.: 3 of 5
8
9
10
11


Douglas
PARTNERS
Project No 228571.00
BH ID BH406
Depth 12.00m to 16.00m
Core Box No. 3 of 5
12
13
14
15


Douglas
PARTNERS
Project No: 228571.00
BH ID: BH406
Depth: 16.00m to 20.10m
Core Box No.: 5 of 5
16
17
18
19
20
EOH 20.10m

PIEZOMETER CONSTRUCTION

HOLE NO : BH301_w
FILE / JOB NO : 228571.00
SHEET : 1 OF 1

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

POSITION : E: 307710.5, N: 6243912.0 (56 MGA2020) SURFACE ELEVATION : 27.30 (AHD) ANGLE FROM HORIZONTAL : 90°
RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test
DATE STARTED : 6/5/24 DATE COMPLETED : 7/5/24 DATE LOGGED : 6/5/24 LOGGED BY : SI CHECKED BY :

DRILLING

PROGRESS: DRILLING & CASING: AD/T – HW Casing (0.0–2.85 m), WB; HQ3 (2.85–28.15 m)
WATER LOSS
GROUND WATER LEVELS: 24/05/24 (approx. 9.8 m)

MATERIAL

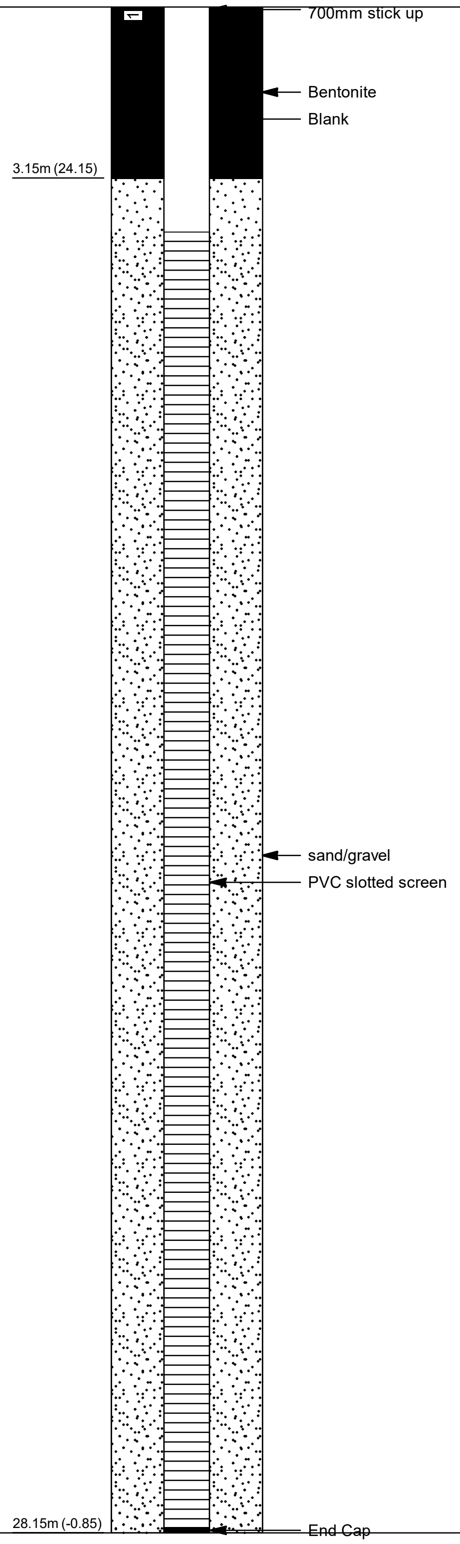
MATERIAL (See geotechnical log for soil/rock detail)

DEPTH (m)	CLASSIFICATION SYMBOL	MATERIAL
0.0–0.15m		FILL: GRAVEL: grey, coarse gravel, aggregate
0.15–0.70m	CH	CLAY: high plasticity, pale grey-brown
0.70–1.20m	CL	CLAY: pale grey, (shaly clay)
1.20–2.85m		SILTSTONE: pale grey, apparently very low to low strength
2.85–5.90m		SILTSTONE: grey and brown, 10-20% fine grained, pale grey sandstone laminations, bedding at 0-5°; moderately weathered to slightly weathered, medium strength
5.90–6.20m		SILTSTONE: dark grey, carbonaceous; slightly weathered, low to medium strength
6.20–6.35m		CORE LOSS 0.15m (6.20-6.35)
6.35–6.50m		SILTSTONE: as above
6.50–7.50m		SILTSTONE: pale grey and grey; fresh, medium strength
7.50–8.25m		SANDSTONE: fine grained, pale grey, 0-10% dark grey siltstone laminations; fresh, medium to very high strength
8.25–13.30m		SILTSTONE: grey, 0-10% pale grey, fine grained sandstone laminations, bedding at 0-5°; highly weathered to fresh, very low to high strength
13.30–15.30m		SANDSTONE: fine grained, pale grey, 0-20% grey and dark grey siltstone laminations, bedding at 0-5°; fresh, very high strength
15.30–16.20m		SILTSTONE: dark grey; slightly weathered, low to medium strength
16.20–18.50m		SANDSTONE: fine grained, pale grey and grey; fresh, very high strength
18.50–28.15m		INTERBEDDED AND INTERLAMINATED SILTSTONE AND SANDSTONE: 50-60% grey to dark grey siltstone, 40-50% pale grey, fine grained sandstone, bedding at 0-5°; fresh, high strength

BH301_w TERMINATED AT 28.15 m
Target depth

PIEZOMETER CONSTRUCTION DETAILS

ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date	Static Water Level
1	Standpipe		28.15 m -0.85 AHD		



This report of well/VWP installation must be read in conjunction with accompanying notes and abbreviations. The geotechnical log is a summary only and the detailed log should be referred to for strata details and any core loss zones.

Douglas PARTNERS

PIEZOMETER CONSTRUCTION

HOLE NO : BH304_w
FILE / JOB NO : 228571.00
SHEET : 1 OF 1

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

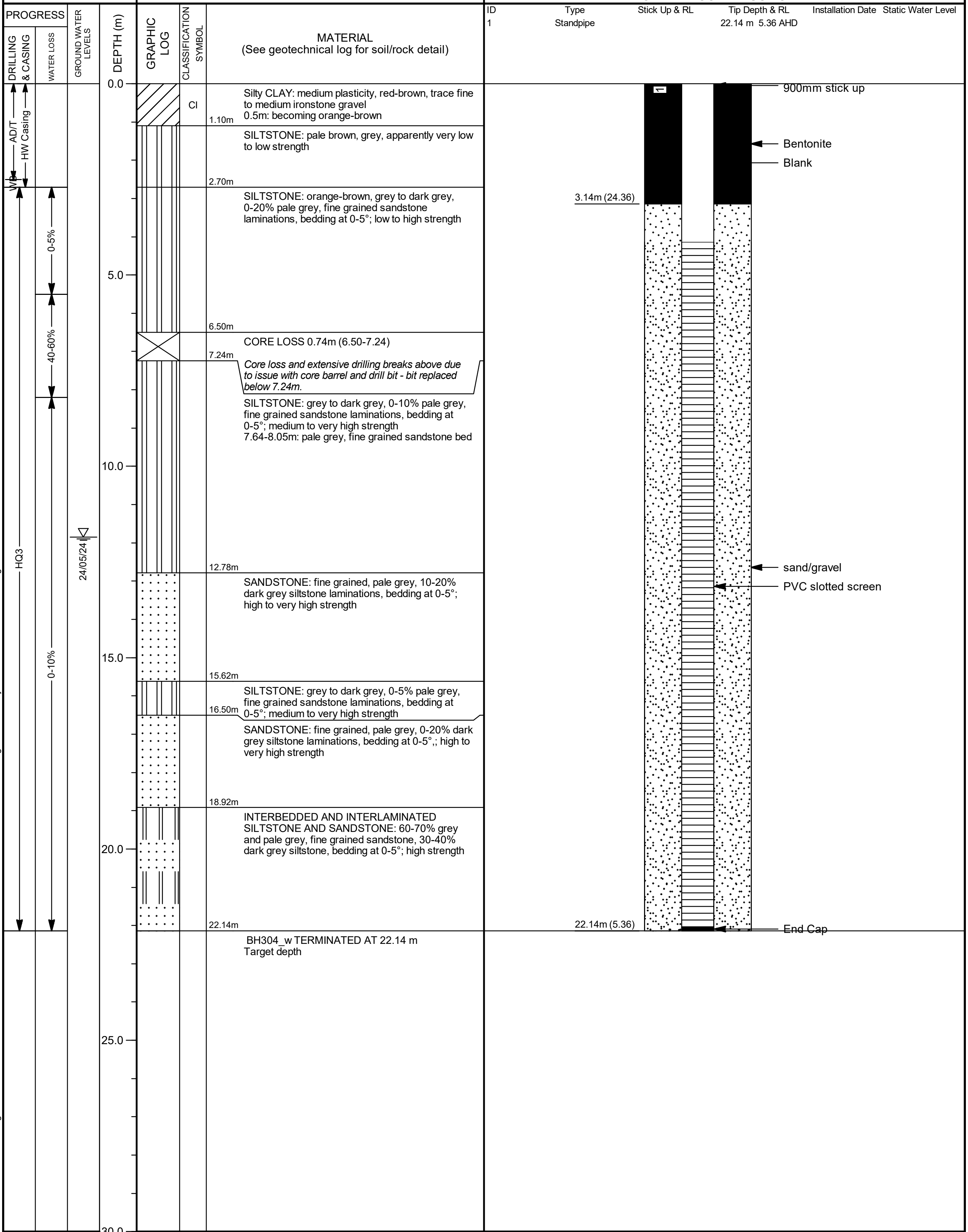
POSITION : E: 307724.6, N: 6243906.7 (56 MGA2020) SURFACE ELEVATION : 27.50 (AHD) ANGLE FROM HORIZONTAL : 90°

RIG TYPE : Hydrapower Scout MOUNTING : Truck CONTRACTOR : Ground Test

DATE STARTED : 30/4/24 DATE COMPLETED : 1/5/24 DATE LOGGED : 1/5/24 LOGGED BY : RT CHECKED BY :

ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date	Static Water Level
1	Standpipe		22.14 m 5.36 AHD		

Depth (m)	Classification Symbol	Material (See geotechnical log for soil/rock detail)
0.0 – 1.10m	CI	Silty CLAY: medium plasticity, red-brown, trace fine to medium ironstone gravel 0.5m: becoming orange-brown
1.10 – 2.70m		SILTSTONE: pale brown, grey, apparently very low to low strength
2.70 – 6.50m		SILTSTONE: orange-brown, grey to dark grey, 0-20% pale grey, fine grained sandstone laminations, bedding at 0-5°; low to high strength
6.50 – 7.24m		CORE LOSS 0.74m (6.50-7.24) *Core loss and extensive drilling breaks above due to issue with core barrel and drill bit - bit replaced below 7.24m.*
7.24 – 12.78m		SILTSTONE: grey to dark grey, 0-10% pale grey, fine grained sandstone laminations, bedding at 0-5°; medium to very high strength 7.64-8.05m: pale grey, fine grained sandstone bed
12.78 – 15.62m		SANDSTONE: fine grained, pale grey, 10-20% dark grey siltstone laminations, bedding at 0-5°; high to very high strength
15.62 – 16.50m		SILTSTONE: grey to dark grey, 0-5% pale grey, fine grained sandstone laminations, bedding at 0-5°; medium to very high strength
16.50 – 18.92m		SANDSTONE: fine grained, pale grey, 0-20% dark grey siltstone laminations, bedding at 0-5°,; high to very high strength
18.92 – 22.14m		INTERBEDDED AND INTERLAMINATED SILTSTONE AND SANDSTONE: 60-70% grey and pale grey, fine grained sandstone, 30-40% dark grey siltstone, bedding at 0-5°; high strength
22.14m		BH304_w TERMINATED AT 22.14 m Target depth



This report of well/VWP installation must be read in conjunction with accompanying notes and abbreviations. The geotechnical log is a summary only and the detailed log should be referred to for strata details and any core loss zones.

Douglas PARTNERS

PIEZOMETER CONSTRUCTION

HOLE NO : BH405_w
FILE / JOB NO : 228571.00
SHEET : 1 OF 1

PROJECT : Proposed Hotel and Apartments
LOCATION : 402 Macquarie Street, Liverpool

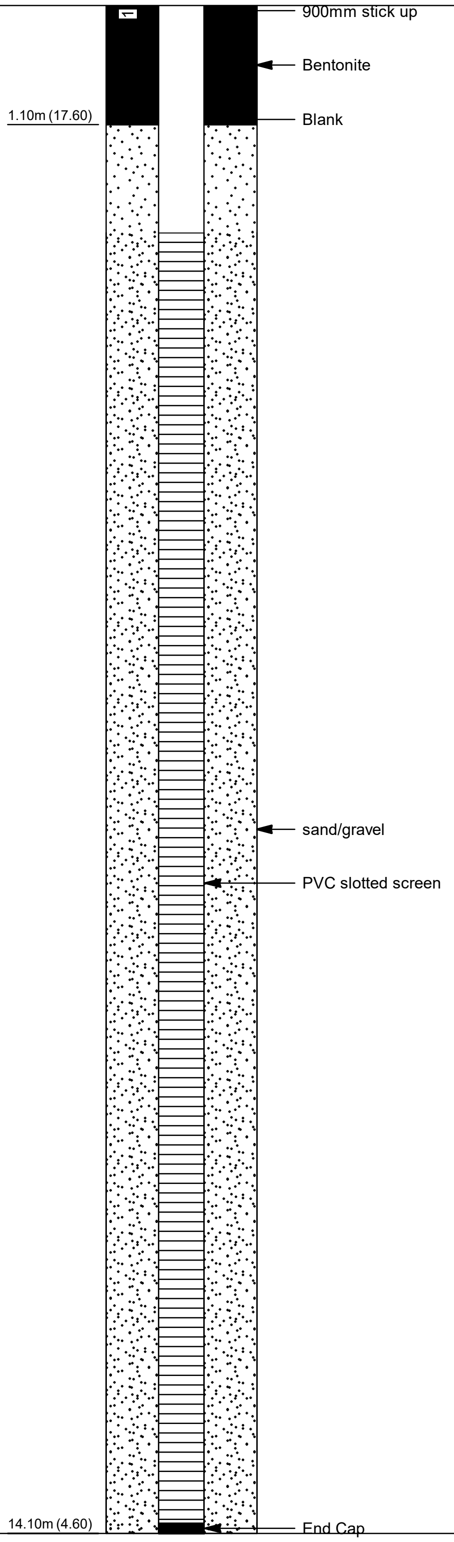
POSITION : E: 307704.7, N: 6243896.0 (56 MGA2020) SURFACE ELEVATION : 18.70 (AHD) ANGLE FROM HORIZONTAL : 90°
RIG TYPE : Hanjin DB8 MOUNTING : Track CONTRACTOR : Rockwell
DATE STARTED : 1/5/24 DATE COMPLETED : 2/5/24 DATE LOGGED : 1/5/24 LOGGED BY : AS CHECKED BY :

DRILLING / MATERIAL

Drilling & Casing	Water Loss	Ground Water Levels	Depth (m)	Material (See geotechnical log for soil/rock detail)
AD/T, HW Casing			0.0–0.69m	SILTSTONE: dark grey, apparently medium strength; slightly weathered to fresh
HQ3	0-5%	24/05/24	0.69–5.50m	SILTSTONE: dark grey, 0-10% pale grey, fine grained sandstone laminations, bedding at 0-5°, with interbedded sandstone bands; fresh, low to high strength 1.70-2.00m: pale grey
			5.50–7.80m	INTERBEDDED AND INTERLAMINATED SILTSTONE AND SANDSTONE: 40-80% dark grey siltstone, 20-60% pale grey, fine grained sandstone, bedding at 0-5°; fresh, medium to very high strength
			7.80–10.20m	SANDSTONE: fine grained, pale grey, 0-20% dark grey siltstone laminations, bedding at 0-5°,; fresh, high to very high strength
			10.20–14.10m	INTERBEDDED AND INTERLAMINATED SILTSTONE AND SANDSTONE: 60-80% dark grey siltstone, 20-40% pale grey, fine grained sandstone, bedding at 0-5°; fresh, high to very high strength
			14.10m	BH405_w TERMINATED AT 14.10 m Target depth

PIEZOMETER CONSTRUCTION DETAILS

ID	Type	Stick Up & RL	Tip Depth & RL	Installation Date	Static Water Level
1	Standpipe		14.10 m 4.60 AHD		



This report of well/VWP installation must be read in conjunction with accompanying notes and abbreviations. The geotechnical log is a summary only and the detailed log should be referred to for strata details and any core loss zones.

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Appendix D

Permeability Testing

Packer Testing

Rising Head Tests

WATER PRESSURE TEST RESULTS

Client : The Grand Liverpool Pty Ltd **Project No. :** 228571
Project : Proposed Hotel and Apartments **Bore :** BH301
Location : 402 Macquarie Street, Liverpool **Test section :** 8.70-28.15m

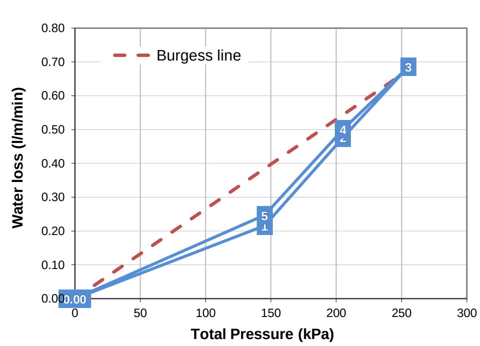
Test Details

Date:	8.05.2024	Bottom of packer (m):	8.70	Height of pressure gauge (m):	1.0	Drum Area (m^2):	
Bore diameter (mm):	96	Bore depth (m):	28.15	Vertical Depth to groundwater (m):	8.7		0.264
Bore inclination (deg):	90	Section length (m):	19.45	(or depth to base of packer)			

Hg = gauge pressure, Hl = head loss in rods and packer, Hw = (gauge height + groundwater depth)x 9.81, Total = Hg+Hw-Hl

PRESSURE Hg (kPa)	Hl (kPa)	Total (kPa)	Test Duration (min)	FLOW RATES: Flowmeter Initial (litres)	Flowmeter Final (litres)	Flowmeter Total (litres)	Drum readings Initial (mm)	Drum readings Final (mm)	Drum readings Equivalent litres	Leakage (litres)	Assigned Flow (litres)	Water Loss (l/m/min)	Lugeons (l/m/min at 1000 kPa)	Approx Permeability (m/sec)
50	0	145	5	886.0	907.0	21.0	700.0	630.0	18.5	0.0	21.0	0.2	1.5	1.5E-07
50	0	145	5	907.0	929.0	22.0	630.0	580.0	13.2	0.0	22.0	0.2	1.6	1.6E-07
50	0	145	5	929.0	949.0	20.0	580.0	500.0	21.1	0.0	20.0	0.2	1.4	1.4E-07
110	0	205	5	977.0	1021.0	44.0	610.0	460.0	39.6		44.0	0.5	2.2	2.2E-07
110	0	205	5	1021.0	1059.0	38.0	460.0	320.0	37.0		38.0	0.4	1.9	1.9E-07
110	0	205	5	1067.0	1124.0	57.0	520.0	320.0	52.8		57.0	0.6	2.9	2.9E-07
160	0	255	5	1148.0	1213.0	65.0	690.0	450.0	63.4		65.0	0.7	2.6	2.6E-07
160	0	255	5	1251.0	1322.0	71.0	800.0	500.0	79.3		71.0	0.7	2.9	2.9E-07
160	0	255	5	1322.0	1386.0	64.0	500.0	300.0	52.8		64.0	0.7	2.6	2.6E-07
110	0	205	5	1420.0	1480.0	60.0	700.0	550.0	39.6		60.0	0.6	3.0	3.0E-07
110	0	205	5	1480.0	1518.0	38.0	550.0	400.0	39.6		38.0	0.4	1.9	1.9E-07
110	0	205	5	1518.0	1566.0	48.0	400.0	240.0	42.3		48.0	0.5	2.4	2.4E-07
50	0	145	5	1587.0	1608.0	21.0	700.0	620.0	21.1		21.0	0.2	1.5	1.5E-07
50	0	145	5	1608.0	1632.0	24.0	620.0	530.0	23.8		24.0	0.2	1.7	1.7E-07
50	0	145	5	1632.0	1659.0	27.0	530.0	430.0	26.4		27.0	0.3	1.9	1.9E-07

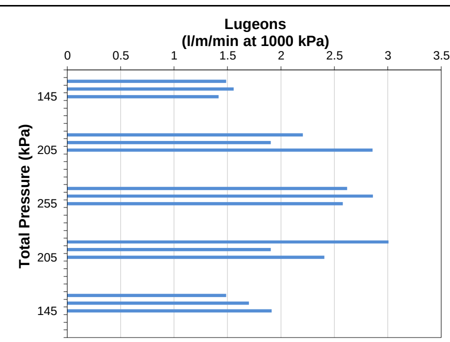
Notes



Averages			
Stage	Pressure (kPa)	Water Loss (l/m/min)	Lugeons (l/m/min at 1000kPa)
1	145	0.22	1.49
2	205	0.48	2.32
3	255	0.69	2.69
4	205	0.50	2.44
5	145	0.25	1.70

Houlsby Flow Pattern	Dilation
Houlsby Lugeon value	2
Burgess Lugeon value	3

Calculated: SI
Checked: LJH
Date: 15-May-24



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WATER PRESSURE TEST RESULTS

Client : The Grand Liverpool Pty Ltd **Project No. :** 228571.00
Project : Proposed Hotel and Apartments **Bore :** BH302
Location : 402 Macquarie Street, Liverpool **Test section :** 9.50-25.30m

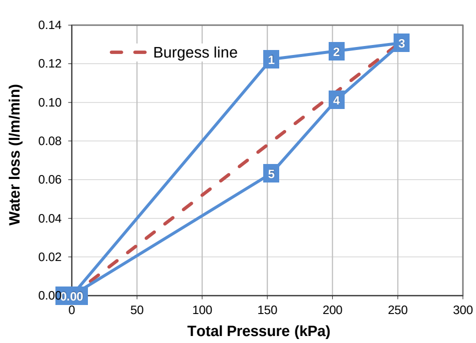
Test Details

Date:	9.05.2024	Bottom of packer (m):	9.50	Height of pressure gauge (m):	1.0	Drum Area (m^2):	
Bore diameter (mm):	96	Bore depth (m):	25.30	Vertical Depth to groundwater (m):	9.5		0.264
Bore inclination (deg):	90	Section length (m):	15.80	(or depth to base of packer)			

Hg = gauge pressure, Hl = head loss in rods and packer, Hw = (gauge height + groundwater depth)x 9.81, Total = Hg+Hw-Hl

PRESSURE Hg (kPa)	Hl (kPa)	Total (kPa)	Test Duration (min)	FLOW RATES Flowmeter Initial (litres)	Flowmeter Final (litres)	Flowmeter Total (litres)	Drum readings Initial (mm)	Drum readings Final (mm)	Drum readings Equivalent litres	Leakage (litres)	Assigned Flow (litres)	Water Loss (l/m/min)	Lugeons (l/m/min at 1000 kPa)	Approx Permeability (m/sec)
50	0	153	5	723.0	729.0	6.0	760.0	730.0	7.9		6.0	0.1	0.5	5.0E-08
50	0	153	5	729.0	744.0	15.0	730.0	690.0	10.6		15.0	0.2	1.2	1.2E-07
50	0	153	5	744.0	752.0	8.0	690.0	670.0	5.3		8.0	0.1	0.7	6.6E-08
100	0	203	5	758.0	769.0	11.0	640.0	610.0	7.9		11.0	0.1	0.7	6.9E-08
100	0	203	5	769.0	778.0	9.0	610.0	580.0	7.9		9.0	0.1	0.6	5.6E-08
100	0	203	5	778.0	788.0	10.0	580.0	540.0	10.6		10.0	0.1	0.6	6.2E-08
150	0	253	5	792.0	803.0	11.0	500.0	480.0	5.3		11.0	0.1	0.6	5.5E-08
150	0	253	5	803.0	812.0	9.0	480.0	460.0	5.3		9.0	0.1	0.5	4.5E-08
150	0	253	5	812.0	823.0	11.0	460.0	430.0	7.9		11.0	0.1	0.6	5.5E-08
100	0	203	5	832.0	841.0	9.0	750.0	720.0	7.9		9.0	0.1	0.6	5.6E-08
100	0	203	5	841.0	849.0	8.0	720.0	690.0	7.9		8.0	0.1	0.5	5.0E-08
100	0	203	5	849.0	856.0	7.0	690.0	660.0	7.9		7.0	0.1	0.4	4.4E-08
50	0	153	5	859.0	865.0	6.0	650.0	635.0	4.0		6.0	0.1	0.5	5.0E-08
50	0	153	5	865.0	869.0	4.0	635.0	615.0	5.3		4.0	0.1	0.3	3.3E-08
50	0	153	5	869.0	874.0	5.0	615.0	590.0	6.6		5.0	0.1	0.4	4.1E-08

Notes

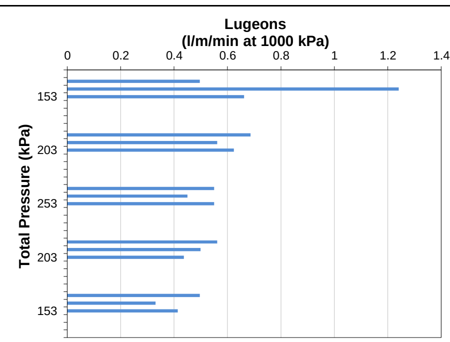


Averages

Stage	Pressure (kPa)	Water Loss (l/m/min)	Lugeons (l/m/min at 1000kPa)
1	153	0.12	0.80
2	203	0.13	0.62
3	253	0.13	0.52
4	203	0.10	0.50
5	153	0.06	0.41

Houlsby Flow Pattern	Void Filling
Houlsby Lugeon value	0.4
Burgess Lugeon value	0.5

Calculated: SI
Checked: LJH
Date: 15-May-24



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WATER PRESSURE TEST RESULTS

Client : The Grand Liverpool Pty Ltd **Project No. :** 228571.00
Project : Proposed Hotel and Apartments **Bore :** BH303
Location : 402 Macquarie Street, Liverpool **Test section :** 14.00-24.15m

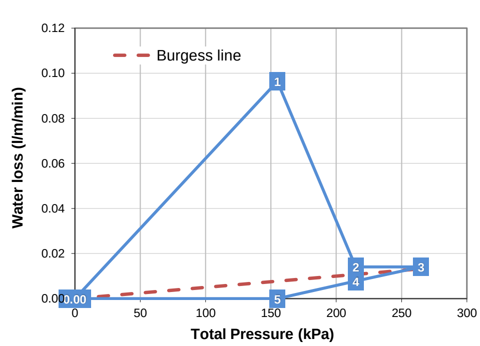
Test Details

Date:	3-May-24	Bottom of packer (m):	14.00	Height of pressure gauge (m):	1.0	Drum Area (m^2):	
Bore diameter (mm):	96	Bore depth (m):	24.15	Vertical Depth to groundwater (m):	9.7	0.264	
Bore inclination (deg):	90	Section length (m):	10.15	(or depth to base of packer)			

Hg = gauge pressure, Hl = head loss in rods and packer, Hw = (gauge height + groundwater depth)x 9.81, Total = Hg+Hw-Hl

PRESSURE Hg (kPa)	Hl (kPa)	Total (kPa)	Test Duration (min)	FLOW RATES Flowmeter Initial (litres)	Flowmeter Final (litres)	Flowmeter Total (litres)	Drum readings Initial (mm)	Drum readings Final (mm)	Drum readings Equivalent litres	Leakage (litres)	Assigned Flow (litres)	Water Loss (l/m/min)	Lugeons (l/m/min at 1000 kPa)	Approx Permeability (m/sec)
50	0	155	5	242.0	248.0	6.0	180.0	208.0	7.4	0.0	6.0	0.1	0.8	7.6E-08
50	0	155	5	248.0	258.0	10.0	208.0	235.0	7.1	0.0	10.0	0.2	1.3	1.3E-07
50	0	155	5	258.0	260.5	2.5	235.0	250.0	4.0	0.0	2.5	0.0	0.3	3.2E-08
50	0	155	5	260.5	260.5	0.0	250.0	254.0	1.1	0.0	1.1	0.0	0.1	1.3E-08
110	0	215	5	260.5	260.5	0.0	260.0	265.0	1.3	0.5	0.8	0.0	0.1	7.5E-09
110	0	215	5	260.5	260.5	0.0	265.0	267.0	0.5	0.0	0.5	0.0	0.0	4.8E-09
110	0	215	5	260.5	260.5	0.0	267.0	270.0	0.8	0.0	0.8	0.0	0.1	7.3E-09
160	0	265	5	260.5	260.5	0.0	270.0	277.0	1.8	0.5	1.3	0.0	0.1	1.0E-08
160	0	265	5	260.5	260.5	0.0	277.0	280.0	0.8	0.0	0.8	0.0	0.1	5.9E-09
160	0	265	5	260.5	260.5	0.0	280.0	280.0	0.0	0.0	0.0	0.0	0.0	0.0E+00
110	0	215	5	260.5	260.5	0.0	280.0	282.0	0.5	0.4	0.1	0.0	0.0	1.2E-09
110	0	215	5	260.5	260.5	0.0	282.0	285.0	0.8	0.0	0.8	0.0	0.1	7.3E-09
110	0	215	5	260.5	260.5	0.0	285.0	286.0	0.3	0.0	0.3	0.0	0.0	2.4E-09
50	0	155	5	260.5	260.5	0.0	286.0	286.0	0.0	0.4	0.0	0.0	0.0	0.0E+00
50	0	155	5	260.5	260.5	0.0	286.0	286.0	0.0	0.0	0.0	0.0	0.0	0.0E+00
50	0	155	5	260.5	260.5	0.0	286.0	286.0	0.0	0.0	0.0	0.0	0.0	0.0E+00

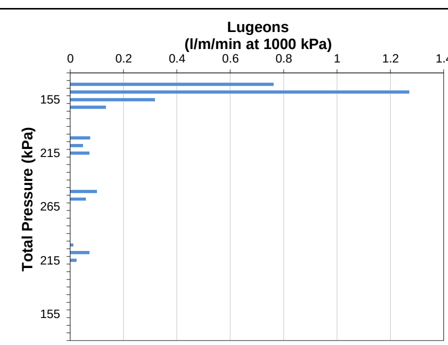
Notes



Averages			
Stage	Pressure (kPa)	Water Loss (l/m/min)	Lugeons (l/m/min at 1000kPa)
1	155	0.10	0.62
2	215	0.01	0.07
3	265	0.01	0.05
4	215	0.01	0.04
5	155	0.00	0.00

Houlsby Flow Pattern	Void Filling
Houlsby Lugeon value	<0.1
Burgess Lugeon value	<0.1

Calculated: RT
Checked: LJH
Date: 15-May-24



Douglas Partners Pty Ltd
ABN 75 053 980 117
www.douglaspartners.com.au

Permeability Testing - Rising Head Test Report

Client:	The Grand Liverpool Pty Ltd	Project No:	228571.00
Project:	Proposed Hotel and Apartments	Test date:	24-May-24
Location:	402 Macquarie Street, Liverpool	Tested by:	RT

Test Location — **Test No.** BH301

Description: Standpipe in borehole — Surface Level: 27.3 m AHD

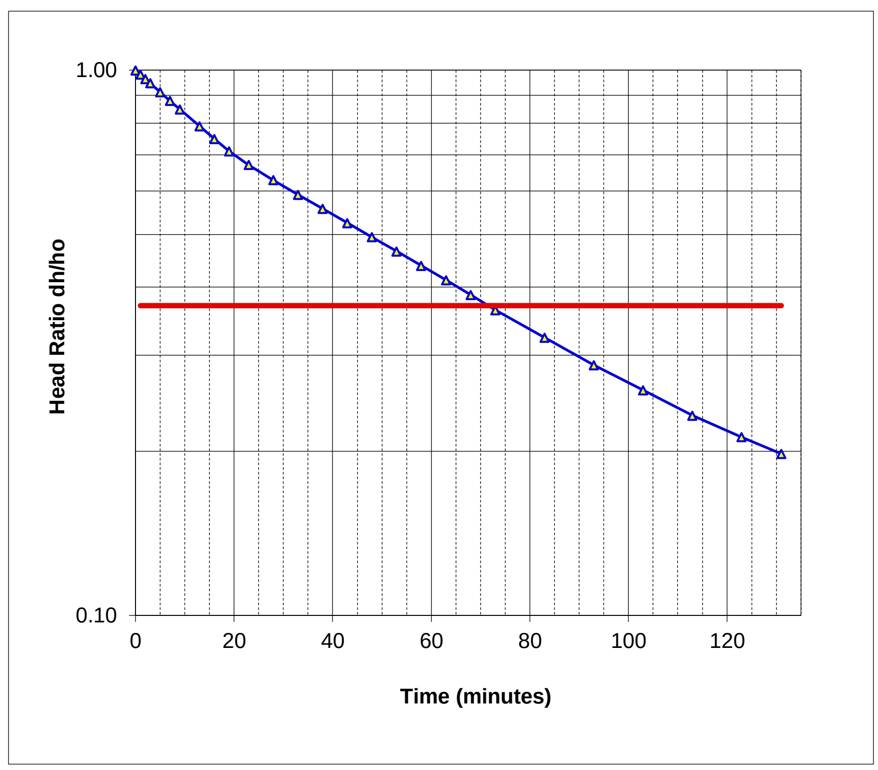
Material type: Bringelly Shale (siltstone and sandstone)

Details of Well Installation

Effective diameter (2re)	100	mm	Depth to water before test	9.9	m
borehole diameter (2R)	100	mm	Depth to water at start of test	21.02	m
Effective Length of well screen (Le)	18.25	m	Depth of top of gravel pack	3.15	m
			Depth of base of gravel pack	28.15	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0	21.02	11.12	1.000
1	20.82	10.92	0.982
2	20.62	10.72	0.964
3	20.42	10.52	0.946
5	20.03	10.13	0.912
7	19.66	9.76	0.878
9	19.32	9.42	0.847
13	18.68	8.78	0.790
16	18.22	8.32	0.748
19	17.80	7.90	0.711
23	17.35	7.45	0.670
28	16.89	6.99	0.628
33	16.47	6.57	0.591
38	16.09	6.19	0.557
43	15.73	5.83	0.525
48	15.39	5.49	0.494
53	15.07	5.17	0.465
58	14.77	4.87	0.438
63	14.48	4.58	0.412
68	14.21	4.31	0.387
73	13.94	4.04	0.363
83	13.49	3.59	0.323
93	13.10	3.20	0.288
103	12.78	2.88	0.259
113	12.48	2.58	0.232
123	12.26	2.36	0.212
131	12.10	2.2	0.198



To = 72.00 mins
4320 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity **k = 9.4E-08** m/sec
= 8.1E-03 m/day

Permeability Testing - Rising Head Test Report

Client:	The Grand Liverpool Pty Ltd	Project No:	228571.00
Project:	Proposed Hotel and Apartments	Test date:	24-May-24
Location:	402 Macquarie Street, Liverpool	Tested by:	RT

Test Location — **Test No.** BH304

Description: Standpipe in borehole — Surface Level: 27.5 m AHD

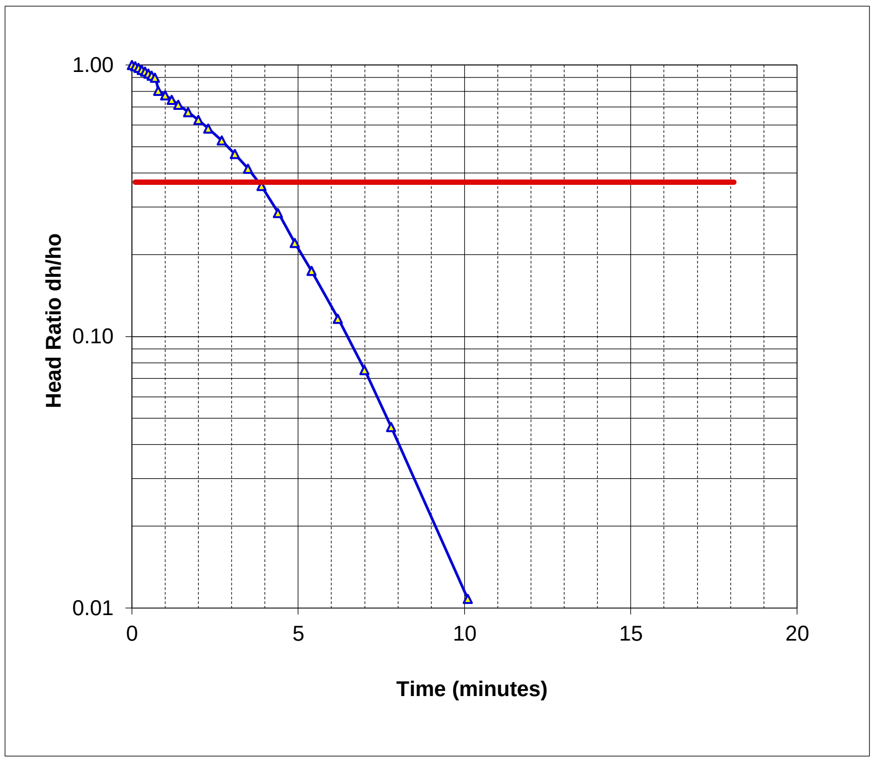
Material type: Bringelly Shale (siltstone and sandstone)

Details of Well Installation

Effective diameter (2re)	100	mm	Depth to water before test	11.9	m
borehole diameter (2R)	100	mm	Depth to water at start of test	18.74	m
Effective Length of well screen (Le)	10.24	m	Depth of top of gravel pack	3.14	m
			Depth of base of gravel pack	22.14	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	18.74	6.84	1.000
0.1	18.67	6.77	0.990
0.2	18.57	6.67	0.975
0.3	18.47	6.57	0.960
0.4	18.36	6.46	0.945
0.5	18.26	6.36	0.930
0.6	18.16	6.26	0.915
0.7	18.06	6.16	0.900
0.8	17.40	5.50	0.804
1.0	17.19	5.29	0.773
1.2	16.99	5.09	0.745
1.4	16.79	4.89	0.714
1.7	16.48	4.58	0.670
2.0	16.19	4.29	0.627
2.3	15.90	4.00	0.584
2.7	15.50	3.60	0.527
3.1	15.11	3.21	0.470
3.5	14.74	2.84	0.415
3.9	14.35	2.45	0.358
4.4	13.85	1.95	0.285
4.9	13.41	1.51	0.221
5.4	13.09	1.19	0.174
6.2	12.70	0.80	0.116
7.0	12.41	0.51	0.075
7.8	12.22	0.32	0.046
10.1	11.97	0.07	0.011
18.1	11.90	0	0.000



To = 3.80 mins
228 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity k = **2.8E-06** m/sec
= **2.5E-01** m/day

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Permeability Testing - Rising Head Test Report

Client:	The Grand Liverpool Pty Ltd	Project No:	228571.00
Project:	Proposed Hotel and Apartments	Test date:	24-May-24
Location:	402 Macquarie Street, Liverpool	Tested by:	RT

Test Location **Test No.** BH405

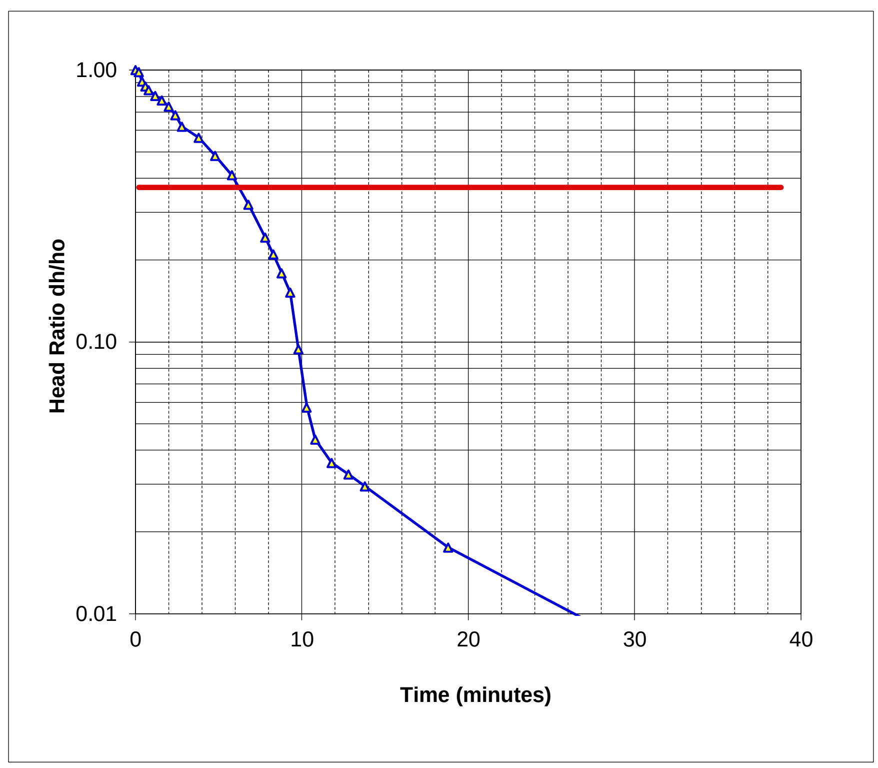
Description:	Standpipe in borehole	Surface Level:	18.7 m AHD
Material type:	Bringelly Shale (siltstone and sandstone)		

Details of Well Installation

Effective diameter (2re)	100	mm	Depth to water before test	2.92	m
borehole diameter (2R)	100	mm	Depth to water at start of test	12.87	m
Effective Length of well screen (Le)	11.18	m	Depth of top of gravel pack	1.10	m
			Depth of base of gravel pack	14.10	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	12.87	9.95	1.000
0.2	12.69	9.77	0.982
0.4	11.95	9.03	0.907
0.6	11.59	8.67	0.871
0.8	11.33	8.41	0.845
1.2	10.93	8.01	0.805
1.6	10.63	7.71	0.775
2.0	10.22	7.30	0.733
2.4	9.72	6.80	0.683
2.8	9.08	6.16	0.619
3.8	8.53	5.61	0.564
4.8	7.73	4.81	0.483
5.8	7.00	4.08	0.410
6.8	6.10	3.18	0.319
7.8	5.33	2.41	0.243
8.3	5.01	2.09	0.210
8.8	4.70	1.78	0.179
9.3	4.43	1.51	0.152
9.8	3.85	0.93	0.094
10.3	3.49	0.57	0.057
10.8	3.36	0.44	0.044
11.8	3.28	0.36	0.036
12.8	3.24	0.32	0.033
13.8	3.21	0.29	0.029
18.8	3.09	0.17	0.018
28.8	3.00	0.08	0.008
38.8	2.92	0	0.000



To = 8.00 mins
480 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity **k = 1.3E-06** m/sec
= 1.1E-01 m/day

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Permeability Testing - Rising Head Test Report

Client:	The Grand Liverpool Pty Ltd	Project No:	228571.00
Project:	Proposed Hotel and Apartments	Test date:	19-Jun-24
Location:	402 Macquarie Street, Liverpool	Tested by:	RT

Test Location — **Test No.** BH304

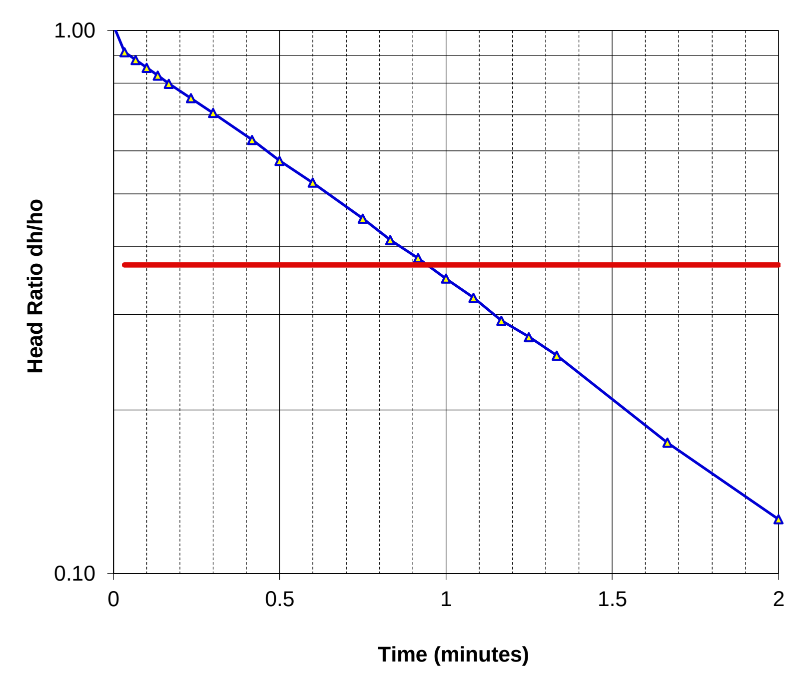
Description:	Standpipe in borehole	Surface Level:	27.5 m AHD
Material type:	Bringelly Shale (siltstone and sandstone)		

Details of Well Installation

Effective diameter (2re)	100	mm	Depth to water before test	10.41	m
borehole diameter (2R)	100	mm	Depth to water at start of test	10.66	m
Effective Length of well screen (Le)	11.73	m	Depth of top of gravel pack	3.14	m
			Depth of base of gravel pack	22.14	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	10.66	0.25	1.023
0.03	10.63	0.22	0.912
0.07	10.62	0.21	0.883
0.10	10.62	0.20	0.854
0.13	10.61	0.20	0.827
0.17	10.60	0.19	0.798
0.23	10.59	0.18	0.750
0.30	10.58	0.17	0.705
0.42	10.56	0.15	0.629
0.50	10.55	0.14	0.576
0.60	10.54	0.13	0.525
0.75	10.52	0.11	0.450
0.83	10.51	0.10	0.411
0.92	10.50	0.09	0.381
1.00	10.49	0.08	0.349
1.08	10.49	0.08	0.322
1.17	10.48	0.07	0.292
1.25	10.48	0.07	0.273
1.33	10.47	0.06	0.252
1.67	10.45	0.04	0.174
2.00	10.44	0.03	0.126



To = 0.90 mins
54 secs

Theory: Rising Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity k = **1.1E-05** m/sec
= **9.3E-01** m/day

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Permeability Testing - Falling Head Test Report

Client:	The Grand Liverpool Pty Ltd	Project No:	228571.00
Project:	Proposed Hotel and Apartments	Test date:	19-Jun-24
Location:	402 Macquarie Street, Liverpool	Tested by:	RT

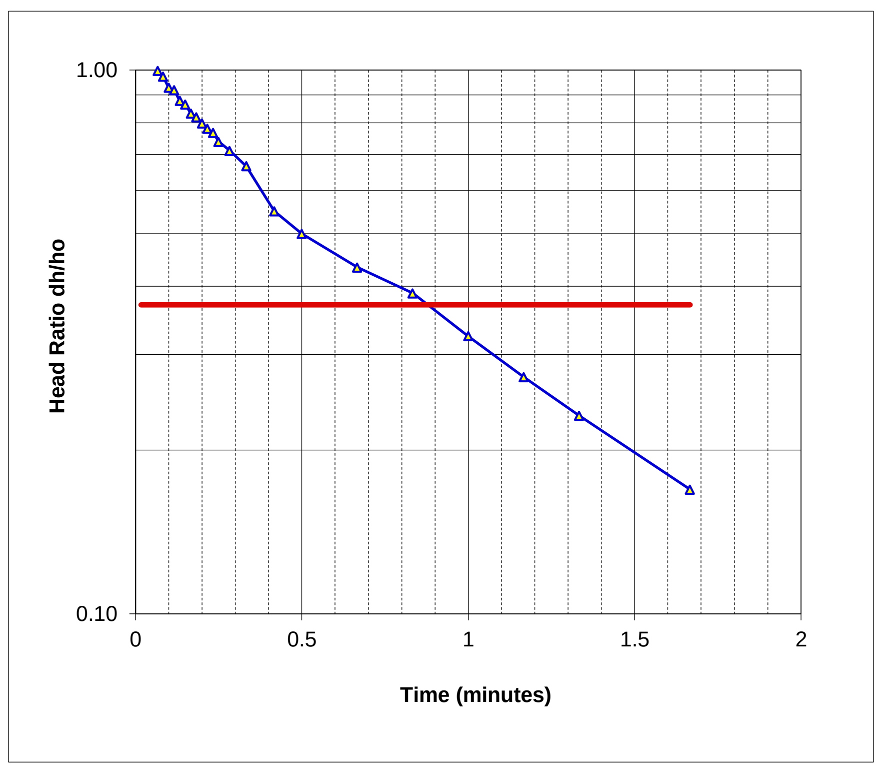
Test Location		**Test No.**	BH304	
Description:	Standpipe in borehole	Surface Level:	27.5	m AHD
Material type:	Bringelly Shale (siltstone and sandstone)			

Details of Well Installation

Effective diameter (2re)	100	mm	Depth to water before test	10.41	m
borehole diameter (2R)	100	mm	Depth to water at start of test	9.91	m
Effective Length of well screen (Le)	11.73	m	Depth of top of gravel pack	3.14	m
			Depth of base of gravel pack	22.14	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.0	9.91	0.50	1.661
0.02	10.00	0.41	1.370
0.03	10.06	0.35	1.168
0.05	10.09	0.32	1.064
0.07	10.11	0.30	0.996
0.08	10.12	0.29	0.974
0.10	10.13	0.28	0.928
0.12	10.13	0.28	0.918
0.13	10.15	0.26	0.878
0.15	10.15	0.26	0.864
0.17	10.16	0.25	0.831
0.18	10.16	0.25	0.820
0.20	10.17	0.24	0.798
0.22	10.18	0.23	0.780
0.23	10.18	0.23	0.767
0.25	10.19	0.22	0.738
0.28	10.20	0.21	0.710
0.33	10.21	0.20	0.666
0.42	10.24	0.17	0.550
0.50	10.26	0.15	0.500
0.67	10.28	0.13	0.433
0.83	10.29	0.12	0.389
1.00	10.31	0.10	0.324
1.17	10.33	0.08	0.273
1.33	10.34	0.07	0.231
1.67	10.36	0.05	0.169
		10.41	34.700



To = 0.90 mins
54 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity **k = 1.1E-05** m/sec
= 9.3E-01 m/day

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Permeability Testing - Rising Head Test Report

Client:	The Grand Liverpool Pty Ltd	Project No:	228571.00
Project:	Proposed Hotel and Apartments	Test date:	19-Jun-24
Location:	402 Macquarie Street, Liverpool	Tested by:	RT

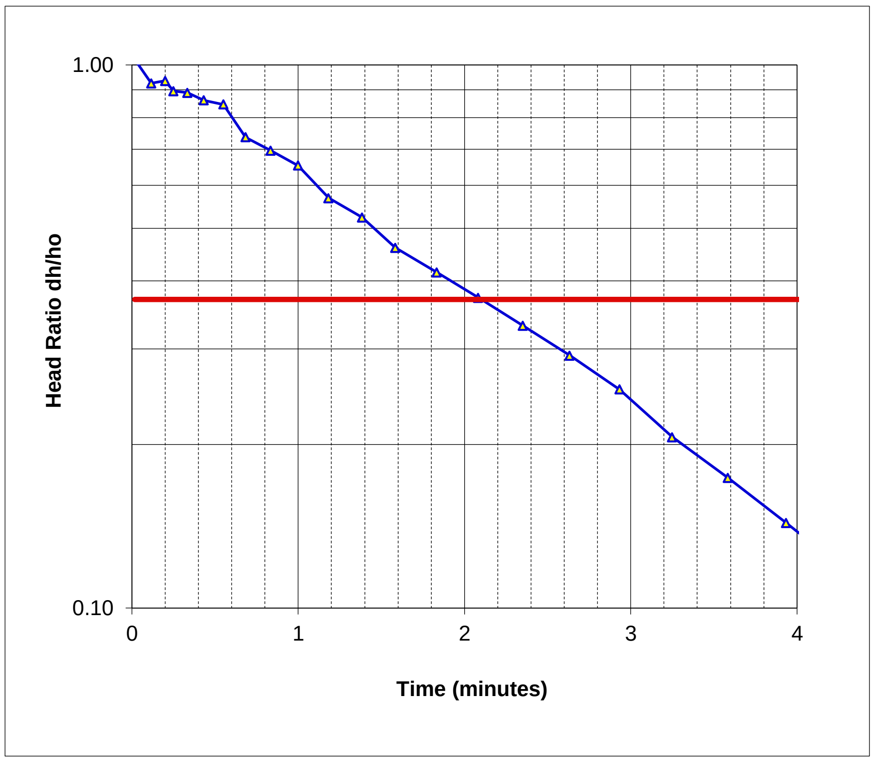
Test Location		**Test No.**	BH405	
Description:	Standpipe in borehole	Surface Level:	18.7	m AHD
Material type:	Bringelly Shale (siltstone and sandstone)			

Details of Well Installation

Effective diameter (2re)	50	mm	Depth to water before test	1.32	m
borehole diameter (2R)	100	mm	Depth to water at start of test	1.96	m
Effective Length of well screen (Le)	12.00	m	Depth of top of gravel pack	1.10	m
			Depth of base of gravel pack	14.10	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.00	1.96	0.64	1.070
0.02	1.95	0.63	1.042
0.03	1.92	0.60	1.008
0.12	1.88	0.56	0.926
0.20	1.88	0.56	0.935
0.25	1.86	0.54	0.895
0.33	1.85	0.53	0.889
0.43	1.84	0.52	0.861
0.55	1.83	0.51	0.846
0.68	1.76	0.44	0.736
0.83	1.74	0.42	0.696
1.00	1.71	0.39	0.653
1.18	1.66	0.34	0.569
1.38	1.63	0.31	0.524
1.58	1.60	0.28	0.461
1.83	1.57	0.25	0.415
2.08	1.54	0.22	0.373
2.35	1.52	0.20	0.331
2.63	1.50	0.18	0.292
2.93	1.47	0.15	0.253
3.25	1.44	0.12	0.206
3.58	1.42	0.10	0.174
3.93	1.41	0.09	0.144
4.30	1.39	0.07	0.117



To = 2.10 mins
126 secs

Theory: Rising Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity k = **1.1E-06** m/sec
= **9.8E-02** m/day

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Permeability Testing - Falling Head Test Report

Client:	The Grand Liverpool Pty Ltd	Project No:	228571.00
Project:	Proposed Hotel and Apartments	Test date:	19-Jun-24
Location:	402 Macquarie Street, Liverpool	Tested by:	RT

Test Location — **Test No.** BH405

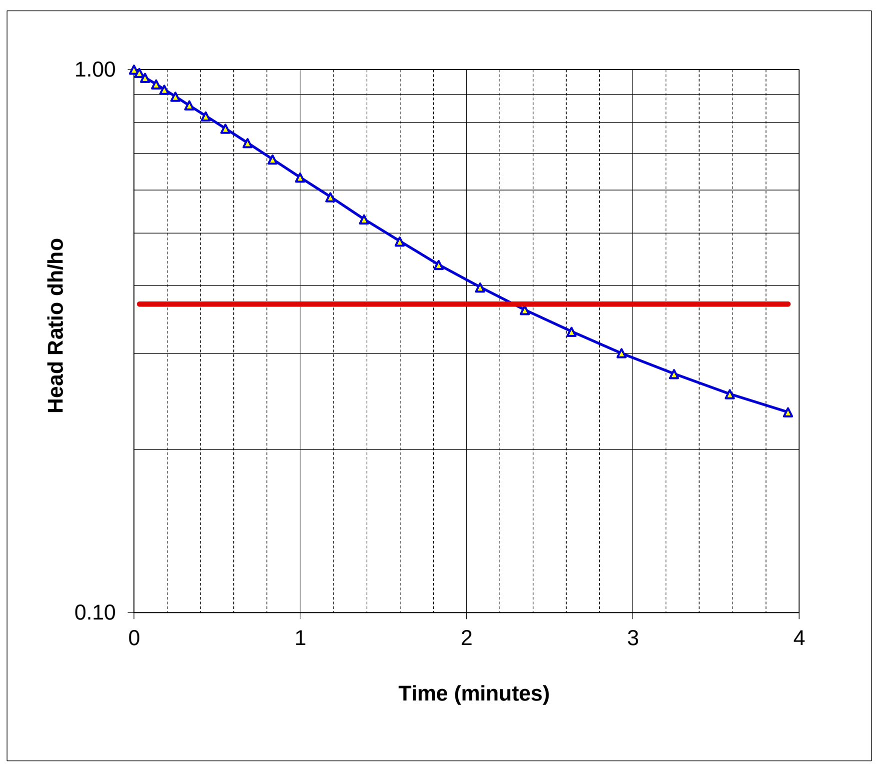
Description:	Standpipe in borehole	Surface Level:	18.7	m AHD
Material type:	Bringelly Shale (siltstone and sandstone)			

Details of Well Installation

Effective diameter (2re)	50 mm	Depth to water before test	1.39	m
borehole diameter (2R)	100 mm	Depth to water at start of test	0.75	m
Effective Length of well screen (Le)	12.00 m	Depth of top of gravel pack	1.10	m
		Depth of base of gravel pack	14.10	m

Test Results

Time (min)	Depth (m)	Change in Head dH (m)	dH/Ho
0.00	0.75	0.64	1.000
0.03	0.75	0.64	0.987
0.07	0.77	0.62	0.967
0.13	0.78	0.61	0.939
0.18	0.80	0.59	0.918
0.25	0.82	0.57	0.892
0.33	0.84	0.55	0.859
0.43	0.86	0.53	0.821
0.55	0.89	0.50	0.779
0.68	0.92	0.47	0.733
0.83	0.95	0.44	0.684
1.00	0.98	0.41	0.633
1.18	1.01	0.38	0.582
1.38	1.05	0.34	0.530
1.60	1.08	0.31	0.483
1.83	1.11	0.28	0.437
2.08	1.13	0.26	0.397
2.35	1.16	0.23	0.361
2.63	1.18	0.21	0.329
2.93	1.20	0.19	0.300
3.25	1.21	0.18	0.275
3.58	1.23	0.16	0.253
3.93	1.24	0.15	0.234
		1.39	2.157
		1.39	2.157
		1.39	2.157
		1.39	2.157



To = 2.30 mins
138 secs

Theory: Falling Head Permeability calculated using equation by Hvorslev

$k = [r^2 \ln(Le/R)]/2Le\ To$

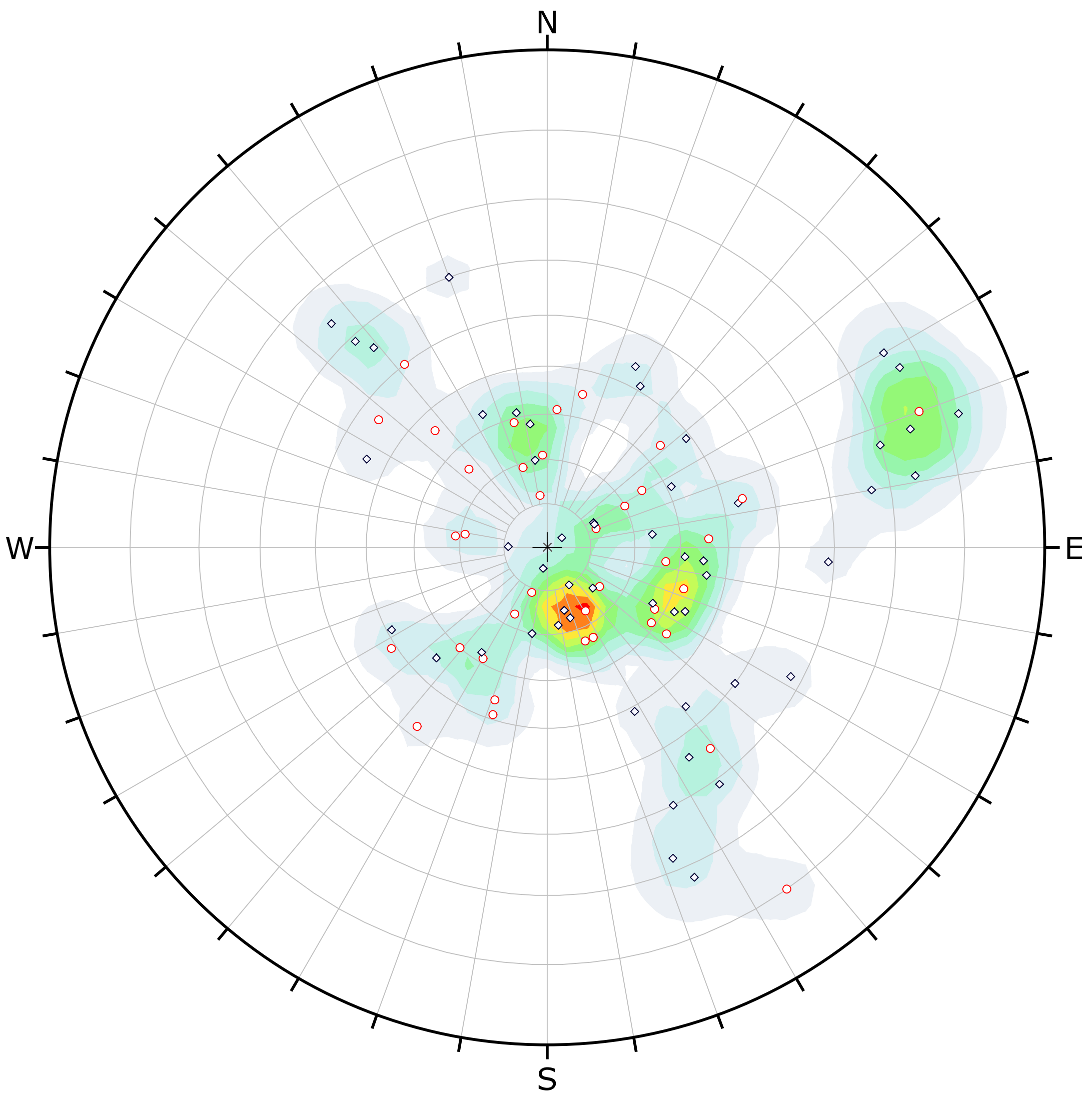
where r = radius of casing
R = radius of well screen
Le = length of well screen
To = time taken to rise or fall to 37% of initial change

Hydraulic Conductivity **k = 1.0E-06** m/sec
= 8.9E-02 m/day

Appendix E

DIPS Analysis

Acoustic Televiewer Reports



Symbol	TYPE	Quantity
◇	Filled joint - CT 1 mm to <10 mm	54
○	Filled joint - FD > 10 mm	39

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 - 10.00

Contour Data	Pole Vectors
Maximum Density	9.44%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	93 (93 Entries)
Hemisphere	Lower
Projection	Equal Angle

Location

All Joint Data

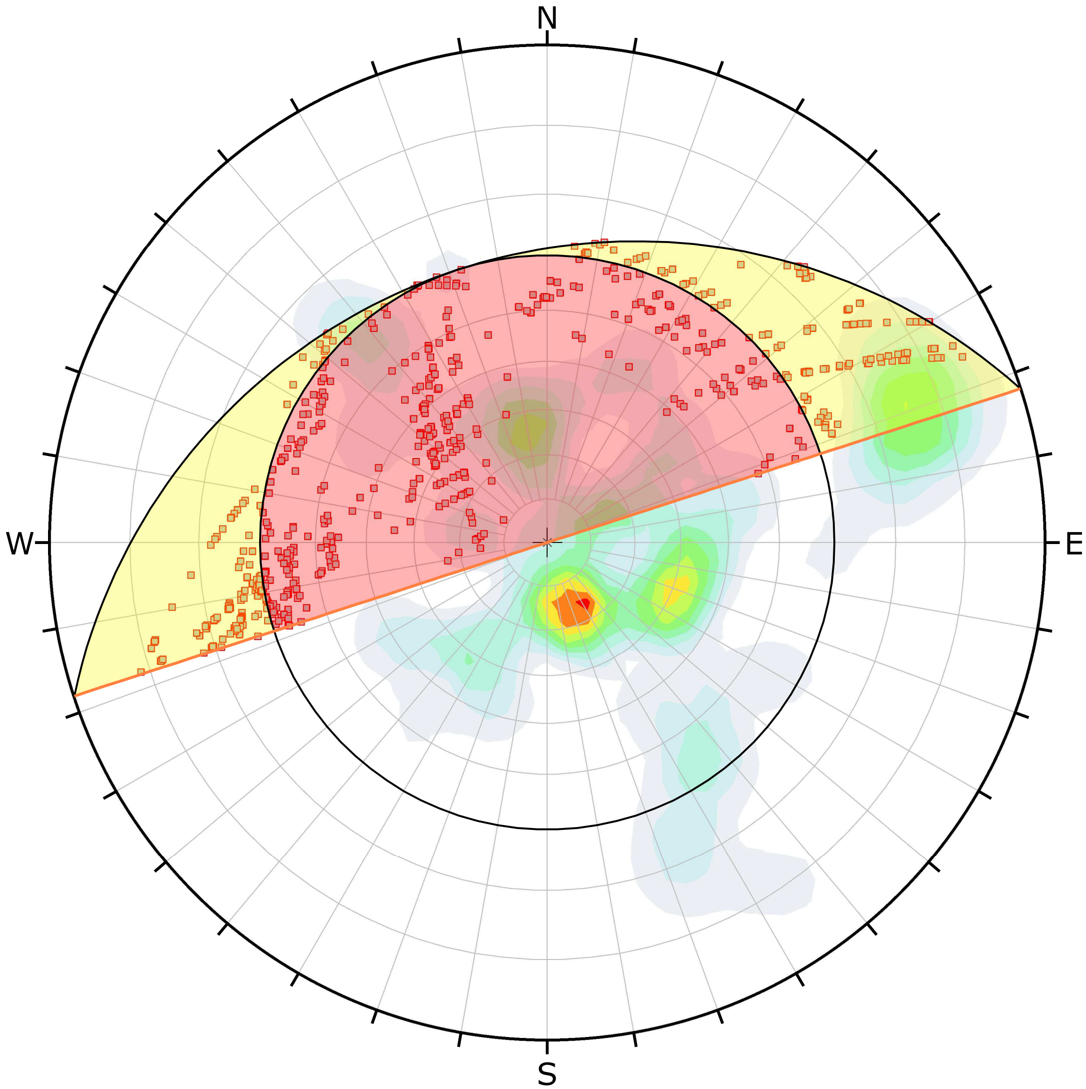
Analysis Description

Stereonet Analysis for Wedge Failure

Project

402 Macquarie Street, Liverpool

DIPS 7.016



Symbol	Feature
▫	Critical Intersection

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 - 10.00
Contour Data	Pole Vectors
Maximum Density	9.44%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Wedge Sliding
Slope Dip	90
Slope Dip Direction	342
Friction Angle	30°

	Critical	Total	%
Wedge Sliding	632	4275	14.78%

Plot Mode	Pole Vectors
Vector Count	93 (93 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	4275
Hemisphere	Lower
Projection	Equal Angle

Douglas PARTNERS | GROUNDED EXPERTISE

DIPS 7.016

Location

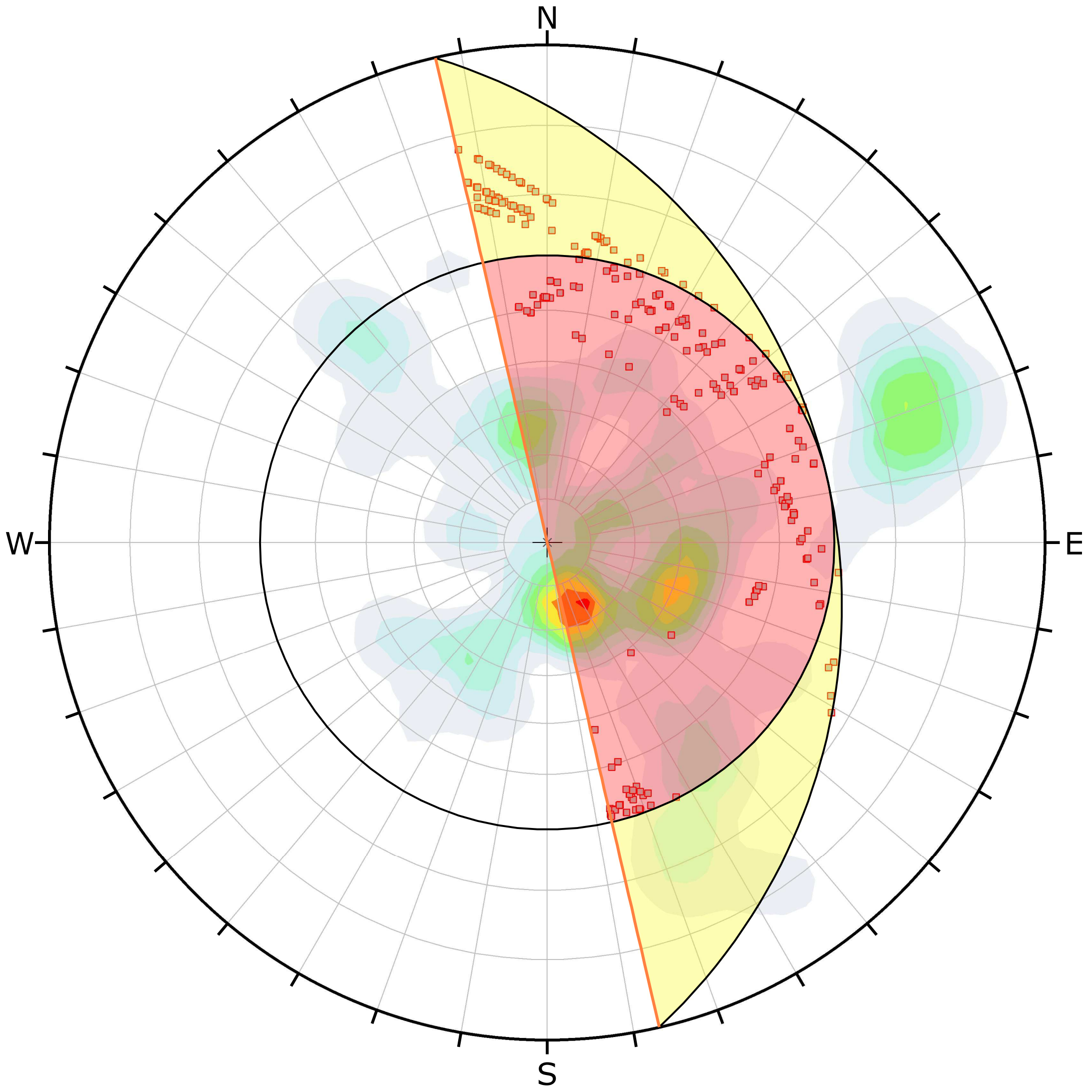
North Face (Macquarie Street)

Analysis Description

Stereonet Analysis for Wedge Failure

Project

402 Macquarie Street, Liverpool



Symbol	Feature
▫	Critical Intersection

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 - 10.00

Contour Data	Pole Vectors
Maximum Density	9.44%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Wedge Sliding		
Slope Dip	90		
Slope Dip Direction	77		
Friction Angle	30°		
	Critical	**Total**	**%**
Wedge Sliding	234	4275	5.47%

Plot Mode	Pole Vectors
Vector Count	93 (93 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	4275
Hemisphere	Lower
Projection	Equal Angle

Douglas PARTNERS | GROUNDED EXPERTISE

Location

East Face (168 Terminus St)

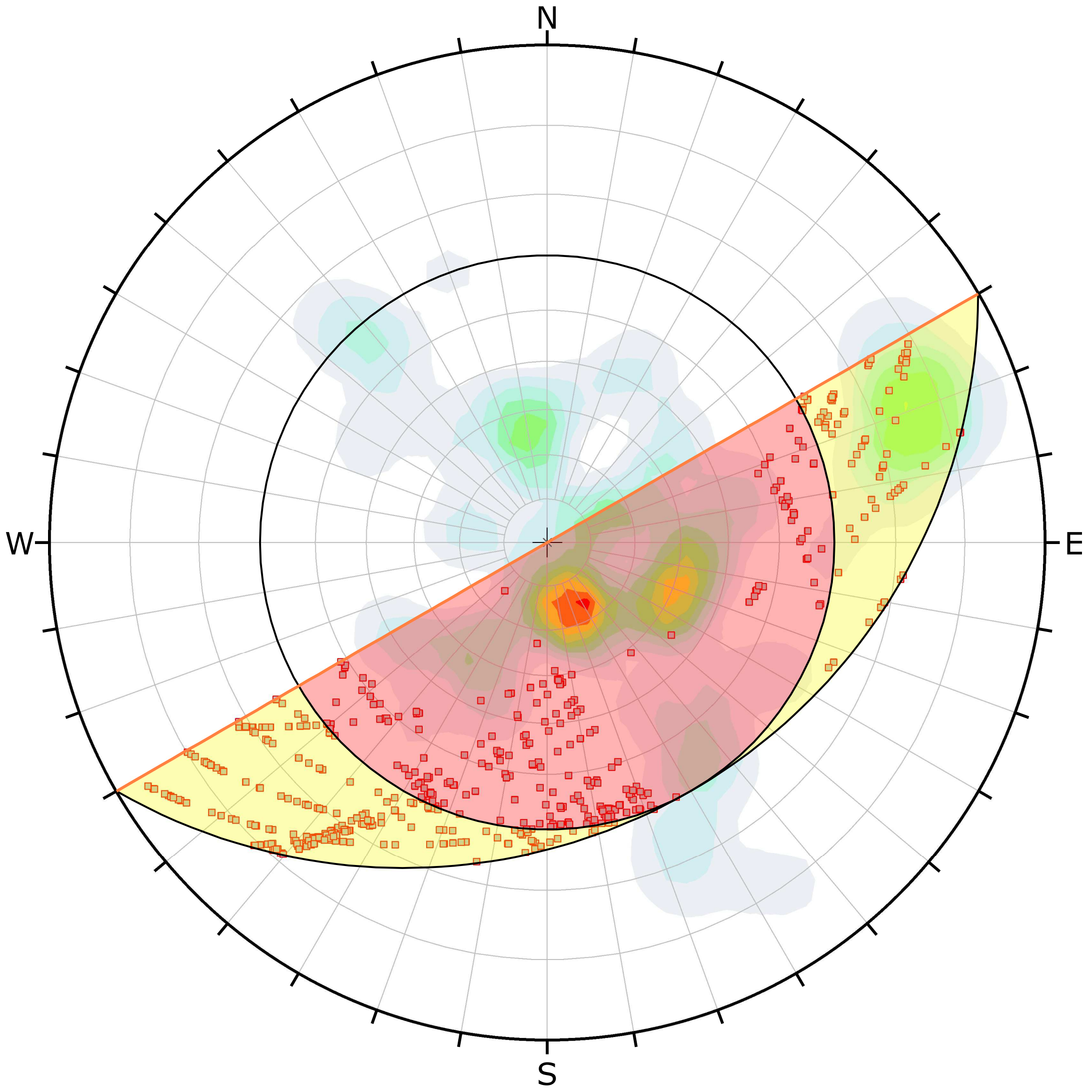
Analysis Description

Stereonet Analysis for Wedge Failure

Project

402 Macquarie Street, Liverpool

DIPS 7.016



Symbol	Feature
▫	Critical Intersection

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 - 10.00

Contour Data	Pole Vectors
Maximum Density	9.44%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Wedge Sliding		
Slope Dip	90		
Slope Dip Direction	150		
Friction Angle	30°		
	Critical	**Total**	**%**
Wedge Sliding	557	4275	13.03%

Plot Mode	Pole Vectors
Vector Count	93 (93 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	4275
Hemisphere	Lower
Projection	Equal Angle

Douglas PARTNERS | GROUNDED EXPERTISE

Location

South Face (Two Buildings)

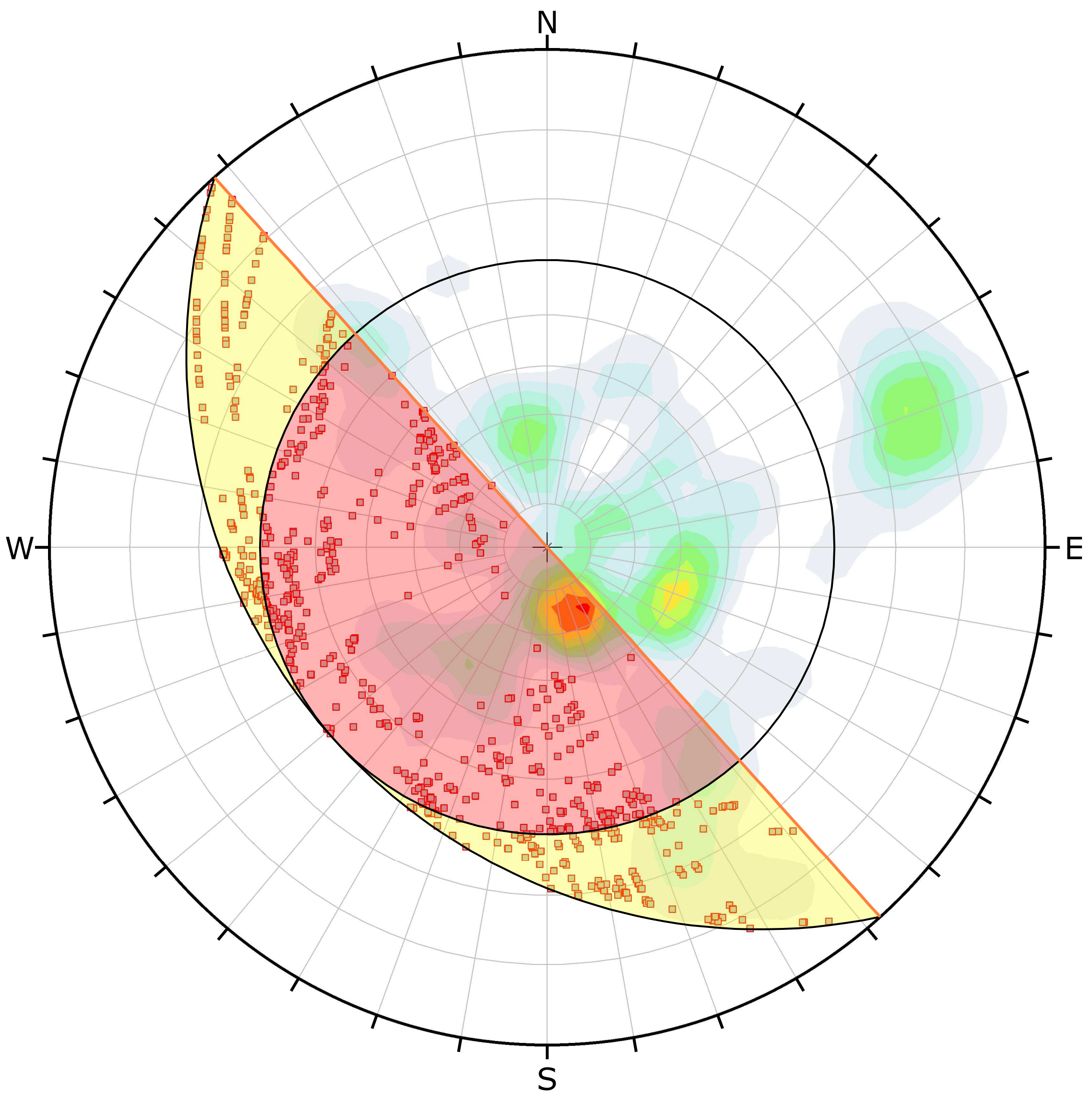
Analysis Description

Stereonet Analysis for Wedge Failure

Project

402 Macquarie Street, Liverpool

DIPS 7.016



Symbol	Feature
▫	Critical Intersection

Color	Density Concentrations
	0.00 - 1.00
	1.00 - 2.00
	2.00 - 3.00
	3.00 - 4.00
	4.00 - 5.00
	5.00 - 6.00
	6.00 - 7.00
	7.00 - 8.00
	8.00 - 9.00
	9.00 - 10.00

Contour Data	Pole Vectors
Maximum Density	9.44%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Kinematic Analysis	Wedge Sliding
Slope Dip	90
Slope Dip Direction	228
Friction Angle	30°

	Critical	**Total**	**%**
Wedge Sliding	785	4275	18.36%

Plot Mode	Pole Vectors
Vector Count	93 (93 Entries)
Intersection Mode	Grid Data Planes
Intersections Count	4275
Hemisphere	Lower
Projection	Equal Angle

Douglas PARTNERS | GROUNDED EXPERTISE

Location

West Face (Carey Street)

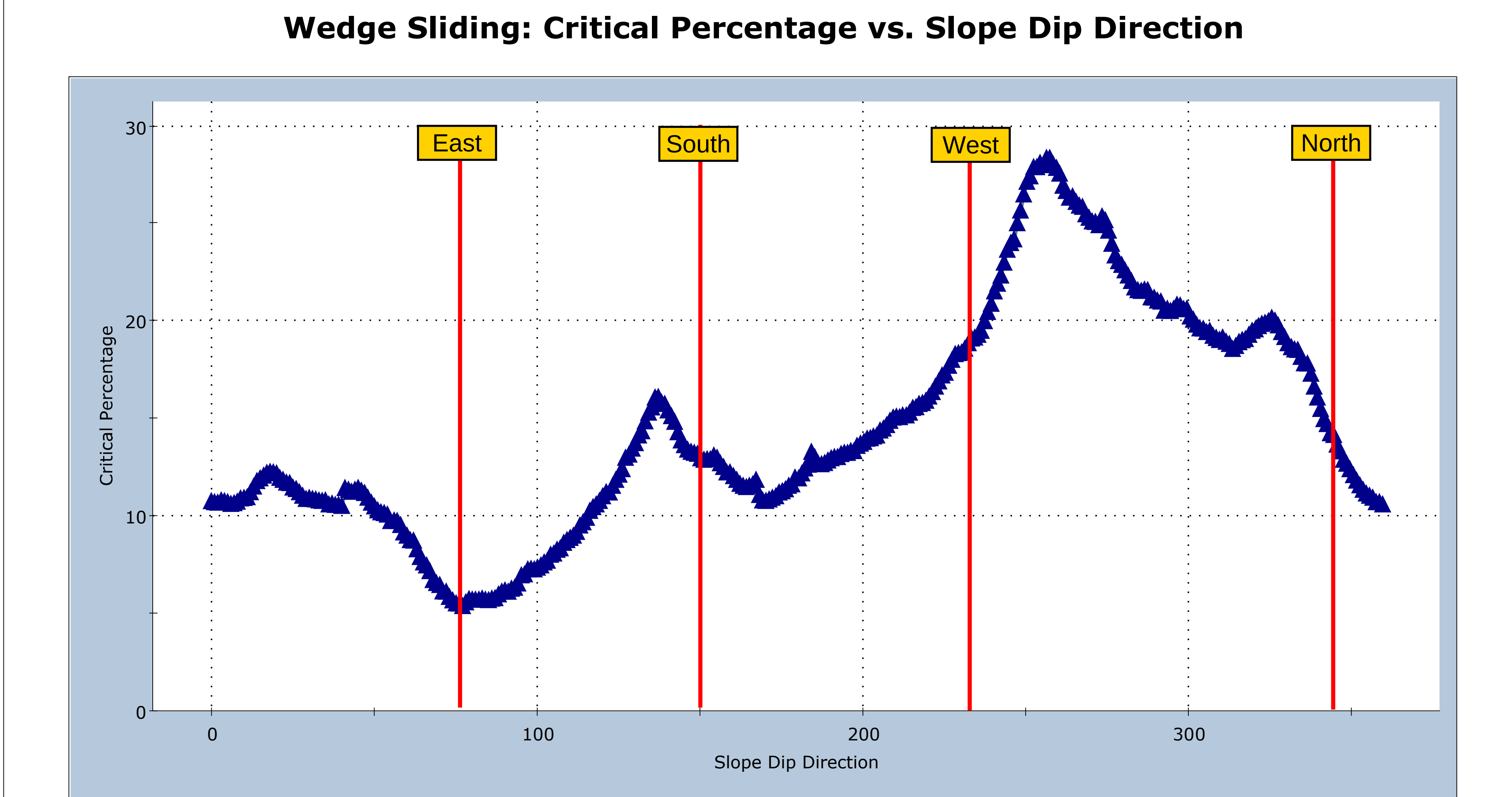
Analysis Description

Stereonet Analysis for Wedge Failure

Project

402 Macquarie Street, Liverpool

DIPS 7.016



Mean Values

Slope Dip = 90 **Slope Dip Direction = 0** **Friction Angle = 30** **Lateral Limit = 20**

Douglas Partners GROUNDED EXPERTISE	*Location* Critical Percentage vs. Slope Dip Direction
	Analysis Description Stereonet Analysis for Wedge Failure
DIPS 7.016	*Project* 402 Macquarie Street, Liverpool

Douglas Partners- Liverpool
402 Macquarie Street

Borehole - BH301

ATV Interpreted Features Report

Groundsearch Australia Pty. Limited
Issued: 17 May 2024

www.groundsearch.com.au

2024 Member
Association of Mining and Exploration Companies

DISCLAIMER

The data used in this report were obtained using equipment manufactured by LIM Logging/Electromind. The interpretations given in this report are based on judgement and experience of Groundsearch Australia's personnel. They are provided for Douglas Partner's 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

J Lea

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 2024 site investigation programme for Douglas Partners- Liverpool.

LIM Logging BHTV acoustic televiewer logging tool was run to collect data in the field on 10 May 2024. The data in this report are from 3.30 to 27.84 mbgl.

The 208 identified features are interpreted as bedding planes and fractures. The bedding to fracture ratio is 12:1.

The LIM Logging 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** with density contours as pole vectors in the **lower hemisphere**.

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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 2024 site investigation programme for Douglas Partners- Liverpool.

LIM Logging BHTV acoustic televiewer logging tool was run to collect data in the field on 10 May 2024. The data in this report are from 3.30 to 27.84 mbgl.

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The LIM Logging 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** with density contours as pole vectors in the **lower hemisphere**.

The ATV takes an oriented image of the borehole using high-resolution sound waves. The acoustic image is displayed as 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 180 measurements around the borehole at each high-resolution sample interval. These data can be oriented to Magnetic North and displayed in real-time while logging using the LIM BHTV Logging System.

Analysis software includes colour adjustment, fracture dip and dip direction 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 and by mudcake adhered to the borehole wall.

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. Both sides of the 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 inclination angle and azimuth 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 **Magnetic North**-referenced:

- Text summary of the interpreted features

- Logs that show geological features with their subjective 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:

    - Natural gamma
    - ATV image referenced to Magnetic North
    - Colour-coded tadpoles that represent feature dip and dip direction
    - 3D ATV image with feature planes
    - Bedding polar plot referenced to Magnetic North
    - Fracture polar plot referenced to Magnetic North
    - Fracture frequency/M
    - Defect RQD

- Table containing feature curve ID, midpoint mbgl, dip angle, dip azimuth and feature description.

- Feature density contour plots as pole vectors in the lower hemisphere

The Rock Quality Designation (RQD) is a measure of the degree of jointing of fractures in a rock mass with:

- Image sample interval = 0.1 m
- Image length reported = 1.0 m

RQD values are:

- <0.25 - very poor
- 0.25 - 0.50 - poor
- 0.50 - 0.75 - fair
- 0.75 - 0.90 - good
- 0.90 - 1.00 - excellent

3.0 BH301 interpretations

The 208 identified features are interpreted as bedding planes and fractures. The bedding to fracture ratio is 12:1.

The density contours for all interpreted features are shown in Figure 1. A description of each interpreted feature is presented in Appendix 1 and the combination log is presented in Appendix 2.

The 192 sedimentary features identified are bedding planes that appear to range in dip from flat-lying to 18^0.

The 16 fractures identified are classified as:

Table 1

Interval section	**Complete data 3.30 – 27.84 mbgl**		
Feature classification	**Feature count**	**Percentage**	**Dip range**
Filled joint - CT 1mm to <10mm	07	44%	20^0 to 75^0
Filled joint - FD >10mm	09	56%	11^0 to 50^0

The sedimentary features identified are classified as:

Interval section	**Complete data 3.30 – 27.84 mbgl**	
Feature classification	**Feature count**	**Dip range**
Bedding	192	00^0 to 18^0

Figures 1 to 5 present the orientation density contour plans for each feature set identified as pole vectors, MN, lower hemisphere.

Feature Dip is represented as 00^0 being the horizontal plane and 90^0 being the vertical plane.

Stereonets show the Feature Dip represented as 00^0 being the centre of the stereonet and 90^0 being the outer circle of the stereonet.

The standards used for reporting are outlined on the following page of this report.

	Code	Tadpole	Sine Wave	
2	Seam/zone base FZ			Fractured zone base
3	Seam/zone base			
4	Fracture plane - open			Fracture plane - open
5	Minor open fracture			Minor open fracture
6	Fracture plane - partially open			Fracture plane - partially open
7	Filled fracture			Filled fracture
8	Bedding plane open			Bedding plane open
9	Fracture plane - closed			Fracture plane - closed
10	Top of data			Top of data
11	Induced fracture			Induced fracture
12	SWL			SWL
13	Fault - FT			Level 1
14	Rocktype boundary			Rocktype boundary
15	Bedding separation plane			Bedding separation plane
16	Fracture plane - discontinuous			Fracture plane - discontinuous
17	Partially filled fracture			Partially filled fracture
18	Irregular vein			Irregular vein
19	Unconformity			Unconformity
20	Base of casing			Base of casing
21	Top of Coal Unit			Top of Coal Unit
22	Base of Coal Unit			Base of Coal Unit
23	Base of weathering			Base of weathering
24	Top of breakout			Top of breakout
25	Base of breakout			Base of breakout
26	Top of washout			Top of washout
27	Base of washout			Base of washout
28	Top of open fracture			Top of open fracture
29	Base of open fracture			Base of open fracture
30	Bedding plane partially open			Bedding plane partially open
31	Parting			Parting
32	Shear plane			Shear plane
33	Face cleat			Face cleat
34	Butt cleat			Butt cleat
35	Intrusive contact			Intrusive contact
36	Irregular fracture			Irregular fracture
37	Open joint >5 mm aperture			Level 2
38	Closed joint <5 mm aperture			Level 3
39	Vein			Level 3
40	Filled joint - SN			Level 3
41	Filled joint - VN <1 mm			Level 3
42	Filled joint - CT 1 mm to <10 mm			Level 3
43	Filled joint - FD > 10 mm			Level 3
44	Lithozone boundary			Lithozone boundary
45	Bedding plane			
46	Top of mineralisation			
47	Base of mineralisation			
48	Crossbedding			

Figure 1 BH301 interpreted features density contours – pole vectors, MN, lower hemisphere

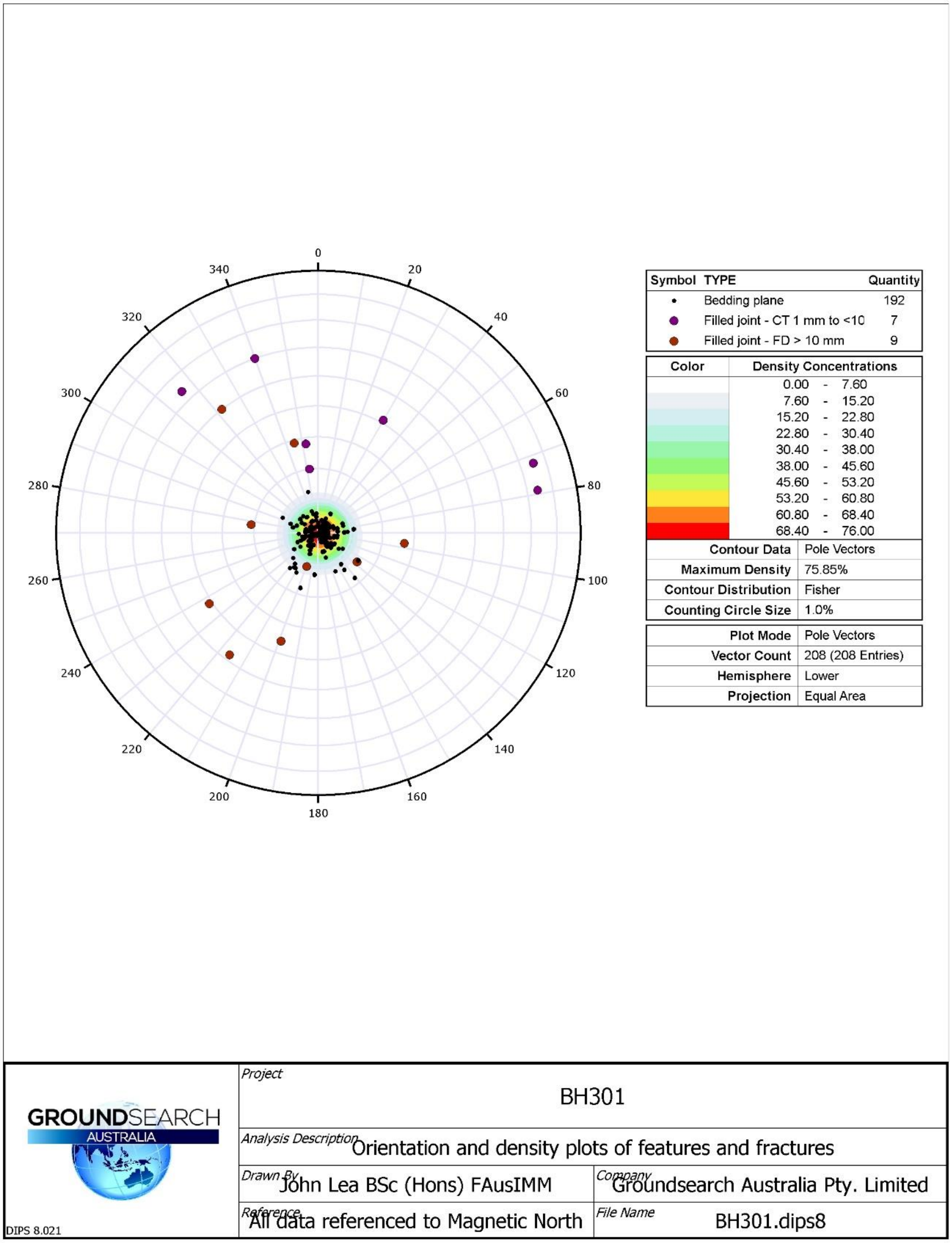
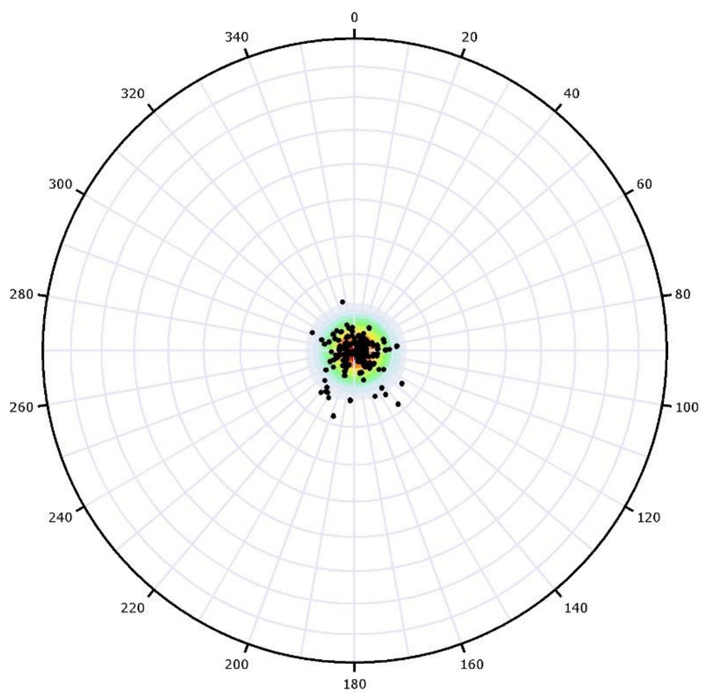


Figure 2 BH301 bedding orientation plan – pole vectors, MN, lower hemisphere



Symbol	TYPE	Quantity
•	Bedding plane	192

Color	Density Concentrations
	0.00 - 8.30
	8.30 - 16.60
	16.60 - 24.90
	24.90 - 33.20
	33.20 - 41.50
	41.50 - 49.80
	49.80 - 58.10
	58.10 - 66.40
	66.40 - 74.70
	74.70 - 83.00

Contour Data	Pole Vectors
Maximum Density	82.13%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	192 (192 Entries)
Hemisphere	Lower
Projection	Equal Area

GROUNDSEARCH AUSTRALIA	*Project* BH301		
	Analysis Description Orientation and density plots of features and fractures		
	Drawn By John Lea BSc (Hons) FAusIMM	*Company* Groundsearch Australia Pty. Limited	
DIPS 8.021	*Reference* All data referenced to Magnetic North	*File Name* BH301.dips8	

Figure 3 BH301 fractures orientation density contour plan – pole vectors, MN, lower hemisphere

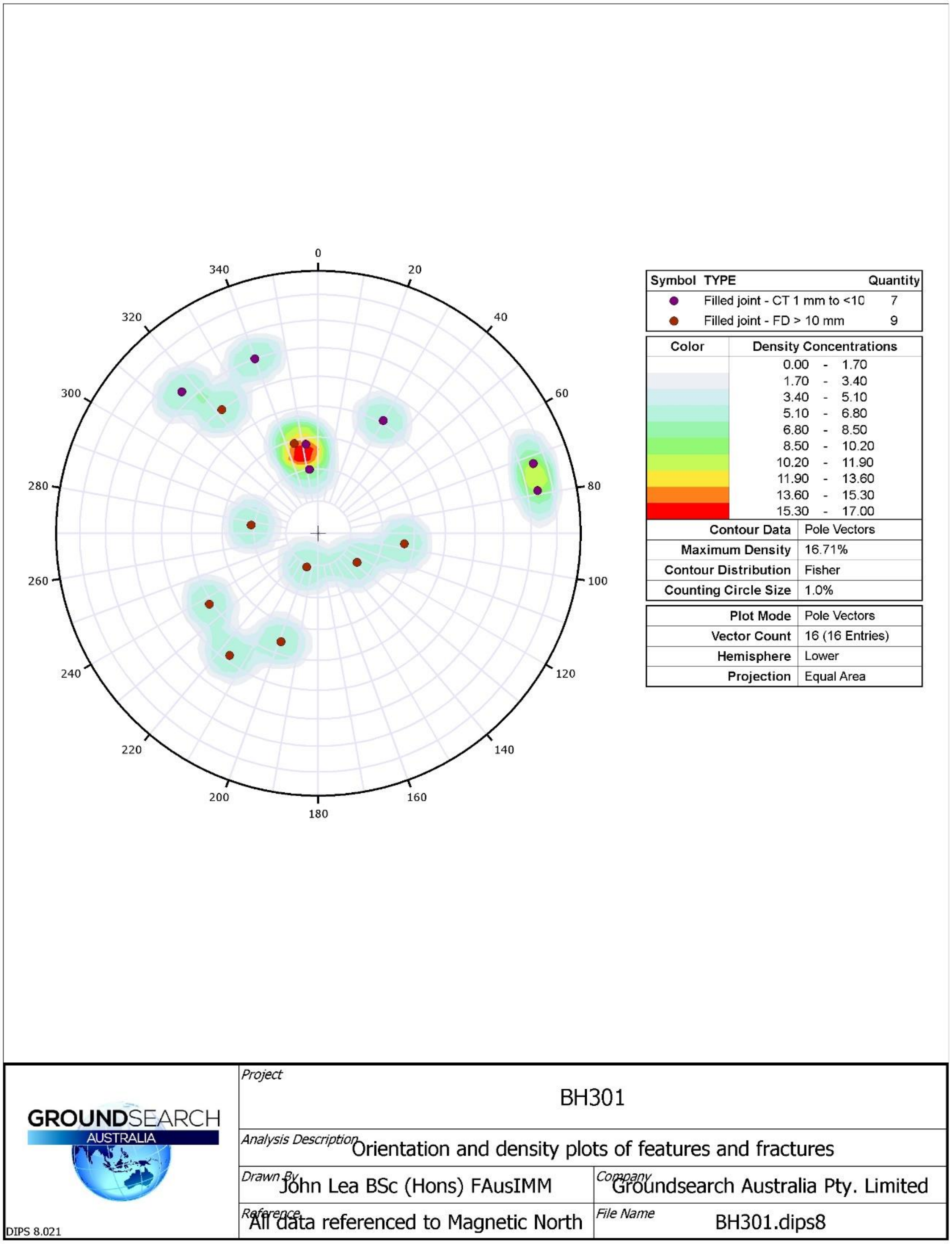


Figure 4 BH301 filled joint – CT 1mm to <10mm density contour plan - pole vectors, MN, lower hemisphere

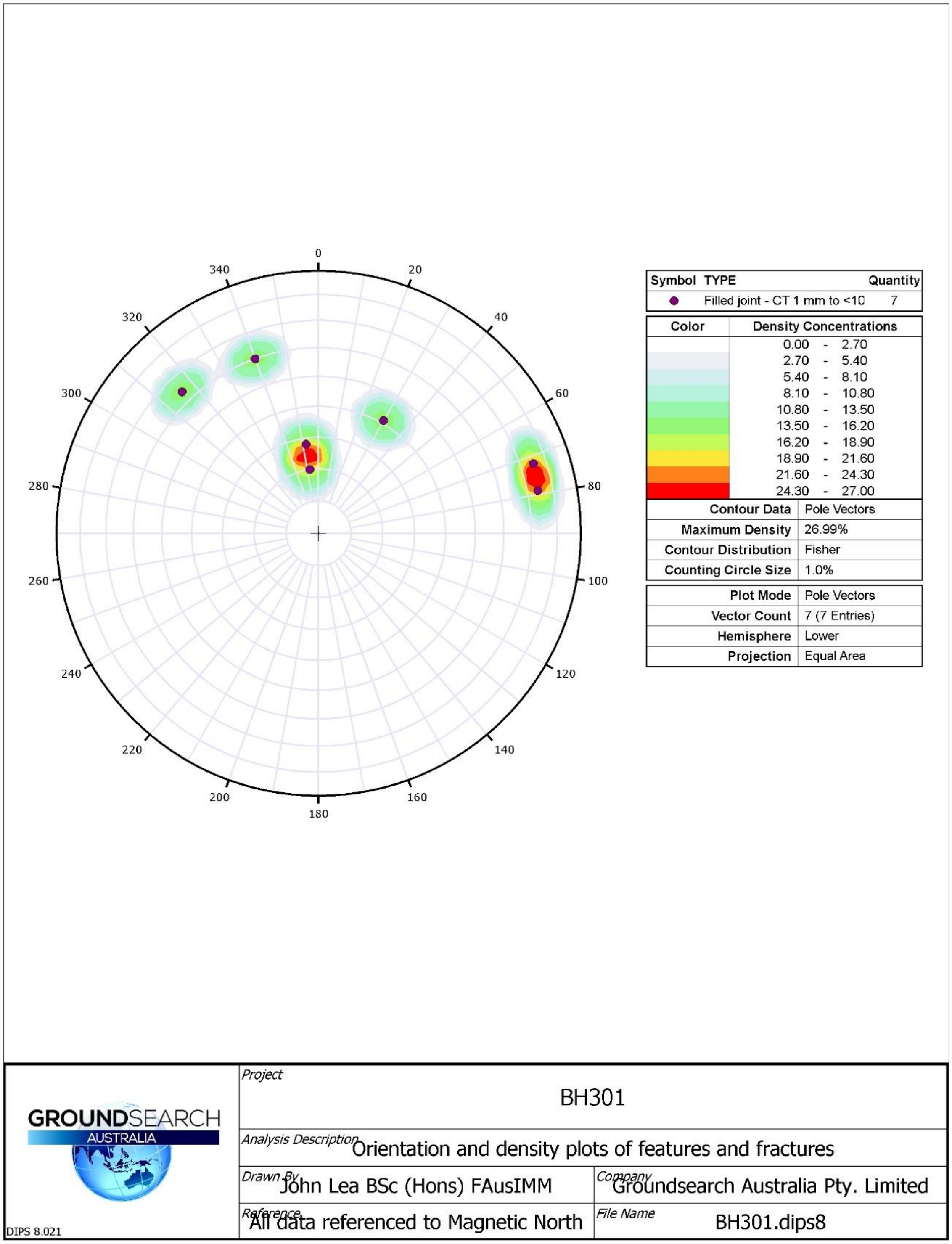
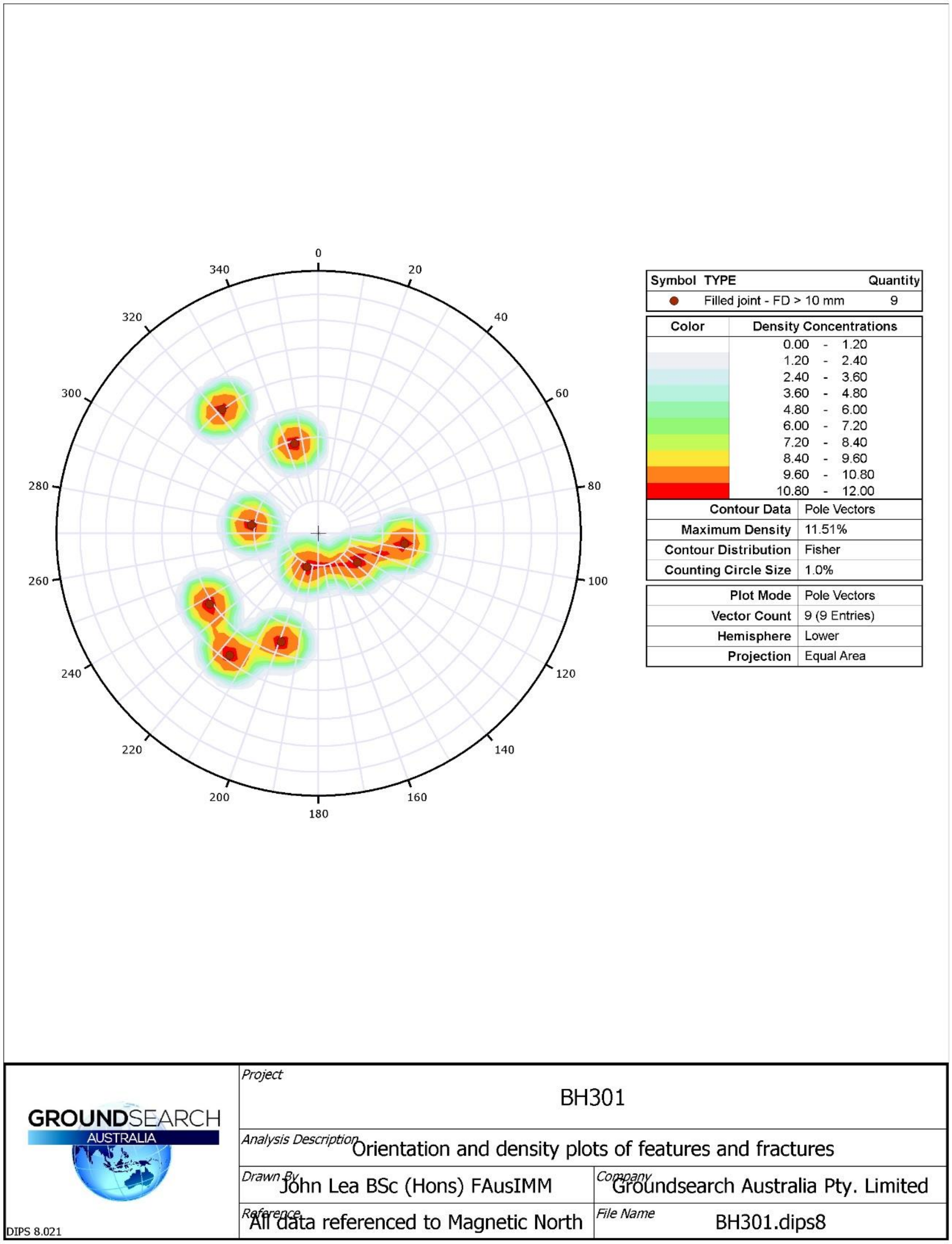


Figure 5 BH301 filled joint – FD >10mm density contour plan - pole vectors, MN, lower hemisphere

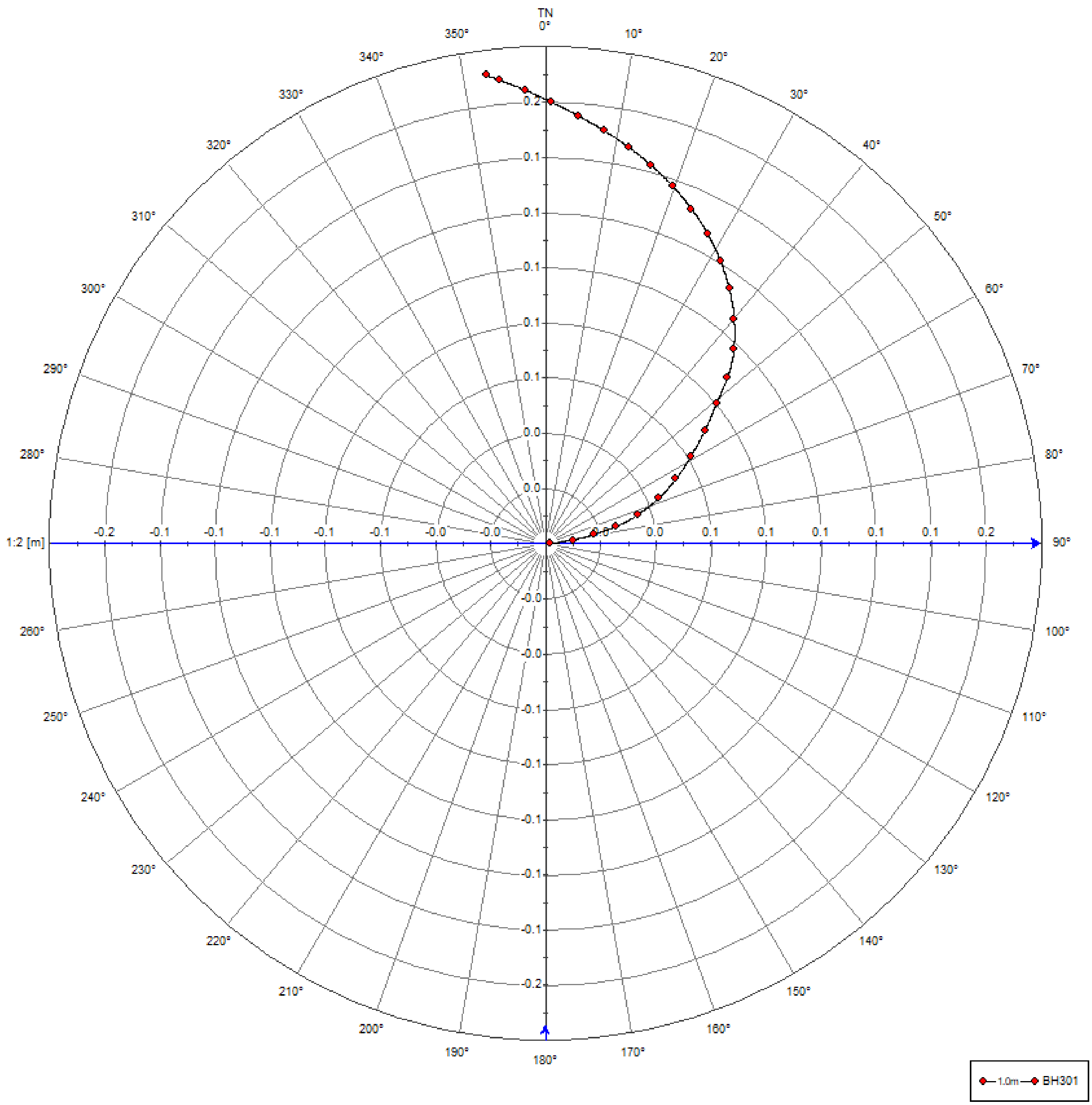


4.0 BH301 borehole deviation data

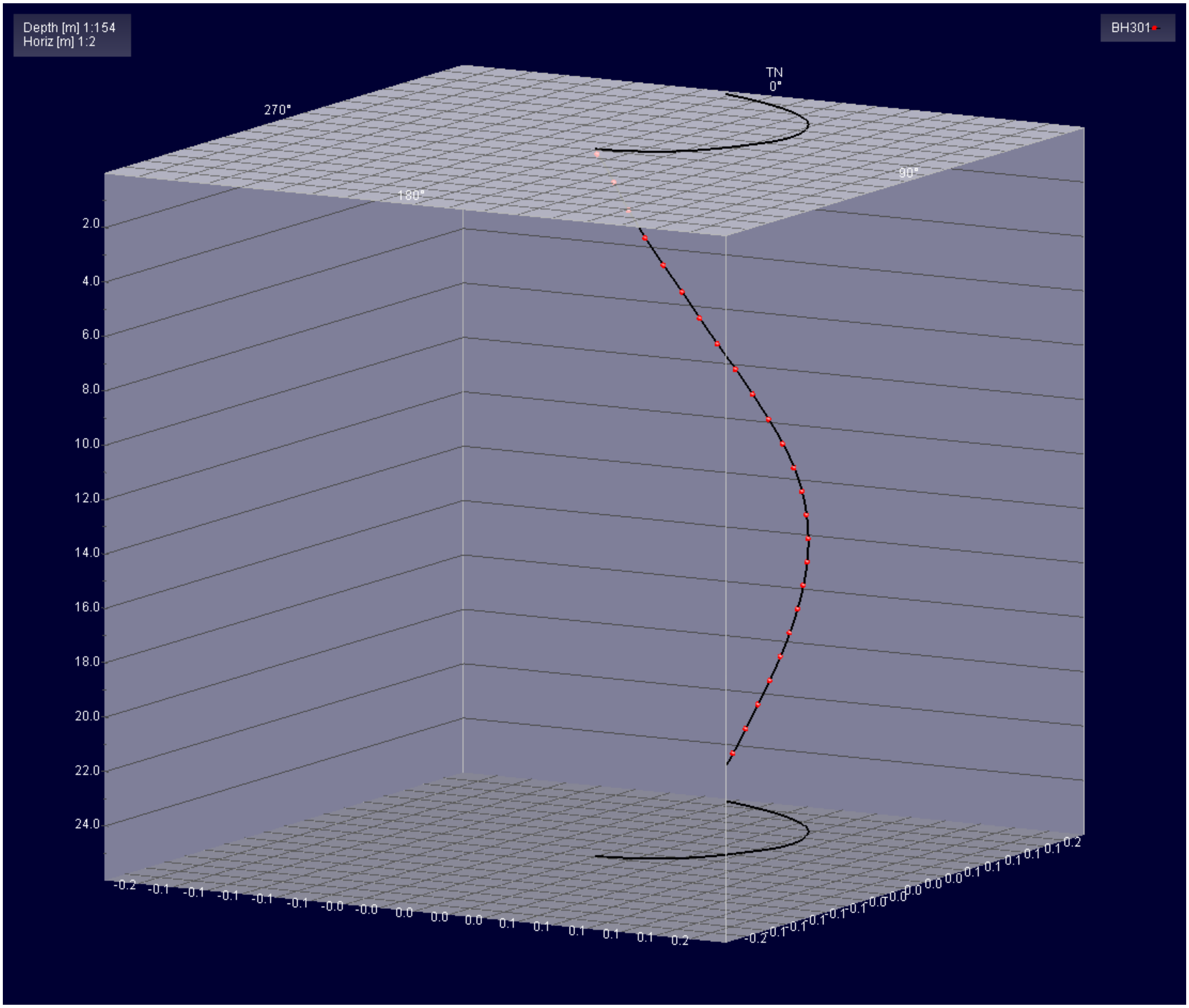
The data are presented in **Table 2** below.

Depth m	INCL DEGREE	AZ DEGREE	Easting [m]	Northing [m]	TVD [m]
0	0.66	83.01	0	0	0
1	0.68	71.39	0.011341	0.002265	0.999932
2	0.65	72.15	0.022646	0.006244	1.99986
3	0.41	70.21	0.031183	0.009043	2.99982
4	0.47	69.51	0.038247	0.011735	3.99979
5	0.5	68.36	0.046231	0.014795	4.99975
6	0.54	65.38	0.054585	0.018501	5.99971
7	0.54	66.44	0.063203	0.022319	6.99967
8	0.54	66.67	0.07182	0.026081	7.99962
9	0.59	67.11	0.080751	0.029962	8.99958
10	0.63	73.17	0.0909	0.033643	9.99952
11	0.58	69.93	0.101031	0.03669	10.9995
12	0.59	64.37	0.110342	0.040753	11.9994
13	0.63	61.88	0.119721	0.045517	12.9994
14	0.64	58.12	0.129317	0.051079	13.9993
15	0.63	57.11	0.13856	0.057048	14.9992
16	0.61	57.07	0.147637	0.062668	15.9992
17	0.62	51.99	0.156266	0.06899	16.9991
18	0.63	52.33	0.164896	0.075643	17.9991
19	0.62	50.65	0.173471	0.082433	18.999
20	0.61	49.08	0.181629	0.089447	19.9989
21	0.61	49.62	0.18978	0.096319	20.9989
22	0.61	48.26	0.197805	0.103312	21.9988
23	0.62	46.72	0.20579	0.110601	22.9988
24	0.61	47.01	0.213608	0.117954	23.9987
25	0.59	46.95	0.221273	0.125173	24.9987
26	0.59	47.04	0.228757	0.132155	25.9986

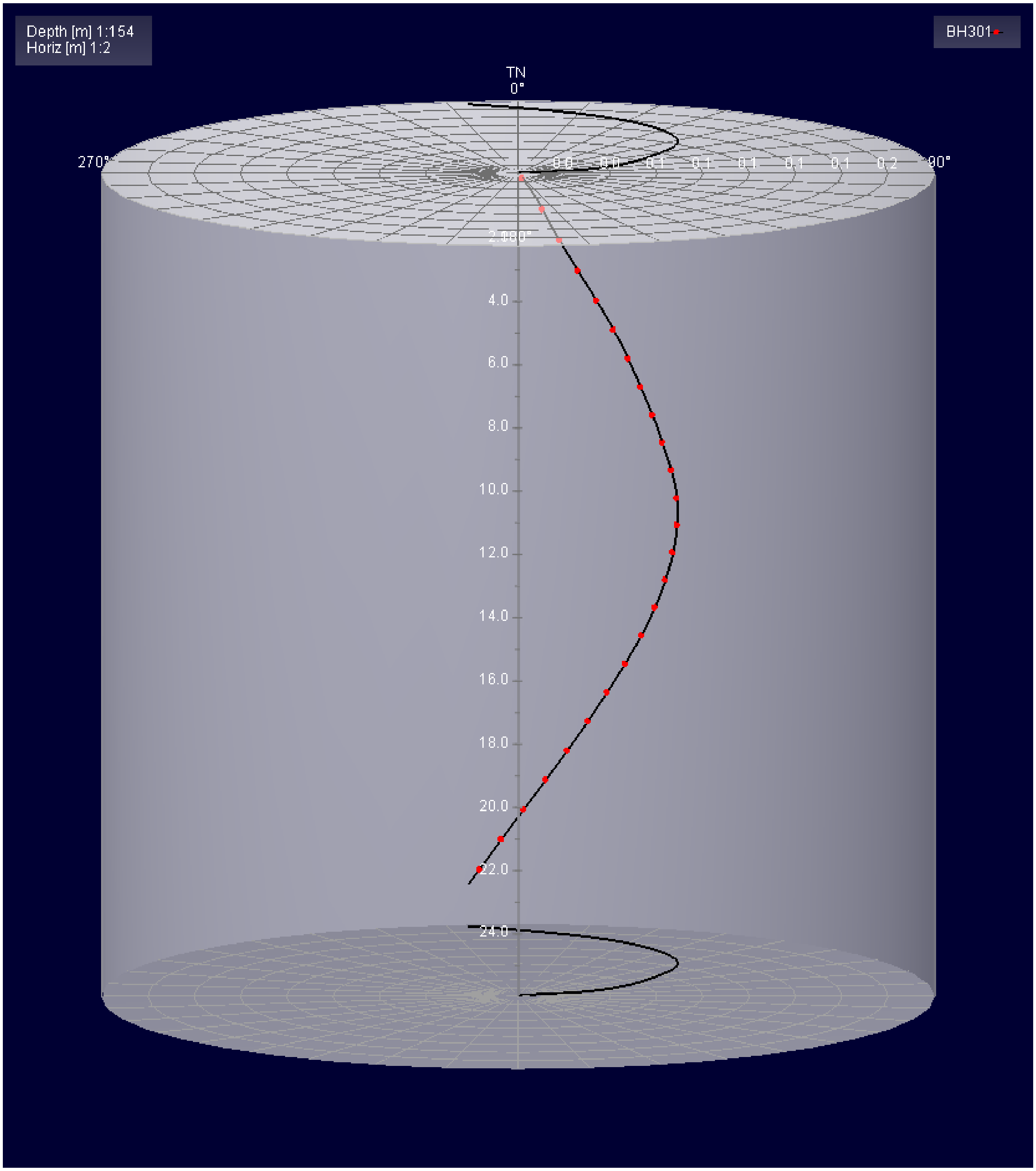
BH301 Bullseye Plot



BH301 Cubic Plot



BH301 Cylindrical Plot



Appendix 1

Tabulated interpreted features report for BH301

Feature ID	Midpoint mbgl	Dip deg.	Azimuth deg. MN	Interpreted feature description
1	3.30			Top of data
2	3.33	4	170	Bedding plane
3	3.34	3	134	Bedding plane
4	3.35	2	174	Bedding plane
5	3.37	1	217	Bedding plane
6	3.49	2	72	Bedding plane
7	3.50	2	76	Bedding plane
8	3.51	2	66	Bedding plane
9	3.53	7	109	Bedding plane
10	3.62	7	52	Bedding plane
11	3.68	8	249	Bedding plane
12	3.69	4	242	Bedding plane
13	3.72	18	18	Bedding plane
14	3.74	5	286	Bedding plane
15	3.76	7	163	Bedding plane
16	3.79	9	303	Bedding plane
17	3.82	7	212	Bedding plane
18	3.83	7	213	Bedding plane
19	3.95	14	29	Bedding plane
20	3.99	13	5	Bedding plane
21	4.07	6	26	Bedding plane
22	4.08	5	26	Bedding plane
23	4.10	7	22	Bedding plane
24	4.26	41	210	Filled joint - CT 1 mm to <10 mm
25	4.47	1	64	Bedding plane
26	4.48	2	54	Bedding plane
27	4.58	3	123	Bedding plane
28	4.59	6	121	Bedding plane
29	4.62	9	56	Bedding plane
30	4.65	5	76	Bedding plane
31	4.72	60	160	Filled joint - CT 1 mm to <10 mm
32	5.09	8	102	Bedding plane
33	5.22	3	330	Bedding plane
34	5.23	3	310	Bedding plane
35	5.38	3	307	Bedding plane

36	5.42	3	313	Bedding plane
37	5.45	5	315	Bedding plane
38	5.50	1	280	Bedding plane
39	5.52	3	273	Bedding plane
40	5.56	1	276	Bedding plane
41	5.57	2	250	Bedding plane
42	5.70	3	131	Bedding plane
43	5.76	3	105	Bedding plane
44	5.78	3	107	Bedding plane
45	5.81	2	60	Bedding plane
46	5.85	3	64	Bedding plane
47	5.89	2	131	Bedding plane
48	5.89	2	122	Bedding plane
49	5.91	3	179	Bedding plane
50	5.97	1	68	Bedding plane
51	5.98	5	67	Bedding plane
52	6.00	6	87	Bedding plane
53	6.01	4	91	Bedding plane
54	6.03	3	102	Bedding plane
55	6.04	4	96	Bedding plane
56	6.24	28	172	Filled joint - CT 1 mm to <10 mm
57	6.26	64	136	Filled joint - CT 1 mm to <10 mm
58	6.29	20	172	Filled joint - CT 1 mm to <10 mm
59	6.35	11	45	Bedding plane
60	6.36	14	39	Bedding plane
61	6.38	7	66	Bedding plane
62	6.42	9	108	Bedding plane
63	6.44	7	108	Bedding plane
64	6.46	4	101	Bedding plane
65	6.50	4	106	Bedding plane
66	6.92	5	252	Bedding plane
67	6.93	4	238	Bedding plane
68	6.94	8	254	Bedding plane
69	6.95	6	266	Bedding plane
70	7.11	3	322	Bedding plane
71	7.15	13	166	Bedding plane
72	7.37	8	249	Bedding plane
73	7.63	2	336	Bedding plane
74	7.64	3	336	Bedding plane
75	7.75	3	318	Bedding plane
76	7.76	3	305	Bedding plane
77	7.95	2	305	Bedding plane
78	7.96	1	30	Bedding plane
79	8.05	5	27	Bedding plane
80	8.46	7	127	Bedding plane

81	8.51	5	255	Bedding plane
82	8.67	8	343	Bedding plane
83	8.67	6	343	Bedding plane
84	8.93	3	40	Bedding plane
85	8.94	1	48	Bedding plane
86	9.02	6	66	Bedding plane
87	9.03	3	70	Bedding plane
88	9.08	13	35	Bedding plane
89	9.13	13	33	Bedding plane
90	9.92	0	248	Bedding plane
91	9.93	2	73	Bedding plane
92	9.99	3	210	Bedding plane
93	10.00	4	195	Bedding plane
94	10.16	12	113	Bedding plane
95	10.21	29	165	Filled joint - FD > 10 mm
96	10.24	36	19	Filled joint - FD > 10 mm
97	10.42	50	142	Filled joint - FD > 10 mm
98	10.68	4	223	Bedding plane
99	10.68	4	202	Bedding plane
100	10.79	15	307	Filled joint - FD > 10 mm
101	10.81	21	97	Filled joint - FD > 10 mm
102	11.16	1	296	Bedding plane
103	11.17	2	89	Bedding plane
104	11.65	1	223	Bedding plane
105	13.36	3	210	Bedding plane
106	13.37	4	147	Bedding plane
107	13.42	5	122	Bedding plane
108	13.42	6	145	Bedding plane
109	13.43	7	138	Bedding plane
110	13.47	6	347	Bedding plane
111	13.75	6	174	Bedding plane
112	13.76	6	165	Bedding plane
113	14.06	4	244	Bedding plane
114	14.06	3	219	Bedding plane
115	14.07	5	208	Bedding plane
116	14.15	4	318	Bedding plane
117	14.16	4	327	Bedding plane
118	14.20	4	74	Bedding plane
119	14.27	6	320	Bedding plane
120	14.40	5	173	Bedding plane
121	14.43	2	242	Bedding plane
122	14.47	3	258	Bedding plane
123	14.58	2	251	Bedding plane
124	14.61	2	205	Bedding plane
125	14.62	2	213	Bedding plane

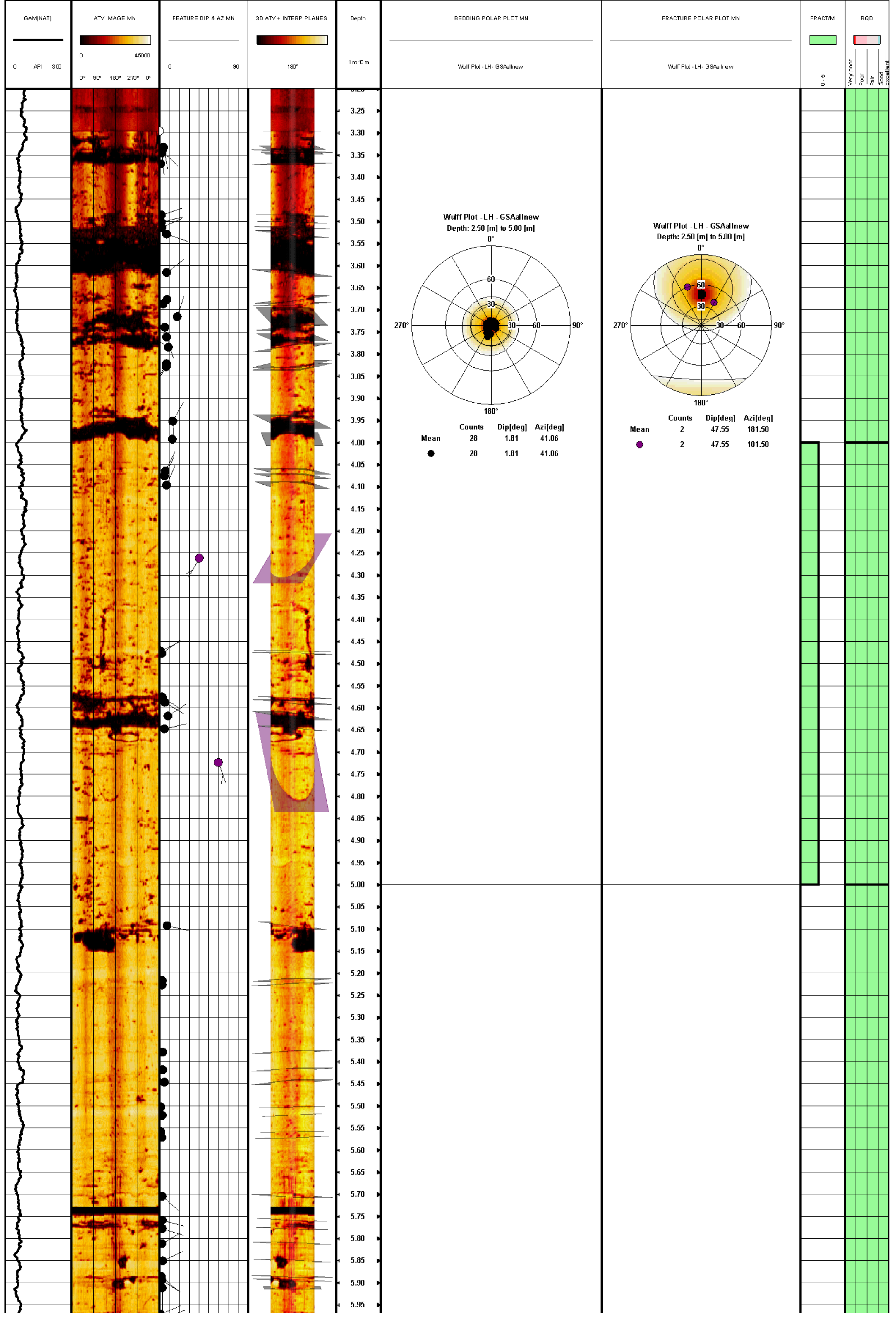
126	14.68	2	270	Bedding plane
127	14.81	5	328	Bedding plane
128	14.81	5	310	Bedding plane
129	14.82	2	301	Bedding plane
130	14.83	3	305	Bedding plane
131	14.84	2	285	Bedding plane
132	15.04	4	154	Bedding plane
133	15.06	2	154	Bedding plane
134	15.20	4	21	Bedding plane
135	15.21	4	37	Bedding plane
136	15.21	4	24	Bedding plane
137	15.22	5	39	Bedding plane
138	15.27	4	50	Bedding plane
139	15.46	1	318	Bedding plane
140	15.47	2	307	Bedding plane
141	15.48	2	271	Bedding plane
142	15.51	11	19	Filled joint - FD > 10 mm
143	15.51	8	308	Bedding plane
144	15.57	1	328	Bedding plane
145	15.57	3	343	Bedding plane
146	15.65	6	143	Bedding plane
147	15.76	6	303	Bedding plane
148	15.78	27	277	Filled joint - FD > 10 mm
149	16.01	41	57	Filled joint - FD > 10 mm
150	16.06	3	268	Bedding plane
151	16.17	13	336	Bedding plane
152	16.23	14	325	Bedding plane
153	16.25	18	321	Bedding plane
154	16.30	48	36	Filled joint - FD > 10 mm
155	16.47	15	305	Bedding plane
156	16.48	12	324	Bedding plane
157	16.50	12	37	Bedding plane
158	16.59	6	278	Bedding plane
159	16.66	8	269	Bedding plane
160	16.70	2	195	Bedding plane
161	16.92	3	246	Bedding plane
162	16.94	4	217	Bedding plane
163	17.17	2	261	Bedding plane
164	17.20	5	309	Bedding plane
165	17.23	2	339	Bedding plane
166	17.24	3	309	Bedding plane
167	17.50	1	294	Bedding plane
168	17.53	2	286	Bedding plane
169	17.57	4	293	Bedding plane
170	17.64	3	321	Bedding plane

Feature ID	Midpoint mbgl	Dip deg.	Azimuth deg. MN	Interpreted feature description
171	17.66	3	299	Bedding plane
172	17.82	1	280	Bedding plane
173	17.98	3	305	Bedding plane
174	17.99	1	294	Bedding plane
175	18.01	1	321	Bedding plane
176	18.18	4	210	Bedding plane
177	18.72	5	246	Bedding plane
178	18.85	3	245	Bedding plane
179	18.86	3	257	Bedding plane
180	19.04	2	264	Bedding plane
181	19.05	3	280	Bedding plane
182	19.07	1	245	Bedding plane
183	20.52	1	234	Bedding plane
184	20.52	2	230	Bedding plane
185	20.66	11	264	Bedding plane
186	20.67	9	268	Bedding plane
187	20.69	6	257	Bedding plane
188	20.70	3	249	Bedding plane
189	20.83	3	270	Bedding plane
190	20.90	6	284	Bedding plane
191	20.91	5	281	Bedding plane
192	21.16	2	302	Bedding plane
193	21.18	6	308	Bedding plane
194	21.64	3	303	Bedding plane
195	21.65	3	298	Bedding plane
196	21.74	3	283	Bedding plane
197	21.91	74	259	Filled joint - CT 1 mm to <10 mm
198	22.08	4	244	Bedding plane
199	22.10	3	227	Bedding plane
200	22.82	4	228	Bedding plane
201	22.83	4	220	Bedding plane
202	23.26	75	252	Filled joint - CT 1 mm to <10 mm
203	23.52	1	277	Bedding plane
204	23.54	2	278	Bedding plane
205	23.55	3	301	Bedding plane
206	23.56	1	281	Bedding plane
207	23.58	4	199	Bedding plane
208	24.69	3	328	Bedding plane
209	24.70	3	51	Bedding plane
210	27.84			Base of data

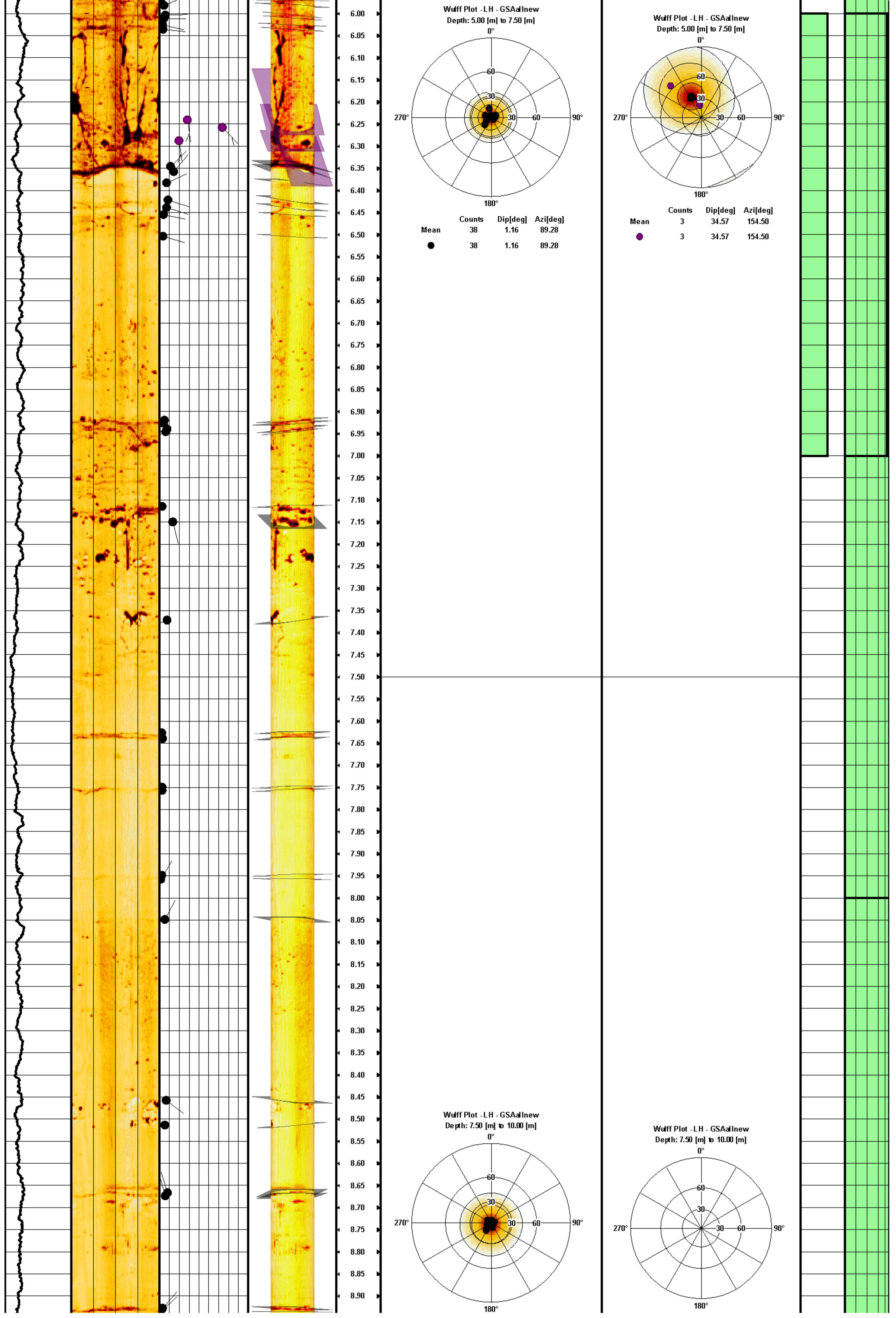
Appendix 2

1:10 Interpretation logs

3.30 To 27.84 mbgl



GAM(NAT)
0 API 300
ATV IMAGE MN
0 45000
0° 90° 180° 270° 0°
FEATURE DIP & AZ MN
0 90
3D ATV + INTERP PLANES
180°
Depth
1m:10m
BEDDING POLAR PLOT MN
Wulff Plot - LH - GSAallnew
FRACTURE POLAR PLOT MN
Wulff Plot - LH - GSAallnew
FRACT/M
0 - 5
RQD
Very poor
Poor
Fair
Good
Excellent
3.25
3.30
3.35
3.40
3.45
3.50
3.55
3.60
3.65
3.70
3.75
3.80
3.85
3.90
3.95
4.00
4.05
4.10
4.15
4.20
4.25
4.30
4.35
4.40
4.45
4.50
4.55
4.60
4.65
4.70
4.75
4.80
4.85
4.90
4.95
5.00
5.05
5.10
5.15
5.20
5.25
5.30
5.35
5.40
5.45
5.50
5.55
5.60
5.65
5.70
5.75
5.80
5.85
5.90
5.95
Wulff Plot - LH - GSAallnew
Depth: 2.50 [m] to 5.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 28 1.81 41.06
28 1.81 41.06
Wulff Plot - LH - GSAallnew
Depth: 2.50 [m] to 5.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 2 47.55 181.50
2 47.55 181.50



6.00
6.05
6.10
6.15
6.20
6.25
6.30
6.35
6.40
6.45
6.50
6.55
6.60
6.65
6.70
6.75
6.80
6.85
6.90
6.95
7.00
7.05
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7.95
8.00
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8.25
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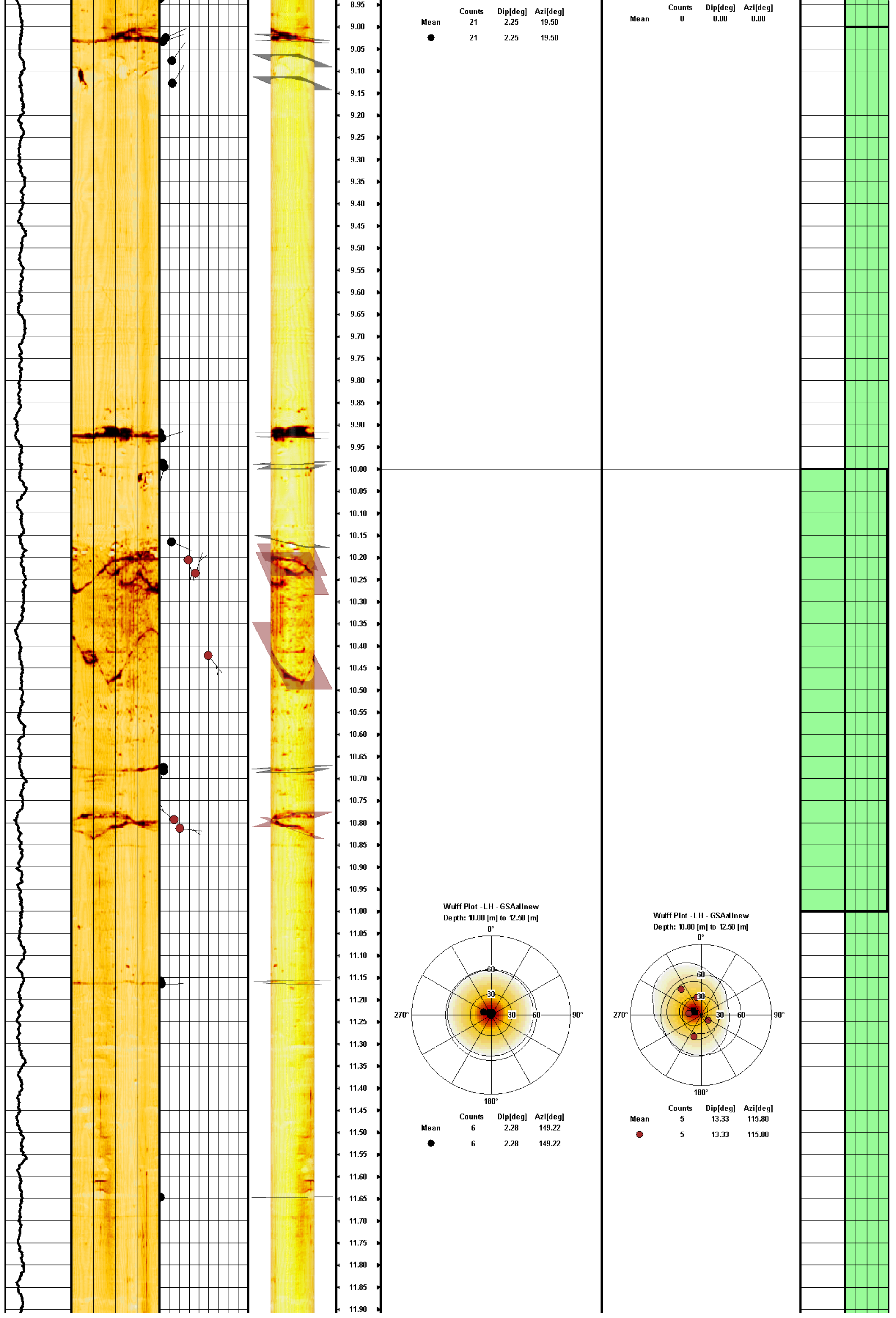
8.35
8.40
8.45
8.50
8.55
8.60
8.65
8.70
8.75
8.80
8.85
8.90
Wulff Plot - LH - GSAallnew
Depth: 5.00 [m] to 7.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 38 1.16 89.28
38 1.16 89.28
Wulff Plot - LH - GSAallnew
Depth: 5.00 [m] to 7.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 3 34.57 154.50
3 34.57 154.50
Wulff Plot - LH - GSAallnew
Depth: 7.50 [m] to 10.00 [m]
0°
90°
180°
270°
30
60
Wulff Plot - LH - GSAallnew
Depth: 7.50 [m] to 10.00 [m]
0°
90°
180°
270°
30
60



Counts Dip[deg] Azi[deg]
Mean 21 2.25 19.50
21 2.25 19.50
Counts Dip[deg] Azi[deg]
Mean 0 0.00 0.00
8.95
9.00
9.05
9.10
9.15
9.20
9.25
9.30
9.35
9.40
9.45
9.50
9.55
9.60
9.65
9.70
9.75
9.80
9.85
9.90
9.95
10.00
10.05
10.10
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10.75
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10.85
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11.00
11.05
11.10
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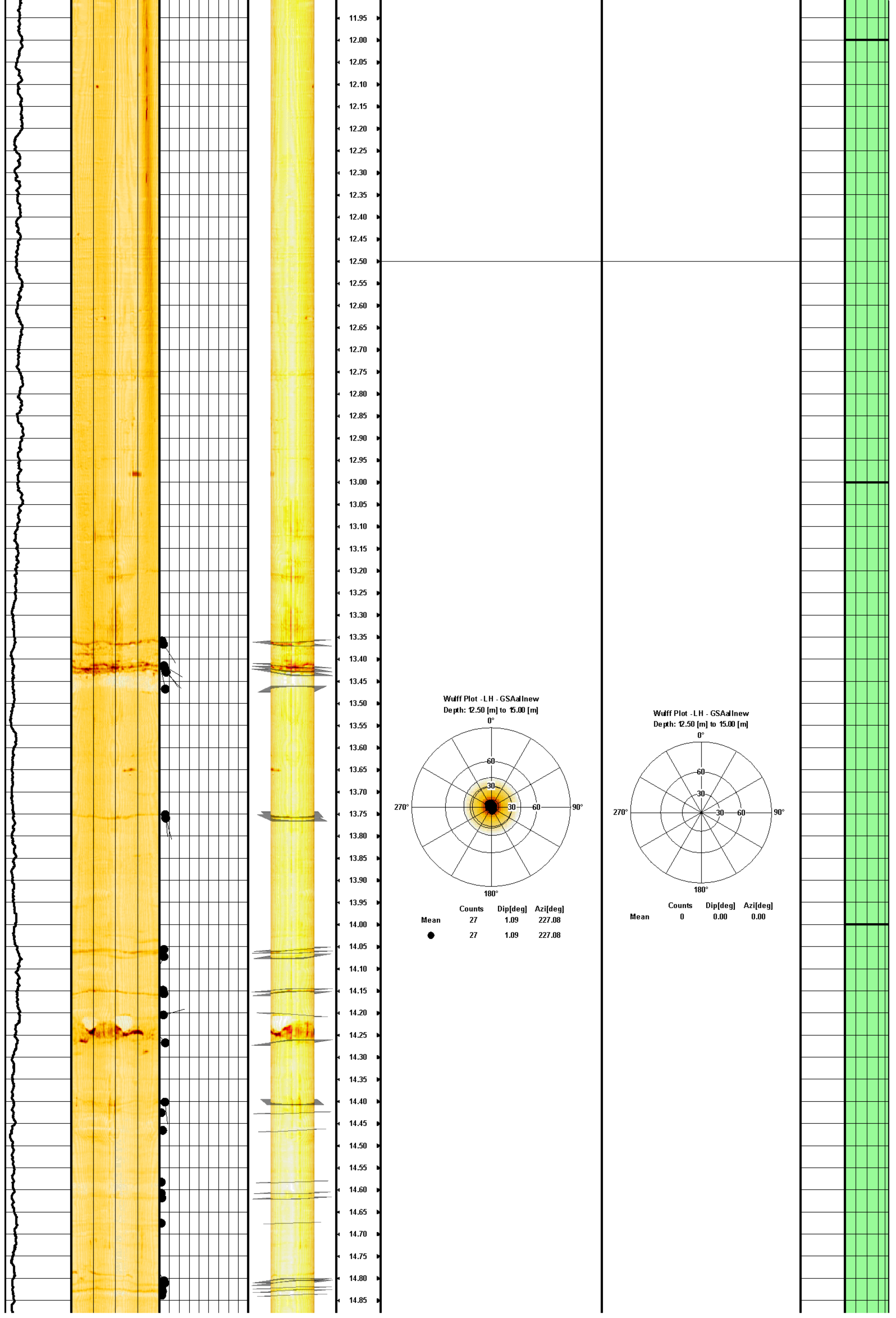
11.30
11.35
11.40
11.45
11.50
11.55
11.60
11.65
11.70
11.75
11.80
11.85
11.90
Wulff Plot - LH - GSAallnew
Depth: 10.00 [m] to 12.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 6 2.28 149.22
6 2.28 149.22
Wulff Plot - LH - GSAallnew
Depth: 10.00 [m] to 12.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 5 13.33 115.80
5 13.33 115.80


11.95
12.00
12.05
12.10
12.15
12.20
12.25
12.30
12.35
12.40
12.45
12.50
12.55
12.60
12.65
12.70
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14.35
14.40
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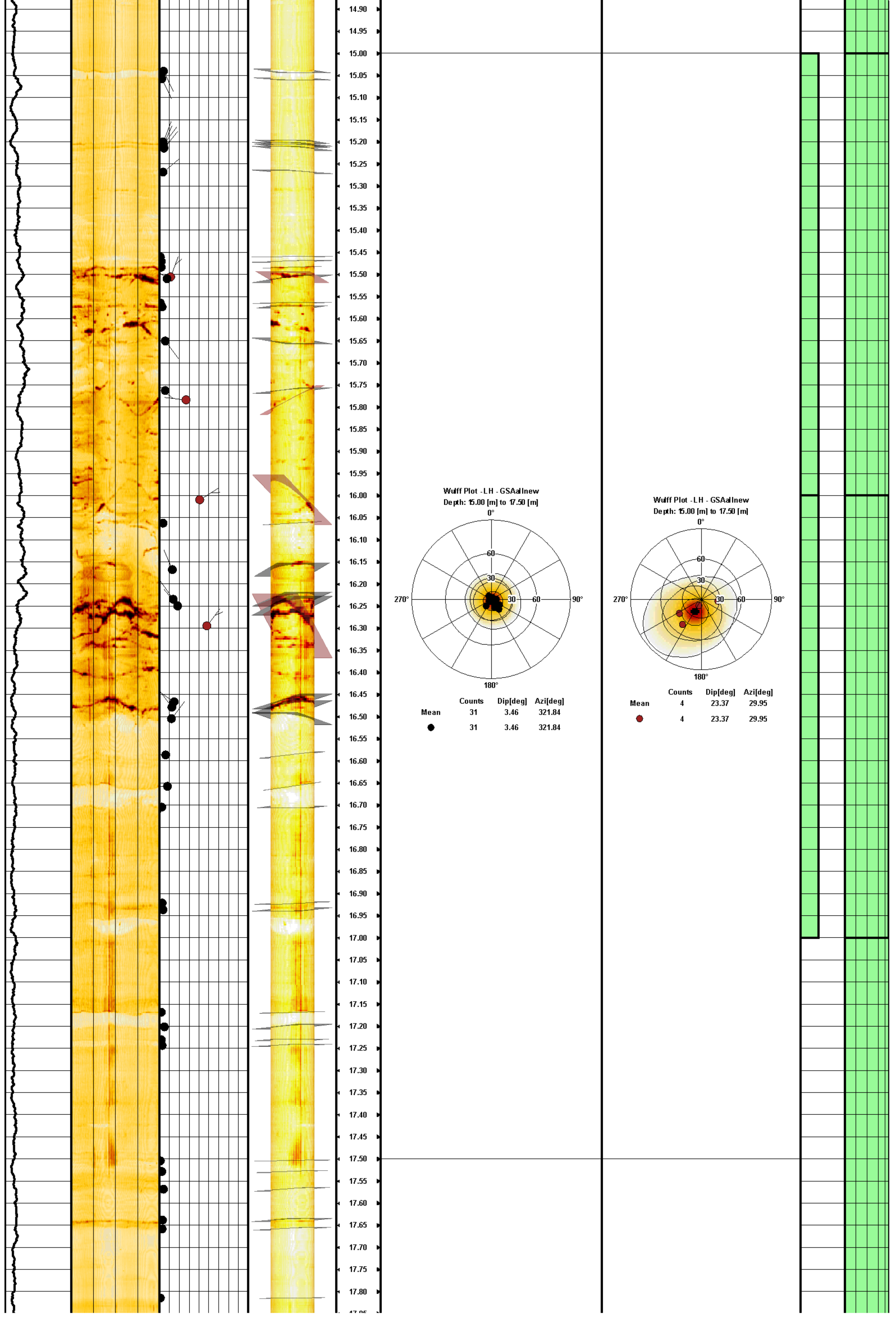
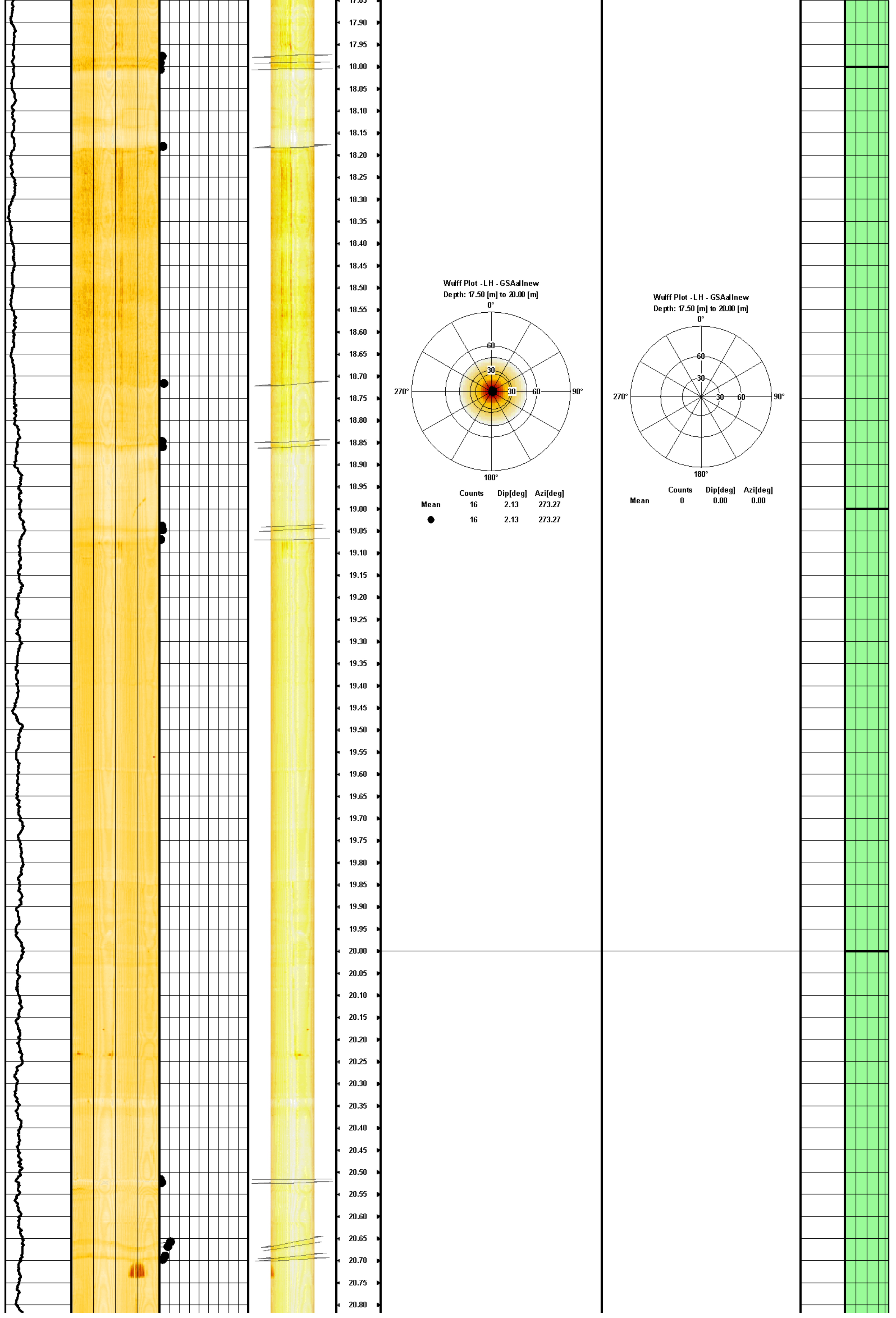
14.50
14.55
14.60
14.65
14.70
14.75
14.80
14.85
Wulff Plot - LH - GSAallnew
Depth: 12.50 [m] to 15.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 27 1.09 227.08
27 1.09 227.08
Wulff Plot - LH - GSAallnew
Depth: 12.50 [m] to 15.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 0 0.00 0.00



14.90
14.95
15.00
15.05
15.10
15.15
15.20
15.25
15.30
15.35
15.40
15.45
15.50
15.55
15.60
15.65
15.70
15.75
15.80
15.85
15.90
15.95
16.00
16.05
16.10
16.15
16.20
16.25
16.30
16.35
16.40
16.45
16.50
16.55
16.60
16.65
16.70
16.75
16.80
16.85
16.90
16.95
17.00
17.05
17.10
17.15
17.20
17.25
17.30
17.35
17.40
17.45
17.50
17.55
17.60
17.65
17.70
17.75
17.80
Wulff Plot - LH - GSAallnew
Depth: 15.00 [m] to 17.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 31 3.46 321.84
31 3.46 321.84
Wulff Plot - LH - GSAallnew
Depth: 15.00 [m] to 17.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 4 23.37 29.95
4 23.37 29.95



17.90
17.95
18.00
18.05
18.10
18.15
18.20
18.25
18.30
18.35
18.40
18.45
18.50
18.55
18.60
18.65
18.70
18.75
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18.85
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19.00
19.05
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19.70
19.75
19.80
19.85
19.90
19.95
20.00
20.05
20.10
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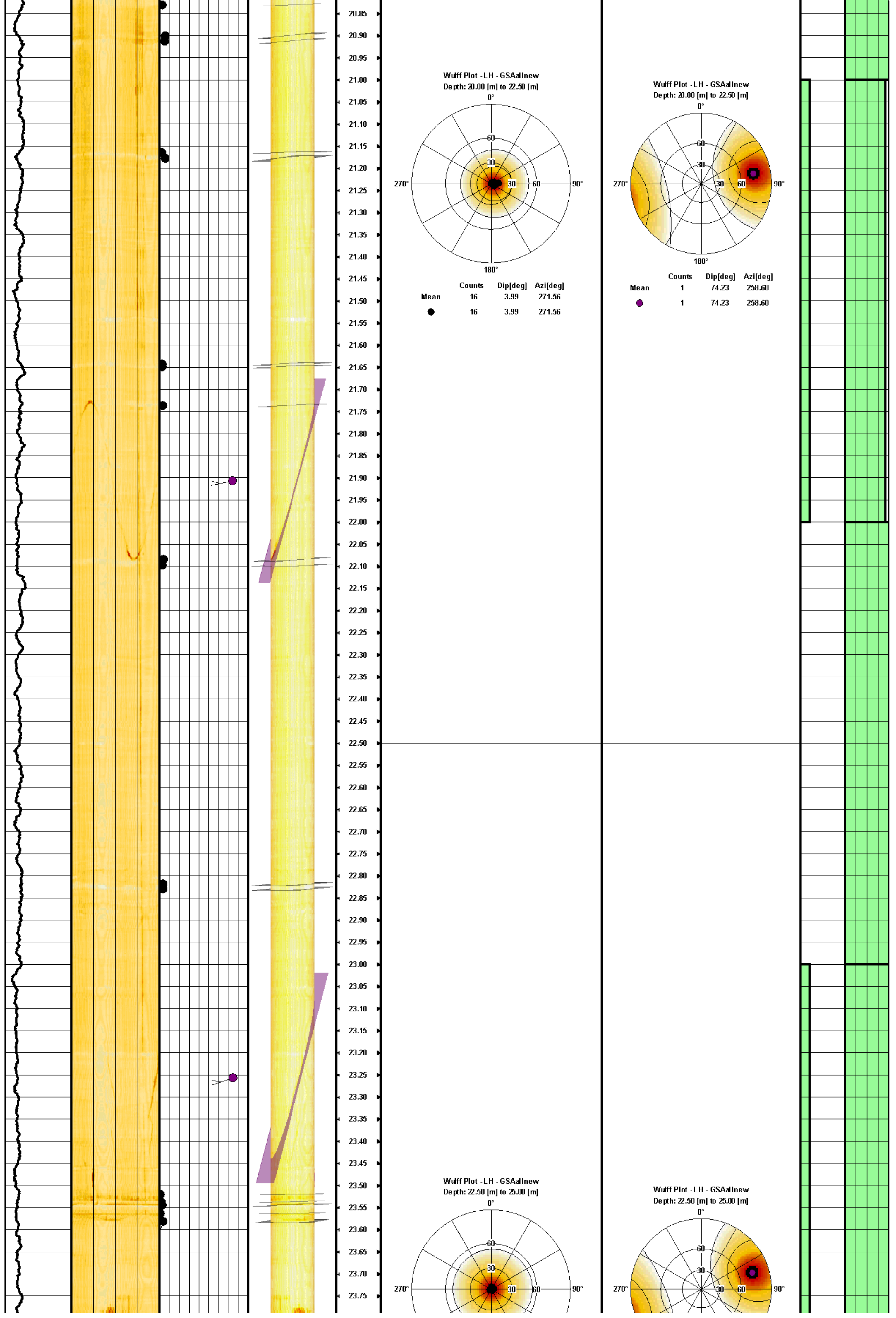
20.20
20.25
20.30
20.35
20.40
20.45
20.50
20.55
20.60
20.65
20.70
20.75
20.80
Wulff Plot - LH - GSAallnew
Depth: 17.50 [m] to 20.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 16 2.13 273.27
16 2.13 273.27
Wulff Plot - LH - GSAallnew
Depth: 17.50 [m] to 20.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 0 0.00 0.00



20.85
20.90
20.95
21.00
21.05
21.10
21.15
21.20
21.25
21.30
21.35
21.40
21.45
21.50
21.55
21.60
21.65
21.70
21.75
21.80
21.85
21.90
21.95
22.00
22.05
22.10
22.15
22.20
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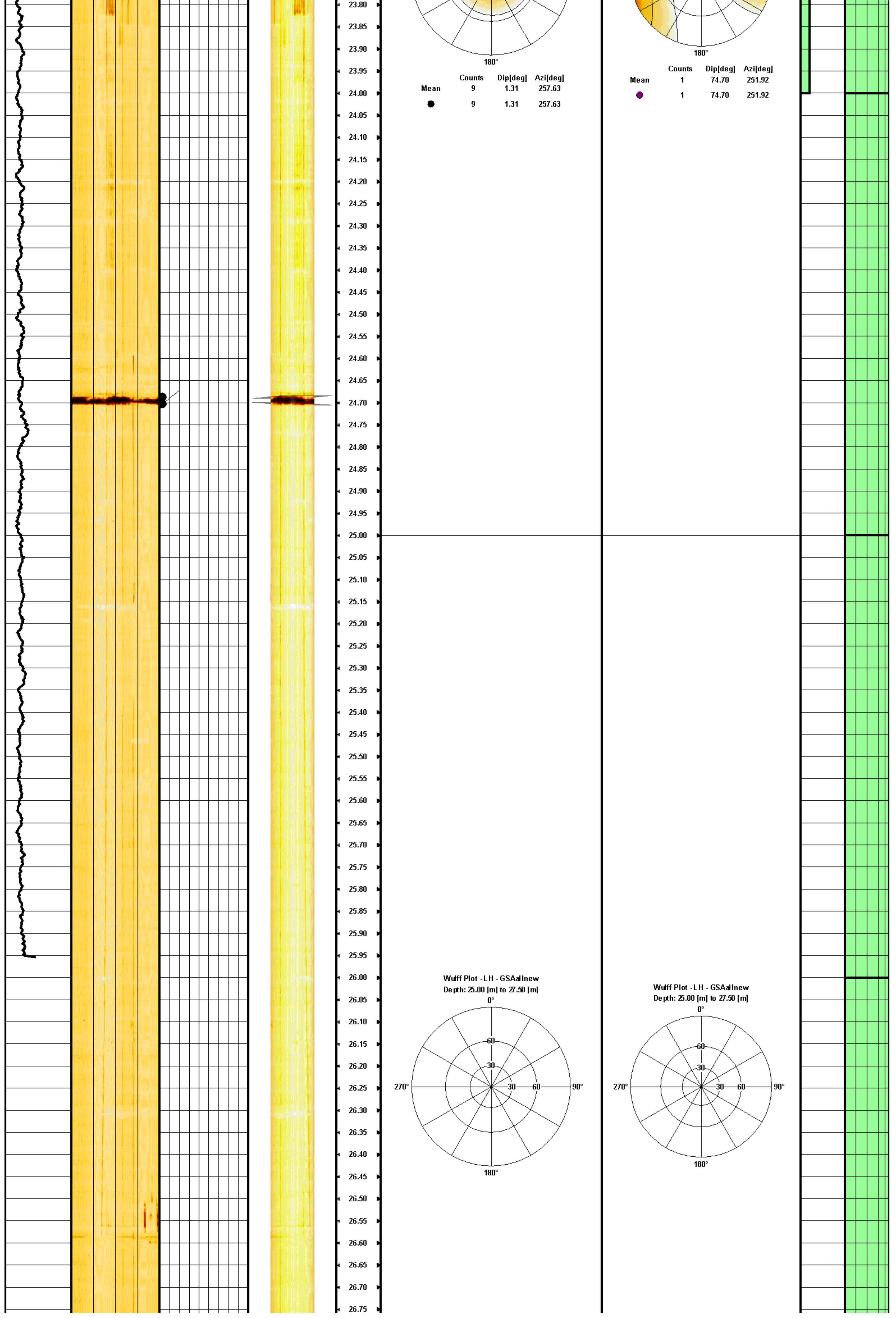
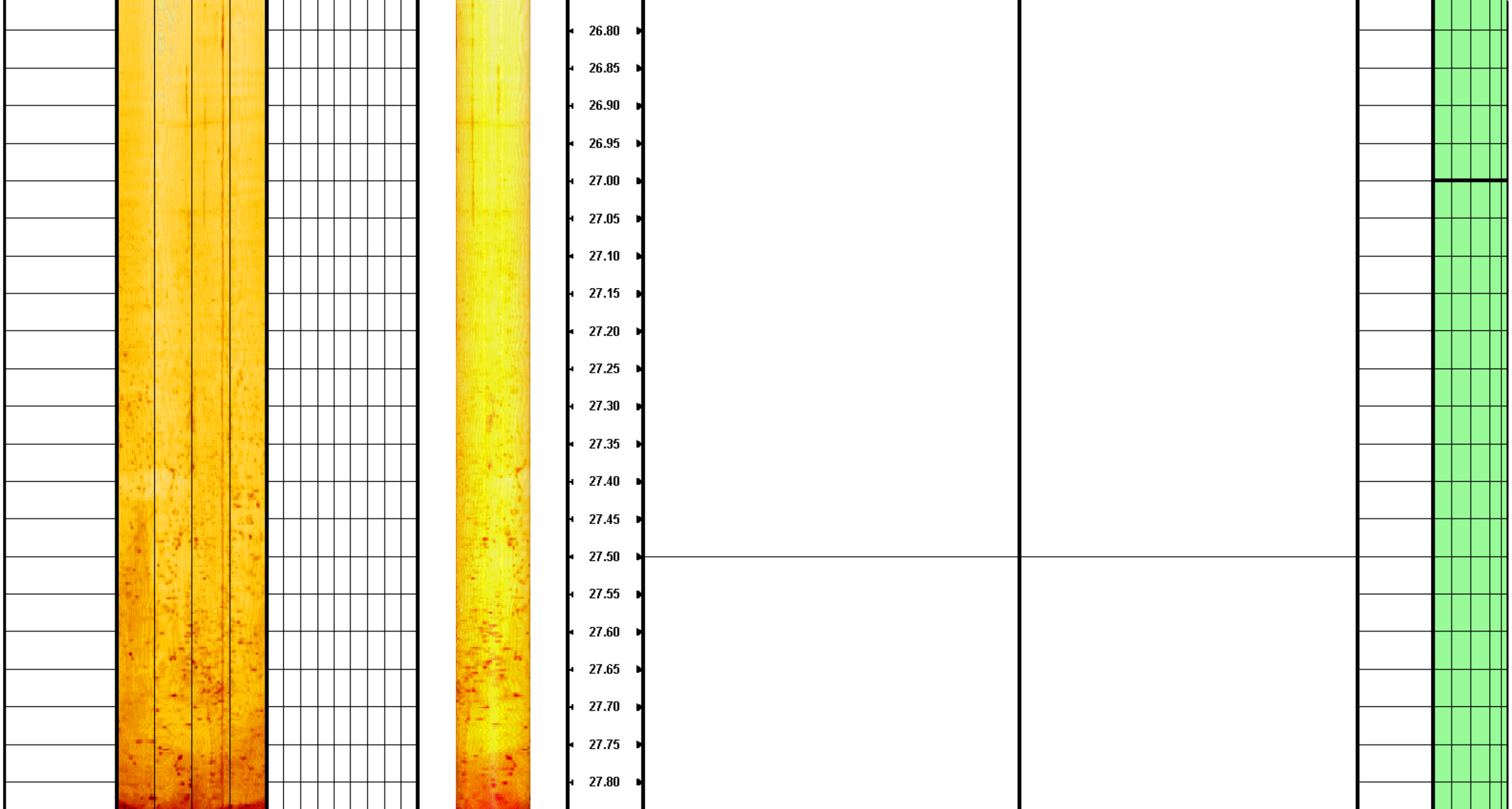
22.35
22.40
22.45
22.50
22.55
22.60
22.65
22.70
22.75
22.80
22.85
22.90
22.95
23.00
23.05
23.10
23.15
23.20
23.25
23.30
23.35
23.40
23.45
23.50
23.55
23.60
23.65
23.70
23.75
Wulff Plot - LH - GSAallnew
Depth: 20.00 [m] to 22.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 16 3.99 271.56
16 3.99 271.56
Wulff Plot - LH - GSAallnew
Depth: 20.00 [m] to 22.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 1 74.23 258.60
1 74.23 258.60
Wulff Plot - LH - GSAallnew
Depth: 22.50 [m] to 25.00 [m]
0°
90°
270°
30
60
Wulff Plot - LH - GSAallnew
Depth: 22.50 [m] to 25.00 [m]
0°
90°
270°
30
60



23.80
23.85
23.90
23.95
24.00
24.05
24.10
24.15
24.20
24.25
24.30
24.35
24.40
24.45
24.50
24.55
24.60
24.65
24.70
24.75
24.80
24.85
24.90
24.95
25.00
25.05
25.10
25.15
25.20
25.25
25.30
25.35
25.40
25.45
25.50
25.55
25.60
25.65
25.70
25.75
25.80
25.85
25.90
25.95
26.00
26.05
26.10
26.15
26.20
26.25
26.30
26.35
26.40
26.45
26.50
26.55
26.60
26.65
26.70
26.75
180°
Counts Dip[deg] Azi[deg]
Mean 9 1.31 257.63
9 1.31 257.63
180°
Counts Dip[deg] Azi[deg]
Mean 1 74.70 251.92
1 74.70 251.92
Wulff Plot - LH - GSAallnew
Depth: 25.00 [m] to 27.50 [m]
0°
60
30
270°
30
60
90°
180°
Wulff Plot - LH - GSAallnew
Depth: 25.00 [m] to 27.50 [m]
0°
60
30
270°
30
60
90°
180°



GAM(NAT)	ATV IMAGE MN	FEATURE DIP & AZ MN	3D ATV + INTERP PLANES	Depth	BEDDING POLAR PLOT MN	FRACTURE POLAR PLOT MN	FRACT/M	RQD
0 API 300	0° 90° 180° 270° 0° 0 45000	0 90	180°	1 m: 10 m	Wulff Plot - LH- GSAallnew	Wulff Plot - LH- GSAallnew	0 - 5	Very poor Poor Fair Good Excellent

Douglas Partners- Liverpool
402 Macquarie Street

Borehole - BH302

ATV Interpreted Features Report

Groundsearch Australia Pty. Limited
Issued: 16 May 2024

DISCLAIMER

The data used in this report were obtained using equipment manufactured by LIM Logging/Electromind. The interpretations given in this report are based on judgement and experience of Groundsearch Australia's personnel. They are provided for Douglas Partner's 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

J Lea

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 2024 site investigation programme for Douglas Partners- Liverpool.

LIM Logging BHTV acoustic televiewer logging tool was run to collect data in the field on 10 May 2024. The data in this report are from 3.48 to 24.35 mbgl.

The 160 identified features are interpreted as bedding planes and fractures. The bedding to fracture ratio is 4.93:1.

The LIM Logging 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** with density contours as pole vectors in the **lower hemisphere**.

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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 2024 site investigation programme for Douglas Partners- Liverpool.

LIM Logging BHTV acoustic televiewer logging tool was run to collect data in the field on 10 May 2024. The data in this report are from 3.48 to 24.35 mbgl.

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The LIM Logging 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** with density contours as pole vectors in the **lower hemisphere**.

The ATV takes an oriented image of the borehole using high-resolution sound waves. The acoustic image is displayed as 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 180 measurements around the borehole at each high-resolution sample interval. These data can be oriented to Magnetic North and displayed in real-time while logging using the LIM BHTV Logging System.

Analysis software includes colour adjustment, fracture dip and dip direction 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 and by mudcake adhered to the borehole wall.

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. Both sides of the 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 inclination angle and azimuth 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 **Magnetic North**-referenced:

- Text summary of the interpreted features
- Logs that show geological features with their subjective 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:
    - Natural gamma
    - ATV image referenced to Magnetic North
    - Colour-coded tadpoles that represent feature dip and dip direction
    - 3D ATV image with feature planes
    - Bedding polar plot referenced to Magnetic North
    - Fracture polar plot referenced to Magnetic North
    - Fracture frequency/M
    - Defect RQD
- Table containing feature curve ID, midpoint mbgl, dip angle, dip azimuth and feature description.
- Feature density contour plots as pole vectors in the lower hemisphere

The Rock Quality Designation (RQD) is a measure of the degree of jointing of fractures in a rock mass with:

- Image sample interval = 0.1 m
- Image length reported = 1.0 m

RQD values are:

- <0.25 - very poor
- 0.25 - 0.50 - poor
- 0.50 - 0.75 - fair
- 0.75 - 0.90 - good
- 0.90 - 1.00 - excellent

3.0 BH302 interpretations

The 160 identified features are interpreted as bedding planes and fractures. The bedding to fracture ratio is 4.93:1.

The density contours for all interpreted features are shown in Figure 1. A description of each interpreted feature is presented in Appendix 1 and the combination log is presented in Appendix 2.

The 133 sedimentary features identified are bedding planes that appear to range in dip from flat-lying to 23^0.

The 27 fractures identified are classified as:

Table 1

Interval section	Complete data 3.48 – 24.35 mbgl		
Feature classification	**Feature count**	**Percentage**	**Dip range**
Filled joint - CT 1mm to <10mm	14	52%	12^0 to 77^0
Filled joint - FD >10mm	13	48%	12^0 to 46^0

The sedimentary features identified are classified as:

Interval section	Complete data 3.48 – 24.35 mbgl	
Feature classification	**Feature count**	**Dip range**
Bedding	133	00^0 to 23^0

Figures 1 to 5 present the orientation density contour plans for each feature set identified as pole vectors, MN, lower hemisphere.

Feature Dip is represented as 00^0 being the horizontal plane and 90^0 being the vertical plane.

Stereonets show the Feature Dip represented as 00^0 being the centre of the stereonet and 90^0 being the outer circle of the stereonet.

The standards used for reporting are outlined on the following page of this report.

	Code	Tadpole	Sine Wave	
2	Seam/zone base FZ			Fractured zone base
3	Seam/zone base			
4	Fracture plane - open			Fracture plane - open
5	Minor open fracture			Minor open fracture
6	Fracture plane - partially open			Fracture plane - partially open
7	Filled fracture			Filled fracture
8	Bedding plane open			Bedding plane open
9	Fracture plane - closed			Fracture plane - closed
10	Top of data			Top of data
11	Induced fracture			Induced fracture
12	SWL			SWL
13	Fault - FT			Level 1
14	Rocktype boundary			Rocktype boundary
15	Bedding separation plane			Bedding separation plane
16	Fracture plane - discontinuous			Fracture plane - discontinuous
17	Partially filled fracture			Partially filled fracture
18	Irregular vein			Irregular vein
19	Unconformity			Unconformity
20	Base of casing			Base of casing
21	Top of Coal Unit			Top of Coal Unit
22	Base of Coal Unit			Base of Coal Unit
23	Base of weathering			Base of weathering
24	Top of breakout			Top of breakout
25	Base of breakout			Base of breakout
26	Top of washout			Top of washout
27	Base of washout			Base of washout
28	Top of open fracture			Top of open fracture
29	Base of open fracture			Base of open fracture
30	Bedding plane partially open			Bedding plane partially open
31	Parting			Parting
32	Shear plane			Shear plane
33	Face cleat			Face cleat
34	Butt cleat			Butt cleat
35	Intrusive contact			Intrusive contact
36	Irregular fracture			Irregular fracture
37	Open joint >5 mm aperture			Level 2
38	Closed joint <5 mm aperture			Level 3
39	Vein			Level 3
40	Filled joint - SN			Level 3
41	Filled joint - VN <1 mm			Level 3
42	Filled joint - CT 1 mm to <10 mm			Level 3
43	Filled joint - FD > 10 mm			Level 3
44	Lithozone boundary			Lithozone boundary
45	Bedding plane			
46	Top of mineralisation			
47	Base of mineralisation			
48	Crossbedding			

Figure 1 BH302 interpreted features density contours – pole vectors, MN, lower hemisphere

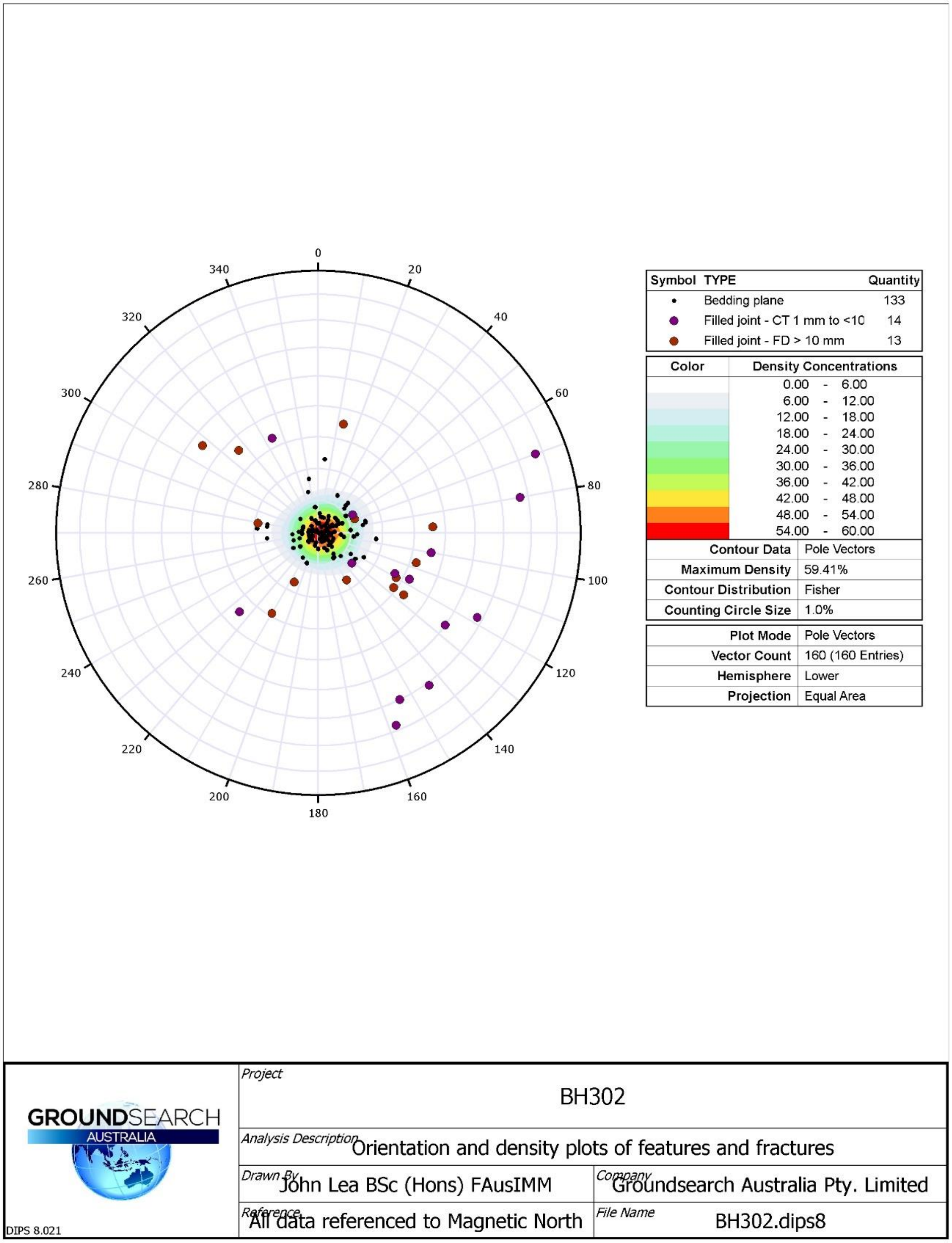


Figure 2 BH302 bedding orientation plan – pole vectors, MN, lower hemisphere

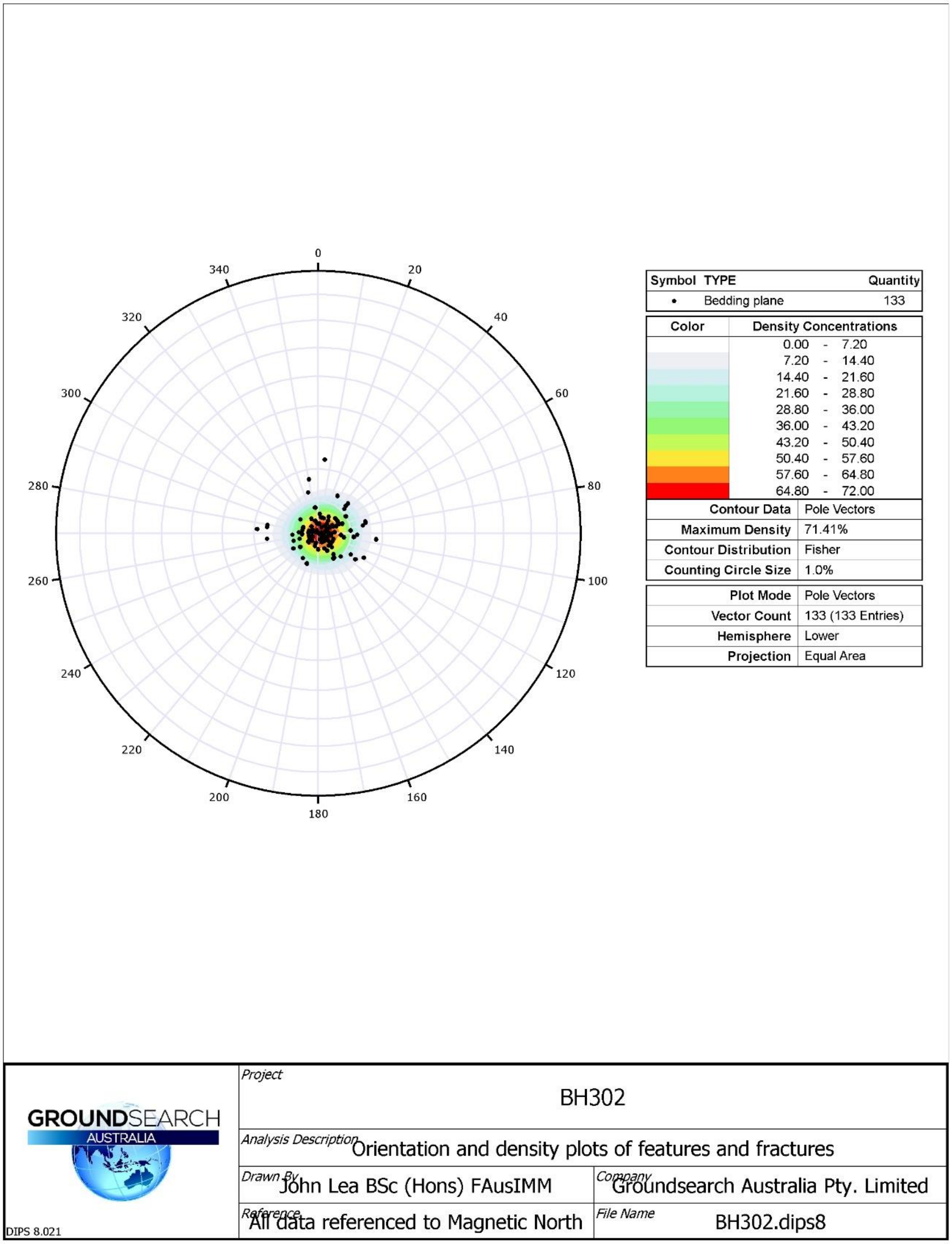


Figure 3 BH302 fractures orientation density contour plan – pole vectors, MN, lower hemisphere

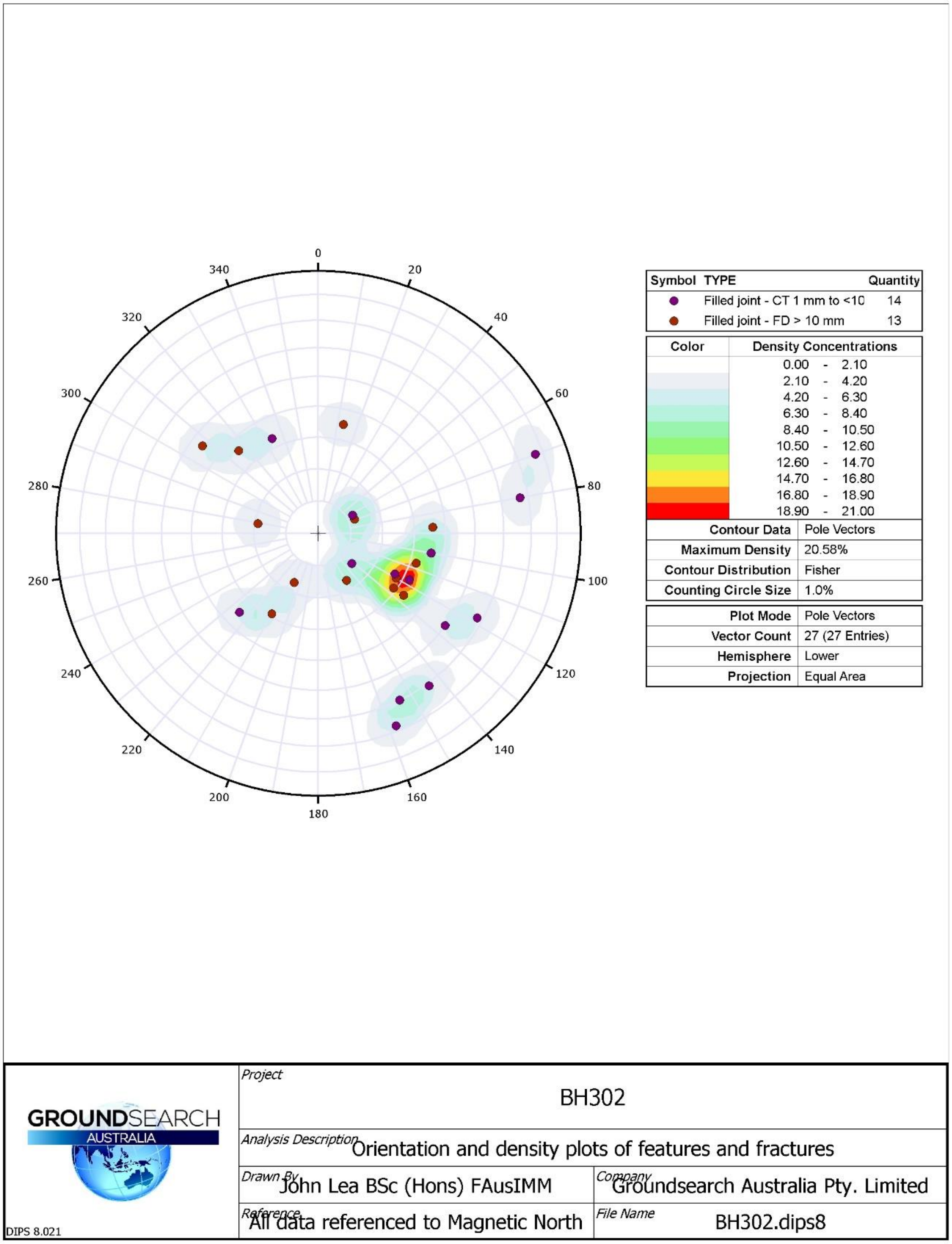


Figure 4 BH302 filled joint – CT 1mm to <10mm density contour plan - pole vectors, MN, lower hemisphere

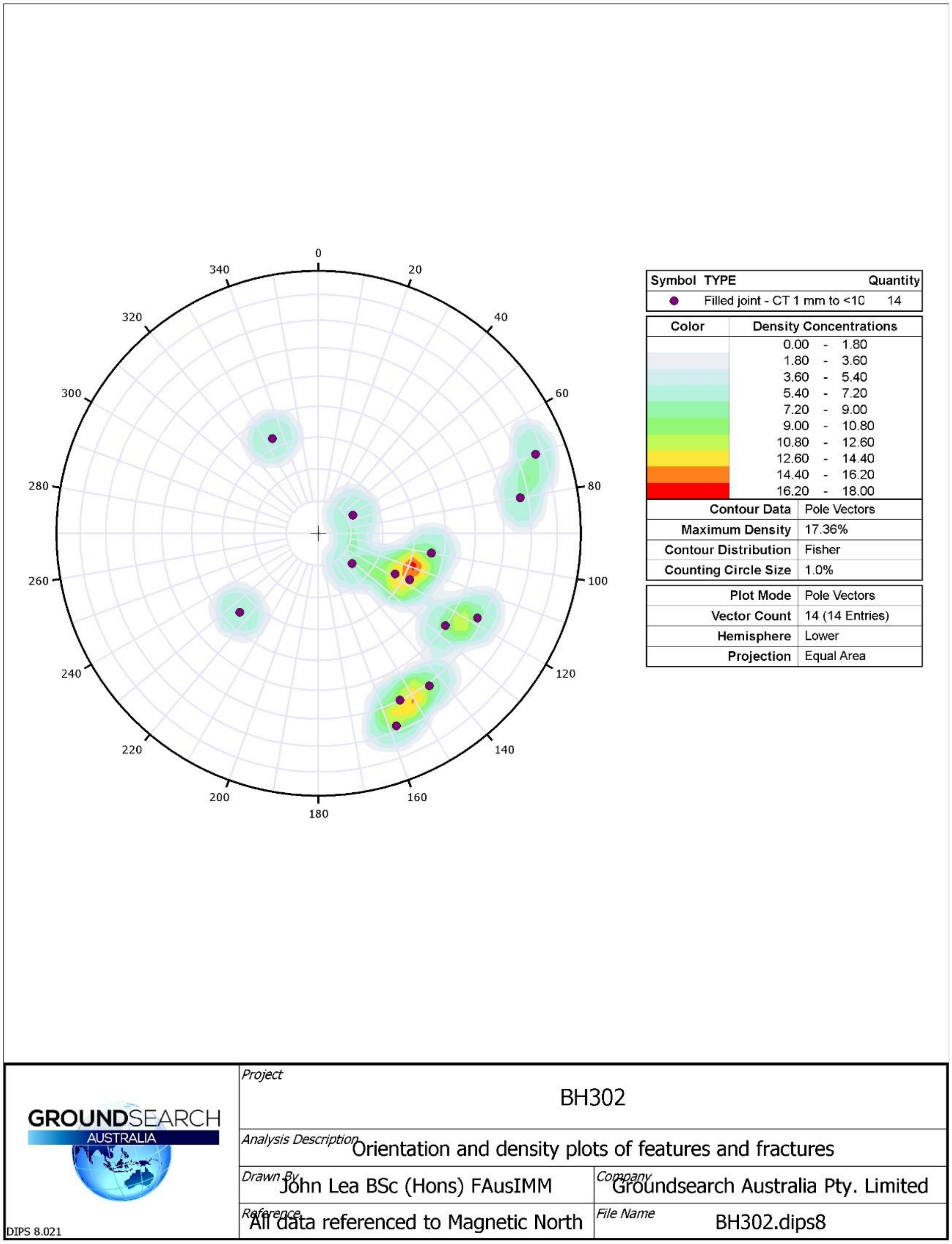
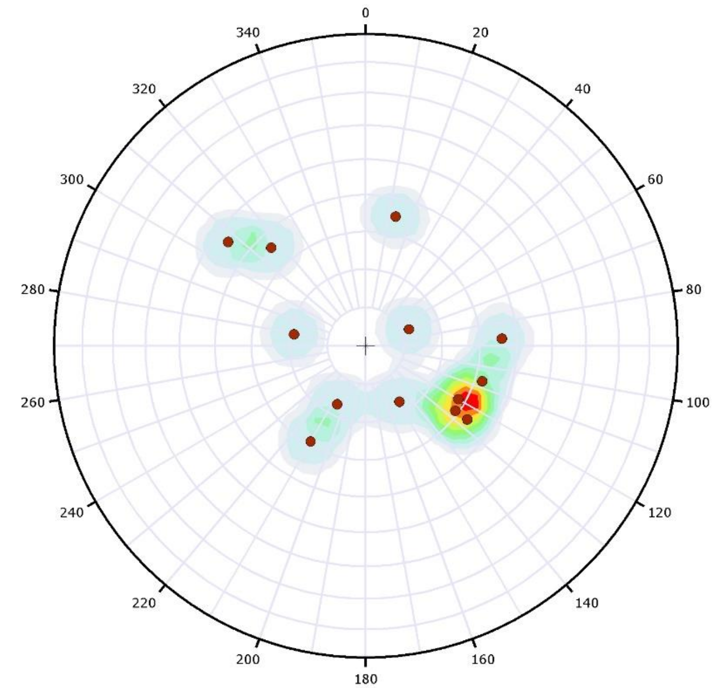


Figure 5 BH302 filled joint – FD >10mm density contour plan - pole vectors, MN, lower hemisphere



Symbol	TYPE	Quantity
●	Filled joint - FD > 10 mm	13

Color	Density Concentrations
	0.00 - 2.80
	2.80 - 5.60
	5.60 - 8.40
	8.40 - 11.20
	11.20 - 14.00
	14.00 - 16.80
	16.80 - 19.60
	19.60 - 22.40
	22.40 - 25.20
	25.20 - 28.00

Contour Data	Pole Vectors
Maximum Density	27.21%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	13 (13 Entries)
Hemisphere	Lower
Projection	Equal Area

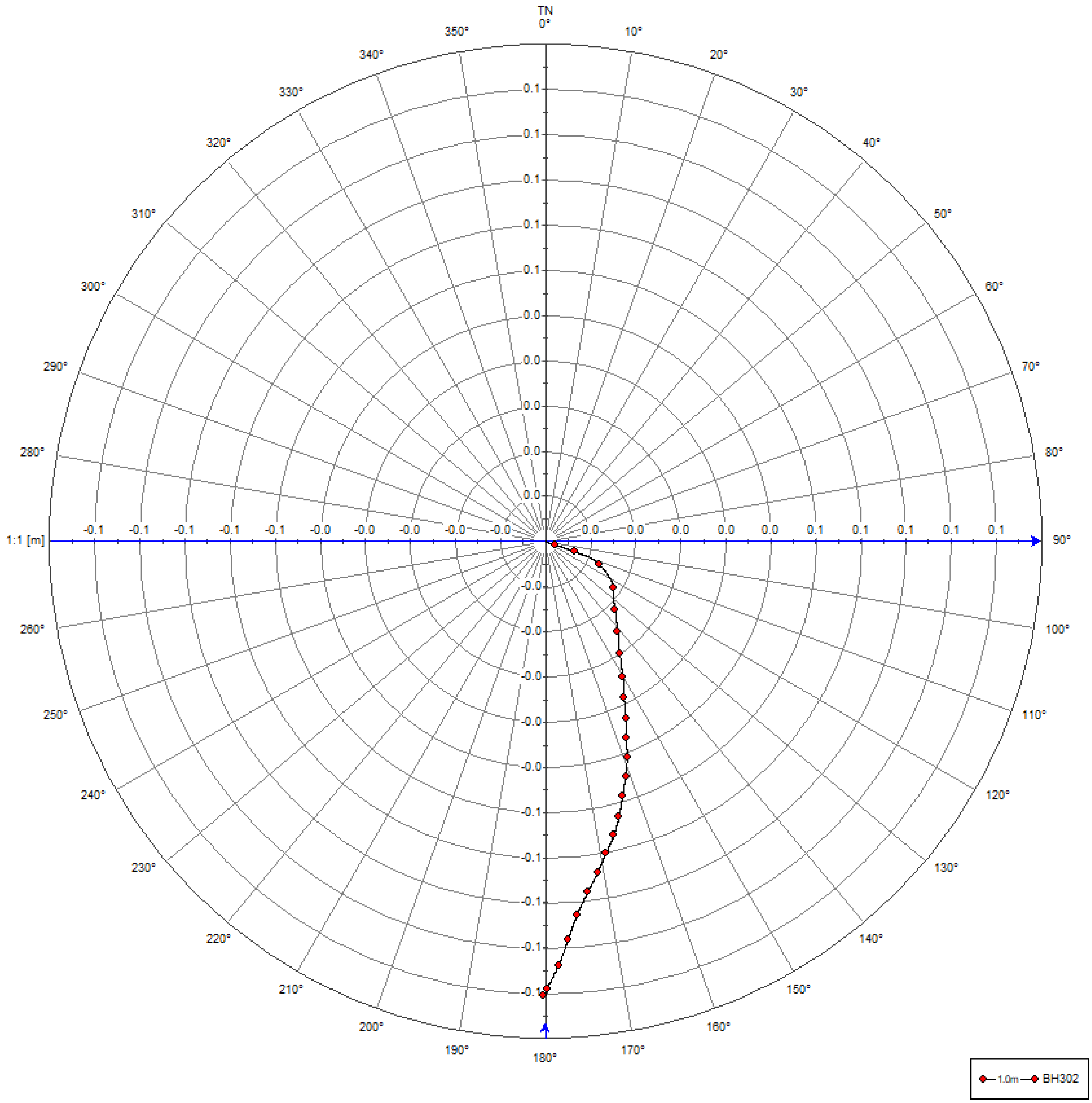
GROUNDSEARCH AUSTRALIA	Project: BH302	
	Analysis Description: Orientation and density plots of features and fractures	
	Drawn By: John Lea BSc (Hons) FAusIMM	Company: Groundsearch Australia Pty. Limited
DIPS 8.021	Reference: All data referenced to Magnetic North	File Name: BH302.dips8

4.0 BH302 borehole deviation data

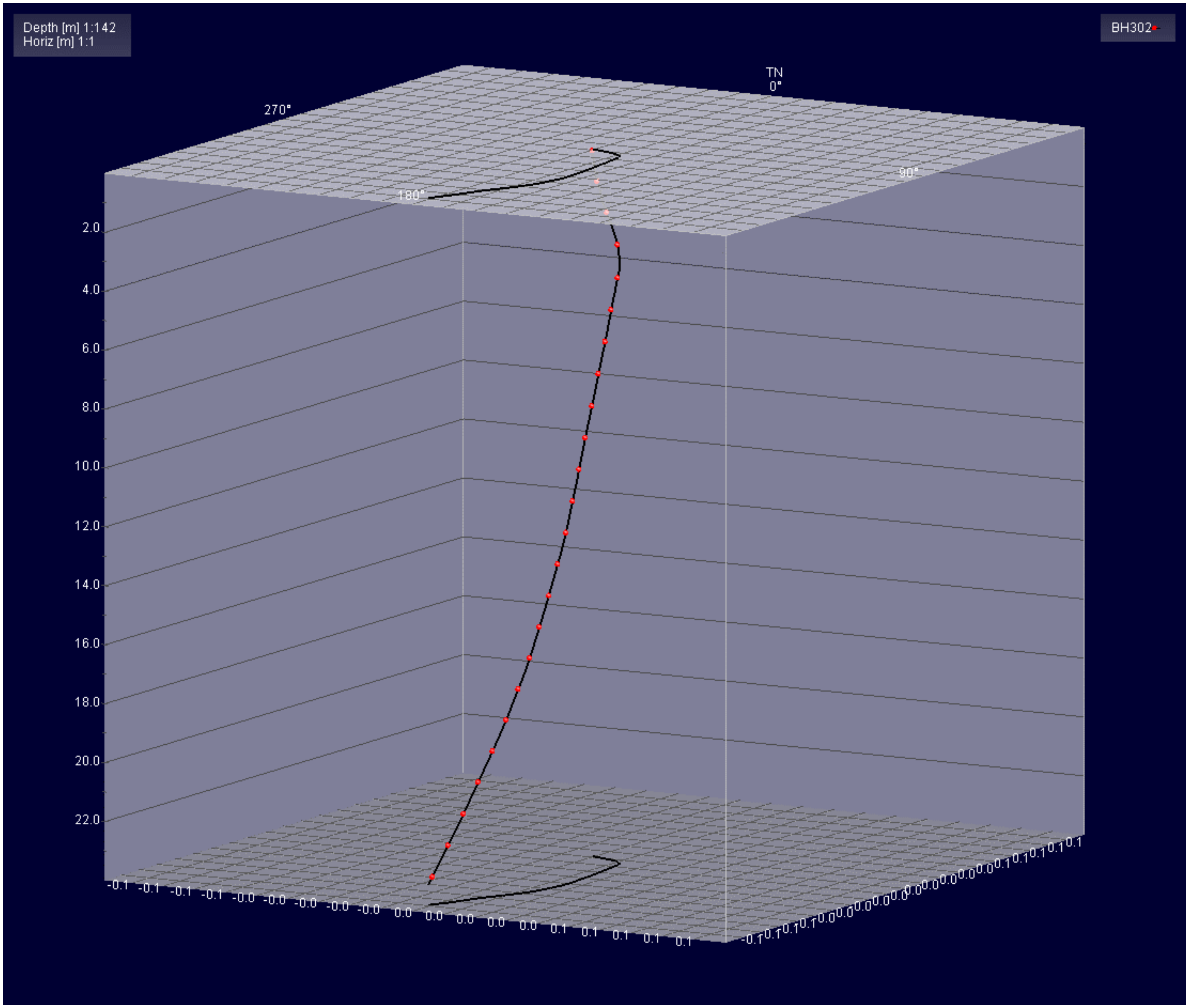
The data are presented in **Table 2** below.

Depth m	INCL DEGREE	AZ DEGREE	Easting [m]	Northing [m]	TVD [m]
0	0.11	124.15	0	0	0
1	0.17	106.75	0.001987	-0.00074	0.999998
2	0.28	110.64	0.00584	-0.00202	1.99999
3	0.34	132.18	0.010577	-0.00441	2.99997
4	0.24	177.29	0.013417	-0.00918	3.99996
5	0.25	172.13	0.01388	-0.0136	4.99995
6	0.24	175.07	0.014397	-0.01792	5.99994
7	0.27	172.88	0.014795	-0.02229	6.99993
8	0.26	174.45	0.015425	-0.02696	7.99992
9	0.23	176.19	0.015719	-0.03119	8.99991
10	0.23	174.93	0.01598	-0.03511	9.9999
11	0.22	179.25	0.016215	-0.0391	10.9999
12	0.23	179.98	0.016293	-0.04295	11.9999
13	0.23	188.59	0.015994	-0.04694	12.9999
14	0.22	189.45	0.015378	-0.05084	13.9999
15	0.23	192.39	0.014649	-0.05478	14.9999
16	0.21	199.77	0.013668	-0.05843	15.9999
17	0.24	204.32	0.012092	-0.06209	16.9998
18	0.25	205.43	0.010373	-0.06593	17.9998
19	0.27	206.88	0.00836	-0.06991	18.9998
20	0.3	200.83	0.0063	-0.07435	19.9998
21	0.31	199.04	0.004527	-0.07939	20.9998
22	0.31	203.19	0.002533	-0.08449	21.9998
23	0.31	205.2	0.000263	-0.08923	22.9998

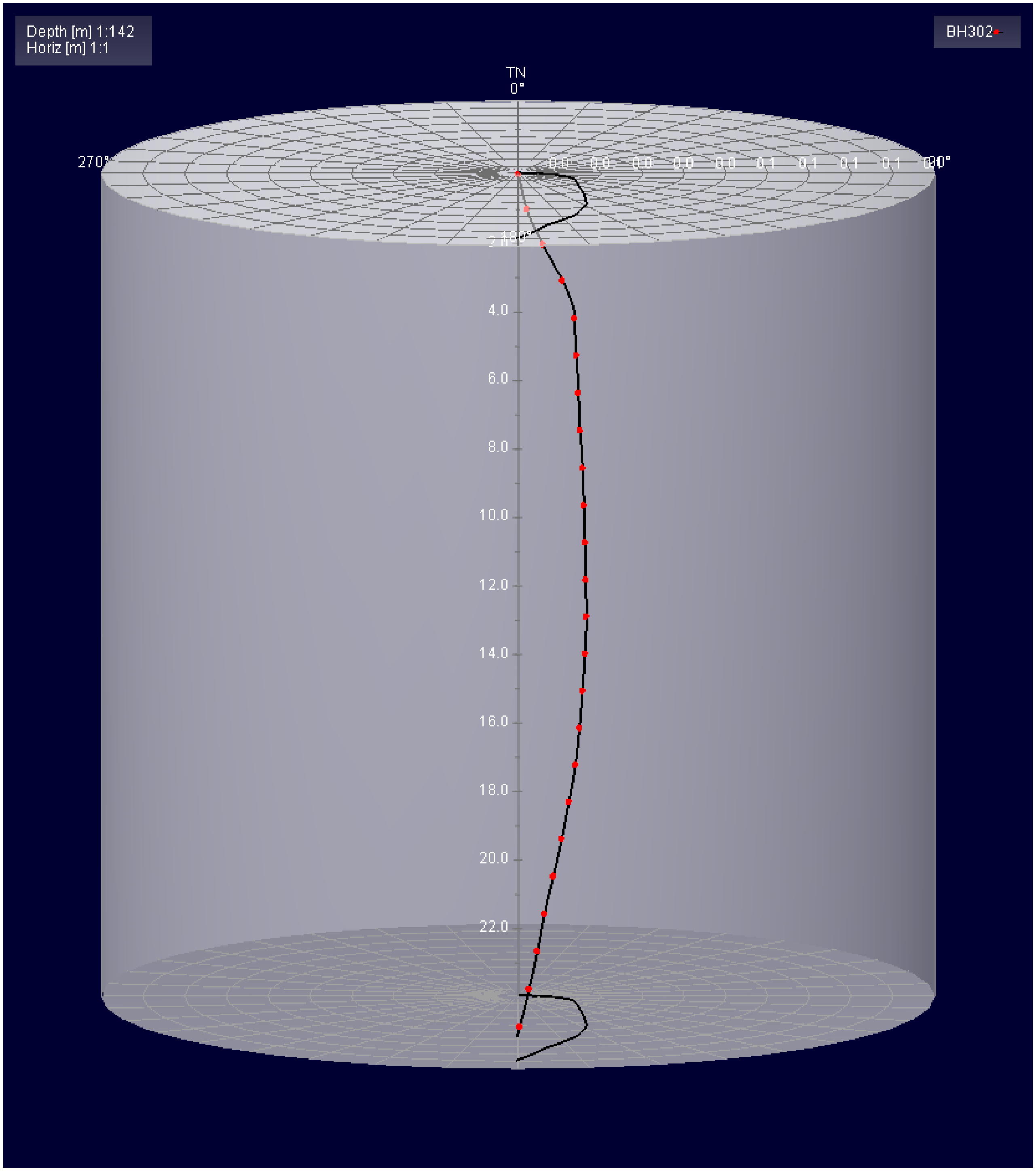
BH302 Bullseye Plot



BH302 Cubic Plot



BH302 Cylindrical Plot



Appendix 1

Tabulated interpreted features report for BH302

Feature ID	Midpoint mbgl	Dip deg.	Azimuth deg. MN	Interpreted feature description
1	3.48			Top of data
2	3.75	3	259	Bedding plane
3	3.76	12	249	Filled joint - FD > 10 mm
4	3.78	28	300	Filled joint - FD > 10 mm
5	3.80	33	306	Filled joint - FD > 10 mm
6	3.83	29	306	Filled joint - FD > 10 mm
7	3.85	36	267	Filled joint - FD > 10 mm
8	3.91	9	32	Bedding plane
9	4.03	5	103	Bedding plane
10	4.07	16	84	Bedding plane
11	4.08	16	97	Bedding plane
12	4.11	19	94	Bedding plane
13	4.13	16	99	Bedding plane
14	4.16	5	154	Bedding plane
15	4.20	29	30	Filled joint - FD > 10 mm
16	4.23	17	26	Filled joint - FD > 10 mm
17	4.25	5	193	Bedding plane
18	4.40	5	190	Bedding plane
19	4.42	5	218	Bedding plane
20	4.46	27	298	Filled joint - CT 1 mm to <10 mm
21	4.49	5	200	Bedding plane
22	4.54	3	135	Bedding plane
23	4.63	12	242	Filled joint - CT 1 mm to <10 mm
24	4.68	19	99	Filled joint - FD > 10 mm
25	4.70	46	127	Filled joint - FD > 10 mm
26	4.75	14	312	Filled joint - CT 1 mm to <10 mm
27	4.77	36	280	Filled joint - CT 1 mm to <10 mm
28	4.79	32	287	Filled joint - FD > 10 mm
29	4.80	36	136	Filled joint - FD > 10 mm
30	4.88	5	1	Bedding plane
31	4.99	5	301	Bedding plane
32	5.05	5	297	Bedding plane
33	5.14	15	256	Bedding plane
34	5.18	9	59	Bedding plane
35	5.51	2	67	Bedding plane
36	5.52	3	56	Bedding plane
37	5.67	17	329	Filled joint - FD > 10 mm
38	5.70	7	128	Bedding plane
39	5.89	5	338	Bedding plane

40	6.18	3	249	Bedding plane
41	6.35	4	47	Bedding plane
42	6.36	3	50	Bedding plane
43	6.49	4	51	Bedding plane
44	6.51	2	58	Bedding plane
45	6.67	3	173	Bedding plane
46	6.84	0	324	Bedding plane
47	6.87	3	41	Bedding plane
48	6.90	10	21	Bedding plane
49	6.95	67	260	Filled joint - CT 1 mm to <10 mm
50	6.96	3	301	Bedding plane
51	7.02	2	316	Bedding plane
52	7.16	0	260	Bedding plane
53	7.18	61	324	Filled joint - CT 1 mm to <10 mm
54	7.24	3	309	Bedding plane
55	7.27	7	274	Bedding plane
56	7.29	12	272	Bedding plane
57	7.30	60	334	Filled joint - CT 1 mm to <10 mm
58	7.30	10	265	Bedding plane
59	7.35	12	225	Bedding plane
60	7.36	3	186	Bedding plane
61	7.43	7	239	Bedding plane
62	7.45	7	228	Bedding plane
63	7.95	11	227	Bedding plane
64	7.98	7	246	Bedding plane
65	8.06	2	342	Bedding plane
66	8.12	7	53	Bedding plane
67	8.32	13	207	Bedding plane
68	8.43	23	185	Bedding plane
69	8.48	13	166	Bedding plane
70	8.51	17	170	Bedding plane
71	8.53	3	76	Bedding plane
72	8.63	2	320	Bedding plane
73	8.73	2	333	Bedding plane
74	8.87	2	121	Bedding plane
75	8.90	3	105	Bedding plane
76	9.12	1	308	Bedding plane
77	9.60	2	345	Bedding plane
78	9.62	1	150	Bedding plane
79	9.80	3	306	Bedding plane
80	10.02	8	279	Bedding plane
81	10.03	3	304	Bedding plane
82	10.15	18	276	Bedding plane
83	10.20	13	225	Bedding plane
84	10.34	3	260	Bedding plane

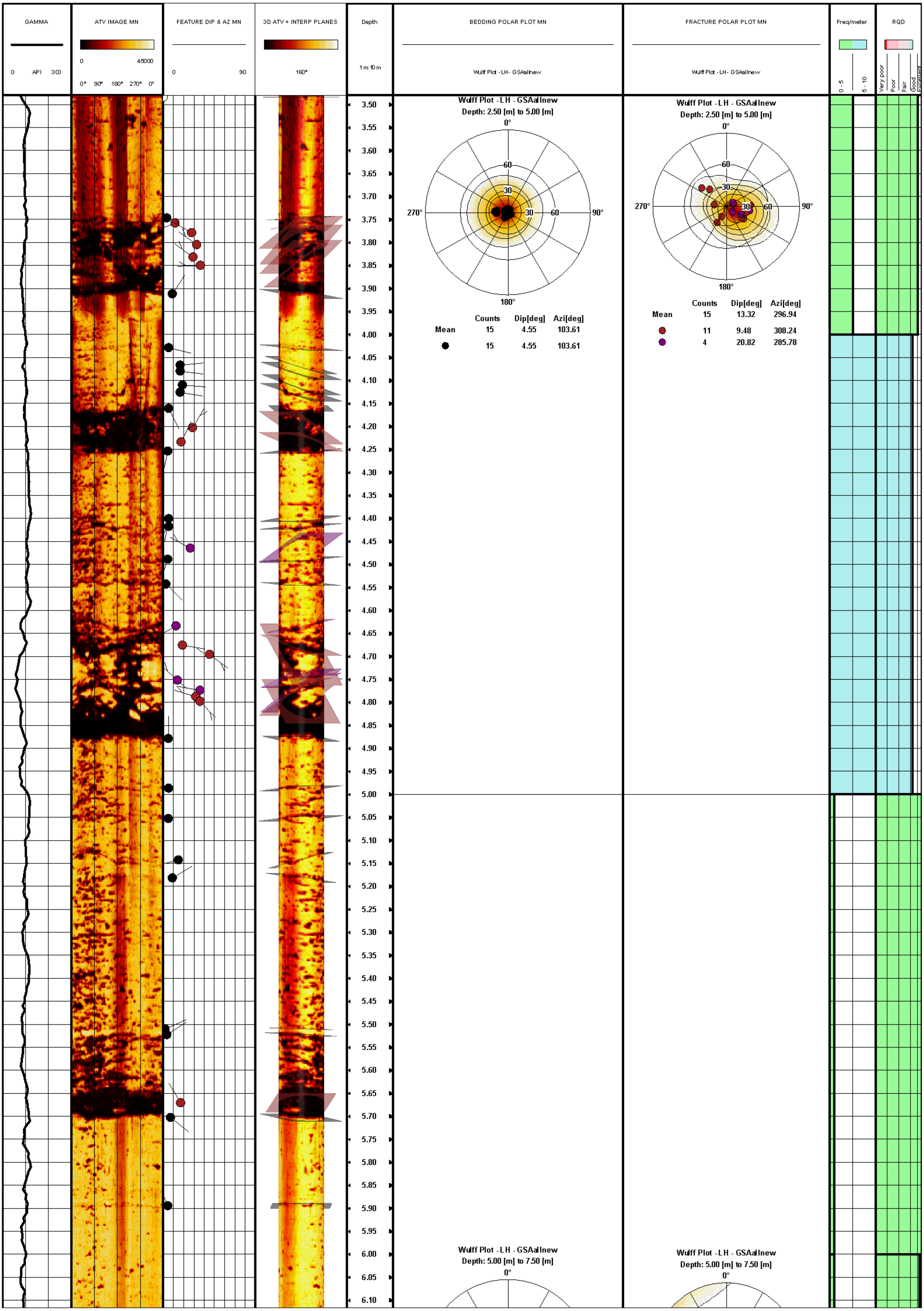
85	10.79	3	286	Bedding plane
86	10.85	3	264	Bedding plane
87	11.02	11	276	Bedding plane
88	11.05	2	289	Bedding plane
89	11.16	6	93	Bedding plane
90	11.21	3	184	Bedding plane
91	11.29	6	184	Bedding plane
92	11.30	8	173	Bedding plane
93	11.33	4	222	Bedding plane
94	11.35	35	193	Filled joint - FD > 10 mm
95	11.35	4	15	Bedding plane
96	11.38	33	154	Filled joint - CT 1 mm to <10 mm
97	11.41	32	297	Filled joint - CT 1 mm to <10 mm
98	11.48	35	45	Filled joint - CT 1 mm to <10 mm
99	11.60	58	298	Filled joint - CT 1 mm to <10 mm
100	11.85	9	327	Bedding plane
101	11.86	6	316	Bedding plane
102	11.88	16	298	Bedding plane
103	11.89	14	305	Bedding plane
104	11.95	3	292	Bedding plane
105	11.97	5	109	Bedding plane
106	12.05	12	303	Bedding plane
107	12.21	3	14	Bedding plane
108	12.30	10	316	Bedding plane
109	12.49	6	333	Bedding plane
110	13.00	6	212	Bedding plane
111	13.12	5	239	Bedding plane
112	13.51	3	309	Bedding plane
113	14.92	5	312	Bedding plane
114	15.20	8	248	Bedding plane
115	15.27	3	219	Bedding plane
116	15.56	2	339	Bedding plane
117	15.59	5	320	Bedding plane
118	15.60	3	324	Bedding plane
119	15.64	9	329	Bedding plane
120	15.80	5	315	Bedding plane
121	15.83	4	280	Bedding plane
122	15.84	3	295	Bedding plane
123	15.86	6	74	Bedding plane
124	15.88	8	87	Bedding plane
125	15.89	8	73	Bedding plane
126	16.03	6	248	Bedding plane
127	16.09	10	239	Bedding plane
128	16.09	10	238	Bedding plane
129	16.23	4	242	Bedding plane

130	16.30	5	193	Bedding plane
131	16.38	5	90	Bedding plane
132	16.48	2	303	Bedding plane
133	16.75	4	308	Bedding plane
134	16.94	5	245	Bedding plane
135	17.07	3	283	Bedding plane
136	17.38	3	311	Bedding plane
137	17.42	3	338	Bedding plane
138	17.74	8	324	Bedding plane
139	17.92	2	253	Bedding plane
140	17.95	3	220	Bedding plane
141	18.15	5	290	Bedding plane
142	18.27	5	266	Bedding plane
143	18.42	4	272	Bedding plane
144	18.44	3	304	Bedding plane
145	18.51	7	230	Bedding plane
146	18.84	5	87	Bedding plane
147	18.94	3	67	Bedding plane
148	18.97	3	93	Bedding plane
149	19.63	4	166	Bedding plane
150	19.76	5	112	Bedding plane
151	19.79	2	105	Bedding plane
152	20.26	77	250	Filled joint - CT 1 mm to <10 mm
153	20.47	3	238	Bedding plane
154	20.53	2	207	Bedding plane
155	21.18	3	135	Bedding plane
156	21.26	68	338	Filled joint - CT 1 mm to <10 mm
157	21.66	1	111	Bedding plane
158	21.78	14	260	Bedding plane
159	21.80	15	257	Bedding plane
160	23.49	1	254	Bedding plane
161	23.82	50	306	Filled joint - CT 1 mm to <10 mm
162	24.35			Base of data
Feature ID	**Midpoint mbgl**	**Dip deg.**	**Azimuth deg. MN**	**Interpreted feature description**

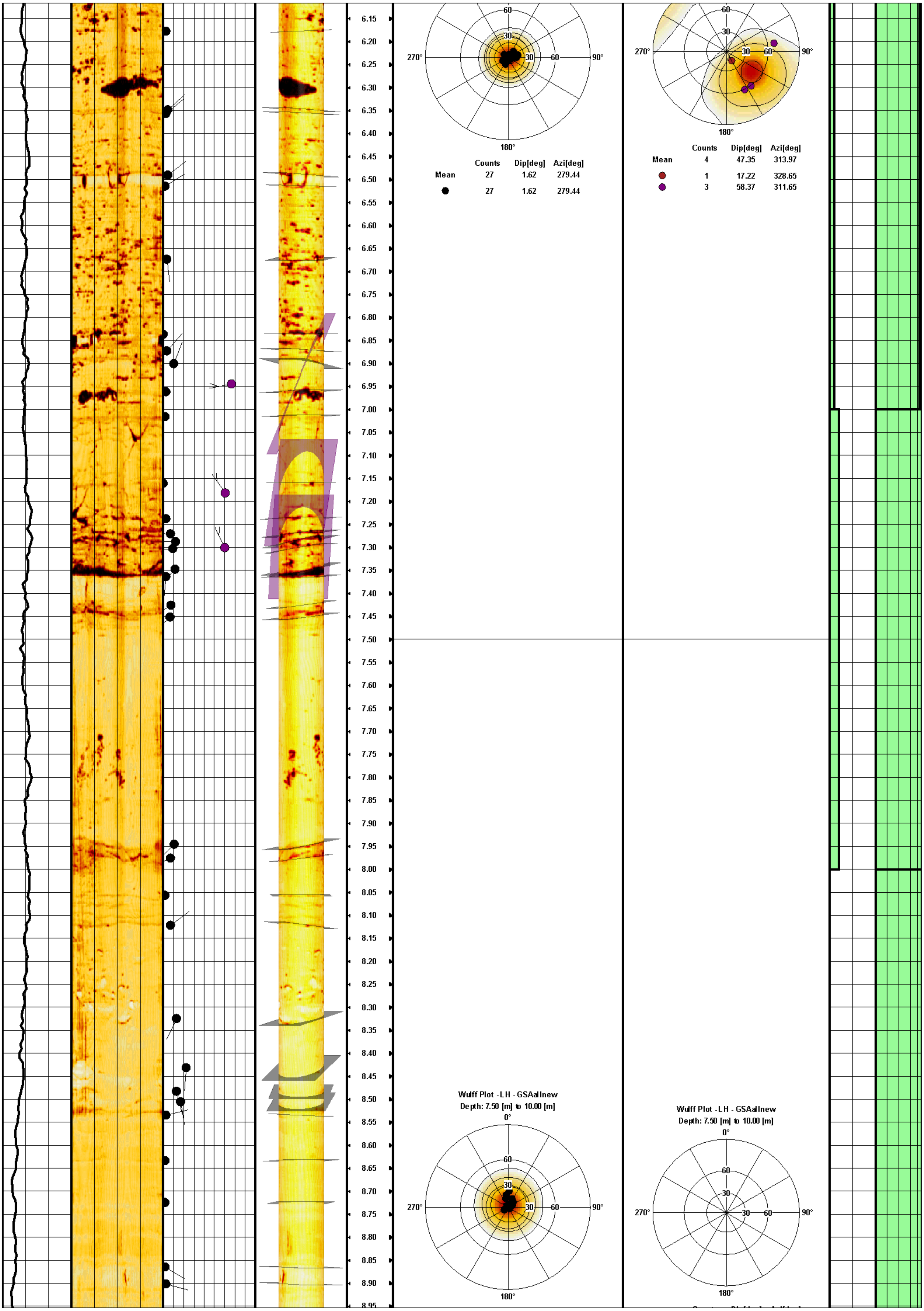
Appendix 2

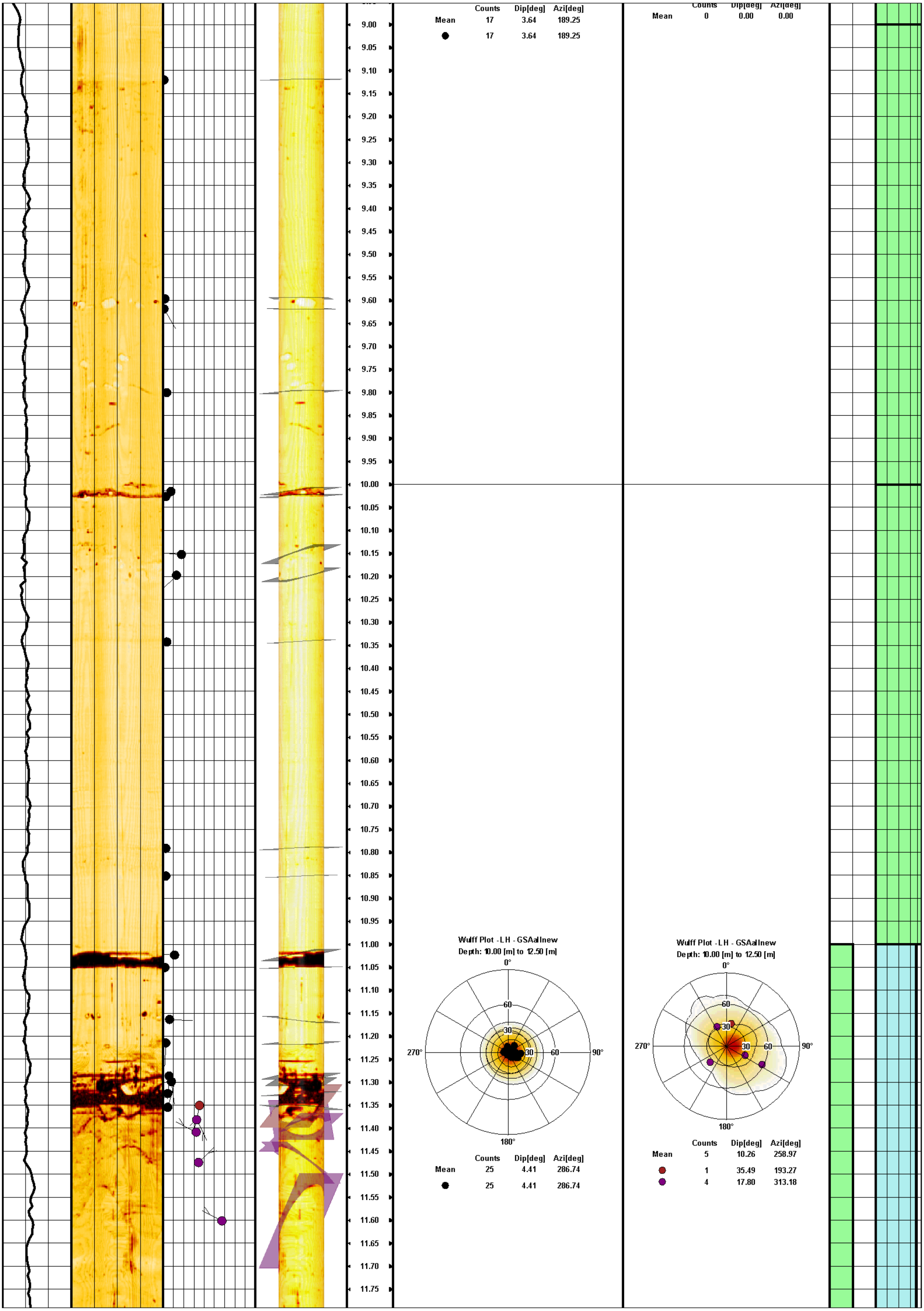
1:10 Interpretation logs

3.48 To 24.35 mbgl



GAMMA
0 API 300
ATV IMAGE MN
0 45000
0° 90° 180° 270° 0°
FEATURE DIP & AZ MN
0 90
3D ATV + INTERP PLANES
180°
Depth
1m:10m
BEDDING POLAR PLOT MN
Wulff Plot - LH - GSAallnew
FRACTURE POLAR PLOT MN
Wulff Plot - LH - GSAallnew
Freq/meter
0 - 5
5 - 10
RQD
Very poor
Poor
Fair
Good
Excellent
3.50 3.55 3.60 3.65 3.70 3.75 3.80 3.85 3.90 3.95 4.00 4.05 4.10 4.15 4.20 4.25 4.30 4.35 4.40 4.45 4.50 4.55 4.60 4.65 4.70 4.75 4.80 4.85 4.90 4.95 5.00 5.05 5.10 5.15 5.20 5.25 5.30 5.35 5.40 5.45 5.50 5.55 5.60 5.65 5.70 5.75 5.80 5.85 5.90 5.95 6.00 6.05 6.10
Wulff Plot - LH - GSAallnew
Depth: 2.50 [m] to 5.00 [m]
0° 90° 180° 270° 30 60
Counts Dip[deg] Azi[deg]
Mean 15 4.55 103.61
15 4.55 103.61
Wulff Plot - LH - GSAallnew
Depth: 2.50 [m] to 5.00 [m]
0° 90° 180° 270° 30 60
Counts Dip[deg] Azi[deg]
Mean 15 13.32 296.94
11 9.48 308.24
4 20.82 285.78
Wulff Plot - LH - GSAallnew
Depth: 5.00 [m] to 7.50 [m]
0°
Wulff Plot - LH - GSAallnew
Depth: 5.00 [m] to 7.50 [m]
0°


6.15
6.20
6.25
6.30
6.35
6.40
6.45
6.50
6.55
6.60
6.65
6.70
6.75
6.80
6.85
6.90
6.95
7.00
7.05
7.10
7.15
7.20
7.25
7.30
7.35
7.40
7.45
7.50
7.55
7.60
7.65
7.70
7.75
7.80
7.85
7.90
7.95
8.00
8.05
8.10
8.15
8.20
8.25
8.30
8.35
8.40
8.45
8.50
8.55
8.60
8.65
8.70
8.75
8.80
8.85
8.90
8.95
Counts Dip[deg] Azi[deg]
Mean 27 1.62 279.44
27 1.62 279.44
Counts Dip[deg] Azi[deg]
Mean 4 47.35 313.97
1 17.22 328.65
3 58.37 311.65
Wulff Plot - LH - GSAallnew
Depth: 7.50 [m] to 10.00 [m]
Wulff Plot - LH - GSAallnew
Depth: 7.50 [m] to 10.00 [m]
0°
90°
180°
270°



Counts Dip[deg] Azi[deg]
Mean 17 3.64 189.25
17 3.64 189.25
Counts Dip[deg] Azi[deg]
Mean 0 0.00 0.00
9.00
9.05
9.10
9.15
9.20
9.25
9.30
9.35
9.40
9.45
9.50
9.55
9.60
9.65
9.70
9.75
9.80
9.85
9.90
9.95
10.00
10.05
10.10
10.15
10.20
10.25
10.30
10.35
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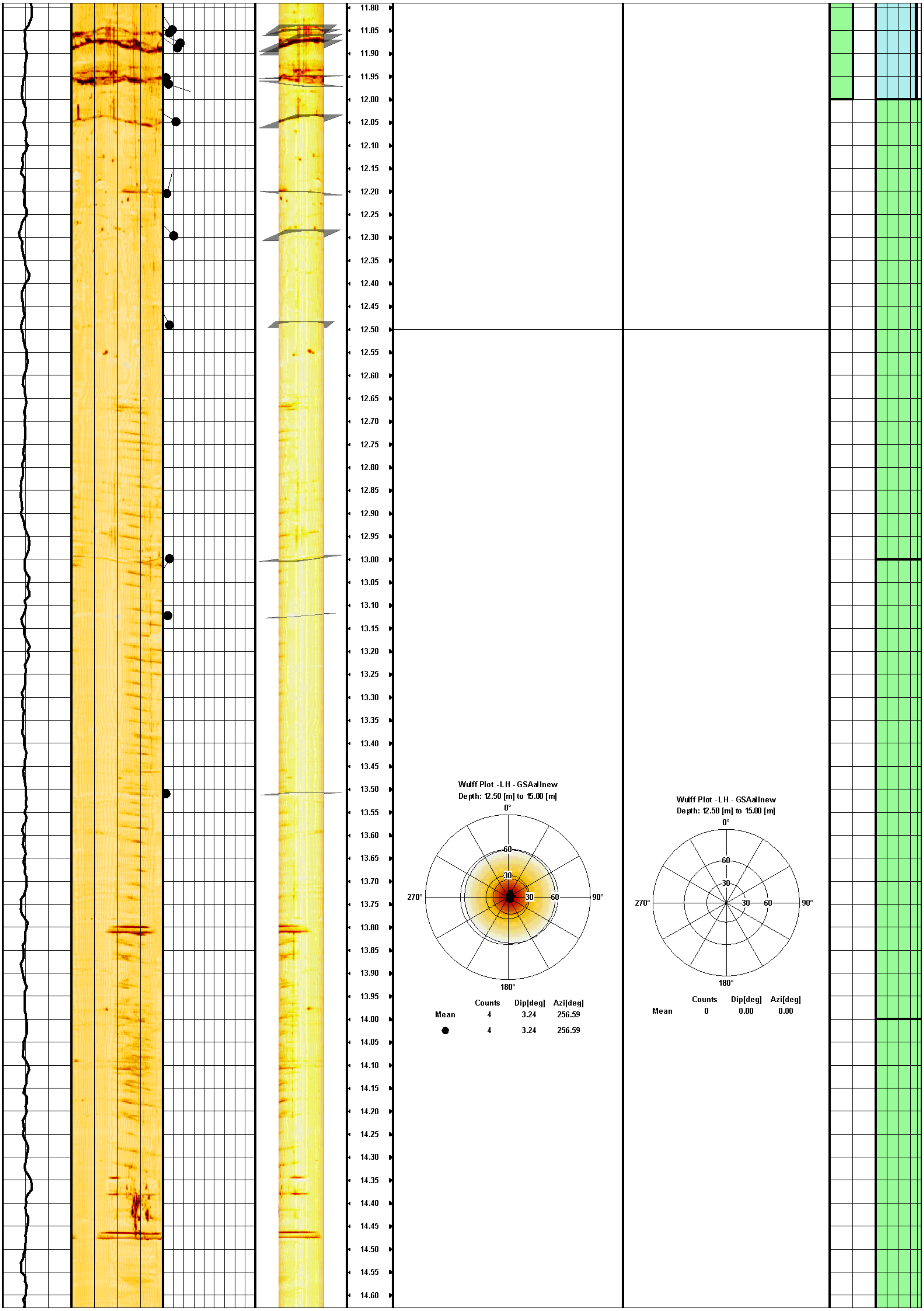
10.45
10.50
10.55
10.60
10.65
10.70
10.75
10.80
10.85
10.90
10.95
11.00
11.05
11.10
11.15
11.20
11.25
11.30
11.35
11.40
11.45
11.50
11.55
11.60
11.65
11.70
11.75
Wulff Plot - LH - GSAallnew
Depth: 10.00 [m] to 12.50 [m]
0°
90°
180°
270°
Counts Dip[deg] Azi[deg]
Mean 25 4.41 286.74
25 4.41 286.74
Wulff Plot - LH - GSAallnew
Depth: 10.00 [m] to 12.50 [m]
0°
90°
180°
270°
Counts Dip[deg] Azi[deg]
Mean 5 10.26 258.97
1 35.49 193.27
4 17.80 313.18


11.80
11.85
11.90
11.95
12.00
12.05
12.10
12.15
12.20
12.25
12.30
12.35
12.40
12.45
12.50
12.55
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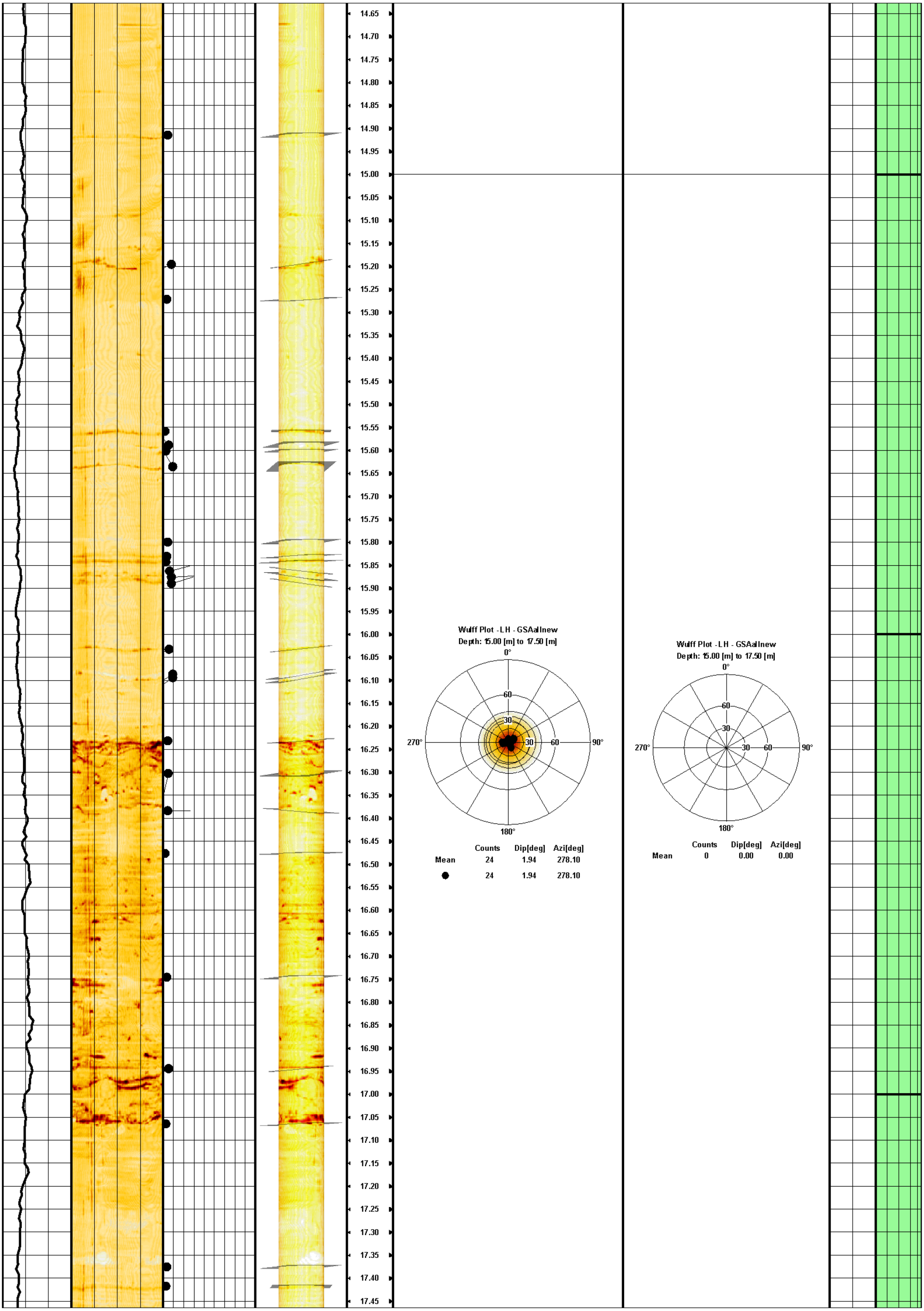
14.45
14.50
14.55
14.60
Wulff Plot - LH - GSAallnew
Depth: 12.50 [m] to 15.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 4 3.24 256.59
4 3.24 256.59
Wulff Plot - LH - GSAallnew
Depth: 12.50 [m] to 15.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 0 0.00 0.00


14.65
14.70
14.75
14.80
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15.75
15.80
15.85
15.90
15.95
16.00
16.05
16.10
16.15
16.20
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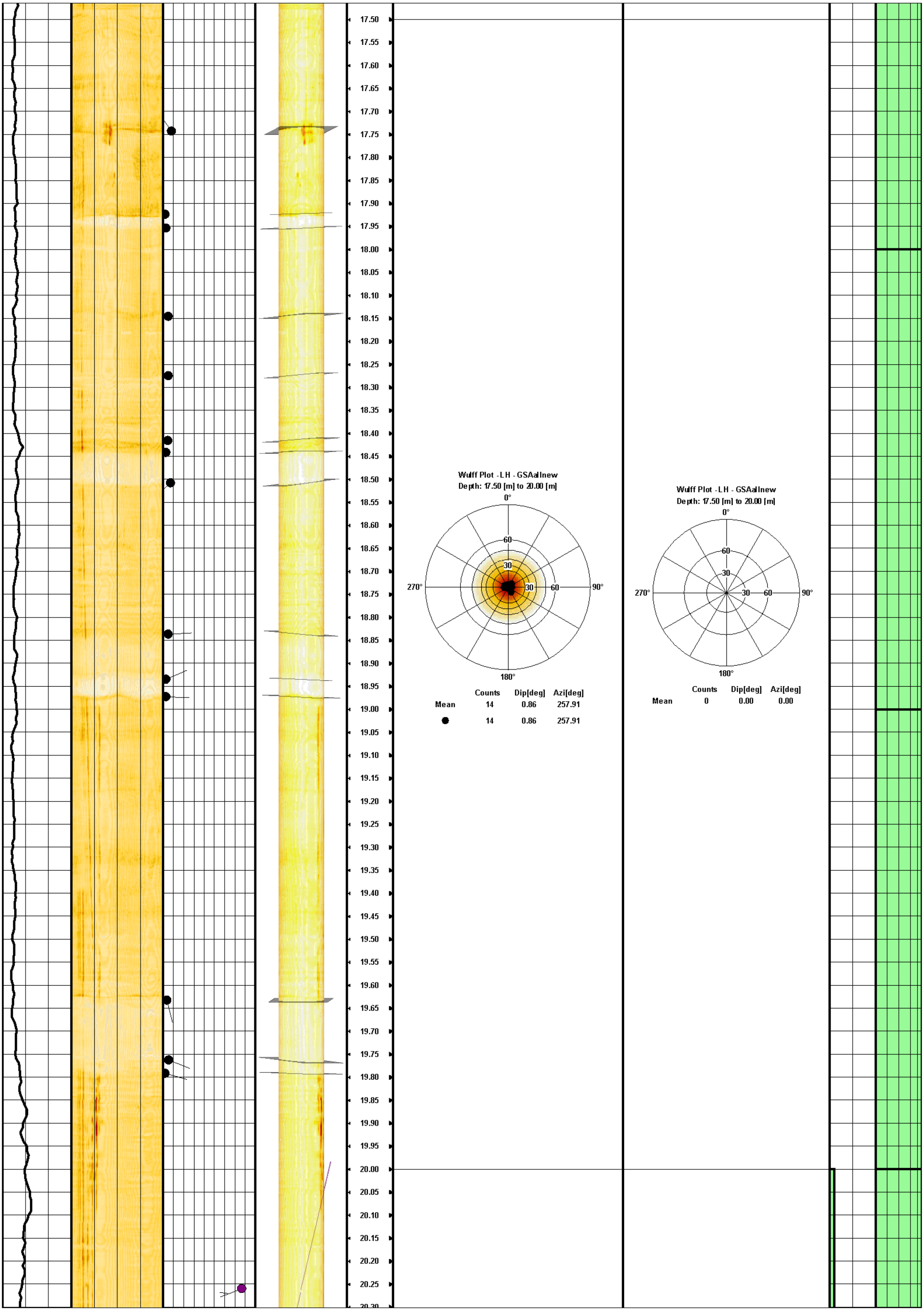
16.30
16.35
16.40
16.45
16.50
16.55
16.60
16.65
16.70
16.75
16.80
16.85
16.90
16.95
17.00
17.05
17.10
17.15
17.20
17.25
17.30
17.35
17.40
17.45
Wulff Plot - LH - GSAallnew
Depth: 15.00 [m] to 17.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 24 1.94 278.10
24 1.94 278.10
Wulff Plot - LH - GSAallnew
Depth: 15.00 [m] to 17.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 0 0.00 0.00


17.50
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18.00
18.05
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18.45
18.50
18.55
18.60
18.65
18.70
18.75
18.80
18.85
18.90
18.95
19.00
19.05
19.10
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19.20
19.25
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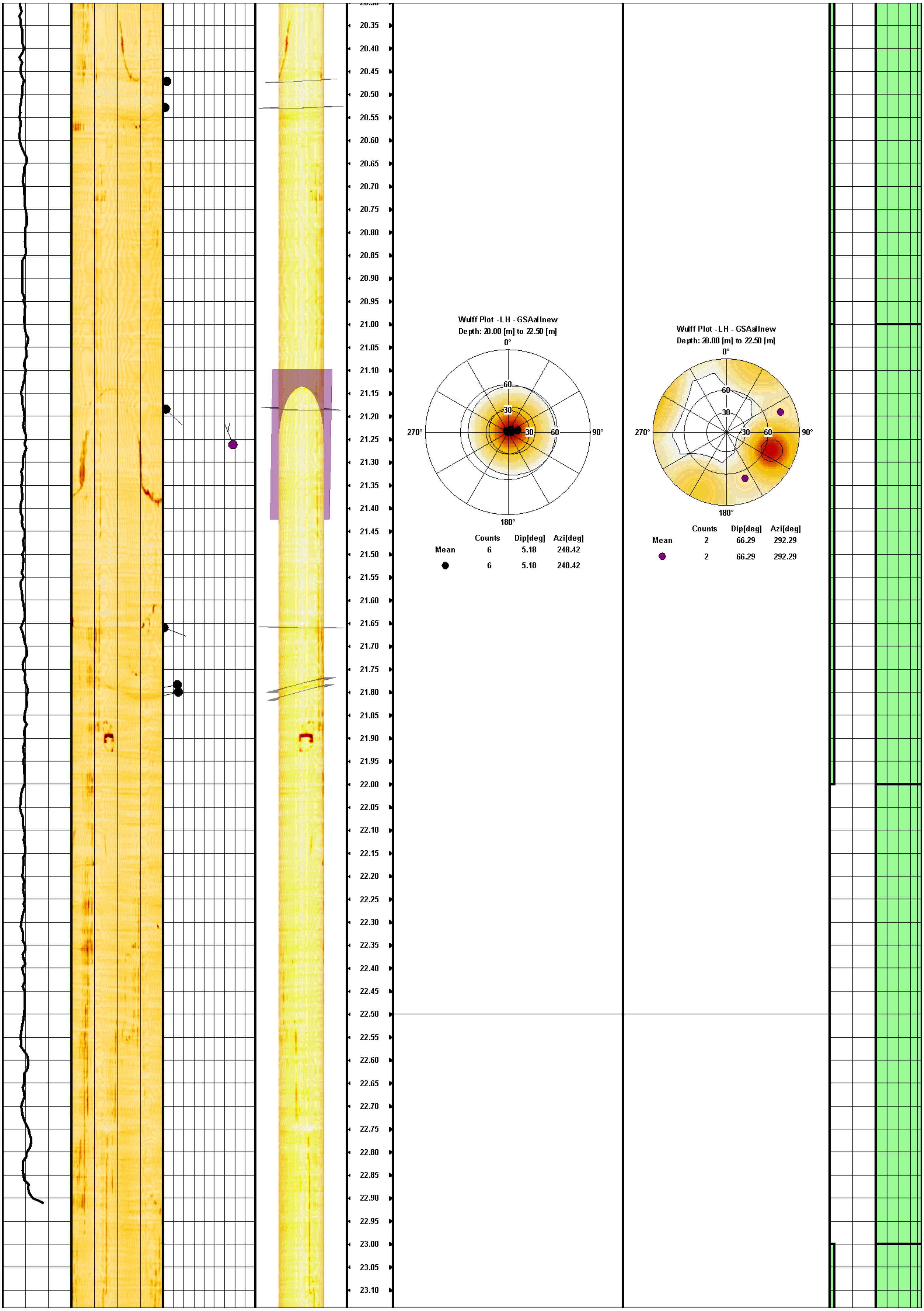
19.55
19.60
19.65
19.70
19.75
19.80
19.85
19.90
19.95
20.00
20.05
20.10
20.15
20.20
20.25
20.30
Wulff Plot - LH - GSAallnew
Depth: 17.50 [m] to 20.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 14 0.86 257.91
14 0.86 257.91
Wulff Plot - LH - GSAallnew
Depth: 17.50 [m] to 20.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 0 0.00 0.00


20.35
20.40
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20.50
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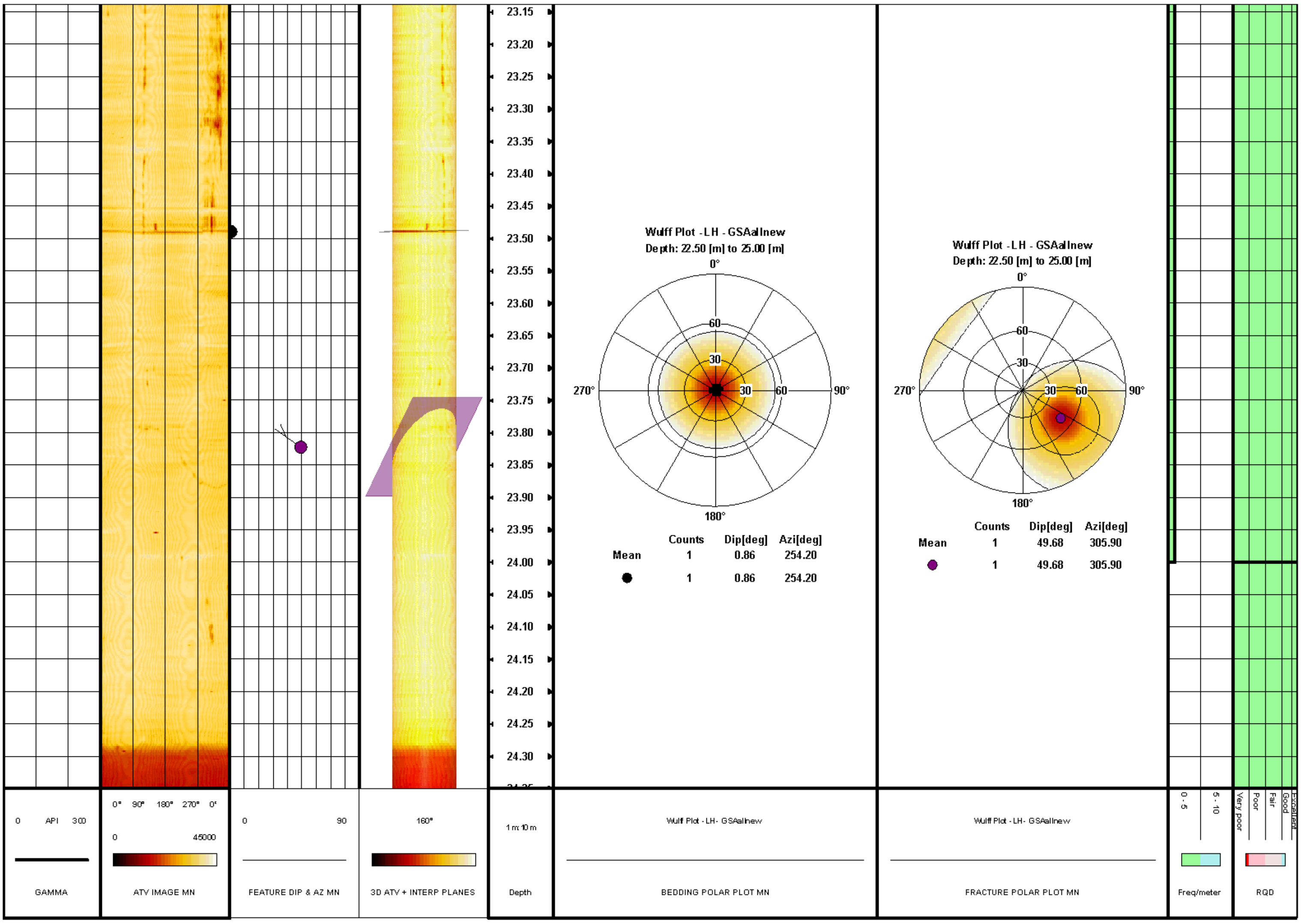
20.60
20.65
20.70
20.75
20.80
20.85
20.90
20.95
21.00
21.05
21.10
21.15
21.20
21.25
21.30
21.35
21.40
21.45
21.50
21.55
21.60
21.65
21.70
21.75
21.80
21.85
21.90
21.95
22.00
22.05
22.10
22.15
22.20
22.25
22.30
22.35
22.40
22.45
22.50
22.55
22.60
22.65
22.70
22.75
22.80
22.85
22.90
22.95
23.00
23.05
23.10
Wulff Plot - LH - GSAallnew
Depth: 20.00 [m] to 22.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 6 5.18 248.42
6 5.18 248.42
Wulff Plot - LH - GSAallnew
Depth: 20.00 [m] to 22.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 2 66.29 292.29
2 66.29 292.29



23.15
23.20
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24.05
24.10
24.15
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24.25
24.30
Wulff Plot - LH - GSAallnew
Depth: 22.50 [m] to 25.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 1 0.86 254.20
1 0.86 254.20
Wulff Plot - LH - GSAallnew
Depth: 22.50 [m] to 25.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 1 49.68 305.90
1 49.68 305.90
0 API 300
GAMMA
0° 90° 180° 270° 0°
0 45000
ATV IMAGE MN
0 90
FEATURE DIP & AZ MN
160°
3D ATV + INTERP PLANES
1 m: 10 m
Depth
Wulf Plot - LH - GSAallnew
BEDDING POLAR PLOT MN
Wulf Plot - LH - GSAallnew
FRACTURE POLAR PLOT MN
0 - 5
5 - 10
Freq/meter
Very poor
Poor
Fair
Good
Excellent
RQD

GROUNDSEARCH AUSTRALIA

Douglas Partners- Liverpool
402 Macquarie Street

Borehole - BH303

ATV Interpreted Features Report

Groundsearch Australia Pty. Limited
Issued: 16 May 2024

www.groundsearch.com.au

AMEC 2024 MEMBER
ASSOCIATION OF MINING AND EXPLORATION COMPANIES

DISCLAIMER

The data used in this report were obtained using equipment manufactured by LIM Logging/Electromind. The interpretations given in this report are based on judgement and experience of Groundsearch Australia's personnel. They are provided for Douglas Partner's 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 borehole that was drilled as a component of the 2024 site investigation programme for Douglas Partners- Liverpool.

LIM Logging BHTV acoustic televiewer logging tool was run to collect data in the field on 07 May 2024. The data in this report are from 2.81 to 23.65 mbgl.

The 356 identified features are interpreted as bedding planes and fractures. The bedding to fracture ratio is 16.8:1.

The LIM Logging 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** with density contours as pole vectors in the **lower hemisphere**.

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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 2024 site investigation programme for Douglas Partners- Liverpool.

LIM Logging BHTV acoustic televiewer logging tool was run to collect data in the field on 07 May 2024. The data in this report are from 2.81 to 23.65 mbgl.

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The ATV takes an oriented image of the borehole using high-resolution sound waves. The acoustic image is displayed as 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 180 measurements around the borehole at each high-resolution sample interval. These data can be oriented to Magnetic North and displayed in real-time while logging using the LIM BHTV Logging System.

Analysis software includes colour adjustment, fracture dip and dip direction 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 and by mudcake adhered to the borehole wall.

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. Both sides of the 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 inclination angle and azimuth 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 **Magnetic North**-referenced:

- Text summary of the interpreted features

- Logs that show geological features with their subjective 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:

    - Natural gamma
    - ATV image referenced to Magnetic North
    - Colour-coded tadpoles that represent feature dip and dip direction
    - Feature aperture in mm
    - 3D ATV image with feature planes
    - Bedding polar plot referenced to Magnetic North
    - Fracture polar plot referenced to Magnetic North
    - Fracture frequency/M
    - Defect RQD

- Table containing feature curve ID, midpoint mbgl, dip angle, dip azimuth, feature description and feature aperature.

- Feature density contour plots as pole vectors in the lower hemisphere

The Rock Quality Designation (RQD) is a measure of the degree of jointing of fractures in a rock mass with:

- Image sample interval = 0.1 m
- Image length reported = 1.0 m

RQD values are:

- <0.25 - very poor
- 0.25 - 0.50 - poor
- 0.50 - 0.75 - fair
- 0.75 - 0.90 - good
- 0.90 - 1.00 - excellent

3.0 BH303 interpretations

The 356 identified features are interpreted as bedding planes and fractures. The bedding to fracture ratio is 16.8:1.

The density contours for all interpreted features are shown in Figure 1. A description of each interpreted feature is presented in Appendix 1 and the combination log is presented in Appendix 2.

The 336 sedimentary features identified are bedding planes that appear to range in dip from flat-lying to 23^0.

The 20 fractures identified are classified as:

Table 1

Interval section	**Complete data 2.81 – 23.65 mbgl**		
Feature classification	**Feature count**	**Percentage**	**Dip range**
Filled joint - CT 1mm to <10mm	15	75%	10^0 to 82^0
Filled joint - FD >10mm	05	25%	20^0 to 25^0

The sedimentary features identified are classified as:

Interval section	**Complete data 2.81 – 23.65 mbgl**	
Feature classification	**Feature count**	**Dip range**
Bedding	336	00^0 to 23^0

Figures 1 to 5 present the orientation density contour plans for each feature set identified as pole vectors, MN, lower hemisphere.

Feature Dip is represented as 00^0 being the horizontal plane and 90^0 being the vertical plane.

Stereonets show the Feature Dip represented as 00^0 being the centre of the stereonet and 90^0 being the outer circle of the stereonet.

The standards used for reporting are outlined on the following page of this report.

	Code	Tadpole	Sine Wave	
2	Seam/zone base FZ			Fractured zone base
3	Seam/zone base			
4	Fracture plane - open			Fracture plane - open
5	Minor open fracture			Minor open fracture
6	Fracture plane - partially open			Fracture plane - partially open
7	Filled fracture			Filled fracture
8	Bedding plane open			Bedding plane open
9	Fracture plane - closed			Fracture plane - closed
10	Top of data			Top of data
11	Induced fracture			Induced fracture
12	SWL			SWL
13	Fault - FT			Level 1
14	Rocktype boundary			Rocktype boundary
15	Bedding separation plane			Bedding separation plane
16	Fracture plane - discontinuous			Fracture plane - discontinuous
17	Partially filled fracture			Partially filled fracture
18	Irregular vein			Irregular vein
19	Unconformity			Unconformity
20	Base of casing			Base of casing
21	Top of Coal Unit			Top of Coal Unit
22	Base of Coal Unit			Base of Coal Unit
23	Base of weathering			Base of weathering
24	Top of breakout			Top of breakout
25	Base of breakout			Base of breakout
26	Top of washout			Top of washout
27	Base of washout			Base of washout
28	Top of open fracture			Top of open fracture
29	Base of open fracture			Base of open fracture
30	Bedding plane partially open			Bedding plane partially open
31	Parting			Parting
32	Shear plane			Shear plane
33	Face cleat			Face cleat
34	Butt cleat			Butt cleat
35	Intrusive contact			Intrusive contact
36	Irregular fracture			Irregular fracture
37	Open joint >5 mm aperture			Level 2
38	Closed joint <5 mm aperture			Level 3
39	Vein			Level 3
40	Filled joint - SN			Level 3
41	Filled joint - VN <1 mm			Level 3
42	Filled joint - CT 1 mm to <10 mm			Level 3
43	Filled joint - FD > 10 mm			Level 3
44	Lithozone boundary			Lithozone boundary
45	Bedding plane			
46	Top of mineralisation			
47	Base of mineralisation			
48	Crossbedding			

Figure 1 BH303 interpreted features density contours – pole vectors, MN, lower hemisphere

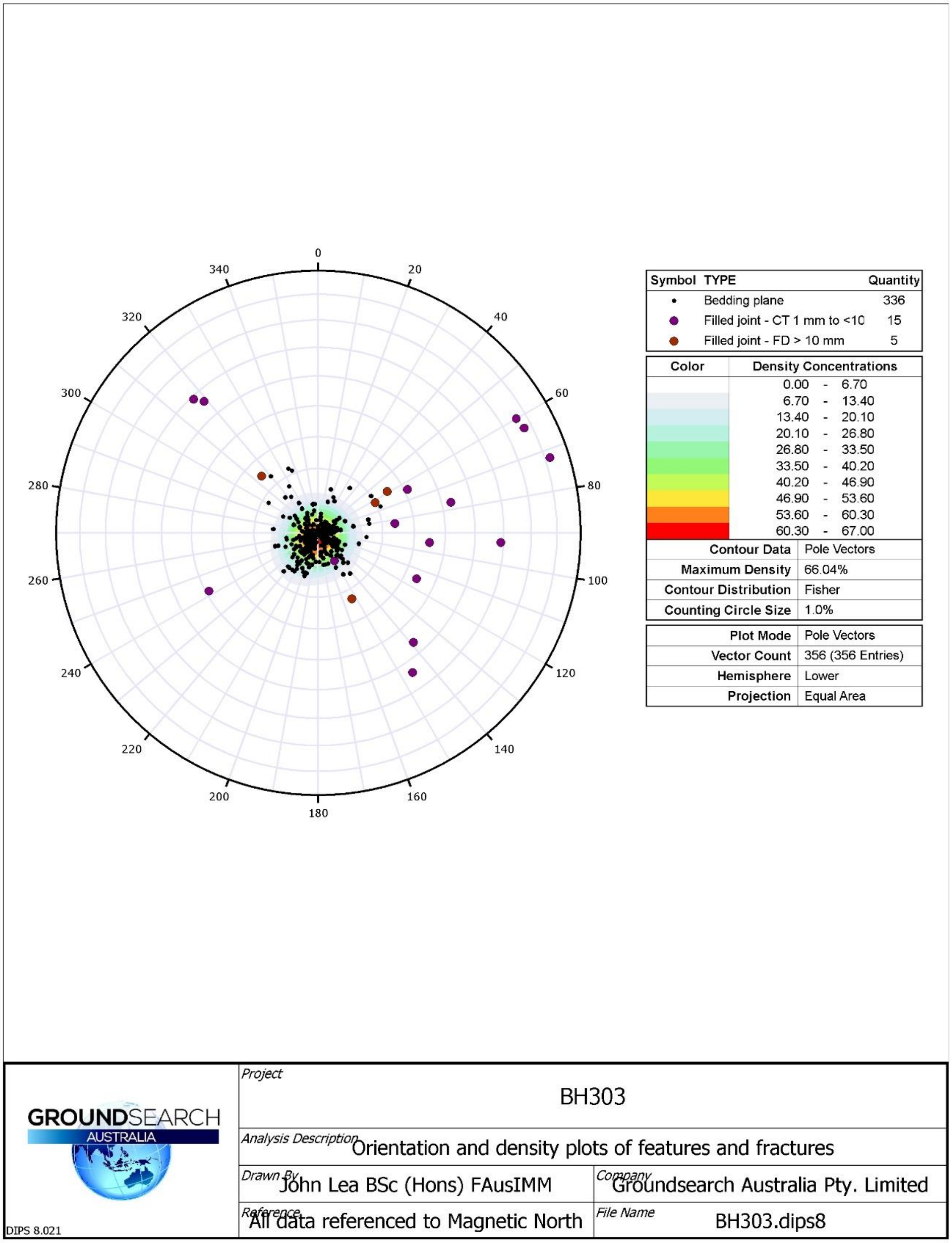
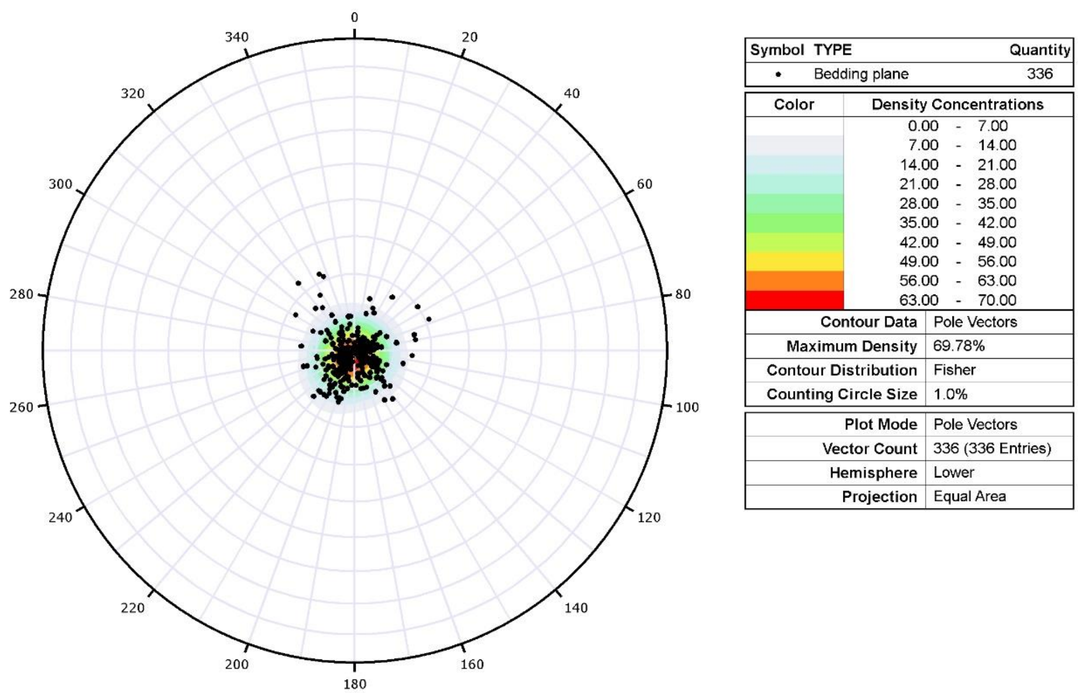
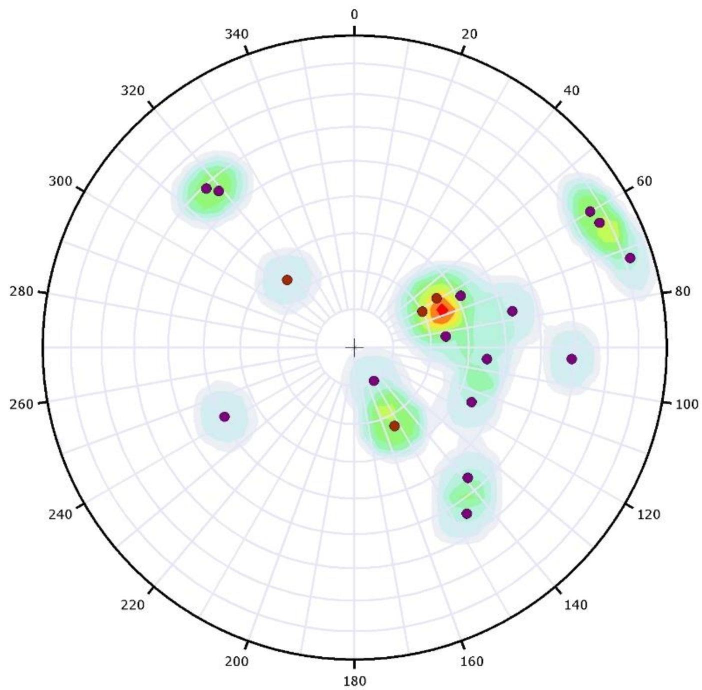


Figure 2 BH303 bedding orientation plan – pole vectors, MN, lower hemisphere



GROUNDSEARCH AUSTRALIA	*Project* BH303	
	Analysis Description Orientation and density plots of features and fractures	
	Drawn By John Lea BSc (Hons) FAusIMM	*Company* Groundsearch Australia Pty. Limited
DIPS 8.021	*Reference* All data referenced to Magnetic North	*File Name* BH303.dips8

Figure 3 BH303 fractures orientation density contour plan – pole vectors, MN, lower hemisphere



Symbol	TYPE	Quantity
● (purple)	Filled joint - CT 1 mm to <10	15
● (brown)	Filled joint - FD > 10 mm	5

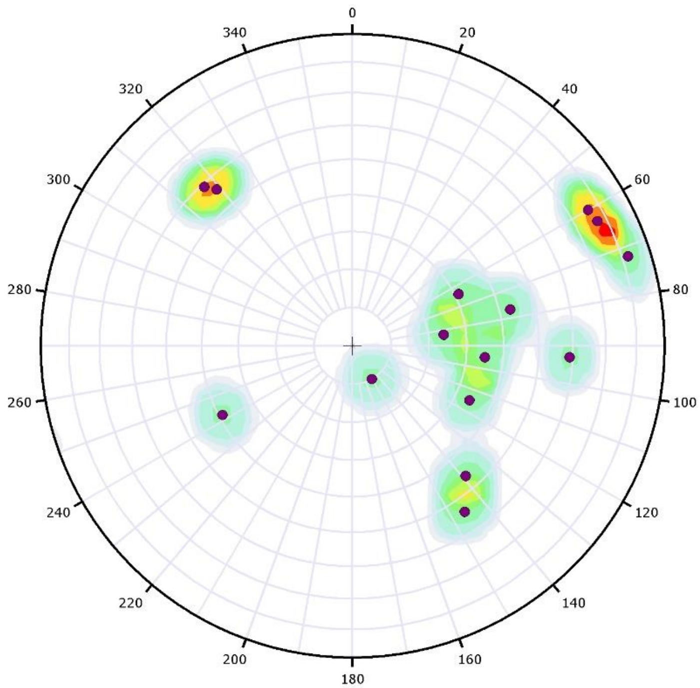
Color	Density Concentrations
	0.00 - 1.70
	1.70 - 3.40
	3.40 - 5.10
	5.10 - 6.80
	6.80 - 8.50
	8.50 - 10.20
	10.20 - 11.90
	11.90 - 13.60
	13.60 - 15.30
	15.30 - 17.00

Contour Data	Pole Vectors
Maximum Density	16.73%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	20 (20 Entries)
Hemisphere	Lower
Projection	Equal Area

GROUNDSEARCH AUSTRALIA	*Project* BH303	
	Analysis Description Orientation and density plots of features and fractures	
	Drawn By John Lea BSc (Hons) FAusIMM	*Company* Groundsearch Australia Pty. Limited
DIPS 8.021	*Reference* All data referenced to Magnetic North	*File Name* BH303.dips8

Figure 4 BH303 filled joint – CT 1mm to <10mm density contour plan - pole vectors, MN, lower hemisphere



Symbol	TYPE	Quantity
●	Filled joint - CT 1 mm to <10	15

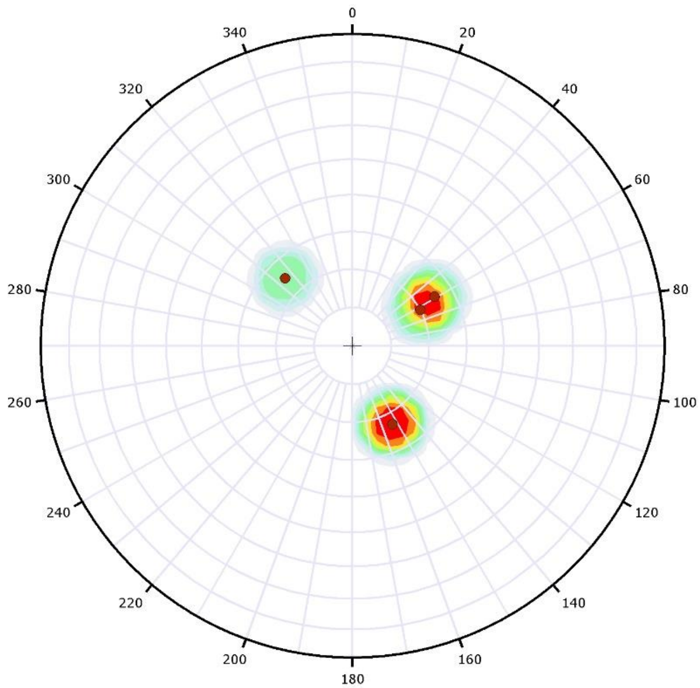
Color	Density Concentrations
	0.00 - 1.60
	1.60 - 3.20
	3.20 - 4.80
	4.80 - 6.40
	6.40 - 8.00
	8.00 - 9.60
	9.60 - 11.20
	11.20 - 12.80
	12.80 - 14.40
	14.40 - 16.00

Contour Data	Pole Vectors
Maximum Density	15.08%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	15 (15 Entries)
Hemisphere	Lower
Projection	Equal Area

GROUNDSEARCH AUSTRALIA	Project: BH303	
	Analysis Description: Orientation and density plots of features and fractures	
	Drawn By: John Lea BSc (Hons) FAusIMM	Company: Groundsearch Australia Pty. Limited
DIPS 8.021	Reference: All data referenced to Magnetic North	File Name: BH303.dips8

Figure 5 BH303 filled joint – FD >10mm density contour plan - pole vectors, MN, lower hemisphere



Symbol	TYPE	Quantity
●	Filled joint - FD > 10 mm	5

Color	Density Concentrations
	0.00 - 4.00
	4.00 - 8.00
	8.00 - 12.00
	12.00 - 16.00
	16.00 - 20.00
	20.00 - 24.00
	24.00 - 28.00
	28.00 - 32.00
	32.00 - 36.00
	36.00 - 40.00

Contour Data	Pole Vectors
Maximum Density	39.73%
Contour Distribution	Fisher
Counting Circle Size	1.0%

Plot Mode	Pole Vectors
Vector Count	5 (5 Entries)
Hemisphere	Lower
Projection	Equal Area

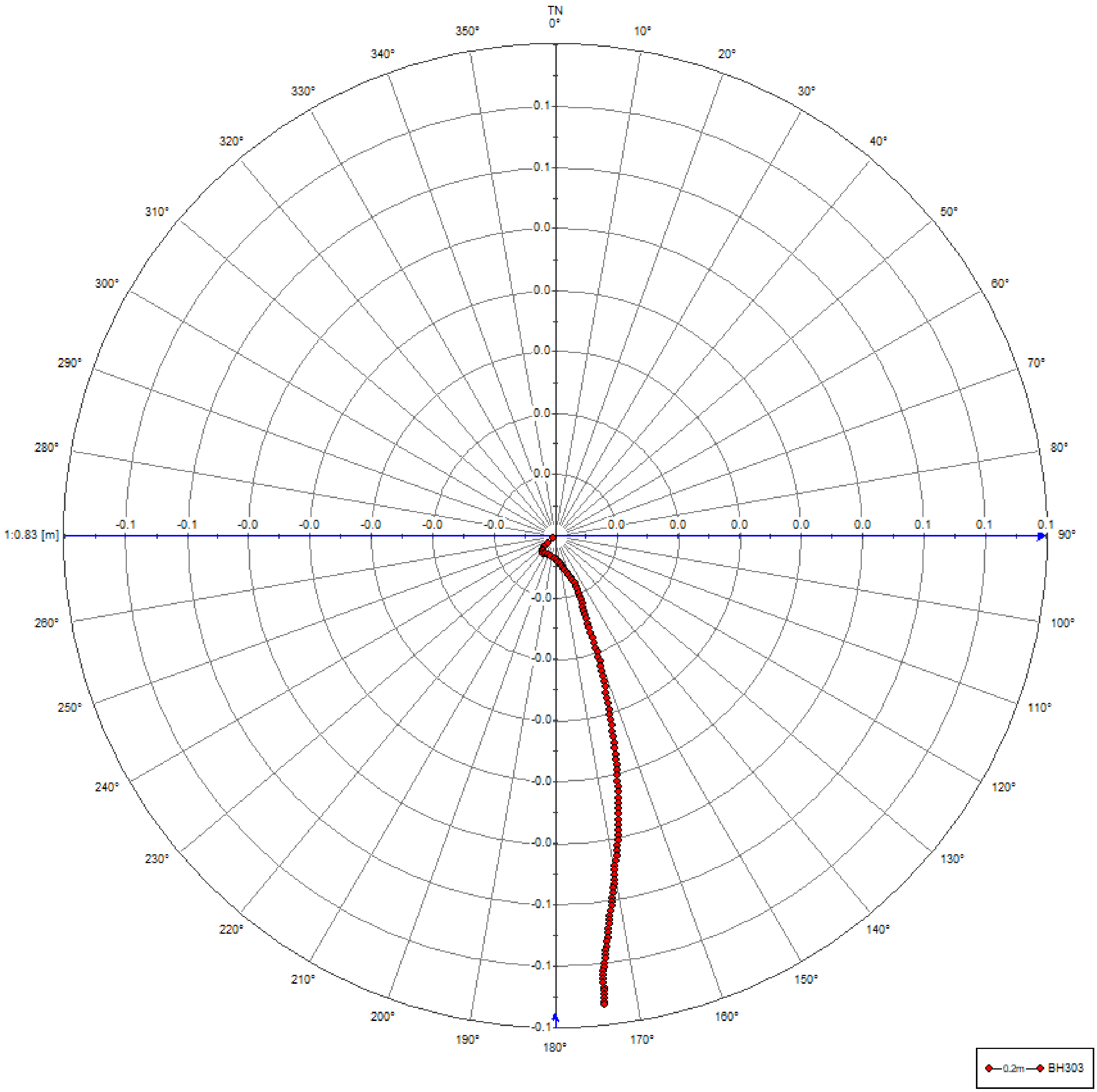
GROUNDSEARCH AUSTRALIA	*Project* BH303	
	Analysis Description Orientation and density plots of features and fractures	
	Drawn By John Lea BSc (Hons) FAusIMM	*Company* Groundsearch Australia Pty. Limited
DIPS 8.021	*Reference* All data referenced to Magnetic North	*File Name* BH303.dips8

4.0 BH303 borehole deviation data

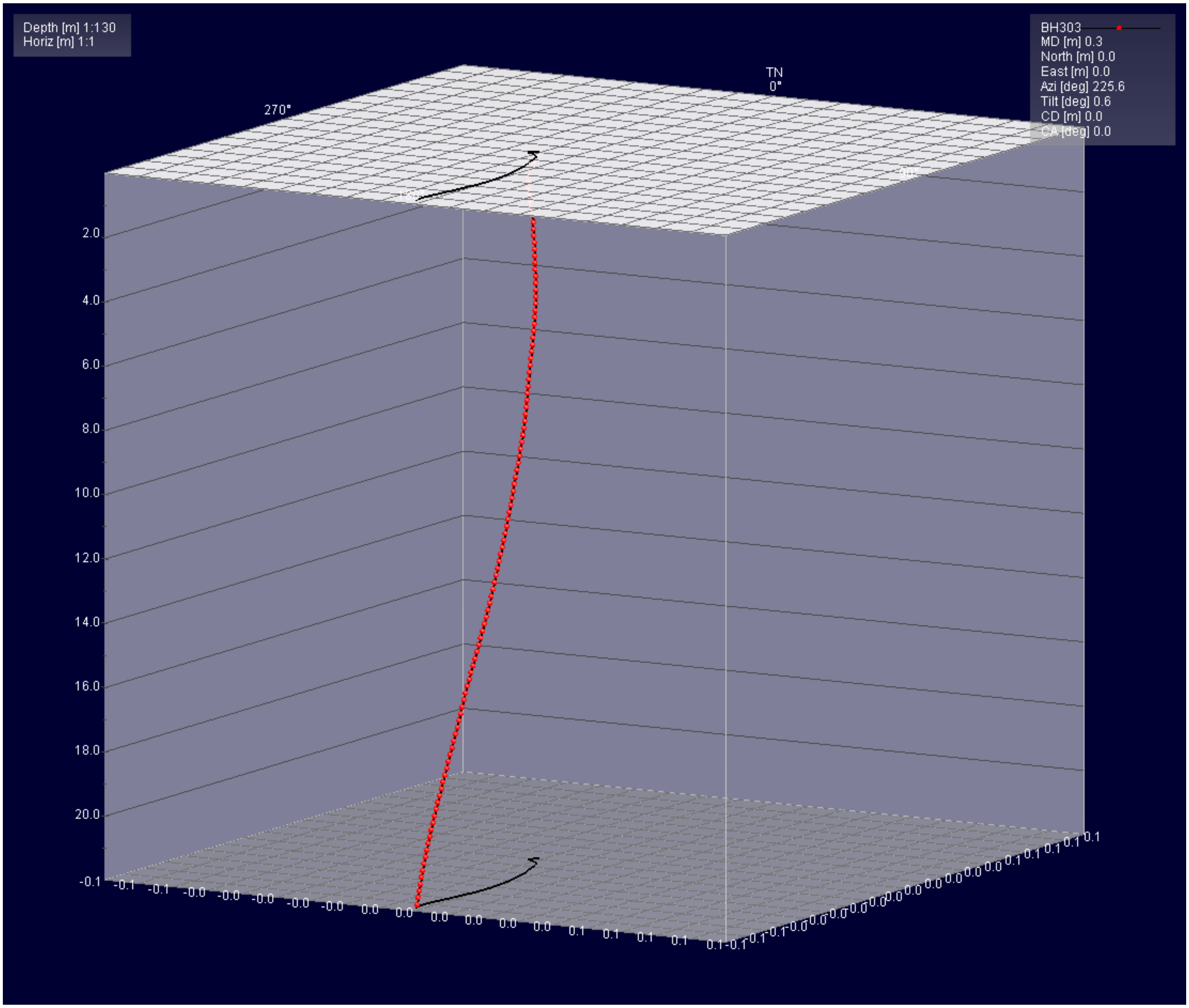
The data are presented in **Table 2** below.

Depth m	INCL DEGREE	AZ DEGREE	Easting [m]	Northing [m]	TVD [m]
0	0.45	225.71	0	0	0
1	0.1	205.85	-0.00383	-0.00403	0.999982
2	0.16	117.79	-0.00243	-0.00504	1.99998
3	0.11	143.1	-0.00073	-0.00665	2.99998
4	0.16	143.62	0.000704	-0.00848	3.99997
5	0.17	158.36	0.002098	-0.01104	4.99997
6	0.18	163.77	0.002929	-0.01388	5.99997
7	0.24	161.81	0.004007	-0.01759	6.99996
8	0.22	163.99	0.005283	-0.02138	7.99995
9	0.26	169.41	0.006196	-0.02542	8.99994
10	0.26	169.44	0.006964	-0.02994	9.99993
11	0.27	171.85	0.007736	-0.03446	10.9999
12	0.25	175.03	0.008255	-0.03901	11.9999
13	0.25	176.24	0.008519	-0.04339	12.9999
14	0.26	180.26	0.008587	-0.04785	13.9999
15	0.24	185.56	0.008414	-0.05221	14.9999
16	0.22	185.58	0.00794	-0.05616	15.9999
17	0.21	186.71	0.007655	-0.05982	16.9999
18	0.21	187.92	0.007181	-0.06345	17.9999
19	0.21	187.17	0.006717	-0.06709	18.9999
20	0.19	186.48	0.006292	-0.07051	19.9998
21	0.19	179.46	0.006093	-0.07383	20.9998
22	0.17	177.03	0.006231	-0.07696	21.9998

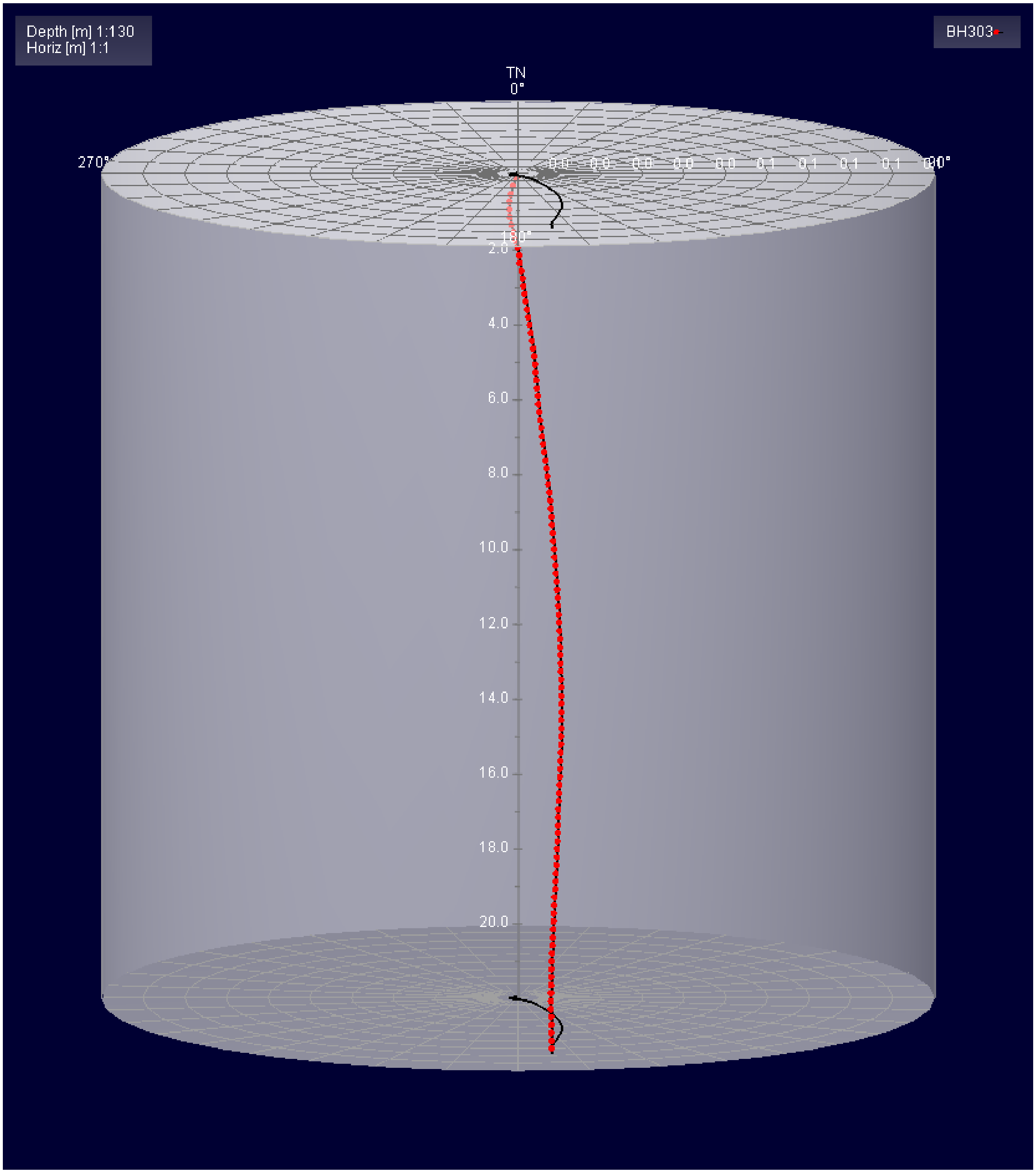
BH303 Bullseye Plot



BH303 Cubic Plot



BH303 Cylindrical Plot



Appendix 1

Tabulated interpreted features report for BH303

Feature ID	Midpoint mbgl	Dip deg.	Azimuth deg. MN	Interpreted feature description
1	2.81			Top of data
2	2.83	23	140	Bedding plane
3	2.86	25	135	Filled joint - FD > 10 mm
4	2.88	18	121	Bedding plane
5	2.97	3	199	Bedding plane
6	2.97	1	266	Bedding plane
7	3.04	14	196	Bedding plane
8	3.04	23	333	Filled joint - FD > 10 mm
9	3.07	11	147	Bedding plane
10	3.13	12	320	Bedding plane
11	3.15	9	294	Bedding plane
12	3.16	2	319	Bedding plane
13	3.16	3	316	Bedding plane
14	3.17	2	318	Bedding plane
15	3.18	5	295	Bedding plane
16	3.19	9	358	Bedding plane
17	3.21	14	18	Bedding plane
18	3.24	5	123	Bedding plane
19	3.25	7	169	Bedding plane
20	3.27	15	137	Bedding plane
21	3.31	1	324	Bedding plane
22	3.32	3	140	Bedding plane
23	3.39	10	315	Bedding plane
24	3.40	9	319	Bedding plane
25	3.43	6	138	Bedding plane
26	3.44	5	143	Bedding plane
27	3.48	10	197	Bedding plane
28	3.49	11	207	Bedding plane
29	3.54	4	243	Bedding plane
30	3.55	3	244	Bedding plane
31	3.65	9	67	Bedding plane
32	3.69	10	40	Bedding plane
33	3.78	10	31	Bedding plane
34	3.84	7	15	Bedding plane
35	3.93	46	319	Filled joint - CT 1 mm to <10 mm
36	3.95	3	66	Bedding plane
37	3.96	2	67	Bedding plane
38	3.99	8	331	Bedding plane
39	4.01	6	353	Bedding plane

40	4.03	5	13	Bedding plane
41	4.04	3	12	Bedding plane
42	4.10	8	59	Bedding plane
43	4.12	9	56	Bedding plane
44	4.13	8	40	Bedding plane
45	4.20	43	257	Filled joint - CT 1 mm to <10 mm
46	4.20	10	48	Bedding plane
47	4.21	10	49	Bedding plane
48	4.27	31	244	Filled joint - CT 1 mm to <10 mm
49	4.45	9	169	Bedding plane
50	4.47	9	173	Bedding plane
51	4.75	5	73	Bedding plane
52	4.75	3	50	Bedding plane
53	4.77	4	71	Bedding plane
54	4.82	3	57	Bedding plane
55	4.88	3	75	Bedding plane
56	4.89	2	68	Bedding plane
57	4.90	4	55	Bedding plane
58	4.91	8	42	Bedding plane
59	4.95	7	55	Bedding plane
60	4.97	4	63	Bedding plane
61	4.98	3	45	Bedding plane
62	4.99	4	35	Bedding plane
63	4.99	3	91	Bedding plane
64	5.02	10	78	Bedding plane
65	5.05	7	18	Bedding plane
66	5.06	6	340	Bedding plane
67	5.08	4	219	Bedding plane
68	5.09	3	230	Bedding plane
69	5.09	2	217	Bedding plane
70	5.10	3	218	Bedding plane
71	5.11	2	262	Bedding plane
72	5.12	4	332	Bedding plane
73	5.22	5	57	Bedding plane
74	5.27	10	81	Bedding plane
75	5.33	6	81	Bedding plane
76	5.40	5	73	Bedding plane
77	5.42	3	53	Bedding plane
78	5.44	5	50	Bedding plane
79	5.48	4	58	Bedding plane
80	5.51	5	29	Bedding plane
81	5.56	5	267	Bedding plane
82	5.59	5	245	Bedding plane
83	5.60	4	236	Bedding plane
84	5.69	4	59	Bedding plane

85	5.70	4	37	Bedding plane
86	5.77	3	300	Bedding plane
87	5.80	6	24	Bedding plane
88	5.91	56	139	Filled joint - CT 1 mm to <10 mm
89	5.93	59	137	Filled joint - CT 1 mm to <10 mm
90	5.96	5	38	Bedding plane
91	6.16	6	41	Bedding plane
92	6.18	5	41	Bedding plane
93	6.23	6	68	Bedding plane
94	6.31	9	25	Bedding plane
95	6.37	2	46	Bedding plane
96	6.40	4	63	Bedding plane
97	6.49	2	52	Bedding plane
98	6.50	3	53	Bedding plane
99	6.60	4	58	Bedding plane
100	6.73	3	61	Bedding plane
101	6.74	1	38	Bedding plane
102	6.78	5	44	Bedding plane
103	6.79	3	53	Bedding plane
104	6.81	4	18	Bedding plane
105	6.81	4	33	Bedding plane
106	6.82	3	34	Bedding plane
107	6.83	3	28	Bedding plane
108	6.90	6	68	Bedding plane
109	6.92	2	46	Bedding plane
110	6.97	76	240	Filled joint - CT 1 mm to <10 mm
111	6.98	10	351	Bedding plane
112	7.03	6	341	Bedding plane
113	7.04	39	62	Filled joint - CT 1 mm to <10 mm
114	7.04	10	342	Bedding plane
115	7.05	10	347	Bedding plane
116	7.06	77	243	Filled joint - CT 1 mm to <10 mm
117	7.14	2	48	Bedding plane
118	7.17	59	273	Filled joint - CT 1 mm to <10 mm
119	7.18	1	296	Bedding plane
120	7.24	5	248	Bedding plane
121	7.26	8	11	Bedding plane
122	7.26	7	34	Bedding plane
123	7.27	7	43	Bedding plane
124	7.32	3	51	Bedding plane
125	7.33	8	42	Bedding plane
126	7.35	8	33	Bedding plane
127	7.37	8	74	Bedding plane
128	7.71	1	208	Bedding plane
129	7.82	6	146	Bedding plane

130	7.83	9	146	Bedding plane
131	7.83	24	263	Filled joint - CT 1 mm to <10 mm
132	7.90	2	319	Bedding plane
133	7.93	5	309	Bedding plane
134	7.98	6	188	Bedding plane
135	8.35	10	11	Bedding plane
136	8.37	7	14	Bedding plane
137	8.63	4	38	Bedding plane
138	8.64	4	51	Bedding plane
139	8.73	3	236	Bedding plane
140	8.87	4	235	Bedding plane
141	8.89	6	262	Bedding plane
142	9.01	1	67	Bedding plane
143	9.11	0	191	Bedding plane
144	9.16	3	101	Bedding plane
145	9.16	2	119	Bedding plane
146	9.41	1	44	Bedding plane
147	9.46	8	235	Bedding plane
148	9.82	13	315	Bedding plane
149	9.83	15	329	Bedding plane
150	9.84	16	322	Bedding plane
151	9.90	3	300	Bedding plane
152	9.91	9	320	Bedding plane
153	9.93	5	257	Bedding plane
154	9.95	9	247	Bedding plane
155	9.96	11	260	Bedding plane
156	10.00	3	43	Bedding plane
157	10.07	20	235	Bedding plane
158	10.11	10	318	Bedding plane
159	10.27	7	30	Bedding plane
160	10.28	6	35	Bedding plane
161	10.85	5	23	Bedding plane
162	10.87	7	36	Bedding plane
163	10.88	6	36	Bedding plane
164	10.89	7	338	Bedding plane
165	10.90	7	354	Bedding plane
166	11.12	4	78	Bedding plane
167	11.13	4	92	Bedding plane
168	11.21	34	295	Filled joint - CT 1 mm to <10 mm
169	11.23	1	271	Bedding plane
170	11.46	54	326	Filled joint - CT 1 mm to <10 mm
171	11.70	6	349	Bedding plane
172	12.04	2	331	Bedding plane
173	12.07	1	332	Bedding plane
174	12.43	6	240	Bedding plane

175	12.44	4	232	Bedding plane
176	12.45	4	90	Bedding plane
177	12.47	2	220	Bedding plane
178	12.49	11	36	Bedding plane
179	12.51	8	21	Bedding plane
180	12.58	4	29	Bedding plane
181	12.59	5	28	Bedding plane
182	12.63	3	331	Bedding plane
183	12.77	4	25	Bedding plane
184	12.78	4	339	Bedding plane
185	13.06	5	287	Bedding plane
186	13.19	6	297	Bedding plane
187	13.20	6	290	Bedding plane
188	13.21	7	293	Bedding plane
189	13.40	1	333	Bedding plane
190	13.43	8	314	Bedding plane
191	13.48	5	303	Bedding plane
192	13.50	6	301	Bedding plane
193	13.51	6	309	Bedding plane
194	13.52	6	313	Bedding plane
195	13.53	4	312	Bedding plane
196	13.61	7	310	Bedding plane
197	13.62	7	302	Bedding plane
198	13.71	2	299	Bedding plane
199	13.72	3	289	Bedding plane
200	13.93	7	306	Bedding plane
201	13.99	7	263	Bedding plane
202	14.03	11	259	Bedding plane
203	14.05	16	255	Bedding plane
204	14.08	13	285	Bedding plane
205	14.09	15	275	Bedding plane
206	14.12	2	87	Bedding plane
207	14.16	6	255	Bedding plane
208	14.17	9	246	Bedding plane
209	14.27	10	18	Bedding plane
210	14.32	12	25	Bedding plane
211	14.33	12	24	Bedding plane
212	14.34	13	18	Bedding plane
213	14.34	13	17	Bedding plane
214	14.35	13	16	Bedding plane
215	14.48	14	35	Bedding plane
216	14.49	11	32	Bedding plane
217	14.50	10	20	Bedding plane
218	14.51	9	5	Bedding plane
219	14.52	11	15	Bedding plane

220	14.53	12	24	Bedding plane
221	14.55	12	33	Bedding plane
222	14.56	10	21	Bedding plane
223	14.57	11	47	Bedding plane
224	14.60	14	42	Bedding plane
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226	14.62	8	41	Bedding plane
227	14.64	6	28	Bedding plane
228	14.76	16	42	Bedding plane
229	14.78	14	32	Bedding plane
230	14.79	14	40	Bedding plane
231	14.80	13	21	Bedding plane
232	14.84	8	349	Bedding plane
233	14.87	8	57	Bedding plane
234	14.90	5	54	Bedding plane
235	14.97	3	150	Bedding plane
236	15.02	4	211	Bedding plane
237	15.04	12	115	Bedding plane
238	15.06	8	108	Bedding plane
239	15.10	9	126	Bedding plane
240	15.12	10	118	Bedding plane
241	15.31	3	200	Bedding plane
242	15.32	5	189	Bedding plane
243	15.40	1	233	Bedding plane
244	15.43	0	286	Bedding plane
245	15.46	4	261	Bedding plane
246	15.47	2	270	Bedding plane
247	15.51	2	278	Bedding plane
248	15.58	2	218	Bedding plane
249	15.59	1	277	Bedding plane
250	15.61	1	59	Bedding plane
251	15.67	3	82	Bedding plane
252	15.68	3	316	Bedding plane
253	15.70	3	299	Bedding plane
254	15.72	4	299	Bedding plane
255	15.91	2	177	Bedding plane
256	15.93	1	147	Bedding plane
257	15.96	3	284	Bedding plane
258	15.97	2	287	Bedding plane
259	16.03	4	188	Bedding plane
260	16.04	3	211	Bedding plane
261	16.08	6	142	Bedding plane
262	16.13	20	242	Filled joint - FD > 10 mm
263	16.28	23	333	Filled joint - FD > 10 mm
264	16.43	5	311	Bedding plane

265	16.47	12	333	Bedding plane
266	16.48	11	317	Bedding plane
267	16.67	7	325	Bedding plane
268	16.80	10	330	Filled joint - CT 1 mm to <10 mm
269	16.81	25	239	Filled joint - FD > 10 mm
270	16.81	8	308	Bedding plane
271	16.85	35	275	Filled joint - CT 1 mm to <10 mm
272	16.85	17	215	Bedding plane
273	16.87	12	203	Bedding plane
274	16.99	21	247	Bedding plane
275	17.06	16	260	Bedding plane
276	17.08	3	271	Bedding plane
277	17.13	5	70	Bedding plane
278	17.17	2	313	Bedding plane
279	17.19	6	105	Bedding plane
280	17.22	14	95	Bedding plane
281	17.26	8	123	Bedding plane
282	17.28	3	102	Bedding plane
283	17.38	13	72	Bedding plane
284	17.39	14	73	Bedding plane
285	17.50	7	325	Bedding plane
286	17.56	7	151	Bedding plane
287	17.57	6	161	Bedding plane
288	17.65	4	235	Bedding plane
289	17.69	4	171	Bedding plane
290	17.85	6	234	Bedding plane
291	17.87	7	235	Bedding plane
292	17.95	1	240	Bedding plane
293	17.95	2	237	Bedding plane
294	18.05	4	190	Bedding plane
295	18.15	3	267	Bedding plane
296	18.17	3	251	Bedding plane
297	18.18	5	250	Bedding plane
298	18.29	2	217	Bedding plane
299	18.30	3	212	Bedding plane
300	18.32	1	243	Bedding plane
301	18.33	2	236	Bedding plane
302	18.35	2	270	Bedding plane
303	18.41	3	327	Bedding plane
304	18.42	4	318	Bedding plane
305	18.45	2	307	Bedding plane
306	18.46	4	305	Bedding plane
307	18.48	3	297	Bedding plane
308	18.61	2	300	Bedding plane
309	18.62	2	30	Bedding plane

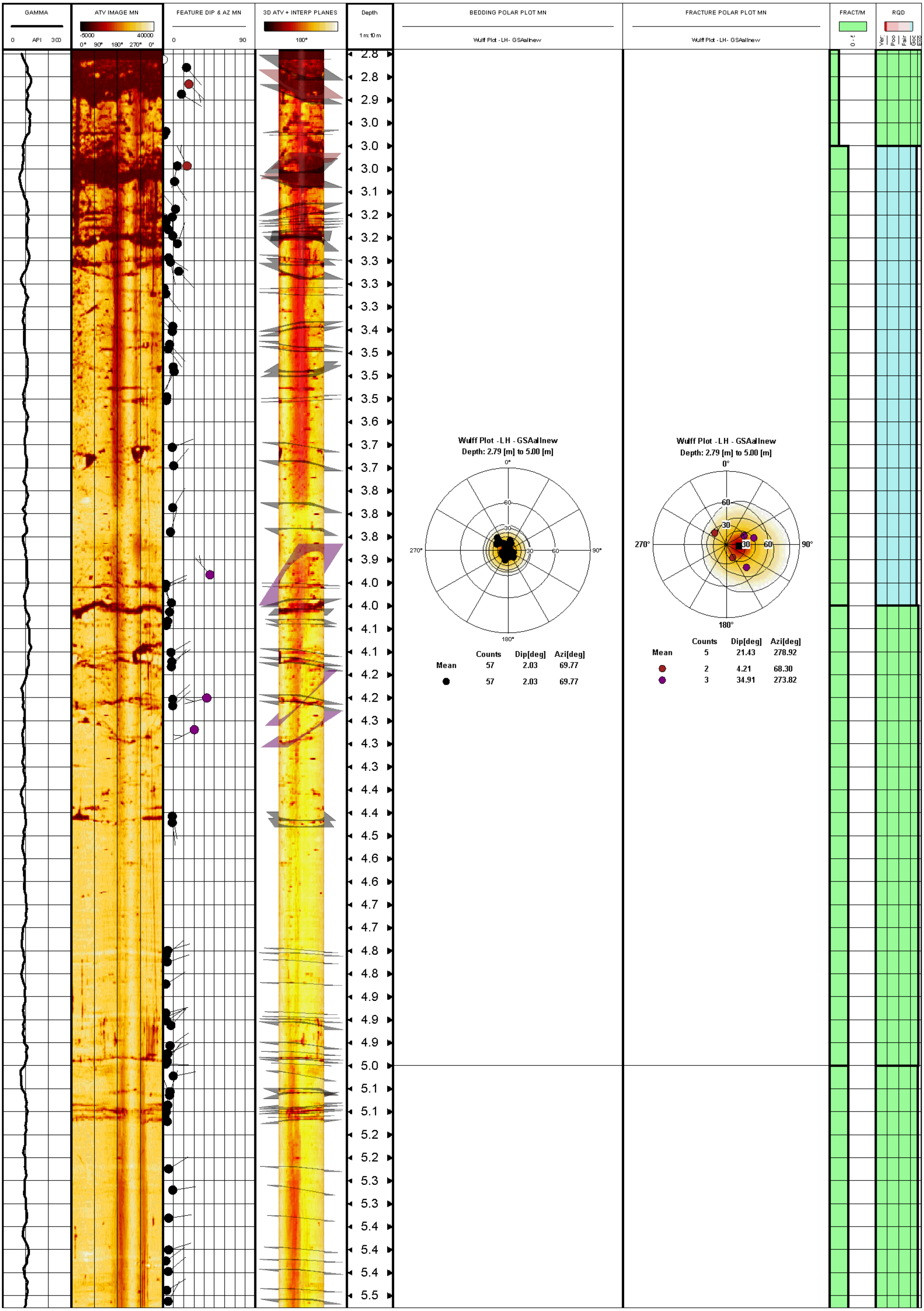
310	18.69	11	67	Bedding plane
311	18.72	6	80	Bedding plane
312	18.75	7	76	Bedding plane
313	18.78	7	118	Bedding plane
314	18.80	4	112	Bedding plane
315	19.44	22	155	Bedding plane
316	19.45	21	157	Bedding plane
317	19.57	2	308	Bedding plane
318	19.63	4	275	Bedding plane
319	19.67	14	143	Bedding plane
320	19.68	17	148	Bedding plane
321	20.38	2	73	Bedding plane
322	20.72	5	96	Bedding plane
323	20.82	0	258	Bedding plane
324	20.85	2	99	Bedding plane
325	20.94	3	87	Bedding plane
326	21.14	5	138	Bedding plane
327	21.17	7	118	Bedding plane
328	21.18	6	108	Bedding plane
329	21.19	2	104	Bedding plane
330	21.21	4	89	Bedding plane
331	21.32	3	263	Bedding plane
332	21.35	3	249	Bedding plane
333	21.37	3	258	Bedding plane
334	21.57	82	252	Filled joint - CT 1 mm to <10 mm
335	21.62	11	36	Bedding plane
336	21.63	6	39	Bedding plane
337	21.85	6	67	Bedding plane
338	21.86	7	54	Bedding plane
339	21.90	8	45	Bedding plane
340	21.98	9	322	Bedding plane
341	22.01	5	337	Bedding plane
342	22.05	7	33	Bedding plane
343	22.11	4	348	Bedding plane
344	22.74	4	133	Bedding plane
345	22.82	4	120	Bedding plane
346	22.88	1	294	Bedding plane
347	22.89	3	255	Bedding plane
348	22.96	4	71	Bedding plane
349	22.96	3	95	Bedding plane
350	23.13	6	291	Bedding plane
351	23.14	4	310	Bedding plane
352	23.35	6	31	Bedding plane
353	23.35	7	14	Bedding plane
354	23.44	9	306	Bedding plane

355	23.52	0	303	Bedding plane
356	23.54	5	56	Bedding plane
357	23.56	6	35	Bedding plane
358	23.65			Base of data
Feature ID	**Midpoint mbgl**	**Dip deg.**	**Azimuth deg. MN**	**Interpreted feature description**

Appendix 2

1:10 Interpretation logs

2.81 to 23.65 mbgl



GAMMA
0 API 300
ATV IMAGE MN
-5000 40000
0° 90° 180° 270° 0°
FEATURE DIP & AZ MN
0 90
3D ATV + INTERP PLANES
180°
Depth
1m:10m
BEDDING POLAR PLOT MN
Wulff Plot - LH - GSAallnew
FRACTURE POLAR PLOT MN
Wulff Plot - LH - GSAallnew
FRACT/M
RQD
2.8
2.8
2.9
3.0
3.0
3.0
3.1
3.2
3.2
3.3
3.3
3.3
3.4
3.5
3.5
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3.6
3.7
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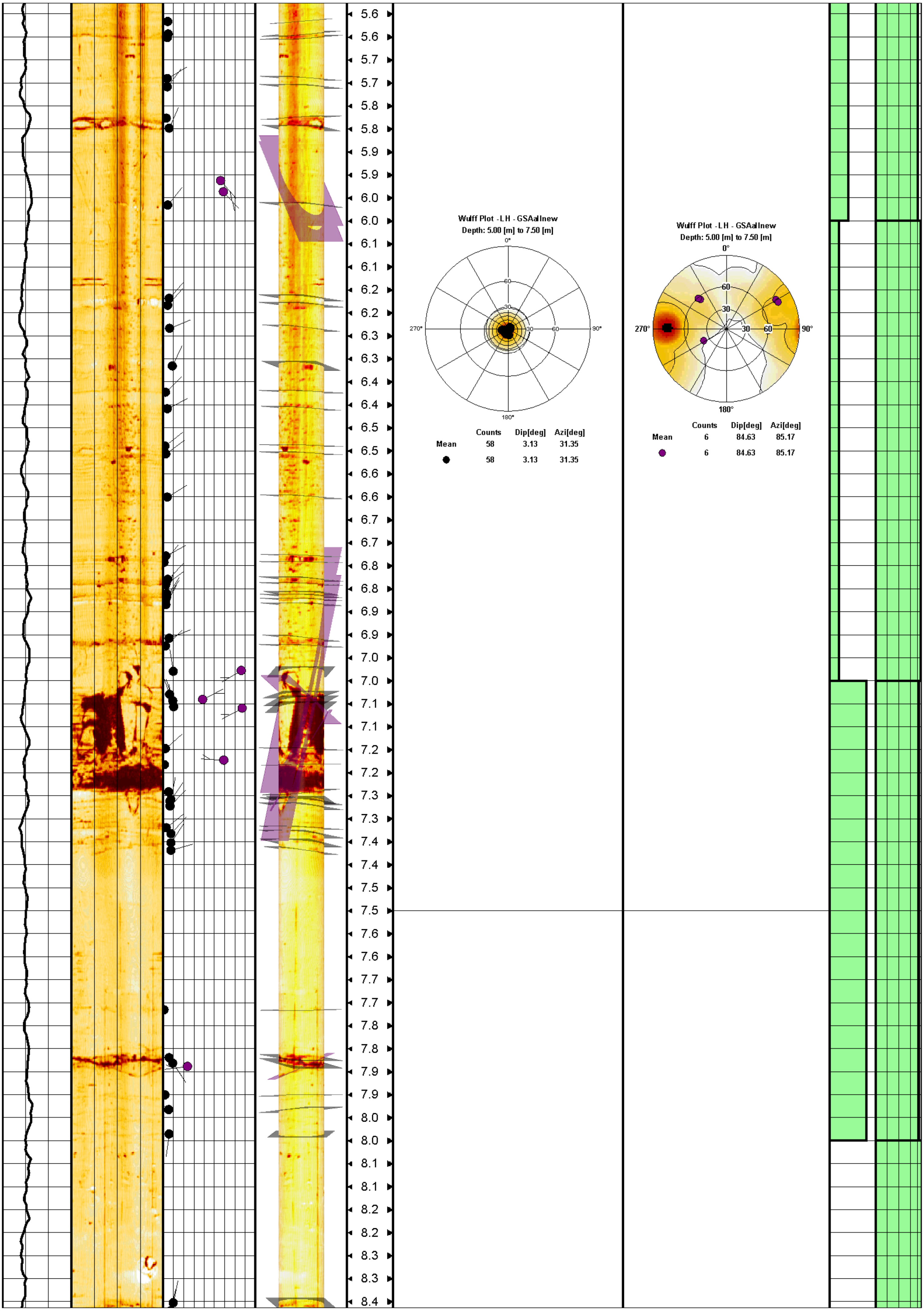
3.8
3.8
3.8
3.9
4.0
4.0
4.1
4.1
4.2
4.2
4.3
4.3
4.3
4.4
4.4
4.5
4.6
4.6
4.7
4.7
4.8
4.8
4.9
4.9
4.9
5.0
5.1
5.1
5.2
5.2
5.3
5.3
5.4
5.4
5.4
5.5
Wulff Plot - LH - GSAallnew
Depth: 2.79 [m] to 5.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 57 2.03 69.77
57 2.03 69.77
Wulff Plot - LH - GSAallnew
Depth: 2.79 [m] to 5.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 5 21.43 278.92
2 4.21 68.30
3 34.91 273.82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6.1
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6.2
6.3
6.3
6.4
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6.5
6.5
6.6
6.6
6.7
6.7
6.8
6.8
6.9
6.9
7.0
7.0
7.1
7.1
7.2
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7.3
7.3
7.4
7.4
7.5
7.5
7.6
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7.7
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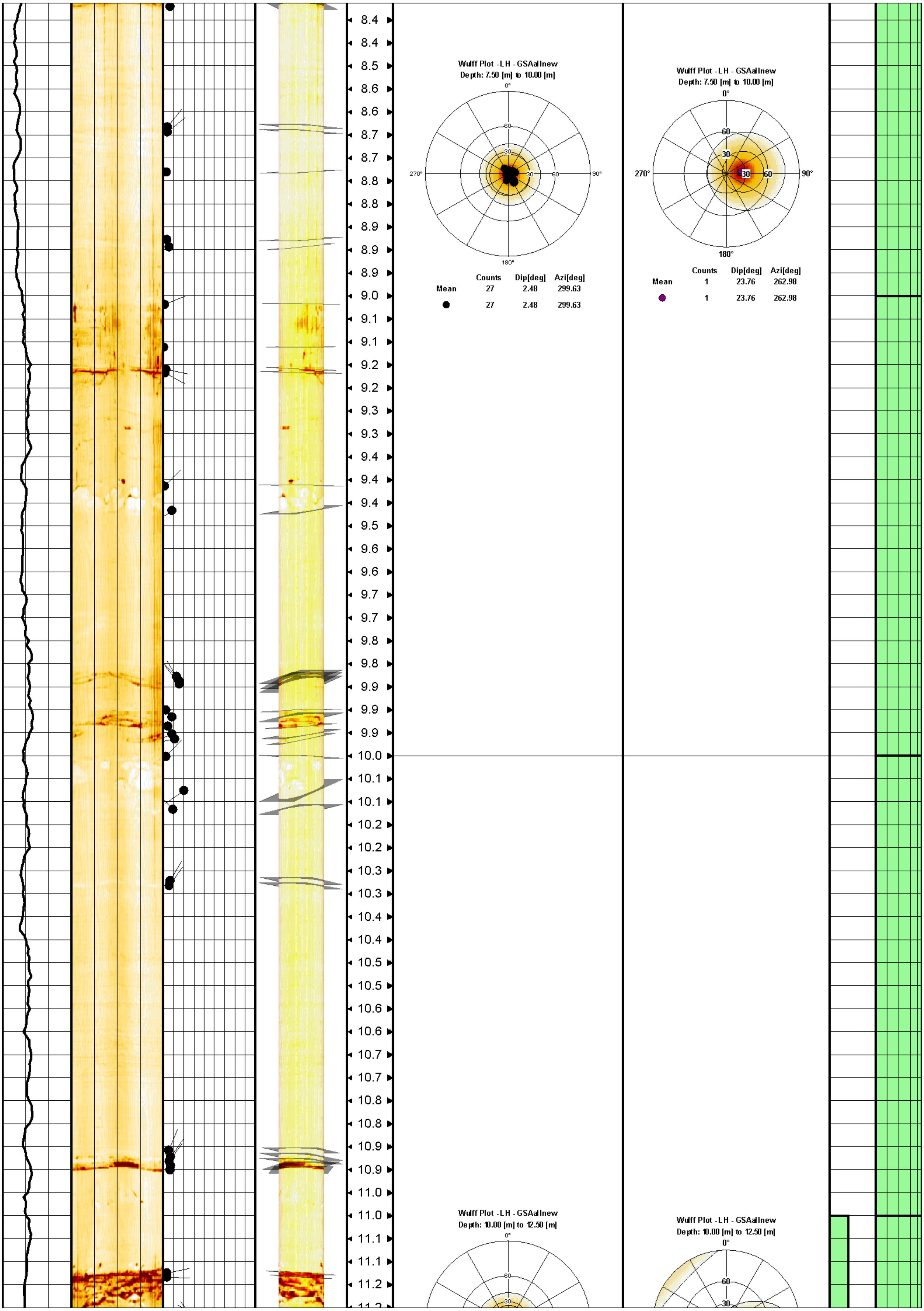
7.8
7.8
7.9
7.9
8.0
8.0
8.1
8.1
8.2
8.2
8.3
8.3
8.4
Wulff Plot - LH - GSAallnew
Depth: 5.00 [m] to 7.50 [m]
0°
90°
180°
270°
30
60
Counts
Dip[deg]
Azi[deg]
Mean
58
3.13
31.35
58
3.13
31.35
Wulff Plot - LH - GSAallnew
Depth: 5.00 [m] to 7.50 [m]
0°
90°
180°
270°
30
60
Counts
Dip[deg]
Azi[deg]
Mean
6
84.63
85.17
6
84.63
85.17



8.4
8.4
8.5
8.6
8.6
8.7
8.7
8.8
8.8
8.9
8.9
8.9
9.0
9.1
9.1
9.2
9.2
9.3
9.3
9.4
9.4
9.4
9.5
9.6
9.6
9.7
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9.9
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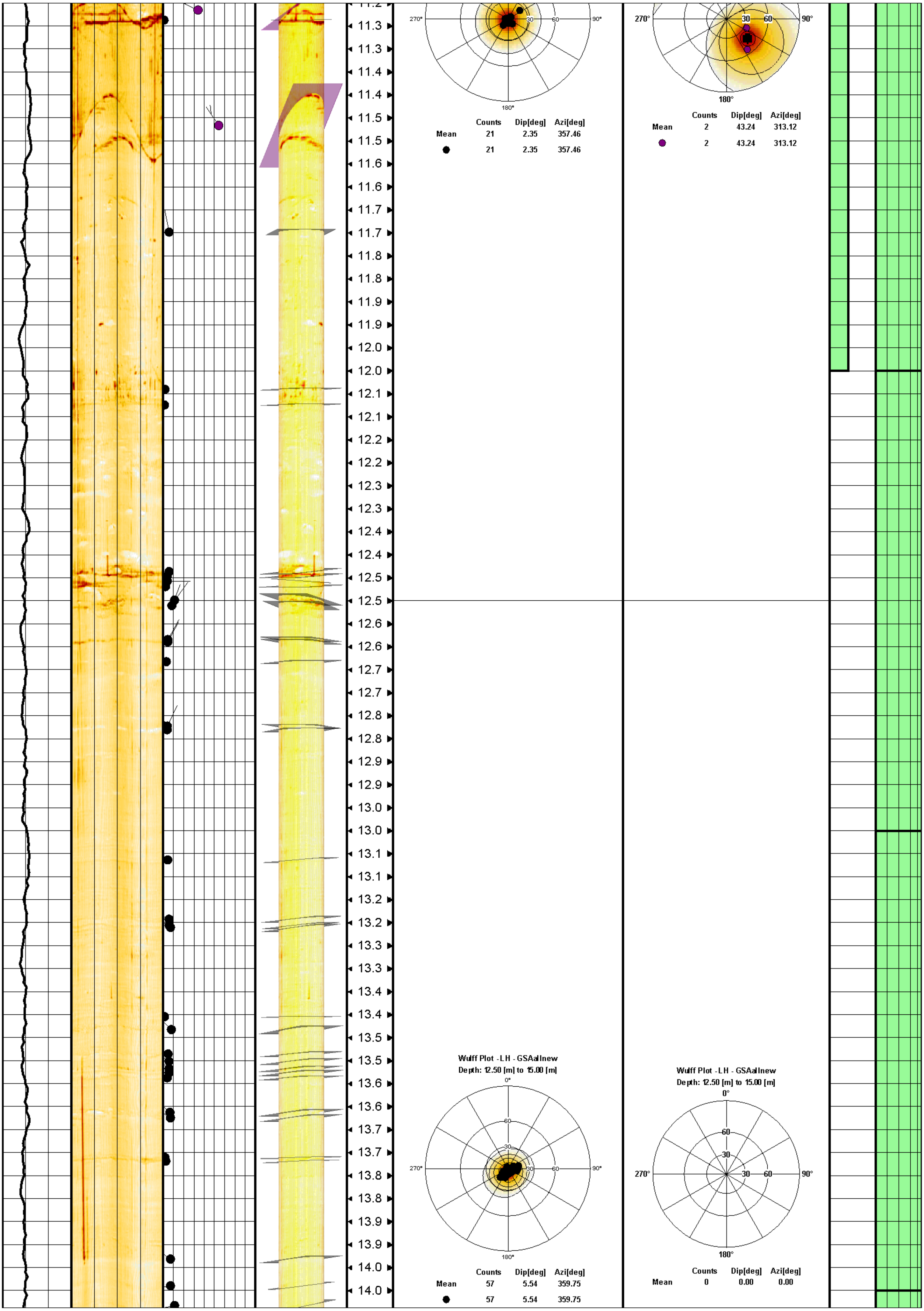
10.5
10.6
10.6
10.7
10.7
10.8
10.8
10.9
10.9
11.0
11.0
11.1
11.1
11.2
Wulff Plot - LH - GSAallnew
Depth: 7.50 [m] to 10.00 [m]
0°
90°
180°
270°
Counts Dip[deg] Azi[deg]
Mean 27 2.48 299.63
27 2.48 299.63
Wulff Plot - LH - GSAallnew
Depth: 7.50 [m] to 10.00 [m]
0°
90°
180°
270°
Counts Dip[deg] Azi[deg]
Mean 1 23.76 262.98
1 23.76 262.98
Wulff Plot - LH - GSAallnew
Depth: 10.00 [m] to 12.50 [m]
Wulff Plot - LH - GSAallnew
Depth: 10.00 [m] to 12.50 [m]
0°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12.0
12.1
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13.0
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13.1
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13.4
13.5
13.5
13.6
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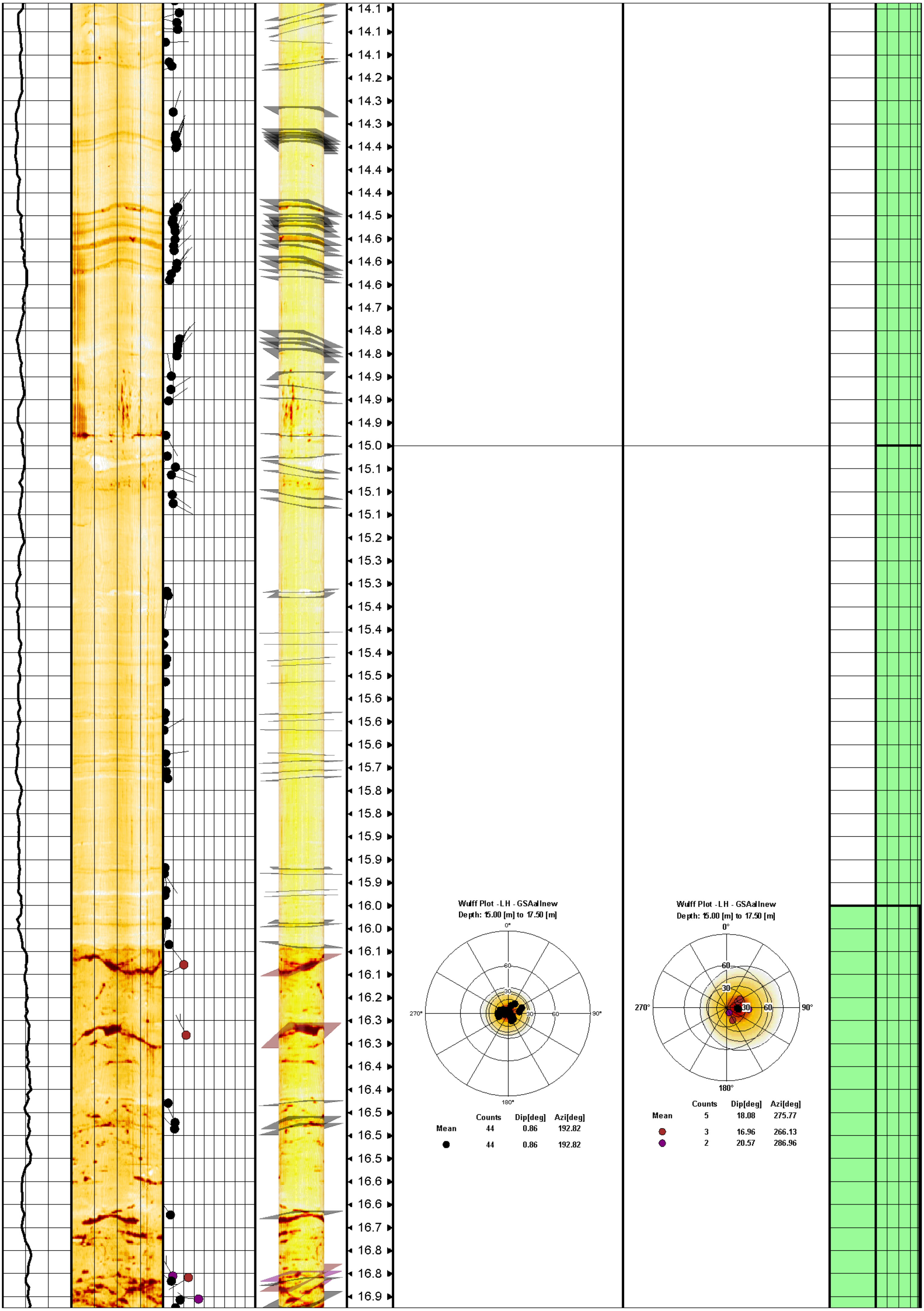
13.7
13.7
13.8
13.8
13.9
13.9
14.0
14.0
270° 30 60 90° 180°
Counts Dip[deg] Azi[deg]
Mean 21 2.35 357.46
21 2.35 357.46
270° 30 60 90° 180°
Counts Dip[deg] Azi[deg]
Mean 2 43.24 313.12
2 43.24 313.12
Wulff Plot - LH - GSAallnew
Depth: 12.50 [m] to 15.00 [m]
0° 60 30 270° 30 60 90° 180°
Counts Dip[deg] Azi[deg]
Mean 57 5.54 359.75
57 5.54 359.75
Wulff Plot - LH - GSAallnew
Depth: 12.50 [m] to 15.00 [m]
0° 60 30 270° 30 60 90° 180°
Counts Dip[deg] Azi[deg]
Mean 0 0.00 0.00



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14.9
15.0
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15.9
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16.0
16.1
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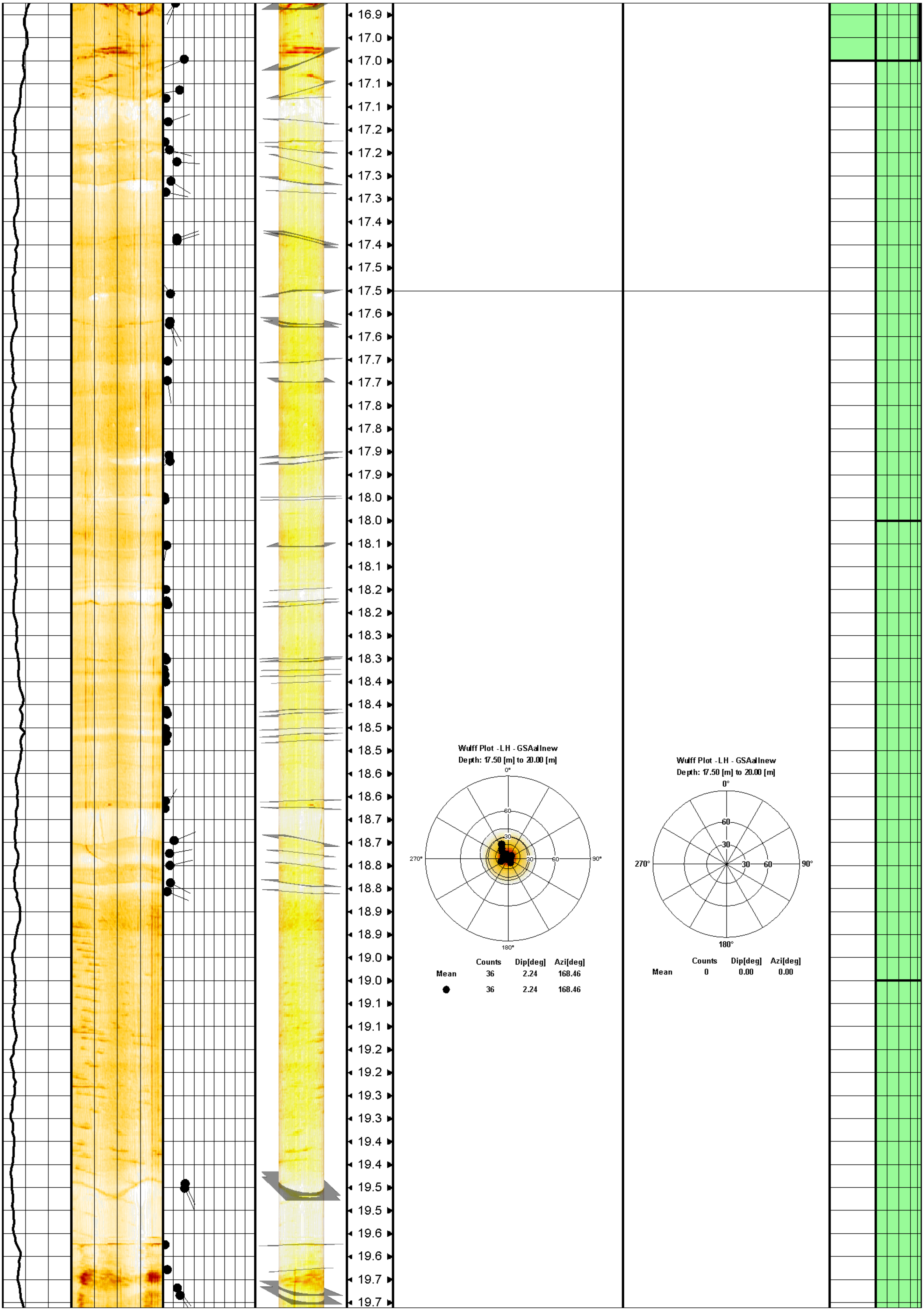
16.4
16.4
16.5
16.5
16.5
16.6
16.6
16.7
16.8
16.8
16.9
Wulff Plot - LH - GSAallnew
Depth: 15.00 [m] to 17.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 44 0.86 192.82
44 0.86 192.82
Wulff Plot - LH - GSAallnew
Depth: 15.00 [m] to 17.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 5 18.08 275.77
3 16.96 266.13
2 20.57 286.96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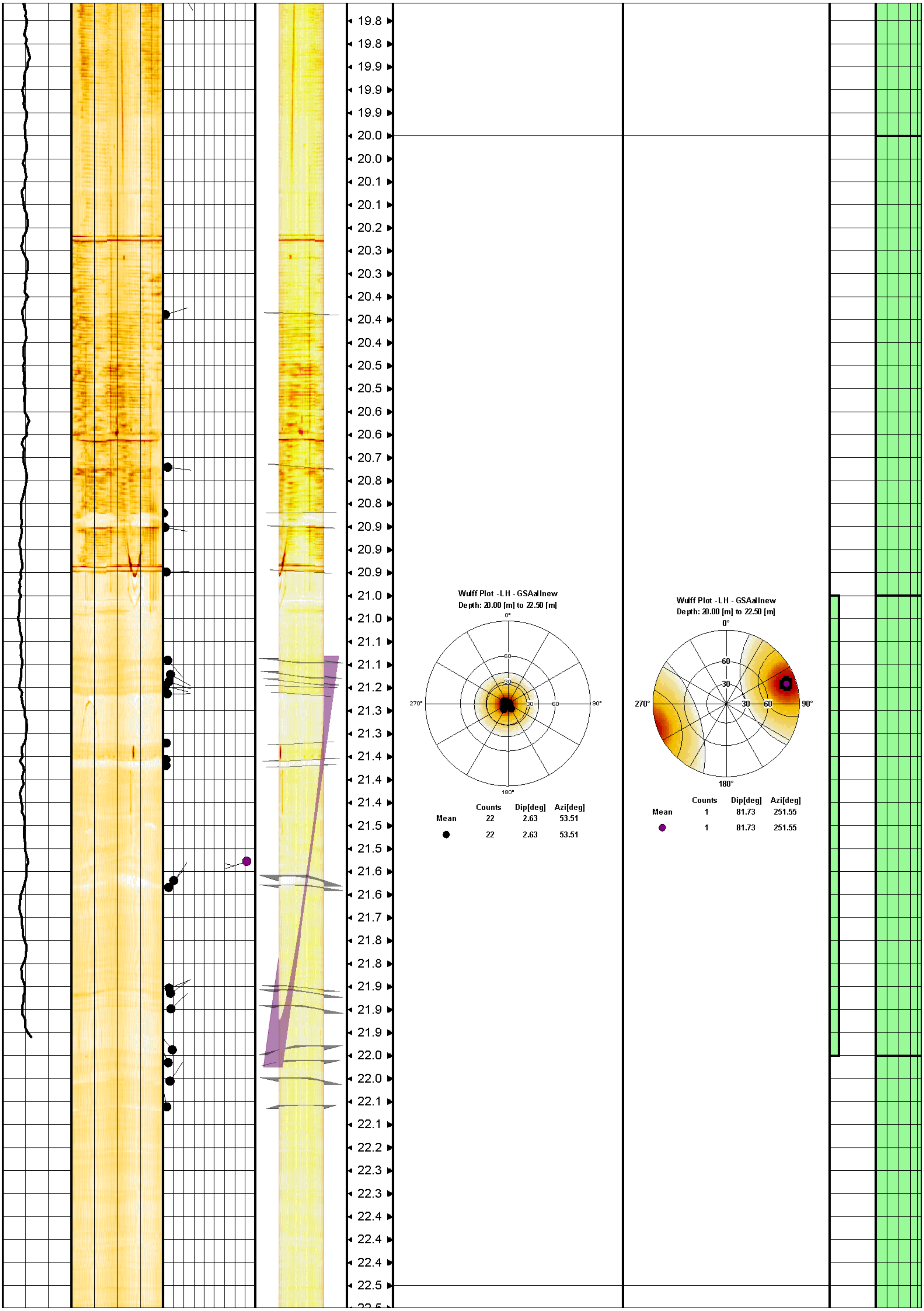
19.7
Wulff Plot - LH - GSAallnew
Depth: 17.50 [m] to 20.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 36 2.24 168.46
36 2.24 168.46
Wulff Plot - LH - GSAallnew
Depth: 17.50 [m] to 20.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 0 0.00 0.00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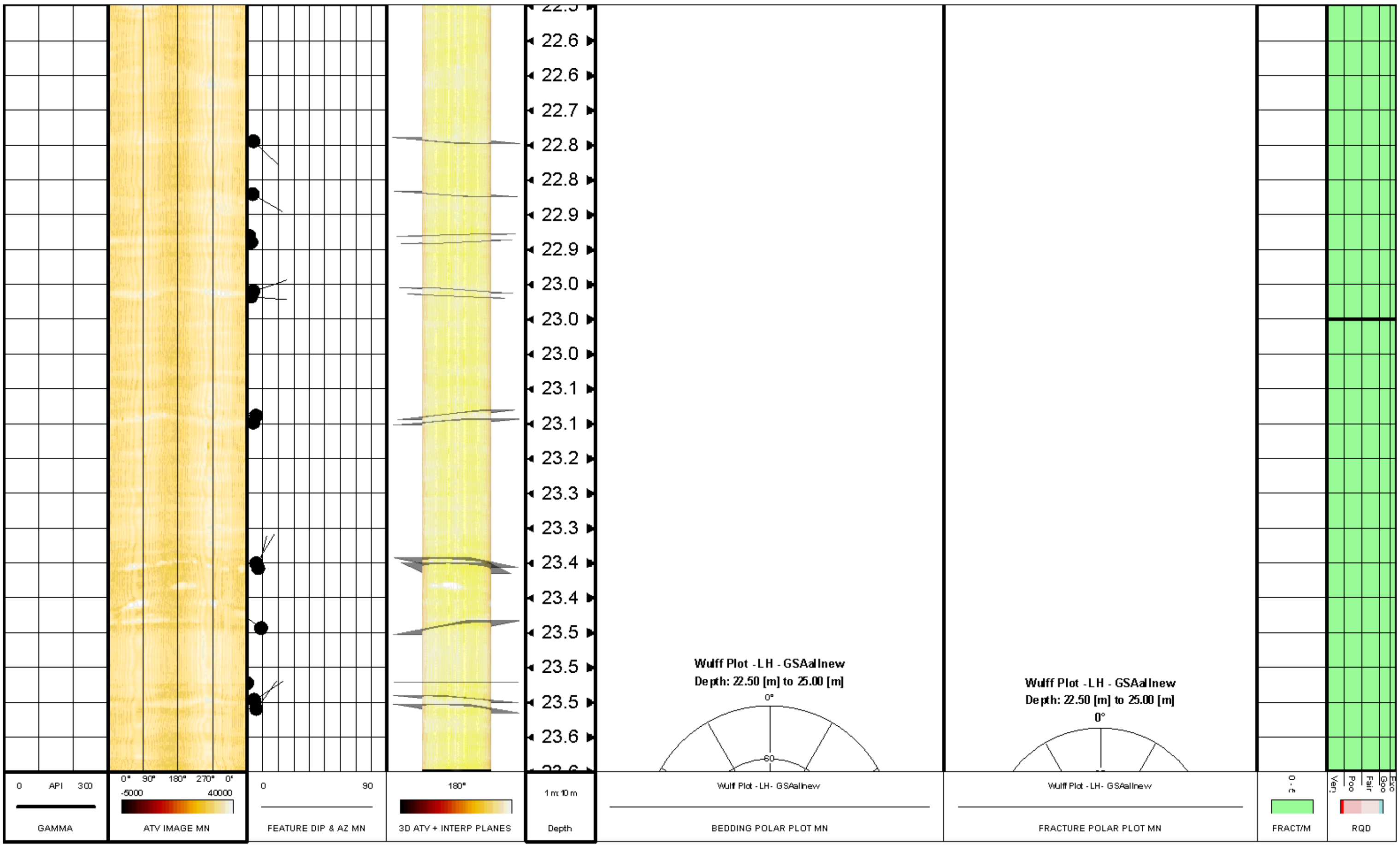
21.9
21.9
22.0
22.0
22.1
22.1
22.2
22.3
22.3
22.4
22.4
22.4
22.5
Wulff Plot - LH - GSAallnew
Depth: 20.00 [m] to 22.50 [m]
0°
90°
180°
270°
30
60
Mean
Counts Dip[deg] Azi[deg]
22 2.63 53.51
22 2.63 53.51
Wulff Plot - LH - GSAallnew
Depth: 20.00 [m] to 22.50 [m]
0°
90°
180°
270°
30
60
Mean
Counts Dip[deg] Azi[deg]
1 81.73 251.55
1 81.73 251.55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23.0
23.0
23.1
23.1
23.2
23.3
23.3
23.4
23.4
23.5
23.5
23.5
23.6
Wulff Plot - LH - GSAallnew
Depth: 22.50 [m] to 25.00 [m]
0°
Wulff Plot - LH - GSAallnew
Depth: 22.50 [m] to 25.00 [m]
0°
0 API 300
GAMMA
0° 90° 180° 270° 0°
-5000 40000
ATV IMAGE MN
0 90
FEATURE DIP & AZ MN
180°
3D ATV + INTERP PLANES
1m:10m
Depth
Wulff Plot - LH - GSAallnew
BEDDING POLAR PLOT MN
Wulff Plot - LH - GSAallnew
FRACTURE POLAR PLOT MN
FRACT/M
RQD

Douglas Partners- Liverpool
402 Macquarie Street

Borehole - BH304

ATV Interpreted Features Report

Groundsearch Australia Pty. Limited
Issued: 16 May 2024

DISCLAIMER

The data used in this report were obtained using equipment manufactured by LIM Logging/Electromind. The interpretations given in this report are based on judgement and experience of Groundsearch Australia's personnel. They are provided for Douglas Partner's 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

J Lea

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 2024 site investigation programme for Douglas Partners- Liverpool.

LIM Logging BHTV acoustic televiewer logging tool was run to collect data in the field on 07 May 2024. The data in this report are from 6.02 to 21.41 mbgl.

The 150 identified features are interpreted as bedding planes and fractures. The bedding to fracture ratio is 9.71:1.

The LIM Logging 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** with density contours as pole vectors in the **lower hemisphere**.

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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 2024 site investigation programme for Douglas Partners- Liverpool.

LIM Logging BHTV acoustic televiewer logging tool was run to collect data in the field on 07 May 2024. The data in this report are from 6.02 to 21.41 mbgl.

The 150 identified features are interpreted as bedding planes and fractures. The bedding to fracture ratio is 9.71:1.

The LIM Logging 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** with density contours as pole vectors in the **lower hemisphere**.

The ATV takes an oriented image of the borehole using high-resolution sound waves. The acoustic image is displayed as 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 180 measurements around the borehole at each high-resolution sample interval. These data can be oriented to Magnetic North and displayed in real-time while logging using the LIM BHTV Logging System.

Analysis software includes colour adjustment, fracture dip and dip direction 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 and by mudcake adhered to the borehole wall.

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. Both sides of the 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 inclination angle and azimuth 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 **Magnetic North**-referenced:

- Text summary of the interpreted features

- Logs that show geological features with their subjective 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:

    - Natural gamma
    - ATV image referenced to Magnetic North
    - Colour-coded tadpoles that represent feature dip and dip direction
    - 3D ATV image with feature planes
    - Bedding polar plot referenced to Magnetic North
    - Fracture polar plot referenced to Magnetic North
    - Fracture frequency/M
    - Defect RQD

- Table containing feature curve ID, midpoint mbgl, dip angle, dip azimuth and feature description.

- Feature density contour plots as pole vectors in the lower hemisphere

The Rock Quality Designation (RQD) is a measure of the degree of jointing of fractures in a rock mass with:

- Image sample interval = 0.1 m
- Image length reported = 1.0 m

RQD values are:

- <0.25 - very poor
- 0.25 - 0.50 - poor
- 0.50 - 0.75 - fair
- 0.75 - 0.90 - good
- 0.90 - 1.00 - excellent

3.0 BH304 interpretations

The 150 identified features are interpreted as bedding planes and fractures. The bedding to fracture ratio is 9.71:1.

The density contours for all interpreted features are shown in Figure 1. A description of each interpreted feature is presented in Appendix 1 and the combination log is presented in Appendix 2.

The 136 sedimentary features identified are bedding planes that appear to range in dip from 01^0 to 21^0.

The 14 fractures identified are classified as:

Table 1

Interval section	**Complete data 6.02 – 21.41 mbgl**		
Feature classification	**Feature count**	**Percentage**	**Dip range**
Filled joint - CT 1mm to <10mm	08	57%	05^0 to 44^0
Filled joint - FD >10mm	06	43%	19^0 to 80^0

The sedimentary features identified are classified as:

Interval section	**Complete data 6.02 – 21.41 mbgl**	
Feature classification	**Feature count**	**Dip range**
Bedding	136	01^0 to 21^0

Figures 1 to 5 present the orientation density contour plans for each feature set identified as pole vectors, MN, lower hemisphere.

Feature Dip is represented as 00^0 being the horizontal plane and 90^0 being the vertical plane.

Stereonets show the Feature Dip represented as 00^0 being the centre of the stereonet and 90^0 being the outer circle of the stereonet.

The standards used for reporting are outlined on the following page of this report.

	Code	Tadpole	Sine Wave	
2	Seam/zone base FZ			Fractured zone base
3	Seam/zone base			
4	Fracture plane - open			Fracture plane - open
5	Minor open fracture			Minor open fracture
6	Fracture plane - partially open			Fracture plane - partially open
7	Filled fracture			Filled fracture
8	Bedding plane open			Bedding plane open
9	Fracture plane - closed			Fracture plane - closed
10	Top of data			Top of data
11	Induced fracture			Induced fracture
12	SWL			SWL
13	Fault - FT			Level 1
14	Rocktype boundary			Rocktype boundary
15	Bedding separation plane			Bedding separation plane
16	Fracture plane - discontinuous			Fracture plane - discontinuous
17	Partially filled fracture			Partially filled fracture
18	Irregular vein			Irregular vein
19	Unconformity			Unconformity
20	Base of casing			Base of casing
21	Top of Coal Unit			Top of Coal Unit
22	Base of Coal Unit			Base of Coal Unit
23	Base of weathering			Base of weathering
24	Top of breakout			Top of breakout
25	Base of breakout			Base of breakout
26	Top of washout			Top of washout
27	Base of washout			Base of washout
28	Top of open fracture			Top of open fracture
29	Base of open fracture			Base of open fracture
30	Bedding plane partially open			Bedding plane partially open
31	Parting			Parting
32	Shear plane			Shear plane
33	Face cleat			Face cleat
34	Butt cleat			Butt cleat
35	Intrusive contact			Intrusive contact
36	Irregular fracture			Irregular fracture
37	Open joint >5 mm aperture			Level 2
38	Closed joint <5 mm aperture			Level 3
39	Vein			Level 3
40	Filled joint - SN			Level 3
41	Filled joint - VN <1 mm			Level 3
42	Filled joint - CT 1 mm to <10 mm			Level 3
43	Filled joint - FD > 10 mm			Level 3
44	Lithozone boundary			Lithozone boundary
45	Bedding plane			
46	Top of mineralisation			
47	Base of mineralisation			
48	Crossbedding			

Figure 1 BH304 interpreted features density contours – pole vectors, MN, lower hemisphere

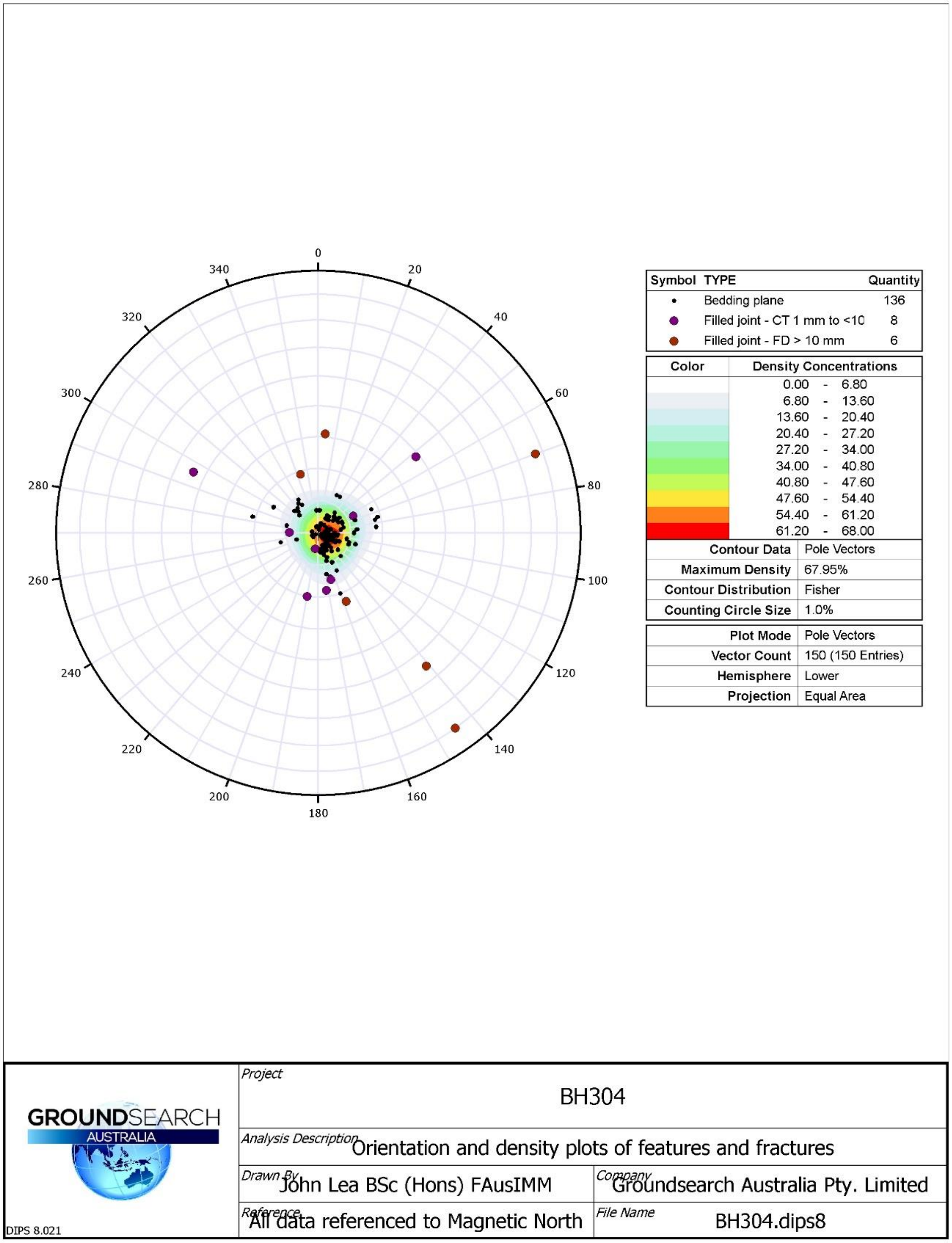


Figure 2 BH304 bedding orientation plan – pole vectors, MN, lower hemisphere

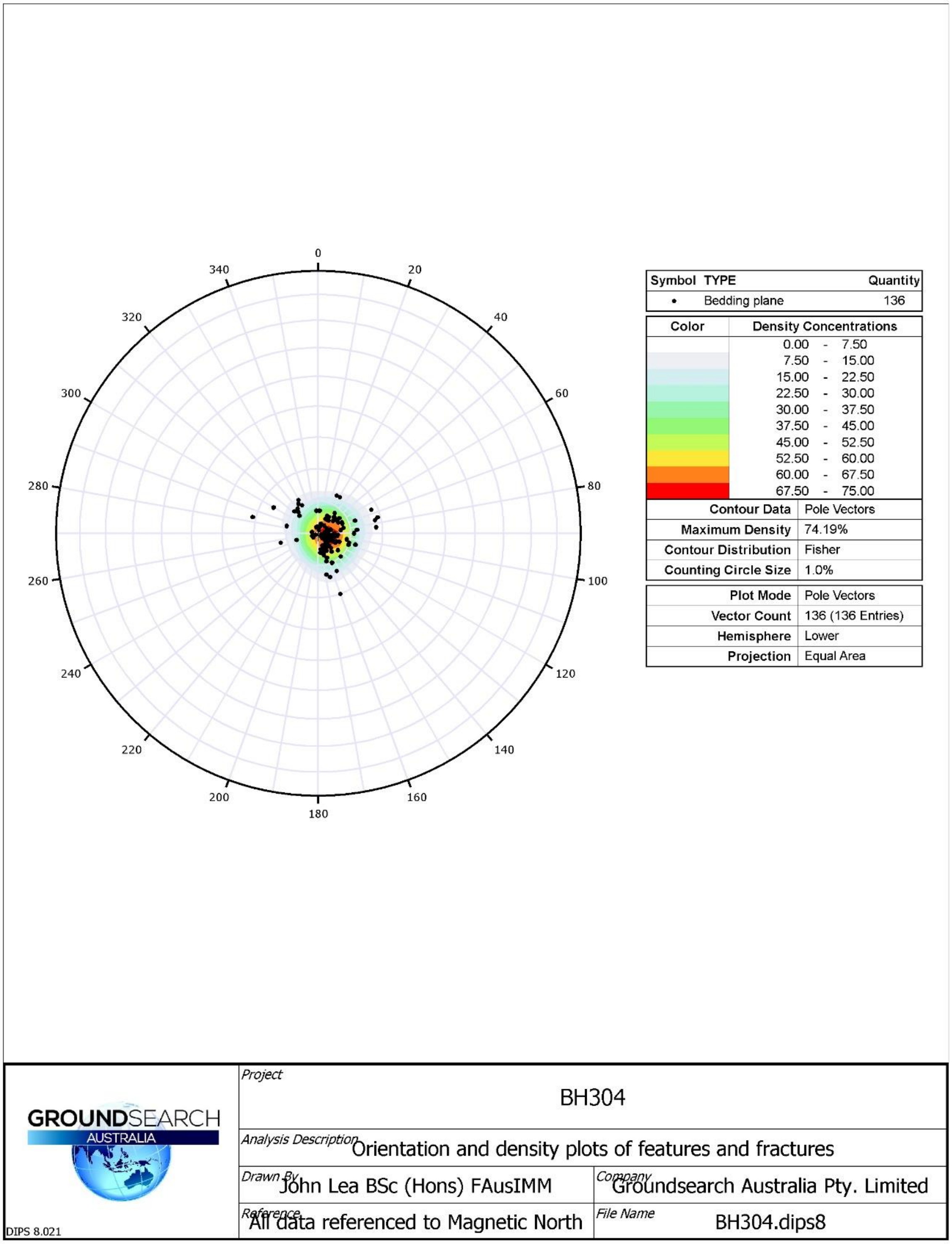


Figure 3 BH304 fractures orientation density contour plan – pole vectors, MN, lower hemisphere

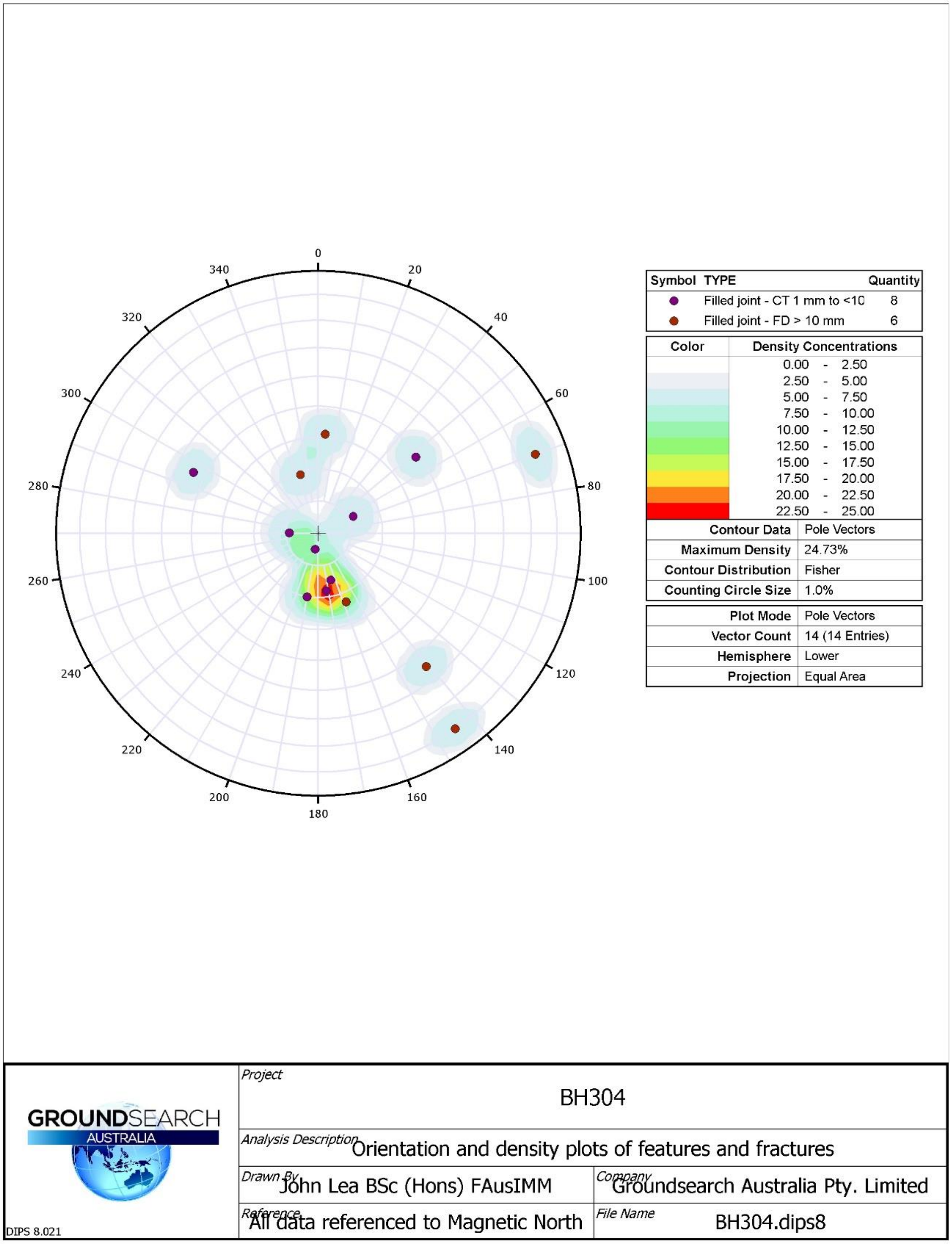


Figure 4 BH304 filled joint – CT 1mm to <10mm density contour plan - pole vectors, MN, lower hemisphere

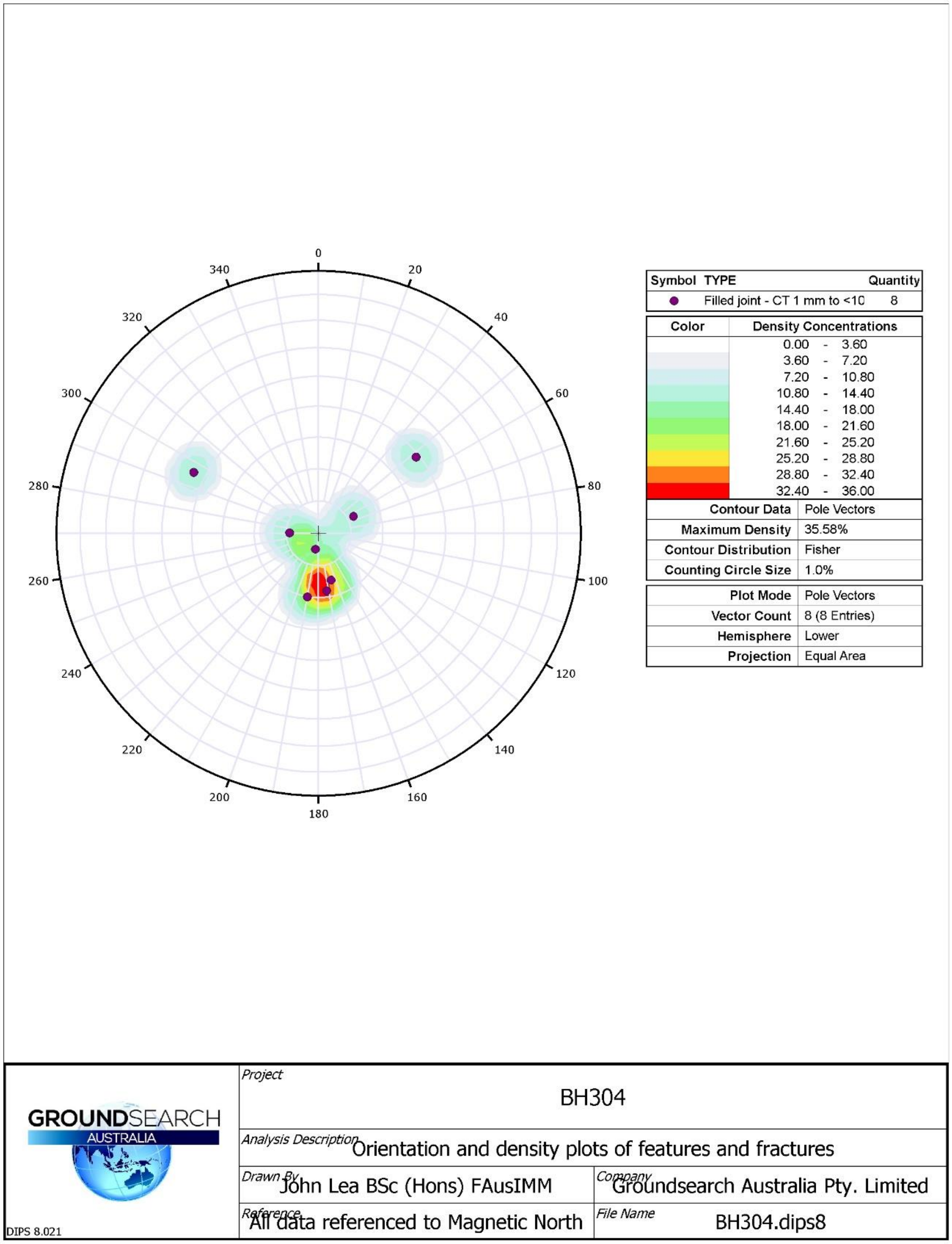
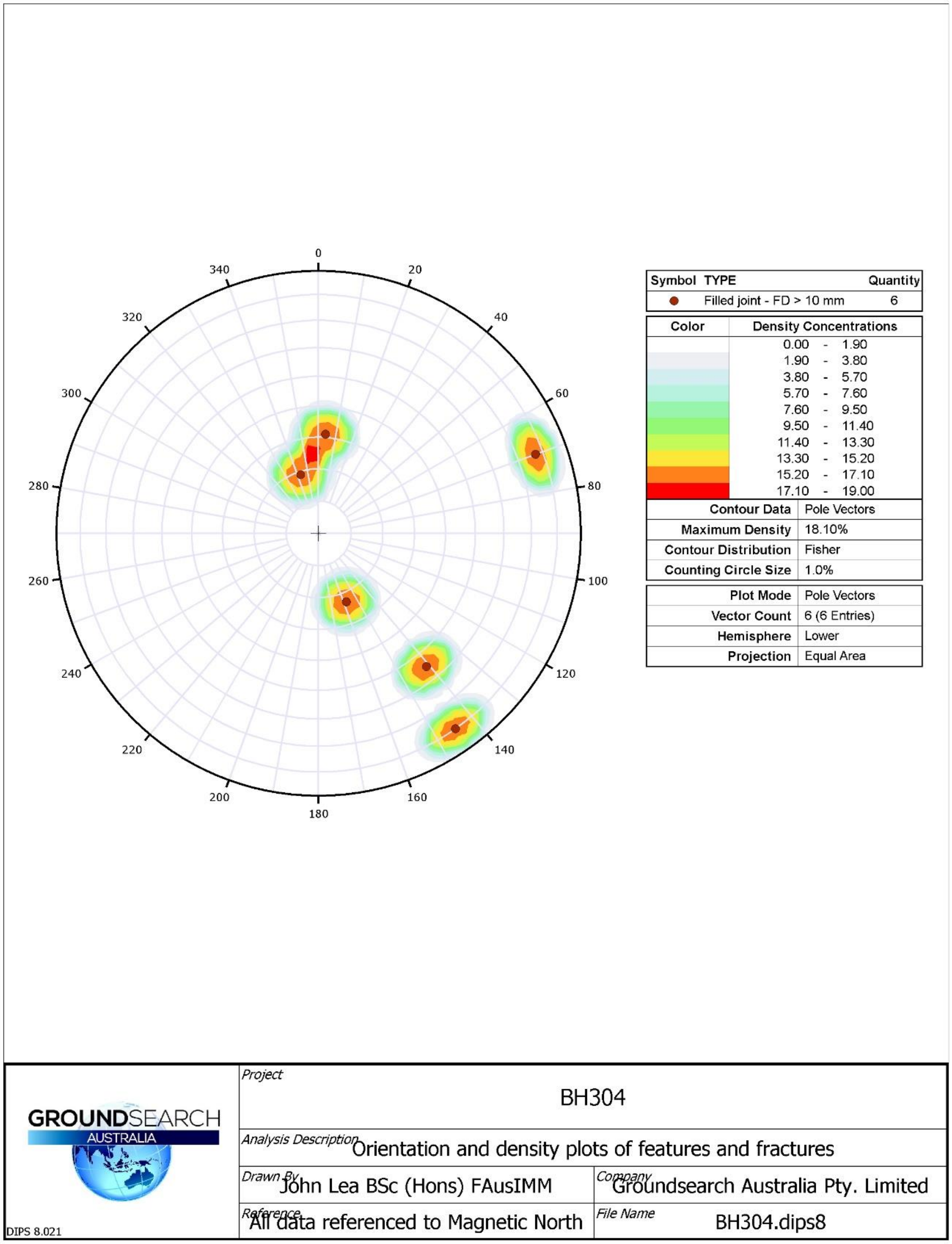


Figure 5 BH304 filled joint – FD >10mm density contour plan - pole vectors, MN, lower hemisphere

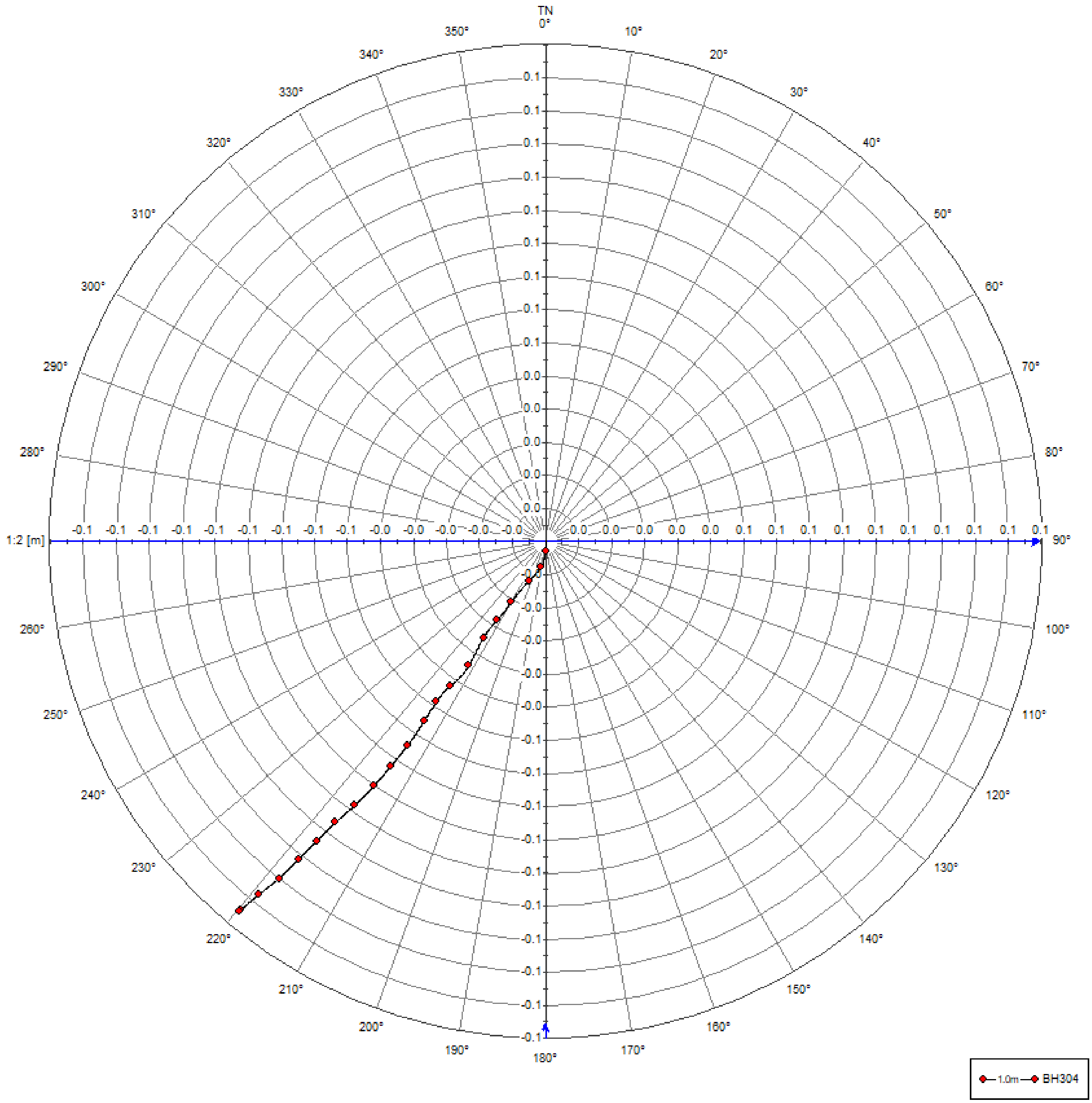


4.0 BH304 borehole deviation data

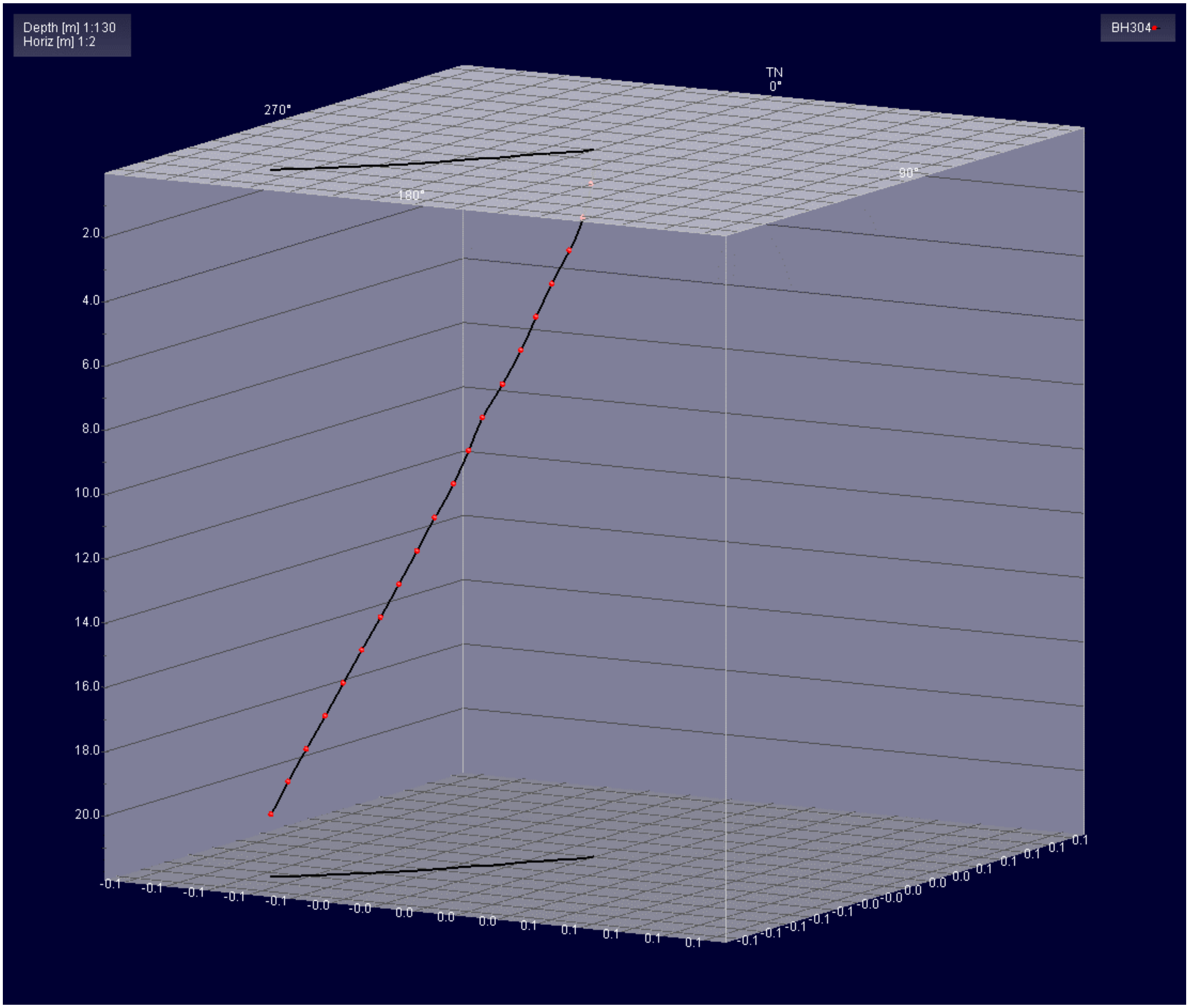
The data are presented in **Table 2** below.

Depth m	INCL DEGREE	AZ DEGREE	Easting [m]	Northing [m]	TVD [m]
0	0.25	160.53	0	0	0
1	0.23	190.64	0.00036	-0.00378	0.99999
2	0.29	209.12	-0.00101	-0.00833	1.99998
3	0.43	224.48	-0.00493	-0.01292	2.99996
4	0.43	217.14	-0.00995	-0.01888	3.99993
5	0.38	224.69	-0.01446	-0.02433	4.99991
6	0.48	213.01	-0.01856	-0.02994	5.99988
7	0.56	211.37	-0.02286	-0.03792	6.99984
8	0.41	228.36	-0.02874	-0.04448	7.9998
9	0.39	213.11	-0.0327	-0.04912	8.99978
10	0.45	212.91	-0.03661	-0.05504	9.99976
11	0.52	217.38	-0.0415	-0.06226	10.9997
12	0.45	219.16	-0.04654	-0.06851	11.9997
13	0.46	222.77	-0.05179	-0.07458	12.9997
14	0.46	228.34	-0.05739	-0.08019	13.9996
15	0.46	226.71	-0.06333	-0.08557	14.9996
16	0.45	226.36	-0.06899	-0.09121	15.9996
17	0.46	224.98	-0.07457	-0.0968	16.9995
18	0.47	228.83	-0.08039	-0.10239	17.9995
19	0.42	231.02	-0.08642	-0.10723	18.9995
20	0.4	231.24	-0.09189	-0.11191	19.9994

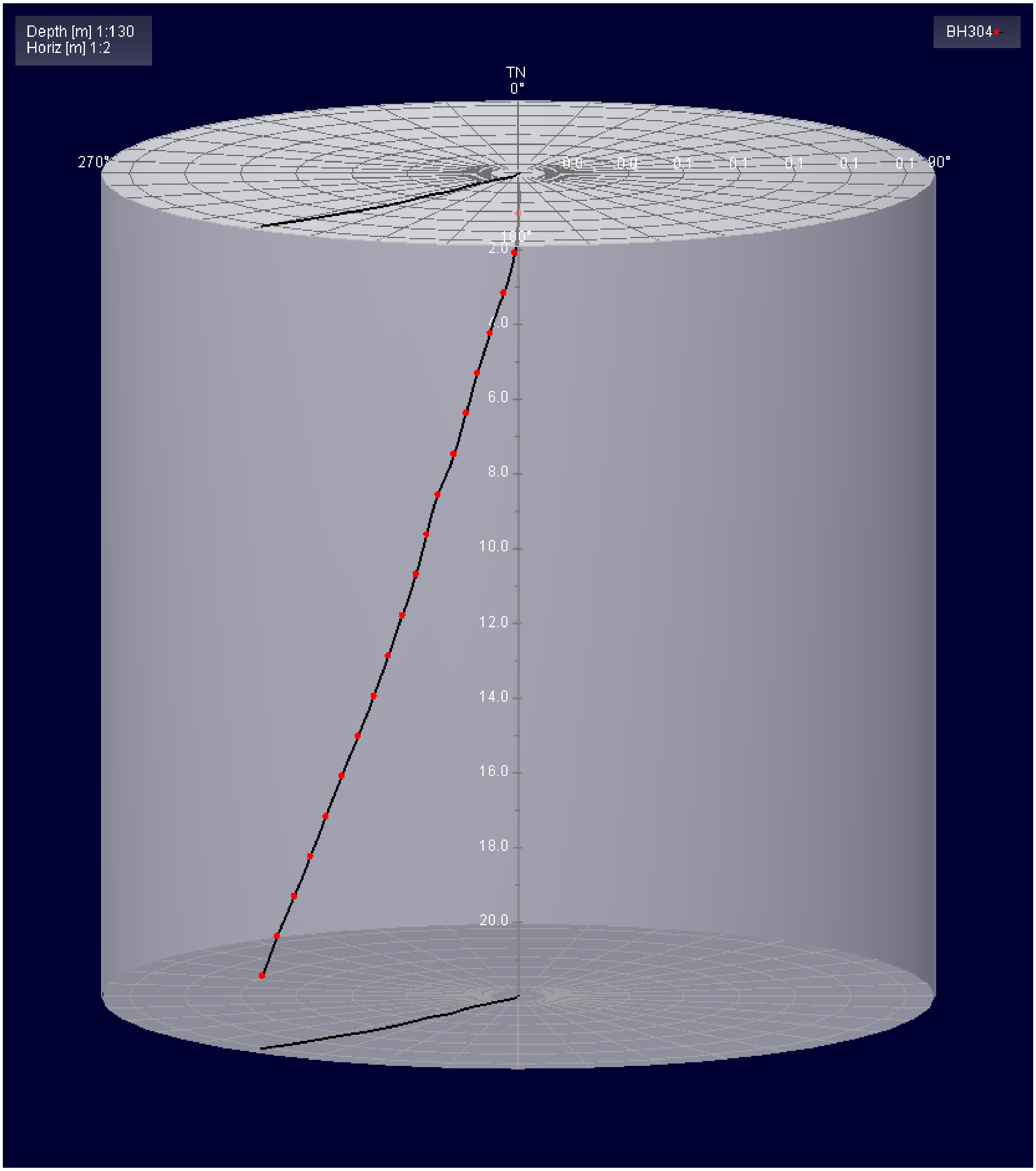
BH304 Bullseye Plot



BH304 Cubic Plot



BH304 Cylindrical Plot



Appendix 1

Tabulated interpreted features report for BH304

Feature ID	Midpoint mbgl	Dip deg.	Azimuth deg. MN	Interpreted feature description
1	6.02			Top of data
2	6.03	3	291	Bedding plane
3	6.04	8	311	Bedding plane
4	6.06	6	346	Bedding plane
5	6.15	9	137	Bedding plane
6	6.16	10	133	Bedding plane
7	6.19	16	120	Bedding plane
8	6.23	10	103	Bedding plane
9	6.30	10	140	Bedding plane
10	6.33	11	146	Bedding plane
11	6.41	3	253	Bedding plane
12	6.41	77	250	Filled joint - FD > 10 mm
13	6.43	3	243	Bedding plane
14	6.49	2	264	Bedding plane
15	6.51	3	218	Bedding plane
16	6.53	8	219	Bedding plane
17	6.55	6	207	Bedding plane
18	6.56	3	279	Bedding plane
19	6.57	5	297	Bedding plane
20	6.58	6	277	Bedding plane
21	6.64	3	238	Bedding plane
22	6.65	2	192	Bedding plane
23	6.67	1	192	Bedding plane
24	6.71	3	300	Bedding plane
25	6.72	4	322	Bedding plane
26	6.93	12	149	Bedding plane
27	6.94	5	11	Filled joint - CT 1 mm to <10 mm
28	6.95	18	352	Filled joint - CT 1 mm to <10 mm
29	7.05	13	334	Bedding plane
30	7.12	8	245	Bedding plane
31	7.28	3	197	Bedding plane
32	7.67	3	271	Bedding plane
33	7.90	80	325	Filled joint - FD > 10 mm
34	8.03	4	294	Bedding plane
35	8.04	6	299	Bedding plane
36	8.05	4	280	Bedding plane
37	8.06	3	267	Bedding plane
38	8.07	1	289	Bedding plane
39	8.08	3	257	Bedding plane

40	8.49	18	246	Bedding plane
41	8.91	9	91	Filled joint - CT 1 mm to <10 mm
42	8.93	12	244	Filled joint - CT 1 mm to <10 mm
43	9.92	2	322	Bedding plane
44	9.92	4	341	Bedding plane
45	10.14	3	268	Bedding plane
46	10.18	8	341	Bedding plane
47	10.19	5	351	Bedding plane
48	10.20	3	316	Bedding plane
49	10.21	1	318	Bedding plane
50	10.22	3	299	Bedding plane
51	10.22	44	116	Filled joint - CT 1 mm to <10 mm
52	10.34	12	265	Bedding plane
53	10.35	12	251	Bedding plane
54	10.50	13	211	Bedding plane
55	10.51	13	206	Bedding plane
56	10.58	18	264	Bedding plane
57	10.68	18	257	Bedding plane
58	10.69	19	255	Bedding plane
59	10.75	8	248	Bedding plane
60	10.92	10	150	Bedding plane
61	11.35	7	183	Bedding plane
62	11.38	5	212	Bedding plane
63	12.71	4	294	Bedding plane
64	12.72	6	294	Bedding plane
65	12.74	3	289	Bedding plane
66	12.75	6	351	Bedding plane
67	12.88	4	334	Bedding plane
68	12.89	4	324	Bedding plane
69	13.04	2	170	Bedding plane
70	13.04	2	160	Bedding plane
71	13.09	2	261	Bedding plane
72	13.10	2	257	Bedding plane
73	13.25	5	207	Bedding plane
74	13.26	3	194	Bedding plane
75	13.49	7	346	Bedding plane
76	13.49	7	324	Bedding plane
77	13.52	5	330	Bedding plane
78	13.52	5	339	Bedding plane
79	13.53	5	342	Bedding plane
80	13.55	6	342	Bedding plane
81	13.68	4	343	Bedding plane
82	13.70	2	318	Bedding plane
83	14.25	5	283	Bedding plane
84	14.28	6	277	Bedding plane

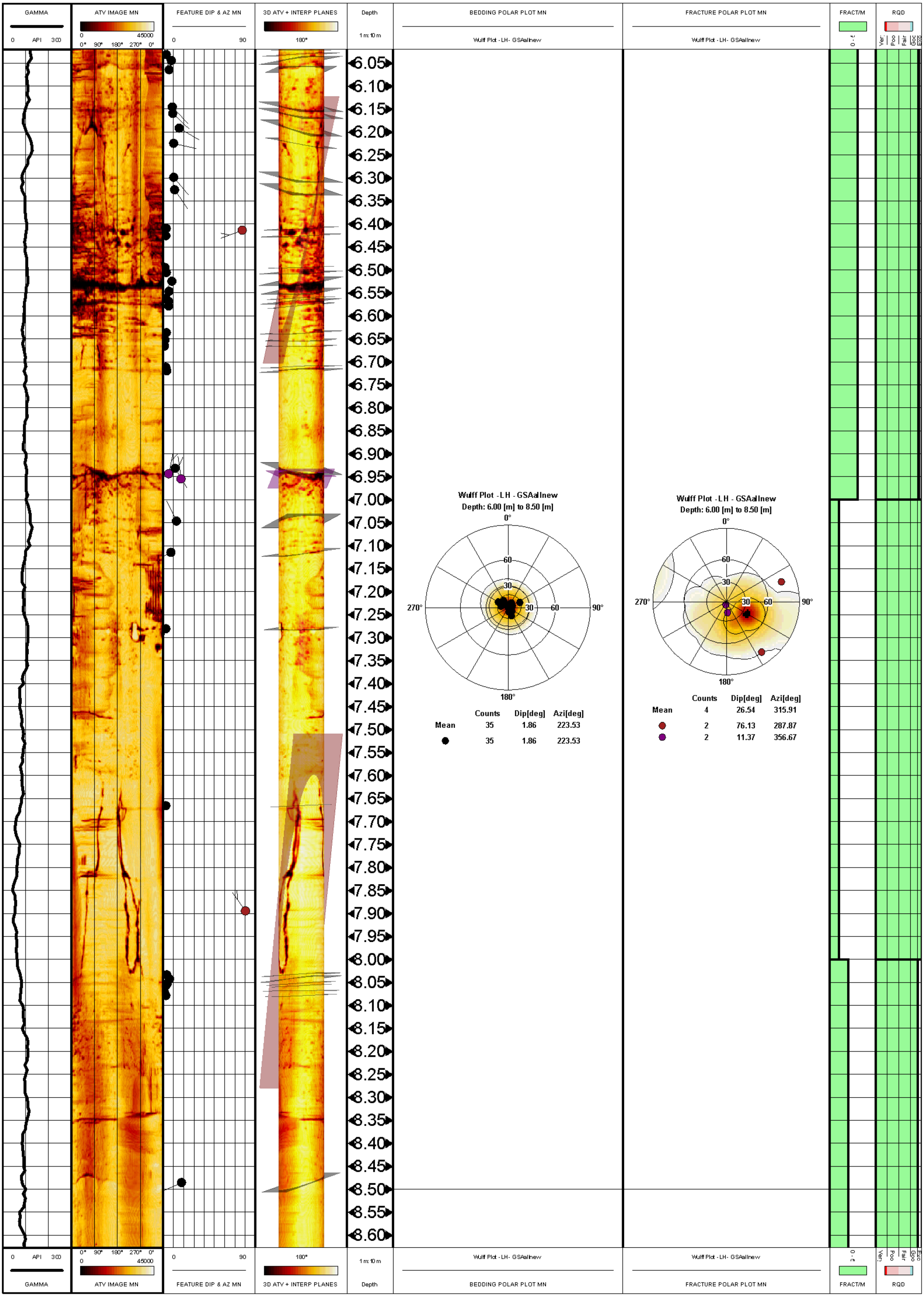
85	14.34	55	321	Filled joint - FD > 10 mm
86	14.35	13	349	Bedding plane
87	14.87	2	58	Bedding plane
88	14.88	2	57	Bedding plane
89	14.91	2	61	Bedding plane
90	14.92	2	51	Bedding plane
91	14.96	2	68	Bedding plane
92	15.02	3	239	Bedding plane
93	15.06	2	258	Bedding plane
94	15.11	4	294	Bedding plane
95	15.13	2	287	Bedding plane
96	15.14	5	299	Bedding plane
97	15.16	3	278	Bedding plane
98	15.24	5	341	Bedding plane
99	15.25	9	344	Bedding plane
100	15.33	7	324	Bedding plane
101	15.34	6	335	Bedding plane
102	15.53	5	219	Bedding plane
103	15.63	1	63	Bedding plane
104	15.65	5	319	Bedding plane
105	15.68	39	232	Filled joint - CT 1 mm to <10 mm
106	15.76	4	279	Bedding plane
107	15.81	6	354	Bedding plane
108	15.82	6	319	Bedding plane
109	15.91	5	345	Bedding plane
110	15.97	14	345	Bedding plane
111	16.00	20	340	Bedding plane
112	16.20	8	133	Bedding plane
113	16.24	10	287	Bedding plane
114	16.24	12	287	Bedding plane
115	16.29	4	307	Bedding plane
116	16.32	23	338	Filled joint - FD > 10 mm
117	16.33	31	184	Filled joint - FD > 10 mm
118	16.37	19	163	Filled joint - FD > 10 mm
119	16.40	4	254	Bedding plane
120	16.45	8	258	Bedding plane
121	16.52	15	345	Filled joint - CT 1 mm to <10 mm
122	16.54	20	10	Filled joint - CT 1 mm to <10 mm
123	16.57	21	104	Bedding plane
124	16.69	7	175	Bedding plane
125	16.73	2	101	Bedding plane
126	16.85	7	73	Bedding plane
127	16.90	12	76	Bedding plane
128	16.94	9	282	Bedding plane
129	16.99	10	291	Bedding plane

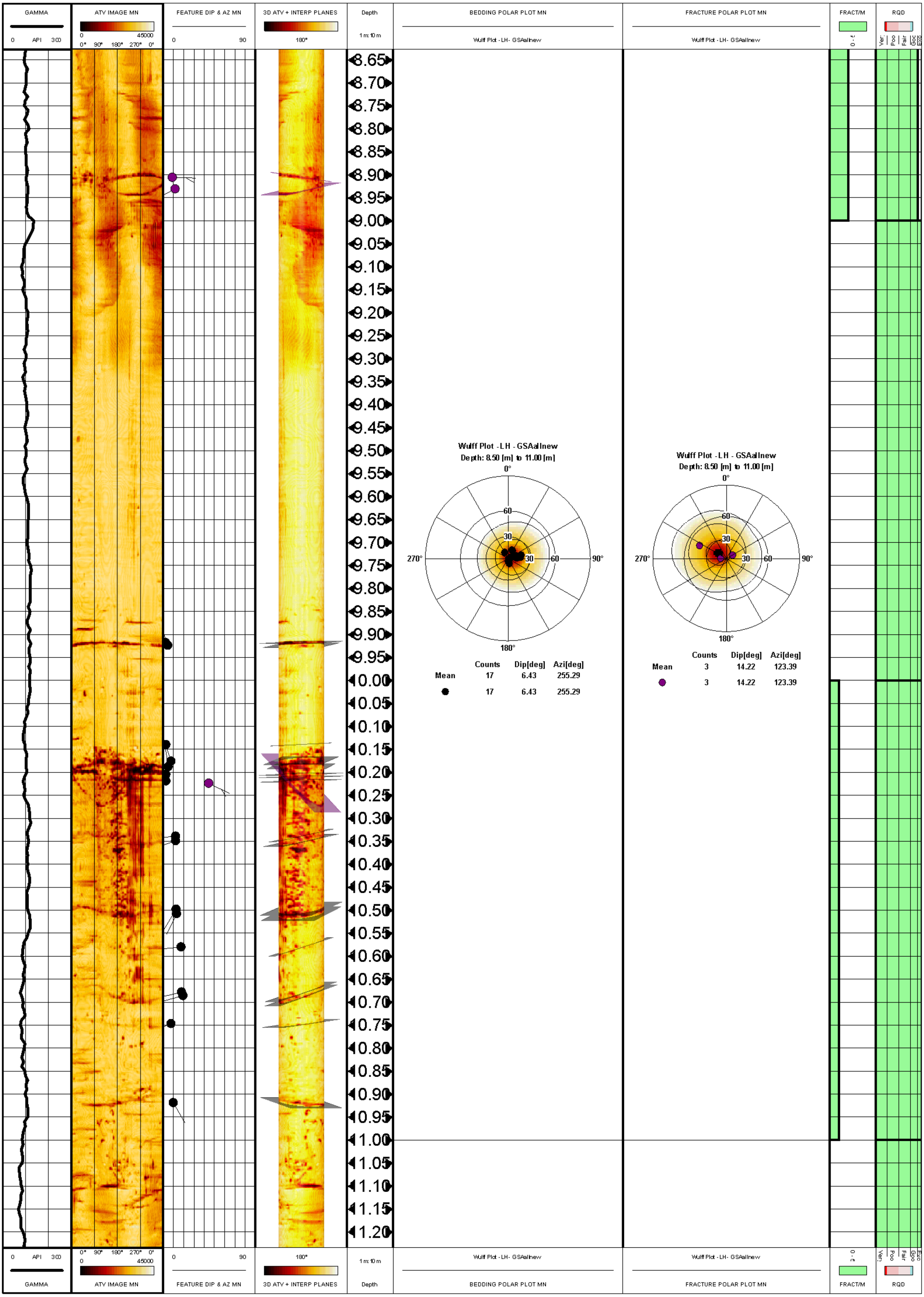
130	17.00	7	292	Bedding plane
131	17.06	10	316	Bedding plane
132	17.19	6	274	Bedding plane
133	17.24	8	234	Bedding plane
134	17.28	5	269	Bedding plane
135	17.31	7	224	Bedding plane
136	17.39	8	245	Bedding plane
137	17.41	7	233	Bedding plane
138	17.44	7	232	Bedding plane
139	17.66	10	335	Bedding plane
140	17.75	3	245	Bedding plane
141	17.76	3	271	Bedding plane
142	17.81	3	275	Bedding plane
143	17.82	4	301	Bedding plane
144	18.38	7	262	Bedding plane
145	18.41	11	270	Bedding plane
146	19.18	4	290	Bedding plane
147	19.55	7	238	Bedding plane
148	19.55	6	230	Bedding plane
149	19.61	6	213	Bedding plane
150	20.41	7	242	Bedding plane
151	20.41	7	242	Bedding plane
152	21.41			Base of data
Feature ID	**Midpoint mbgl**	**Dip deg.**	**Azimuth deg. MN**	**Interpreted feature description**

Appendix 2

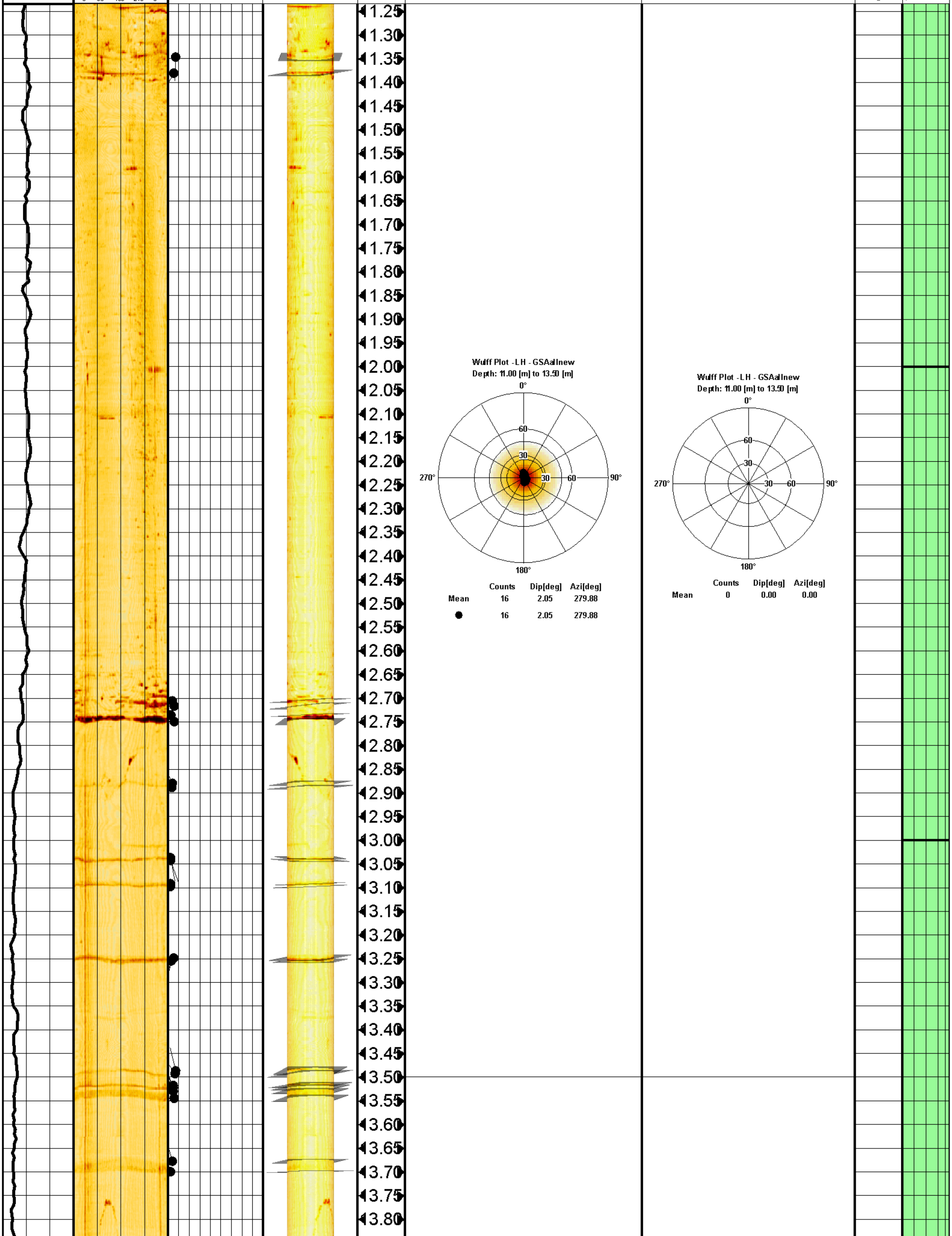
1:10 Interpretation logs

6.02 To 21.41 mbgl


GAMMA
0 API 300
ATV IMAGE MN
0 45000
0° 90° 180° 270° 0°
FEATURE DIP & AZ MN
0 90
3D ATV + INTERP PLANES
180°
Depth
1 m:10 m
BEDDING POLAR PLOT MN
Wulf Plot - LH- GSAallnew
FRACTURE POLAR PLOT MN
Wulf Plot - LH- GSAallnew
FRACT/M
RQD
6.05 6.10 6.15 6.20 6.25 6.30 6.35 6.40 6.45 6.50 6.55 6.60 6.65 6.70 6.75 6.80 6.85 6.90 6.95 7.00 7.05 7.10 7.15 7.20 7.25 7.30 7.35 7.40 7.45 7.50 7.55 7.60 7.65 7.70 7.75 7.80 7.85 7.90 7.95 8.00 8.05 8.10 8.15 8.20 8.25 8.30 8.35 8.40 8.45 8.50 8.55 8.60
Wulff Plot - LH - GSAallnew
Depth: 6.00 [m] to 8.50 [m]
0° 90° 180° 270° 30 60
Counts Dip[deg] Azi[deg]
Mean 35 1.86 223.53
35 1.86 223.53
Wulff Plot - LH - GSAallnew
Depth: 6.00 [m] to 8.50 [m]
0° 90° 180° 270° 30 60
Counts Dip[deg] Azi[deg]
Mean 4 26.54 315.91
2 76.13 287.87
2 11.37 356.67


GAMMA
0 API 300
ATV IMAGE MN
0 45000
0° 90° 180° 270° 0°
FEATURE DIP & AZ MN
0 90
3D ATV + INTERP PLANES
180°
Depth
1m:10m
BEDDING POLAR PLOT MN
Wulf Plot - LH - GSAallnew
FRACTURE POLAR PLOT MN
Wulf Plot - LH - GSAallnew
FRACT/M
RQD
8.65
8.70
8.75
8.80
8.85
8.90
8.95
9.00
9.05
9.10
9.15
9.20
9.25
9.30
9.35
9.40
9.45
9.50
9.55
9.60
9.65
9.70
9.75
9.80
9.85
9.90
9.95
10.00
10.05
10.10
10.15
10.20
10.25
10.30
10.35
10.40
10.45
10.50
10.55
10.60
10.65
10.70
10.75
10.80
10.85
10.90
10.95
11.00
11.05
11.10
11.15
11.20
Wulff Plot - LH - GSAallnew
Depth: 8.50 [m] to 11.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 17 6.43 255.29
17 6.43 255.29
Wulff Plot - LH - GSAallnew
Depth: 8.50 [m] to 11.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 3 14.22 123.39
3 14.22 123.39
Ver Poo Fair Goo Exc
0 API 300
0 45000
FEATURE DIP & AZ MN
3D ATV + INTERP PLANES
Depth
BEDDING POLAR PLOT MN
FRACTURE POLAR PLOT MN
FRACT/M
RQD
GAMMA
ATV IMAGE MN

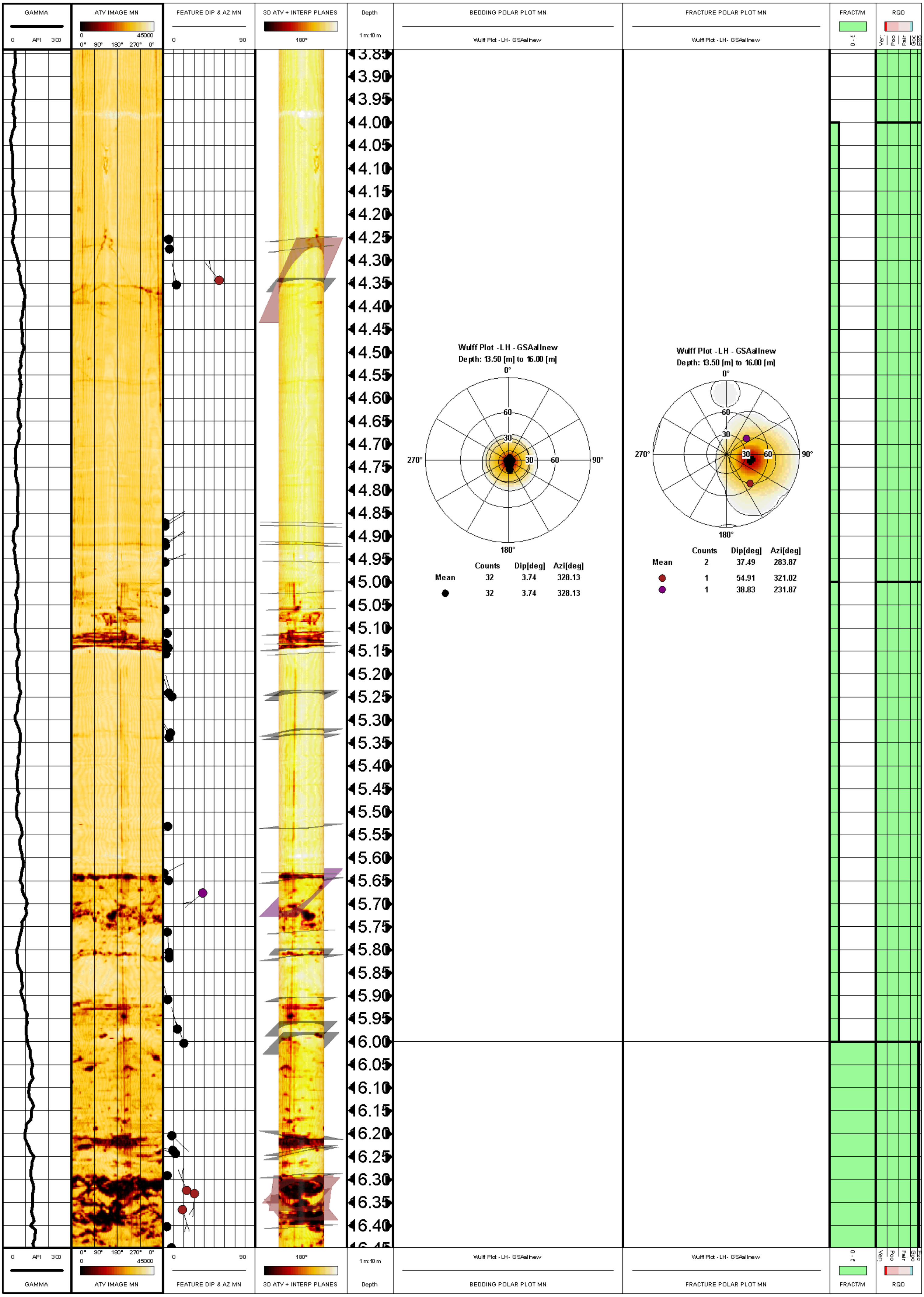
GAMMA	ATV IMAGE MN	FEATURE DIP & AZ MN	3D ATV + INTERP PLANES	Depth	BEDDING POLAR PLOT MN	FRACTURE POLAR PLOT MN	FRACT/M	RQD
0 API 300	0 45000 0° 90° 180° 270° 0°	0 90	180°	1m:10m	Wulff Plot - LH - GSAallnew	Wulff Plot - LH - GSAallnew	0 - 5	Very Poor Fair Good Exc

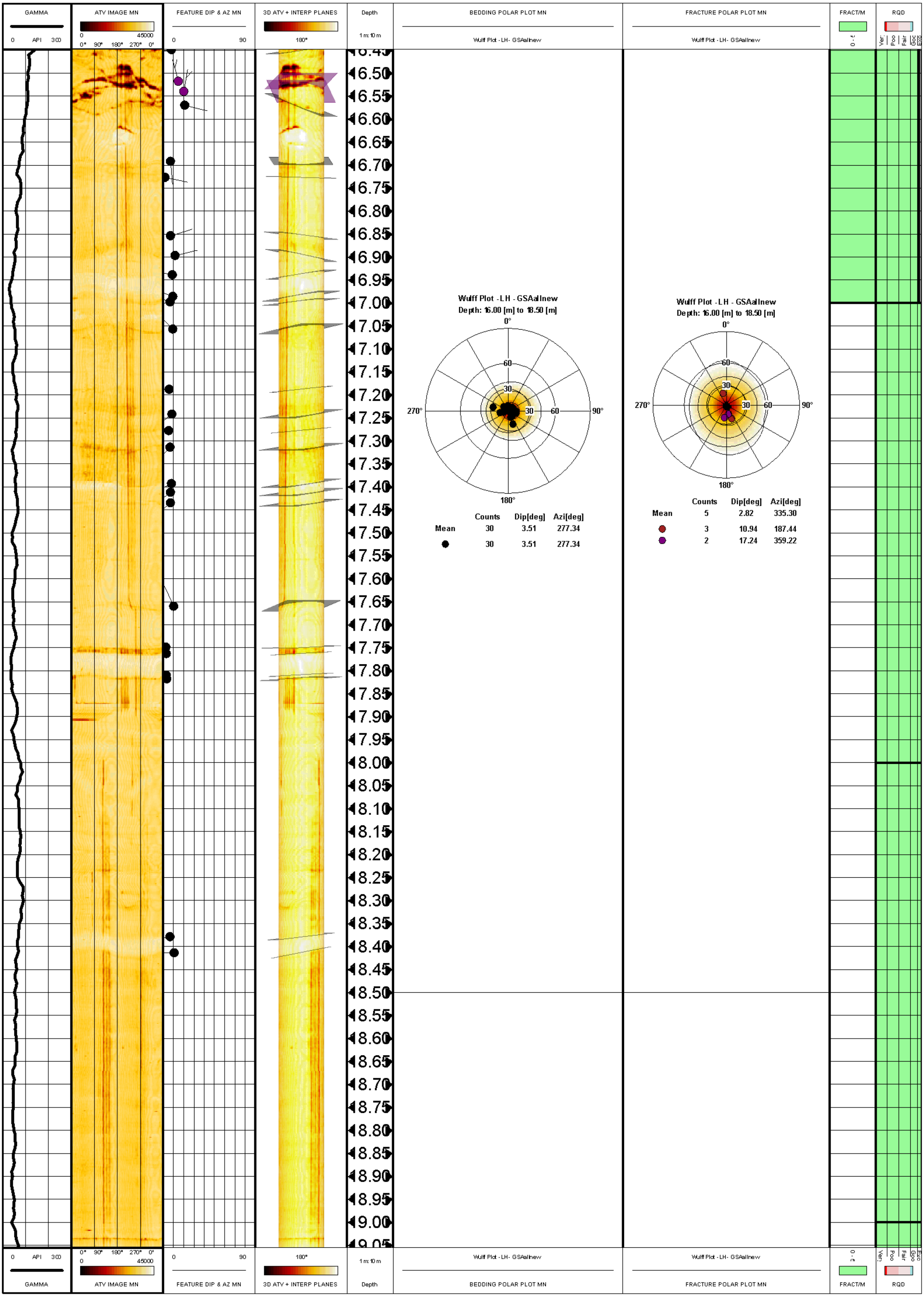


	Counts	Dip[deg]	Azi[deg]
Mean	16	2.05	279.88
●	16	2.05	279.88

	Counts	Dip[deg]	Azi[deg]
Mean	0	0.00	0.00

GAMMA	ATV IMAGE MN	FEATURE DIP & AZ MN	3D ATV + INTERP PLANES	Depth	BEDDING POLAR PLOT MN	FRACTURE POLAR PLOT MN	FRACT/M	RQD
0 API 300	0° 90° 180° 270° 0° 0 45000	0 90	180°	1m:10m	Wulff Plot - LH - GSAallnew	Wulff Plot - LH - GSAallnew	0 - 5	Very Poor Fair Good Exc


GAMMA
0 API 300
ATV IMAGE MN
0 45000
0° 90° 180° 270° 0°
FEATURE DIP & AZ MN
0 90
3D ATV + INTERP PLANES
180°
Depth
1 m:10 m
BEDDING POLAR PLOT MN
Wulff Plot - LH - GSAallnew
FRACTURE POLAR PLOT MN
Wulff Plot - LH - GSAallnew
FRACT/M
RQD
13.85
13.90
13.95
14.00
14.05
14.10
14.15
14.20
14.25
14.30
14.35
14.40
14.45
14.50
14.55
14.60
14.65
14.70
14.75
14.80
14.85
14.90
14.95
15.00
15.05
15.10
15.15
15.20
15.25
15.30
15.35
15.40
15.45
15.50
15.55
15.60
15.65
15.70
15.75
15.80
15.85
15.90
15.95
16.00
16.05
16.10
16.15
16.20
16.25
16.30
16.35
16.40
Wulff Plot - LH - GSAallnew
Depth: 13.50 [m] to 16.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 32 3.74 328.13
32 3.74 328.13
Wulff Plot - LH - GSAallnew
Depth: 13.50 [m] to 16.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 2 37.49 283.87
1 54.91 321.02
1 38.83 231.87
0 API 300
GAMMA
ATV IMAGE MN
FEATURE DIP & AZ MN
3D ATV + INTERP PLANES
Depth
BEDDING POLAR PLOT MN
FRACTURE POLAR PLOT MN
FRACT/M
RQD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3D ATV + INTERP PLANES
Depth
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FRACT/M
RQD
0 API 300
0 45000
0° 90° 180° 270° 0°
0 90
180°
1 m:10 m
Wulff Plot - LH - GSAallnew
16.50
16.55
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16.75
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18.95
19.00
Wulff Plot - LH - GSAallnew
Depth: 16.00 [m] to 18.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
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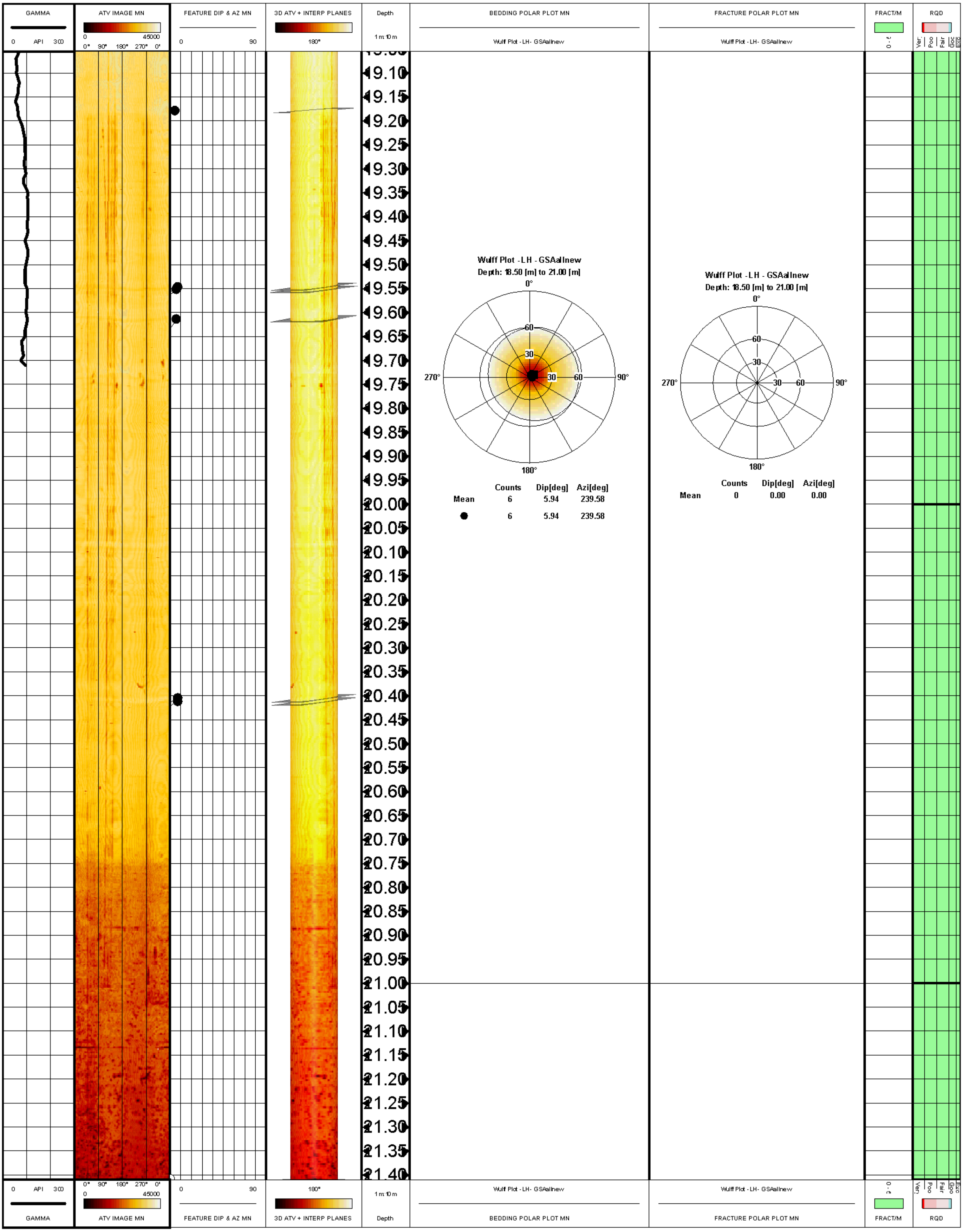
30 3.51 277.34
Wulff Plot - LH - GSAallnew
Depth: 16.00 [m] to 18.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 5 2.82 335.30
3 10.94 187.44
2 17.24 359.22
Ver. Poo Fair Goo Exc


GAMMA
0 API 300
ATV IMAGE MN
0 45000
0° 90° 180° 270° 0°
FEATURE DIP & AZ MN
0 90
3D ATV + INTERP PLANES
180°
Depth
1 m:10 m
BEDDING POLAR PLOT MN
Wulff Plot - LH - GSAallnew
FRACTURE POLAR PLOT MN
Wulff Plot - LH - GSAallnew
FRACT/M
RQD
19.10
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20.75
20.80
20.85
20.90
20.95
21.00
21.05
21.10
21.15
21.20
21.25
21.30
21.35
21.40
Wulff Plot - LH - GSAallnew
Depth: 18.50 [m] to 21.00 [m]
0° 90° 180° 270° 30 60
Counts Dip[deg] Azi[deg]
Mean 6 5.94 239.58
6 5.94 239.58
Wulff Plot - LH - GSAallnew
Depth: 18.50 [m] to 21.00 [m]
0° 90° 180° 270° 30 60
Counts Dip[deg] Azi[deg]
Mean 0 0.00 0.00

Douglas Partners- Liverpool
402 Macquarie Street

Borehole - BH405

ATV Interpreted Features Report

Groundsearch Australia Pty. Limited
Issued: 16 May 2024

www.groundsearch.com.au

AMEC 2024 Member
Association of Mining and Exploration Companies

DISCLAIMER

The data used in this report were obtained using equipment manufactured by LIM Logging/Electromind. The interpretations given in this report are based on judgement and experience of Groundsearch Australia's personnel. They are provided for Douglas Partner's 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

J Lea

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 2024 site investigation programme for Douglas Partners- Liverpool.

LIM Logging BHTV acoustic televiewer logging tool was run to collect data in the field on 07 May 2024. The data in this report are from 1.55 to 13.36 mbgl.

The 125 identified features are interpreted as bedding planes and fractures. The bedding to fracture ratio is 9.42:1.

The LIM Logging 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** with density contours as pole vectors in the **lower hemisphere**.

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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 2024 site investigation programme for Douglas Partners- Liverpool.

LIM Logging BHTV acoustic televiewer logging tool was run to collect data in the field on 07 May 2024. The data in this report are from 1.55 to 13.36 mbgl.

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The LIM Logging 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** with density contours as pole vectors in the **lower hemisphere**.

The ATV takes an oriented image of the borehole using high-resolution sound waves. The acoustic image is displayed as 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 180 measurements around the borehole at each high-resolution sample interval. These data can be oriented to Magnetic North and displayed in real-time while logging using the LIM BHTV Logging System.

Analysis software includes colour adjustment, fracture dip and dip direction 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 and by mudcake adhered to the borehole wall.

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. Both sides of the 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 inclination angle and azimuth 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 **Magnetic North**-referenced:

- Text summary of the interpreted features

- Logs that show geological features with their subjective 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:

    - Natural gamma
    - ATV image referenced to Magnetic North
    - Colour-coded tadpoles that represent feature dip and dip direction
    - 3D ATV image with feature planes
    - Bedding polar plot referenced to Magnetic North
    - Fracture polar plot referenced to Magnetic North
    - Fracture frequency/M
    - Defect RQD

- Table containing feature curve ID, midpoint mbgl, dip angle, dip azimuth and feature description.

- Feature density contour plots as pole vectors in the lower hemisphere

The Rock Quality Designation (RQD) is a measure of the degree of jointing of fractures in a rock mass with:

- Image sample interval = 0.1 m
- Image length reported = 1.0 m

RQD values are:

- <0.25 - very poor
- 0.25 - 0.50 - poor
- 0.50 - 0.75 - fair
- 0.75 - 0.90 - good
- 0.90 - 1.00 - excellent

3.0 BH405 interpretations

The 125 identified features are interpreted as bedding planes and fractures. The bedding to fracture ratio is 9.42:1.

The density contours for all interpreted features are shown in Figure 1. A description of each interpreted feature is presented in Appendix 1 and the combination log is presented in Appendix 2.

The 125 sedimentary features identified are bedding planes that appear to range in dip from flat-lying to 25^0.

The 12 fractures identified are classified as:

Table 1

Interval section	**Complete data 1.55 – 13.36 mbgl**		
Feature classification	**Feature count**	**Percentage**	**Dip range**
Filled joint - CT 1mm to <10mm	08	67%	04^0 to 72^0
Filled joint - FD >10mm	04	33%	30^0 to 44^0

The sedimentary features identified are classified as:

Interval section	**Complete data 1.55 – 13.36 mbgl**	
Feature classification	**Feature count**	**Dip range**
Bedding	125	00^0 to 25^0

Figures 1 to 5 present the orientation density contour plans for each feature set identified as pole vectors, MN, lower hemisphere.

Feature Dip is represented as 00^0 being the horizontal plane and 90^0 being the vertical plane.

Stereonets show the Feature Dip represented as 00^0 being the centre of the stereonet and 90^0 being the outer circle of the stereonet.

The standards used for reporting are outlined on the following page of this report.

	Code	Tadpole	Sine Wave	
2	Seam/zone base FZ			Fractured zone base
3	Seam/zone base			
4	Fracture plane - open			Fracture plane - open
5	Minor open fracture			Minor open fracture
6	Fracture plane - partially open			Fracture plane - partially open
7	Filled fracture			Filled fracture
8	Bedding plane open			Bedding plane open
9	Fracture plane - closed			Fracture plane - closed
10	Top of data			Top of data
11	Induced fracture			Induced fracture
12	SWL			SWL
13	Fault - FT			Level 1
14	Rocktype boundary			Rocktype boundary
15	Bedding separation plane			Bedding separation plane
16	Fracture plane - discontinuous			Fracture plane - discontinuous
17	Partially filled fracture			Partially filled fracture
18	Irregular vein			Irregular vein
19	Unconformity			Unconformity
20	Base of casing			Base of casing
21	Top of Coal Unit			Top of Coal Unit
22	Base of Coal Unit			Base of Coal Unit
23	Base of weathering			Base of weathering
24	Top of breakout			Top of breakout
25	Base of breakout			Base of breakout
26	Top of washout			Top of washout
27	Base of washout			Base of washout
28	Top of open fracture			Top of open fracture
29	Base of open fracture			Base of open fracture
30	Bedding plane partially open			Bedding plane partially open
31	Parting			Parting
32	Shear plane			Shear plane
33	Face cleat			Face cleat
34	Butt cleat			Butt cleat
35	Intrusive contact			Intrusive contact
36	Irregular fracture			Irregular fracture
37	Open joint >5 mm aperture			Level 2
38	Closed joint <5 mm aperture			Level 3
39	Vein			Level 3
40	Filled joint - SN			Level 3
41	Filled joint - VN <1 mm			Level 3
42	Filled joint - CT 1 mm to <10 mm			Level 3
43	Filled joint - FD > 10 mm			Level 3
44	Lithozone boundary			Lithozone boundary
45	Bedding plane			
46	Top of mineralisation			
47	Base of mineralisation			
48	Crossbedding			

Figure 1 BH405 interpreted features density contours – pole vectors, MN, lower hemisphere

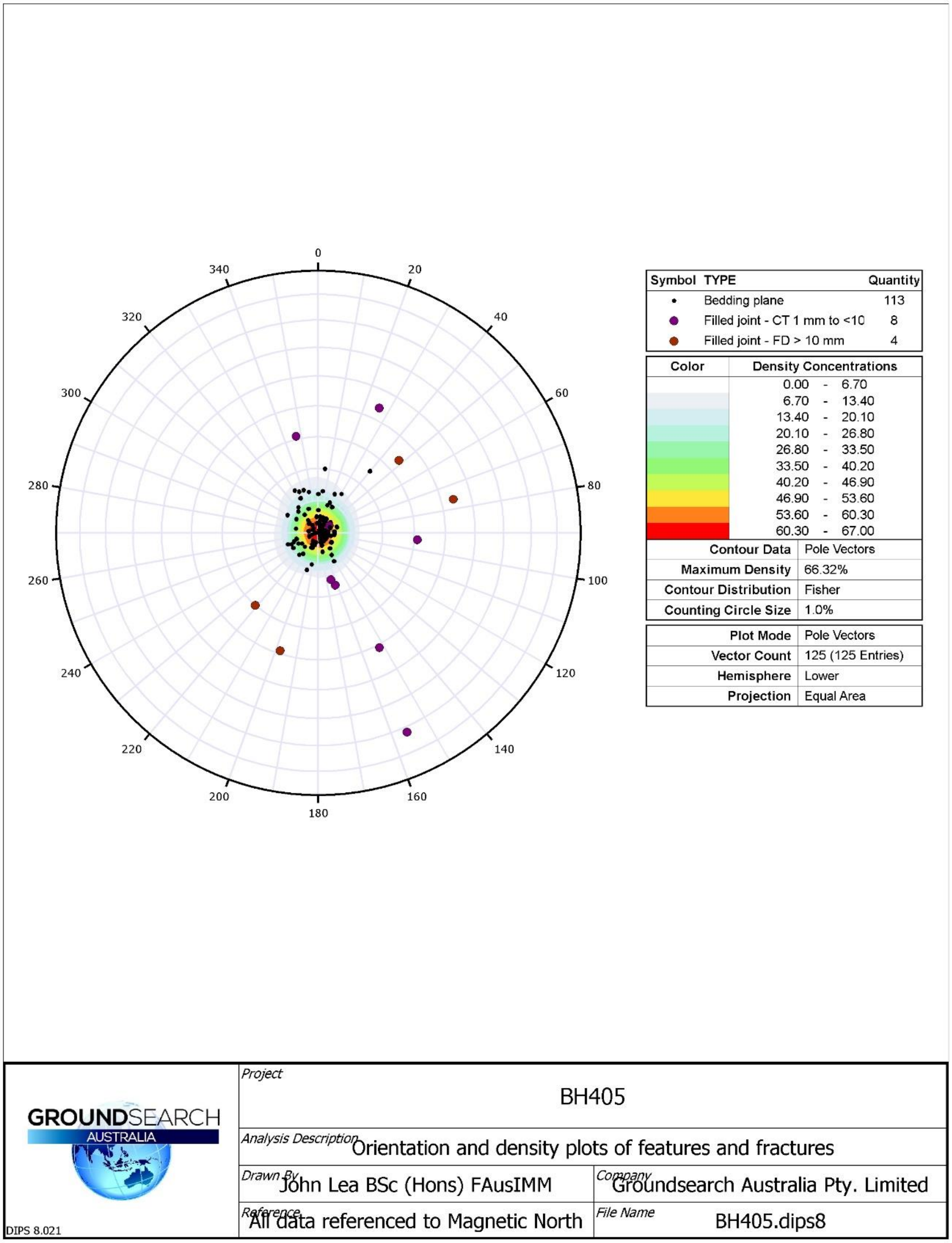


Figure 2 BH405 bedding orientation plan – pole vectors, MN, lower hemisphere

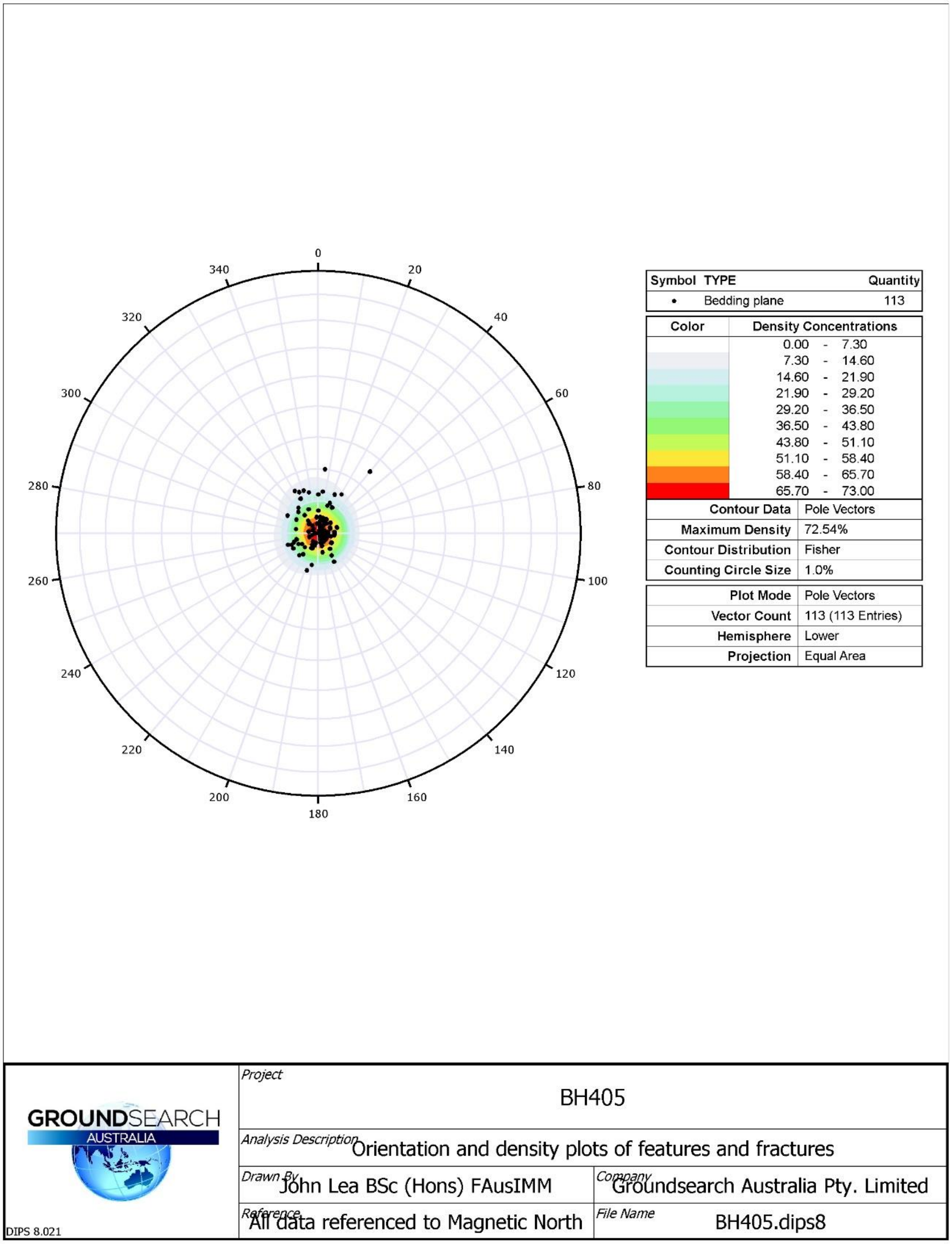


Figure 3 BH405 fractures orientation density contour plan – pole vectors, MN, lower hemisphere

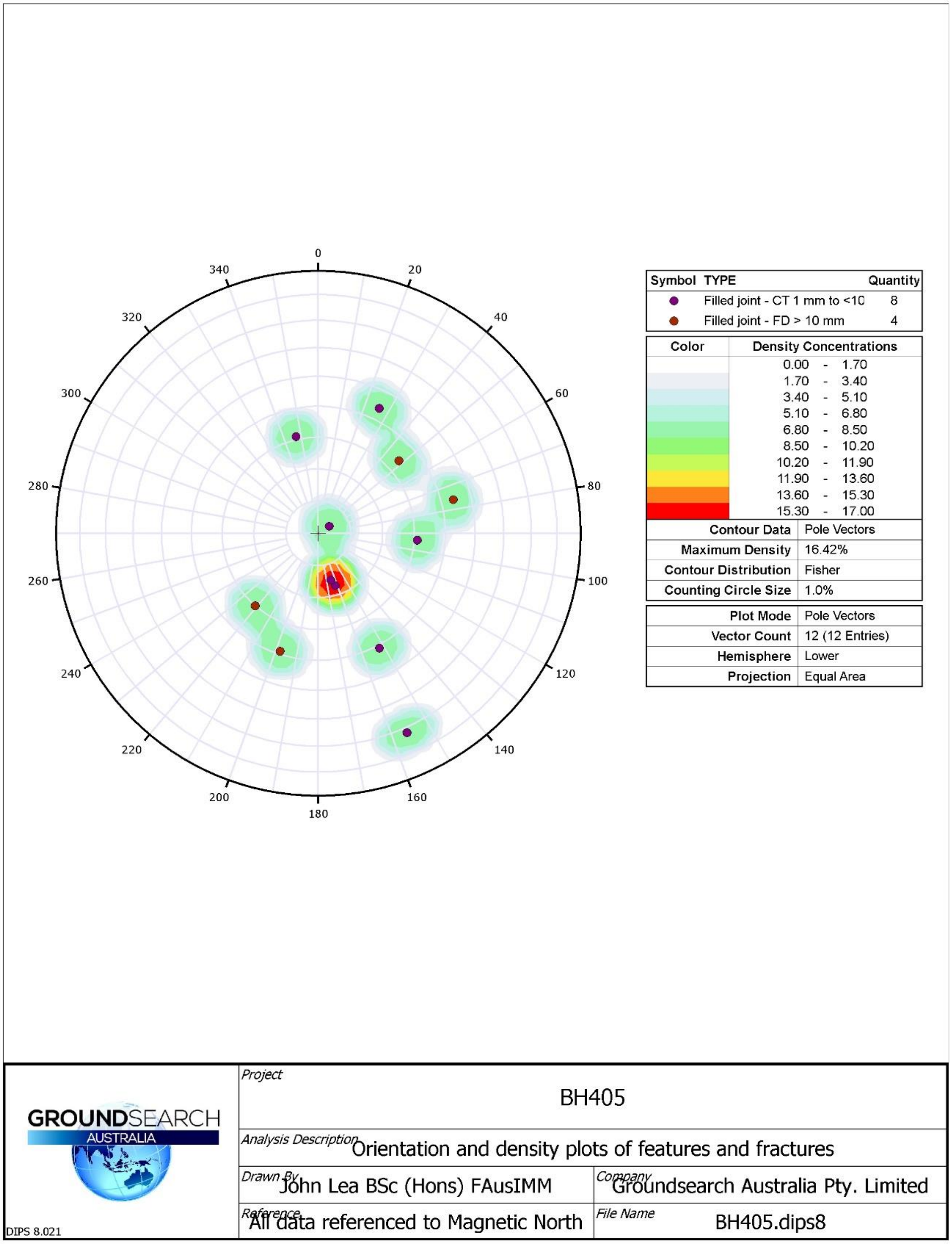


Figure 4 BH405 filled joint – CT 1mm to <10mm density contour plan - pole vectors, MN, lower hemisphere

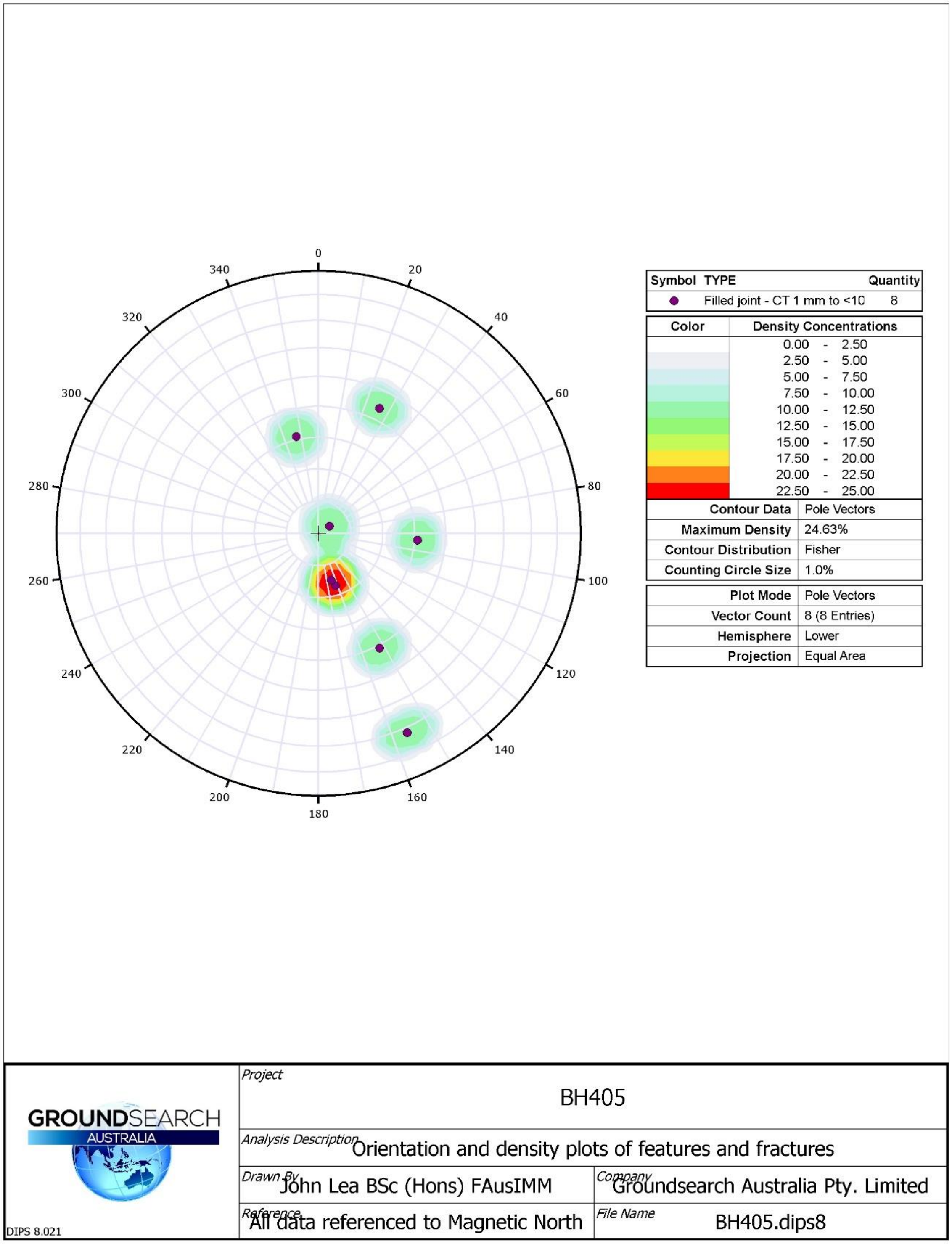
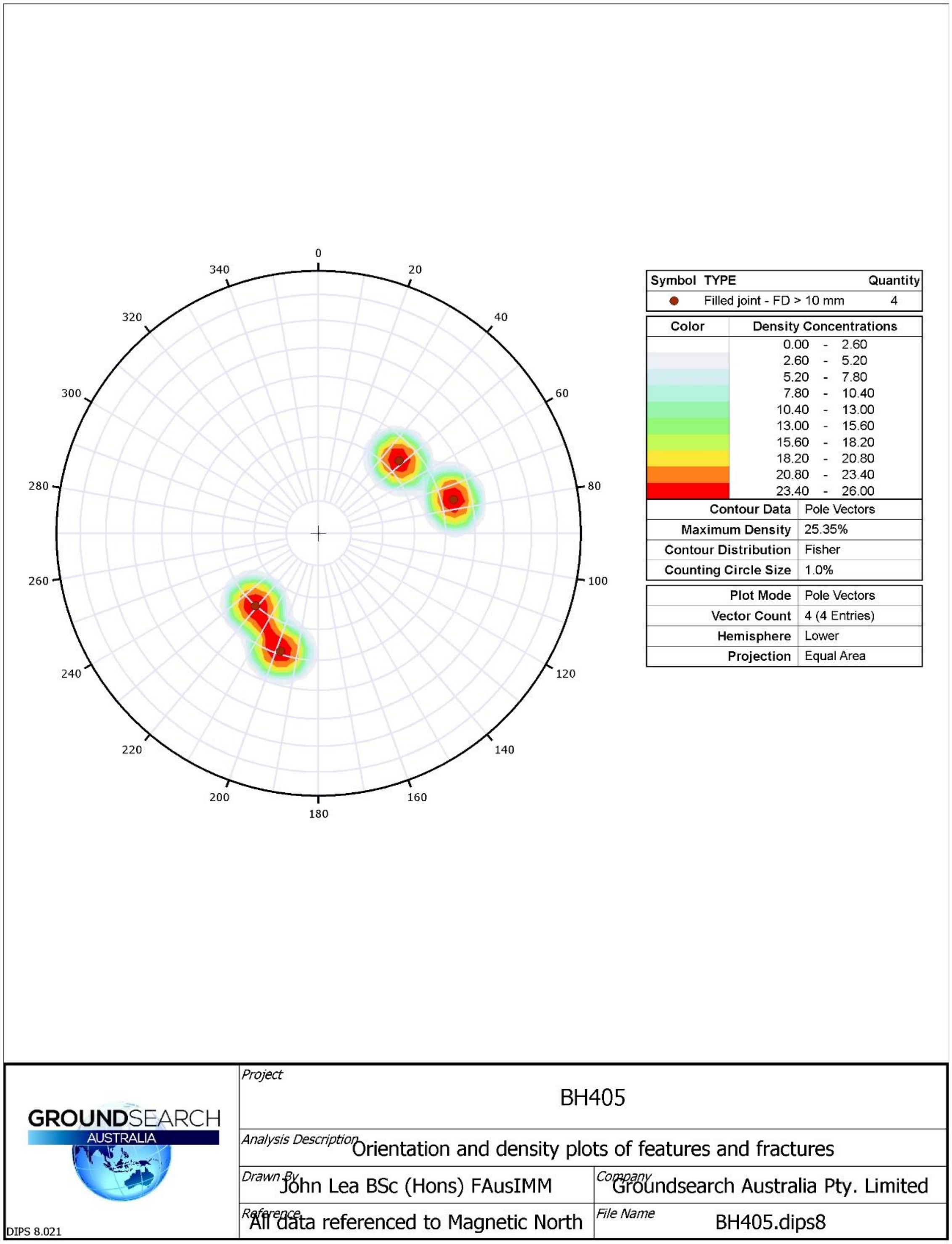


Figure 5 BH405 filled joint – FD >10mm density contour plan - pole vectors, MN, lower hemisphere

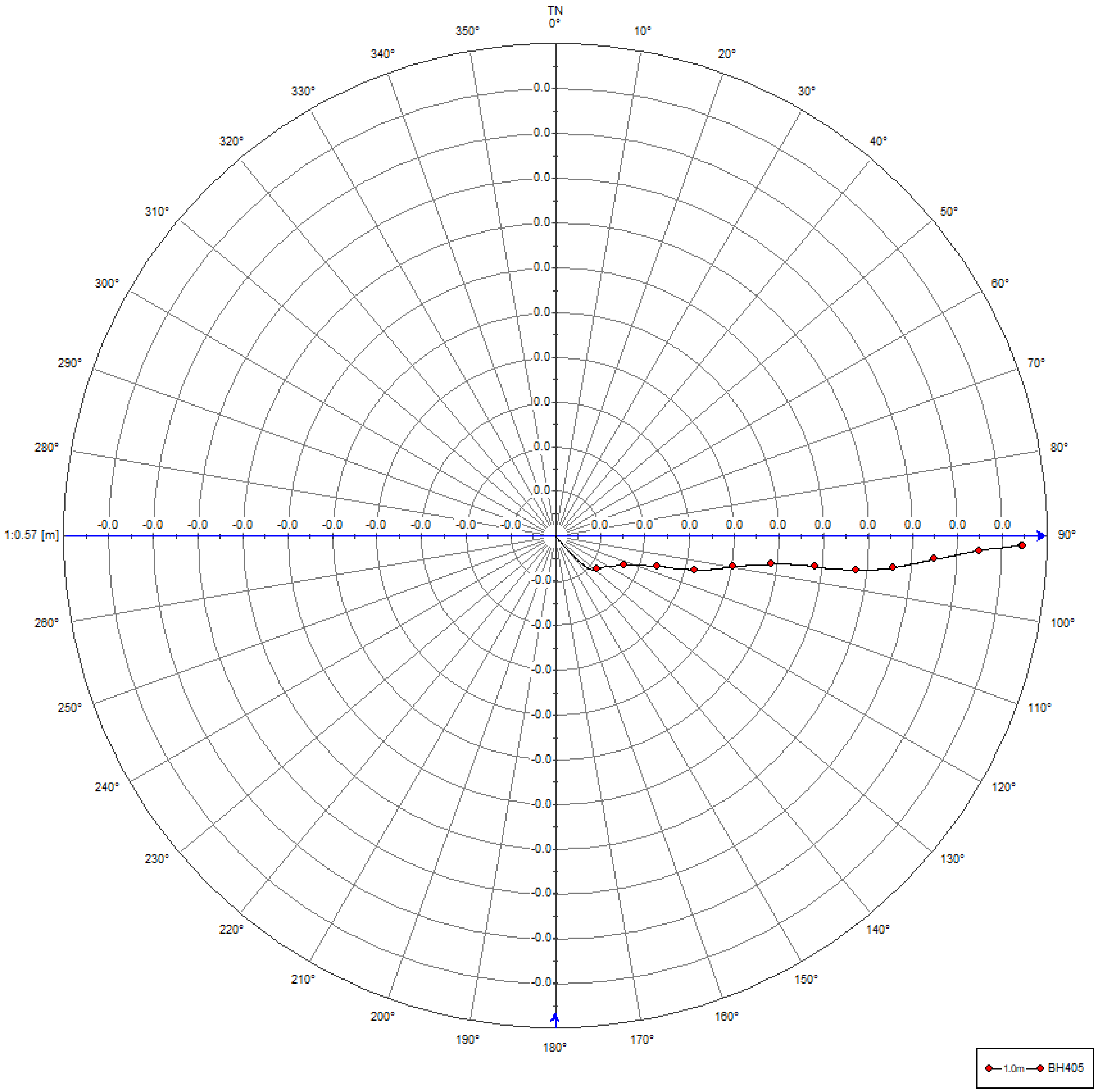


4.0 BH405 borehole deviation data

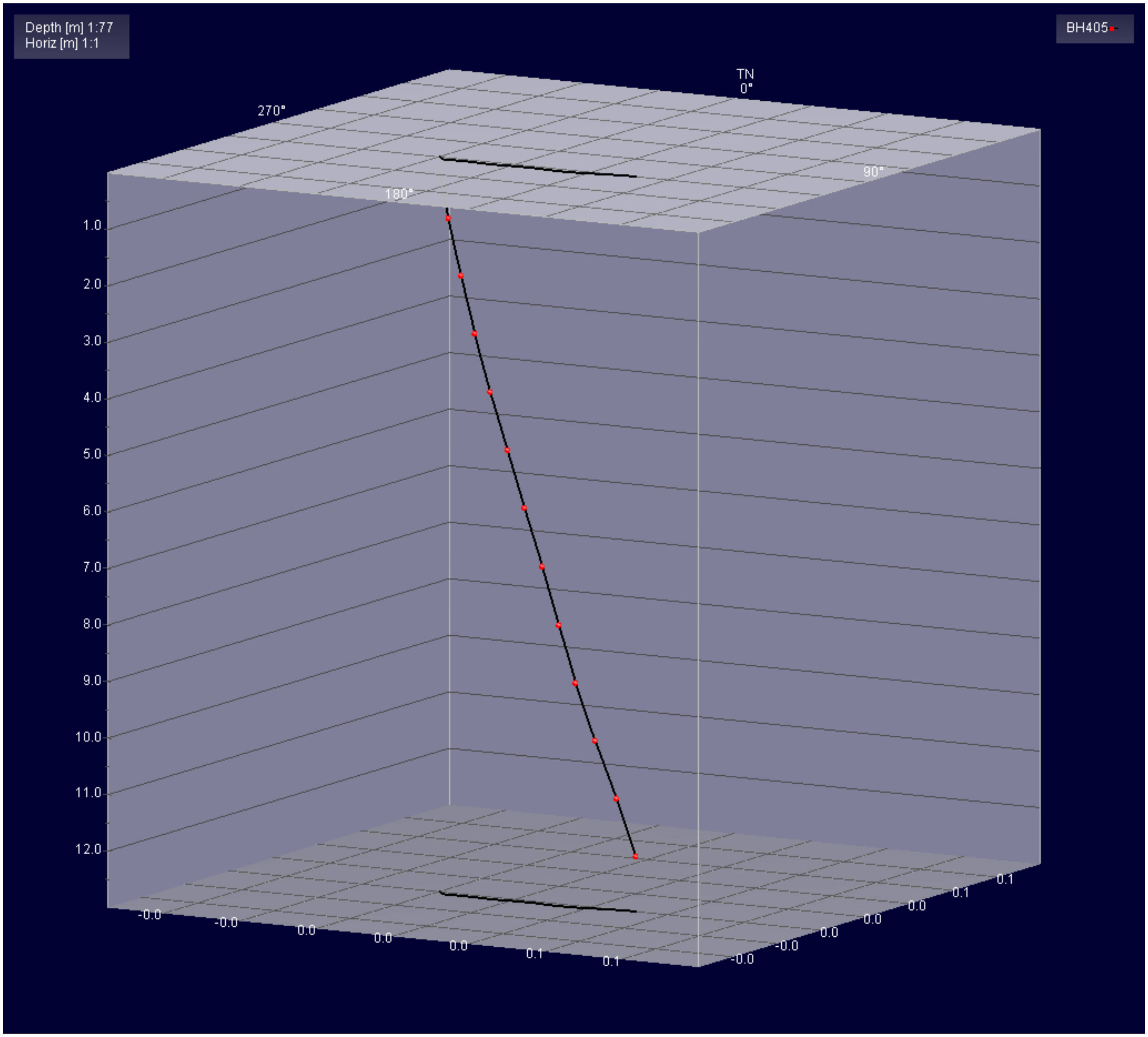
The data are presented in **Table 2** below.

Depth m	INCL DEGREE	AZ DEGREE	Easting [m]	Northing [m]	TVD [m]
0	0.82	140.99	0	0	0
1	0.14	57.67	0.006576	-0.00615	0.999947
2	0.2	84.6	0.009624	-0.00568	1.99994
3	0.2	96.64	0.013313	-0.00578	2.99994
4	0.25	93.26	0.017601	-0.00623	3.99993
5	0.24	83.69	0.021888	-0.00587	4.99992
6	0.25	89.04	0.02623	-0.00558	5.99991
7	0.28	98.16	0.031008	-0.00584	6.9999
8	0.25	91.61	0.035589	-0.00627	7.99989
9	0.24	81.3	0.039852	-0.00598	8.99988
10	0.3	79.74	0.04441	-0.00504	9.99987
11	0.28	78.83	0.049396	-0.00405	10.9999
12	0.27	83.66	0.054169	-0.00348	11.9998

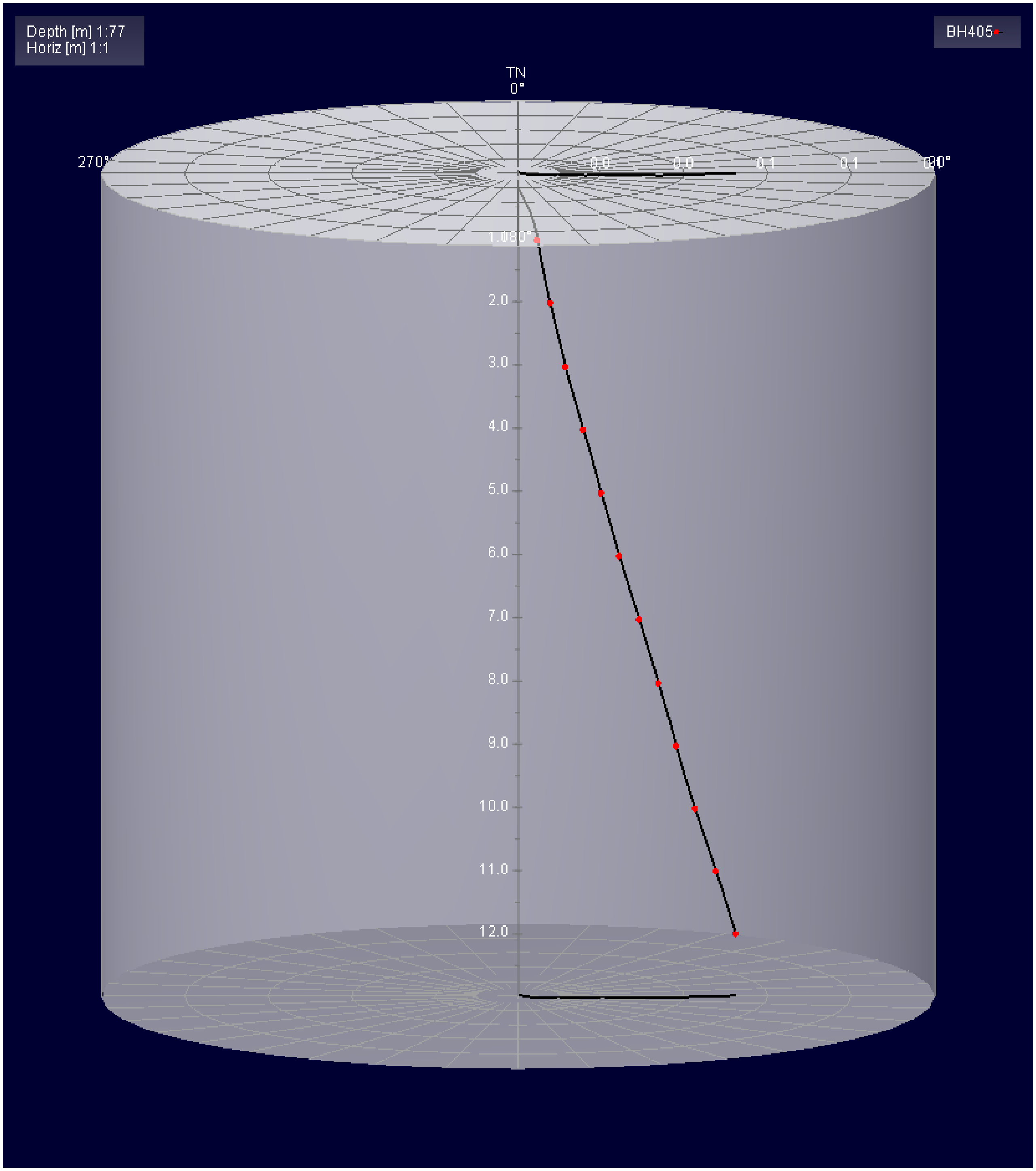
BH405 Bullseye Plot



BH405 Cubic Plot



BH405 Cylindrical Plot



Appendix 1

Tabulated interpreted features report for BH405

Feature ID	Midpoint mbgl	Dip deg.	Azimuth deg. MN	Interpreted feature description
1	1.55			Top of data
2	1.69	7	75	Bedding plane
3	1.70	3	100	Bedding plane
4	1.72	8	36	Bedding plane
5	1.78	14	211	Bedding plane
6	1.89	12	180	Bedding plane
7	1.90	13	186	Bedding plane
8	1.94	6	44	Bedding plane
9	1.95	9	41	Bedding plane
10	2.01	14	161	Bedding plane
11	2.02	13	167	Bedding plane
12	2.05	25	220	Bedding plane
13	2.09	44	256	Filled joint - FD > 10 mm
14	2.25	5	22	Bedding plane
15	2.26	3	33	Bedding plane
16	2.33	72	336	Filled joint - CT 1 mm to <10 mm
17	2.38	2	135	Bedding plane
18	2.38	3	142	Bedding plane
19	2.43	2	73	Bedding plane
20	2.51	14	155	Bedding plane
21	2.51	15	151	Bedding plane
22	2.53	11	120	Bedding plane
23	2.54	10	142	Bedding plane
24	2.55	9	198	Bedding plane
25	2.56	10	201	Bedding plane
26	2.62	2	328	Bedding plane
27	2.82	9	137	Bedding plane
28	2.85	7	143	Bedding plane
29	2.86	8	158	Bedding plane
30	2.93	9	59	Bedding plane
31	2.95	12	17	Bedding plane
32	2.98	7	62	Bedding plane
33	2.99	6	57	Bedding plane
34	4.55	3	263	Bedding plane
35	4.63	2	268	Bedding plane
36	4.73	3	174	Bedding plane
37	4.91	41	332	Filled joint - CT 1 mm to <10 mm
38	4.95	4	189	Bedding plane
39	5.35	3	189	Bedding plane

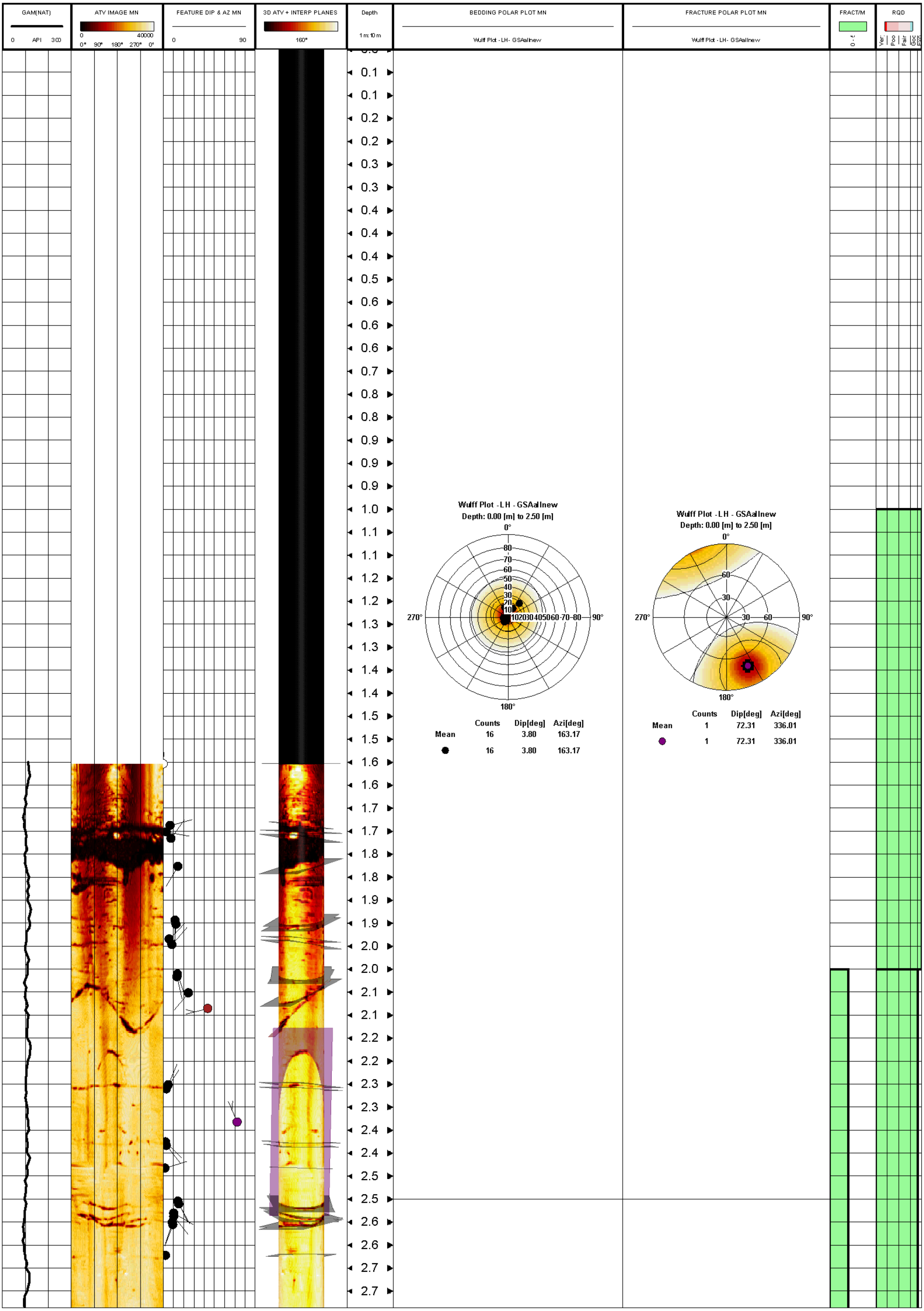
40	5.36	5	141	Bedding plane
41	5.42	2	310	Bedding plane
42	5.44	7	101	Bedding plane
43	5.46	4	248	Bedding plane
44	5.47	5	230	Bedding plane
45	5.64	4	208	Bedding plane
46	5.65	4	221	Bedding plane
47	5.66	4	237	Filled joint - CT 1 mm to <10 mm
48	5.99	6	251	Bedding plane
49	6.00	6	254	Bedding plane
50	6.01	4	284	Bedding plane
51	6.03	5	265	Bedding plane
52	6.11	1	303	Bedding plane
53	6.24	5	274	Bedding plane
54	6.28	4	244	Bedding plane
55	6.30	5	278	Bedding plane
56	6.31	5	268	Bedding plane
57	6.38	1	274	Bedding plane
58	6.38	2	285	Bedding plane
59	6.48	2	216	Bedding plane
60	6.54	3	313	Bedding plane
61	6.54	2	304	Bedding plane
62	6.60	2	301	Bedding plane
63	6.61	3	326	Bedding plane
64	6.77	3	309	Bedding plane
65	6.79	3	288	Bedding plane
66	6.82	3	286	Bedding plane
67	6.84	17	342	Filled joint - CT 1 mm to <10 mm
68	6.95	44	206	Filled joint - CT 1 mm to <10 mm
69	7.00	5	210	Bedding plane
70	7.16	2	194	Bedding plane
71	7.18	5	196	Bedding plane
72	7.29	10	12	Bedding plane
73	7.30	5	25	Bedding plane
74	7.37	34	228	Filled joint - FD > 10 mm
75	7.42	15	345	Filled joint - CT 1 mm to <10 mm
76	7.48	30	41	Filled joint - FD > 10 mm
77	7.50	39	18	Filled joint - FD > 10 mm
78	7.54	20	186	Bedding plane
79	7.75	31	167	Filled joint - CT 1 mm to <10 mm
80	7.80	10	69	Bedding plane
81	7.98	4	134	Bedding plane
82	7.99	2	118	Bedding plane
83	8.16	5	307	Bedding plane
84	8.18	5	305	Bedding plane

85	8.39	1	285	Bedding plane
86	8.43	1	277	Bedding plane
87	8.44	3	274	Bedding plane
88	8.48	5	208	Bedding plane
89	8.59	8	70	Bedding plane
90	8.61	7	74	Bedding plane
91	8.83	5	174	Bedding plane
92	9.07	13	203	Bedding plane
93	9.09	9	208	Bedding plane
94	9.11	7	180	Bedding plane
95	9.14	9	67	Bedding plane
96	9.20	3	68	Bedding plane
97	9.22	4	28	Bedding plane
98	9.24	4	18	Bedding plane
99	9.38	3	345	Bedding plane
100	9.40	6	323	Bedding plane
101	9.49	10	331	Bedding plane
102	9.50	8	329	Bedding plane
103	9.59	2	241	Bedding plane
104	10.09	3	14	Bedding plane
105	10.10	4	344	Bedding plane
106	10.16	3	297	Bedding plane
107	10.31	2	310	Bedding plane
108	10.43	1	329	Bedding plane
109	10.46	2	330	Bedding plane
110	10.47	6	347	Bedding plane
111	10.61	31	274	Filled joint - CT 1 mm to <10 mm
112	10.75	1	202	Bedding plane
113	10.84	3	326	Bedding plane
114	10.84	2	339	Bedding plane
115	11.55	8	122	Bedding plane
116	11.94	0	224	Bedding plane
117	11.99	0	271	Bedding plane
118	12.00	5	187	Bedding plane
119	12.04	3	337	Bedding plane
120	12.07	8	158	Bedding plane
121	12.08	12	153	Bedding plane
122	12.38	3	173	Bedding plane
123	12.52	4	138	Bedding plane
124	12.93	1	86	Bedding plane
125	12.94	1	90	Bedding plane
126	13.18	3	213	Bedding plane
127	13.36			Base of data
Feature ID	**Midpoint mbgl**	**Dip deg.**	**Azimuth deg. MN**	**Interpreted feature description**

Appendix 2

1:10 Interpretation logs

1.55 To 13.36 mbgl



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FEATURE DIP & AZ MN
0 90
3D ATV + INTERP PLANES
180°
Depth
1m:10m
BEDDING POLAR PLOT MN
Wulf Plot - LH - GSAallnew
FRACTURE POLAR PLOT MN
Wulf Plot - LH - GSAallnew
FRACT/M
RQD
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Wulff Plot - LH - GSAallnew
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90°
180°
270°
Counts Dip[deg] Azi[deg]
Mean 16 3.80 163.17
16 3.80 163.17
Wulff Plot - LH - GSAallnew
Depth: 0.00 [m] to 2.50 [m]
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180°
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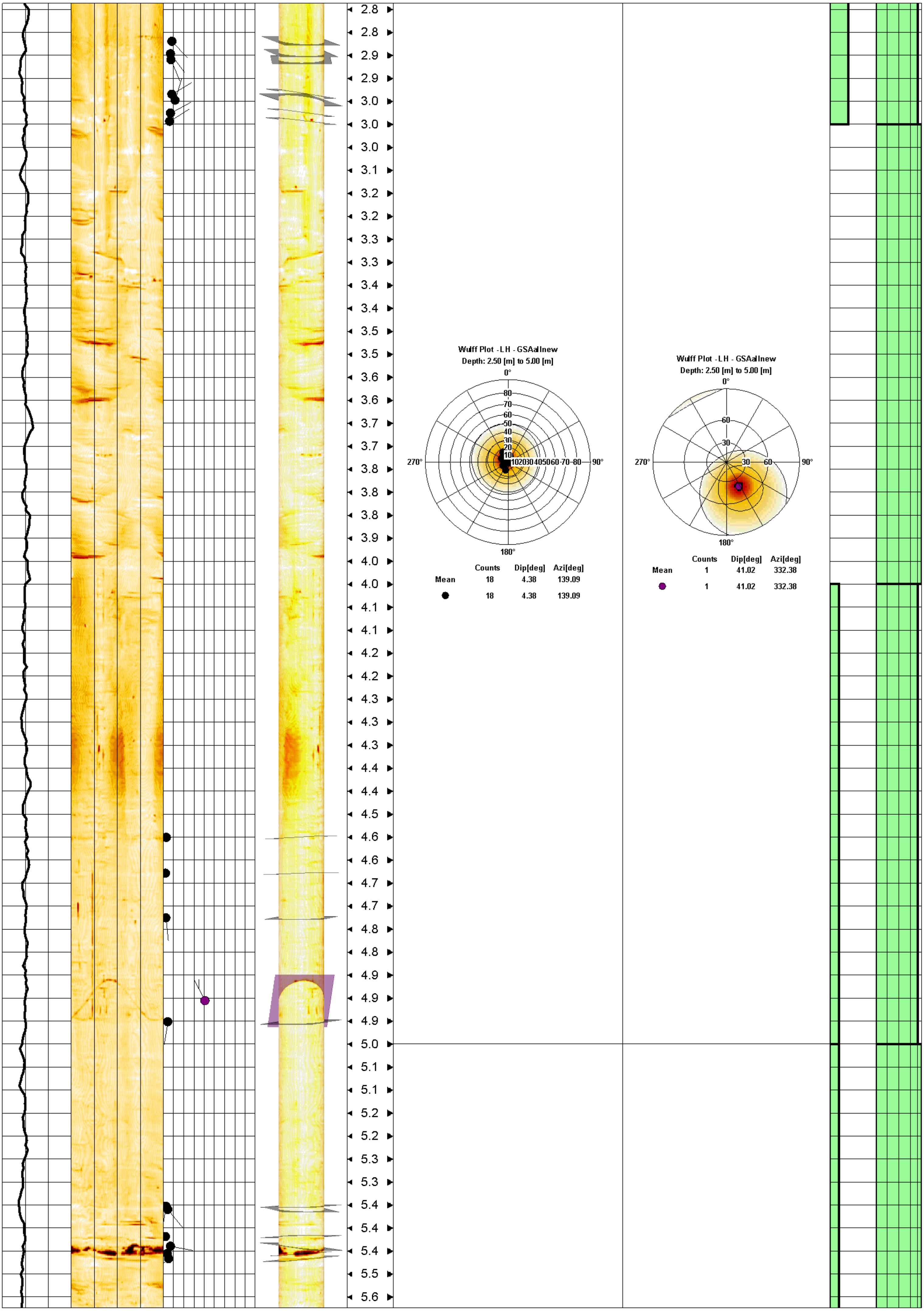
Counts Dip[deg] Azi[deg]
Mean 1 72.31 336.01
1 72.31 336.01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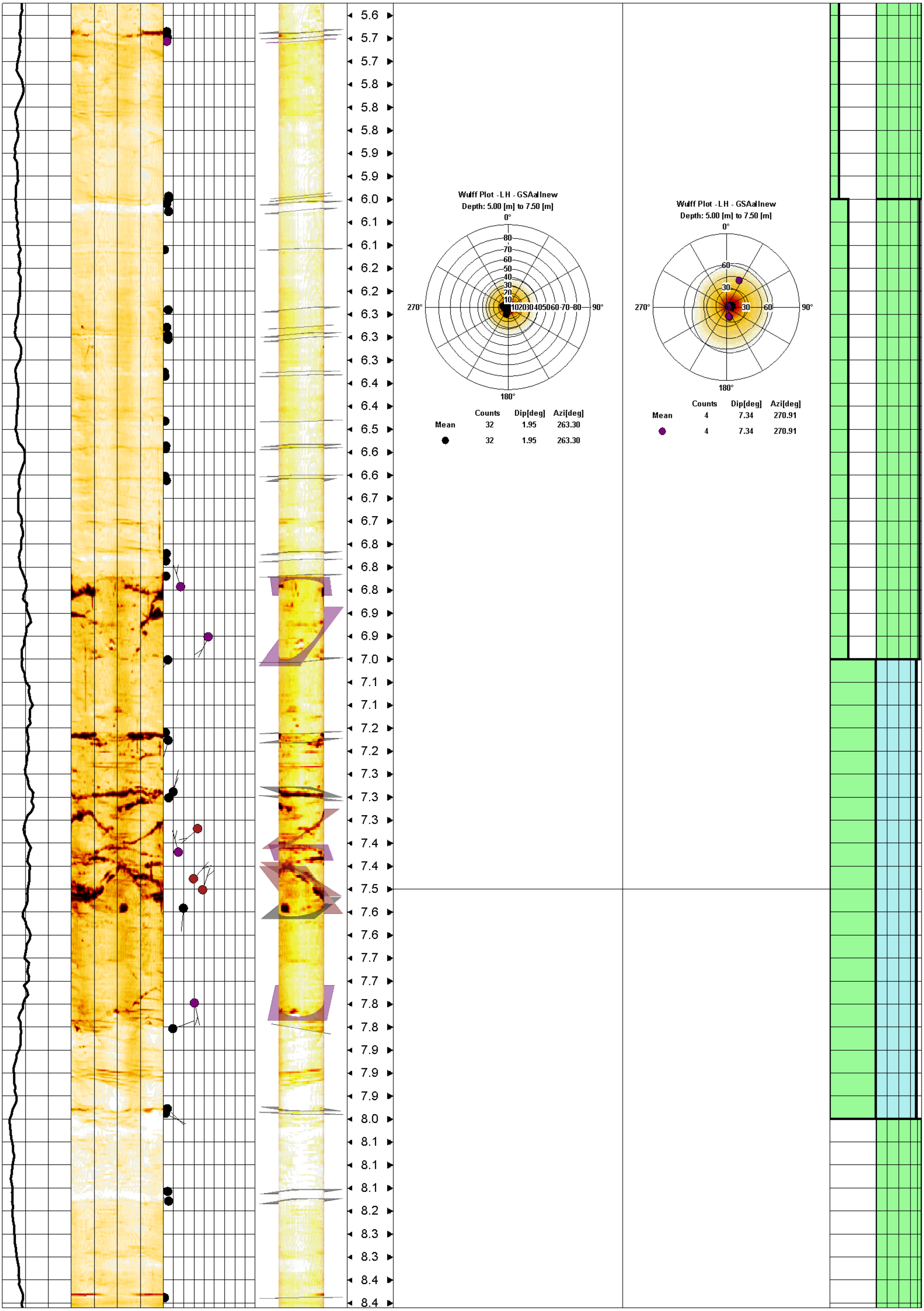
5.2
5.2
5.3
5.3
5.4
5.4
5.4
5.5
5.6
Wulff Plot - LH - GSAallnew
Depth: 2.50 [m] to 5.00 [m]
0°
90°
180°
270°
Counts Dip[deg] Azi[deg]
Mean 18 4.38 139.09
18 4.38 139.09
Wulff Plot - LH - GSAallnew
Depth: 2.50 [m] to 5.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 1 41.02 332.38
1 41.02 332.38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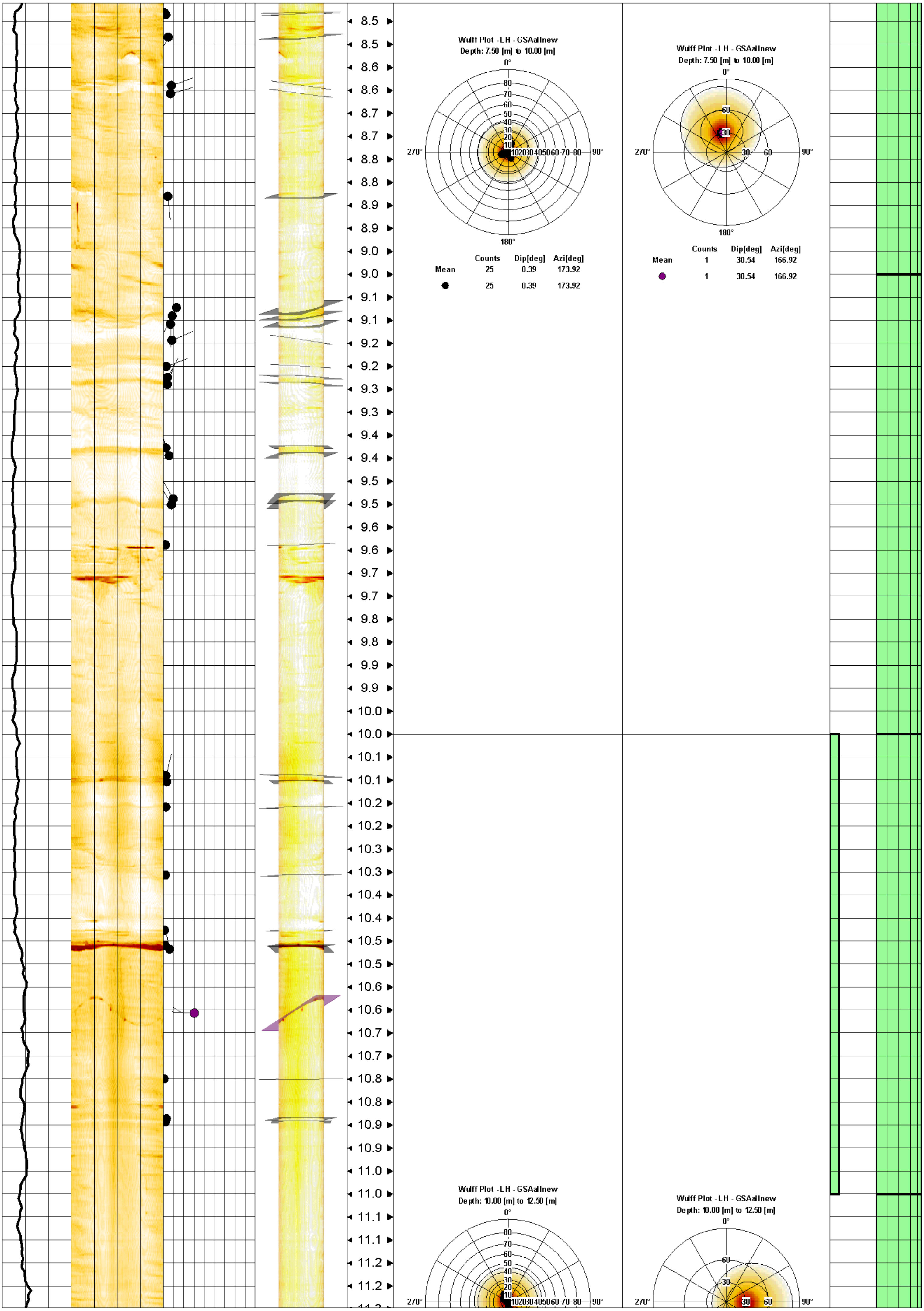
7.9
8.0
8.1
8.1
8.1
8.2
8.3
8.3
8.4
8.4
Wulff Plot - LH - GSAallnew
Depth: 5.00 [m] to 7.50 [m]
0°
90°
180°
270°
Counts Dip[deg] Azi[deg]
Mean 32 1.95 263.30
32 1.95 263.30
Wulff Plot - LH - GSAallnew
Depth: 5.00 [m] to 7.50 [m]
0°
90°
180°
270°
Counts Dip[deg] Azi[deg]
Mean 4 7.34 270.91
4 7.34 270.91


8.5
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8.6
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9.0
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9.9
10.0
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10.6
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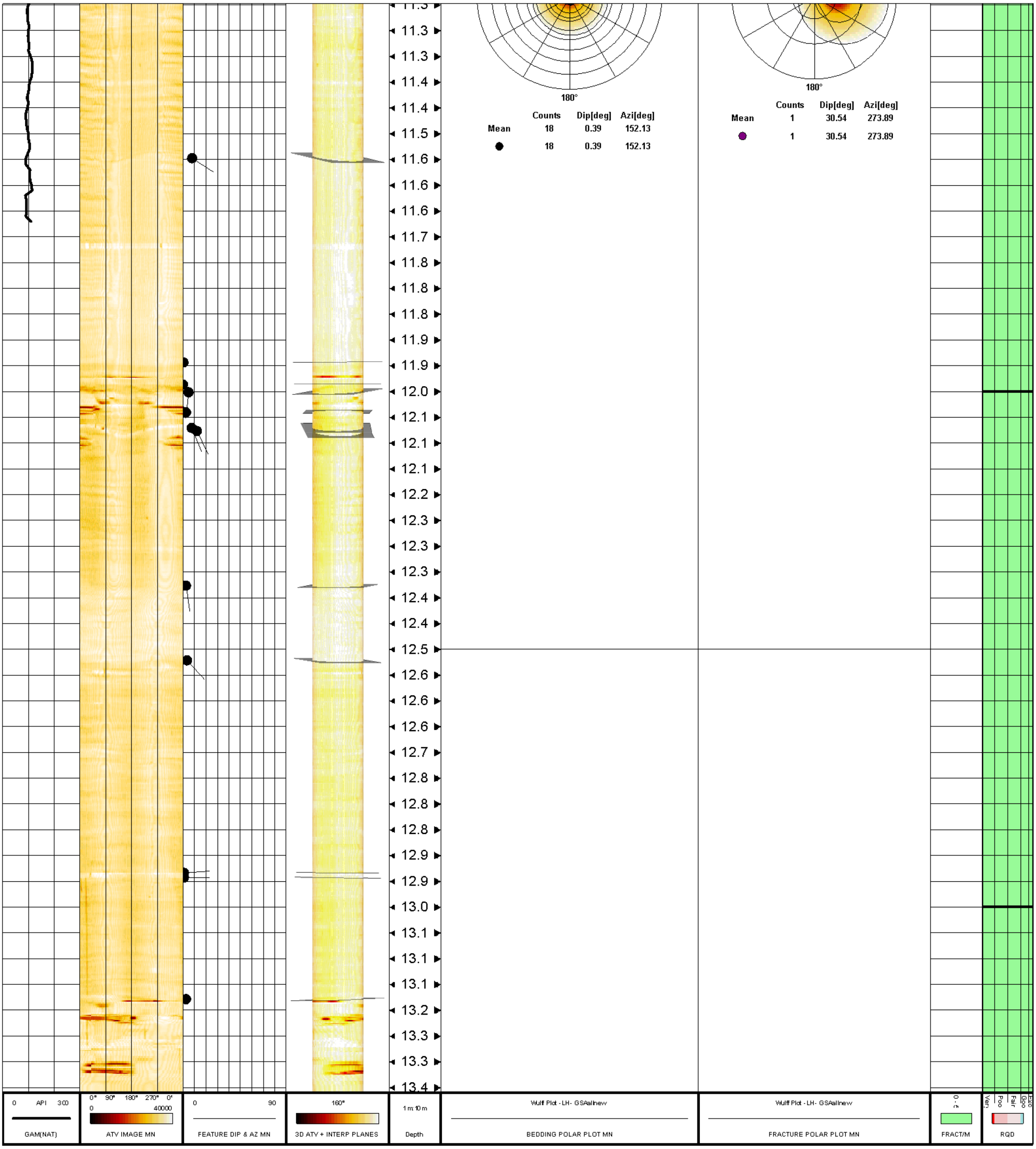
10.7
10.8
10.8
10.9
10.9
11.0
11.0
11.1
11.1
11.2
11.2
Wulff Plot - LH - GSAallnew
Depth: 7.50 [m] to 10.00 [m]
0°
90°
180°
270°
Counts Dip[deg] Azi[deg]
Mean 25 0.39 173.92
25 0.39 173.92
Wulff Plot - LH - GSAallnew
Depth: 7.50 [m] to 10.00 [m]
0°
90°
180°
270°
Counts Dip[deg] Azi[deg]
Mean 1 30.54 166.92
1 30.54 166.92
Wulff Plot - LH - GSAallnew
Depth: 10.00 [m] to 12.50 [m]
0°
90°
270°
Wulff Plot - LH - GSAallnew
Depth: 10.00 [m] to 12.50 [m]
0°
90°
270°


180°
Counts Dip[deg] Azi[deg]
Mean 18 0.39 152.13
18 0.39 152.13
180°
Counts Dip[deg] Azi[deg]
Mean 1 30.54 273.89
1 30.54 273.89
11.3
11.3
11.4
11.4
11.5
11.6
11.6
11.6
11.7
11.8
11.8
11.8
11.9
11.9
12.0
12.1
12.1
12.1
12.2
12.3
12.3
12.3
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12.5
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12.7
12.8
12.8
12.8
12.9
12.9
13.0
13.1
13.1
13.1
13.2
13.3
13.3
13.4
0 API 300
GAM(NAT)
0° 90° 180° 270° 0°
0 40000
ATV IMAGE MN
0 90
FEATURE DIP & AZ MN
180°
3D ATV + INTERP PLANES
1m:10m
Depth
Wulff Plot - LH - GSAallnew
BEDDING POLAR PLOT MN
Wulff Plot - LH - GSAallnew
FRACTURE POLAR PLOT MN
FRACT/M
Very Poor Fair Good Exc
RQD

Douglas Partners- Liverpool
402 Macquarie Street

Borehole - BH406

ATV Interpreted Features Report

Groundsearch Australia Pty. Limited
Issued: 17 May 2024

www.groundsearch.com.au

DISCLAIMER

The data used in this report were obtained using equipment manufactured by LIM Logging/Electromind. The interpretations given in this report are based on judgement and experience of Groundsearch Australia's personnel. They are provided for Douglas Partner's 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 borehole that was drilled as a component of the 2024 site investigation programme for Douglas Partners- Liverpool.

LIM Logging BHTV acoustic televiewer logging tool was run to collect data in the field on 07 May 2024. The data in this report are from 4.15 to 19.33 mbgl.

The 104 identified features are interpreted as bedding planes and fractures. The bedding to fracture ratio is 25:1.

The LIM Logging 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** with density contours as pole vectors in the **lower hemisphere**.

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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 2024 site investigation programme for Douglas Partners- Liverpool.

LIM Logging BHTV acoustic televiewer logging tool was run to collect data in the field on 07 May 2024. The data in this report are from 4.15 to 19.33 mbgl.

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The ATV takes an oriented image of the borehole using high-resolution sound waves. The acoustic image is displayed as 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 180 measurements around the borehole at each high-resolution sample interval. These data can be oriented to Magnetic North and displayed in real-time while logging using the LIM BHTV Logging System.

Analysis software includes colour adjustment, fracture dip and dip direction 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 and by mudcake adhered to the borehole wall.

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. Both sides of the 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 inclination angle and azimuth 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 **Magnetic North**-referenced:

- Text summary of the interpreted features

- Logs that show geological features with their subjective 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:

    - Natural gamma
    - ATV image referenced to Magnetic North
    - Colour-coded tadpoles that represent feature dip and dip direction
    - 3D ATV image with feature planes
    - Bedding polar plot referenced to Magnetic North
    - Fracture polar plot referenced to Magnetic North
    - Fracture frequency/M
    - Defect RQD

- Table containing feature curve ID, midpoint mbgl, dip angle, dip azimuth and feature description.

- Feature density contour plots as pole vectors in the lower hemisphere

The Rock Quality Designation (RQD) is a measure of the degree of jointing of fractures in a rock mass with:

- Image sample interval = 0.1 m
- Image length reported = 1.0 m

RQD values are:

- <0.25 - very poor
- 0.25 - 0.50 - poor
- 0.50 - 0.75 - fair
- 0.75 - 0.90 - good
- 0.90 - 1.00 - excellent

3.0 BH406 interpretations

The 104 identified features are interpreted as bedding planes and fractures. The bedding to fracture ratio is 25:1.

The density contours for all interpreted features are shown in Figure 1. A description of each interpreted feature is presented in Appendix 1 and the combination log is presented in Appendix 2.

The 100 sedimentary features identified are bedding planes that appear to range in dip from flat-lying to 25^0.

The 4 fractures identified are classified as:

Table 1

Interval section	**Complete data 4.15 – 19.33 mbgl**		
Feature classification	**Feature count**	**Percentage**	**Dip range**
Filled joint - CT 1mm to <10mm	02	50%	28^0 to 70^0
Filled joint - FD >10mm	02	50%	12^0 to 21^0

The sedimentary features identified are classified as:

Interval section	**Complete data 4.15 – 19.33 mbgl**	
Feature classification	**Feature count**	**Dip range**
Bedding	100	00^0 to 25^0

Figures 1 to 5 present the orientation density contour plans for each feature set identified as pole vectors, MN, lower hemisphere.

Feature Dip is represented as 00^0 being the horizontal plane and 90^0 being the vertical plane.

Stereonets show the Feature Dip represented as 00^0 being the centre of the stereonet and 90^0 being the outer circle of the stereonet.

The standards used for reporting are outlined on the following page of this report.

	Code	Tadpole	Sine Wave	
2	Seam/zone base FZ			Fractured zone base
3	Seam/zone base			
4	Fracture plane - open			Fracture plane - open
5	Minor open fracture			Minor open fracture
6	Fracture plane - partially open			Fracture plane - partially open
7	Filled fracture			Filled fracture
8	Bedding plane open			Bedding plane open
9	Fracture plane - closed			Fracture plane - closed
10	Top of data			Top of data
11	Induced fracture			Induced fracture
12	SWL			SWL
13	Fault - FT			Level 1
14	Rocktype boundary			Rocktype boundary
15	Bedding separation plane			Bedding separation plane
16	Fracture plane - discontinuous			Fracture plane - discontinuous
17	Partially filled fracture			Partially filled fracture
18	Irregular vein			Irregular vein
19	Unconformity			Unconformity
20	Base of casing			Base of casing
21	Top of Coal Unit			Top of Coal Unit
22	Base of Coal Unit			Base of Coal Unit
23	Base of weathering			Base of weathering
24	Top of breakout			Top of breakout
25	Base of breakout			Base of breakout
26	Top of washout			Top of washout
27	Base of washout			Base of washout
28	Top of open fracture			Top of open fracture
29	Base of open fracture			Base of open fracture
30	Bedding plane partially open			Bedding plane partially open
31	Parting			Parting
32	Shear plane			Shear plane
33	Face cleat			Face cleat
34	Butt cleat			Butt cleat
35	Intrusive contact			Intrusive contact
36	Irregular fracture			Irregular fracture
37	Open joint >5 mm aperture			Level 2
38	Closed joint <5 mm aperture			Level 3
39	Vein			Level 3
40	Filled joint - SN			Level 3
41	Filled joint - VN <1 mm			Level 3
42	Filled joint - CT 1 mm to <10 mm			Level 3
43	Filled joint - FD > 10 mm			Level 3
44	Lithozone boundary			Lithozone boundary
45	Bedding plane			
46	Top of mineralisation			
47	Base of mineralisation			
48	Crossbedding			

Figure 1 BH406 interpreted features density contours – pole vectors, MN, lower hemisphere

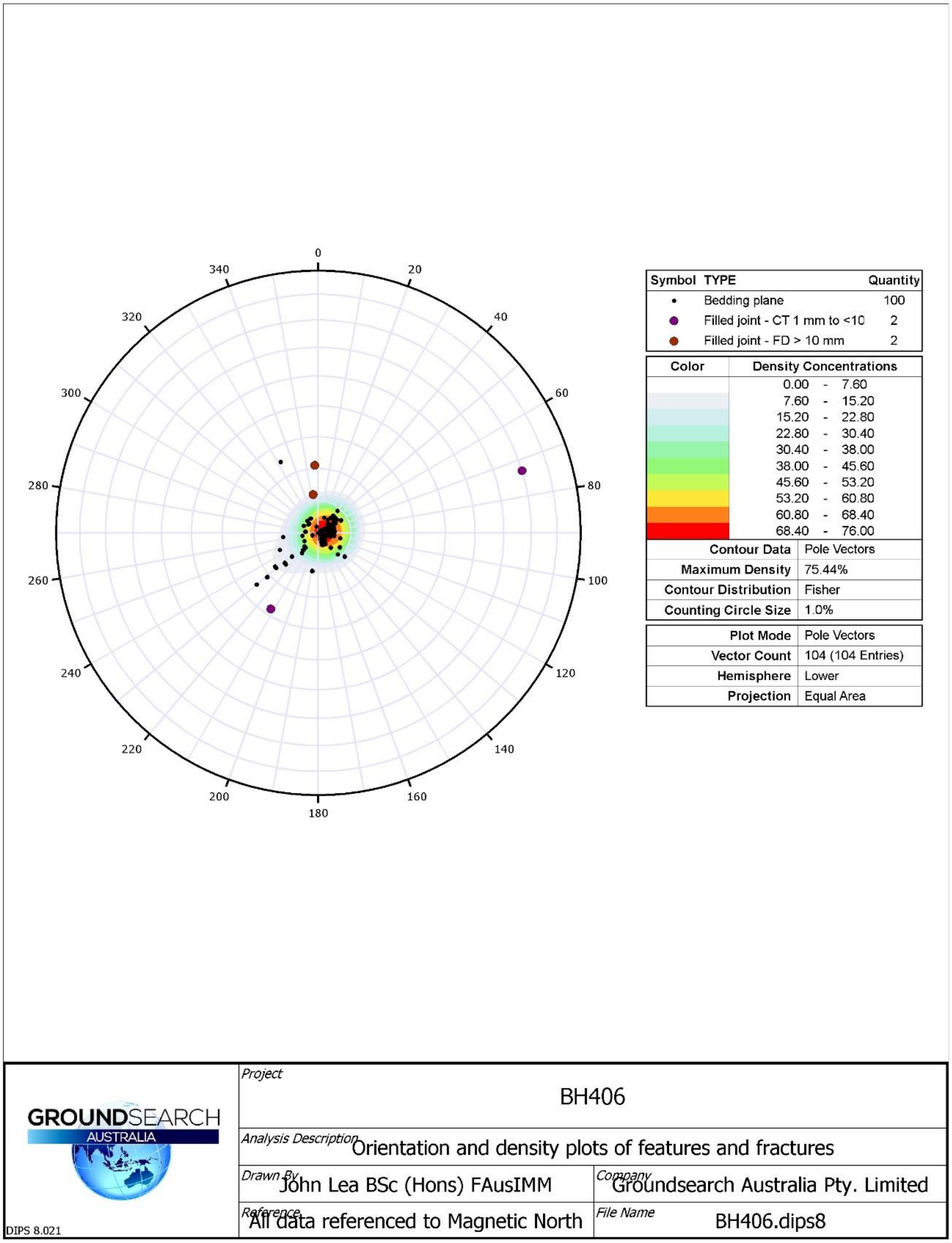


Figure 2 BH406 bedding orientation plan – pole vectors, MN, lower hemisphere

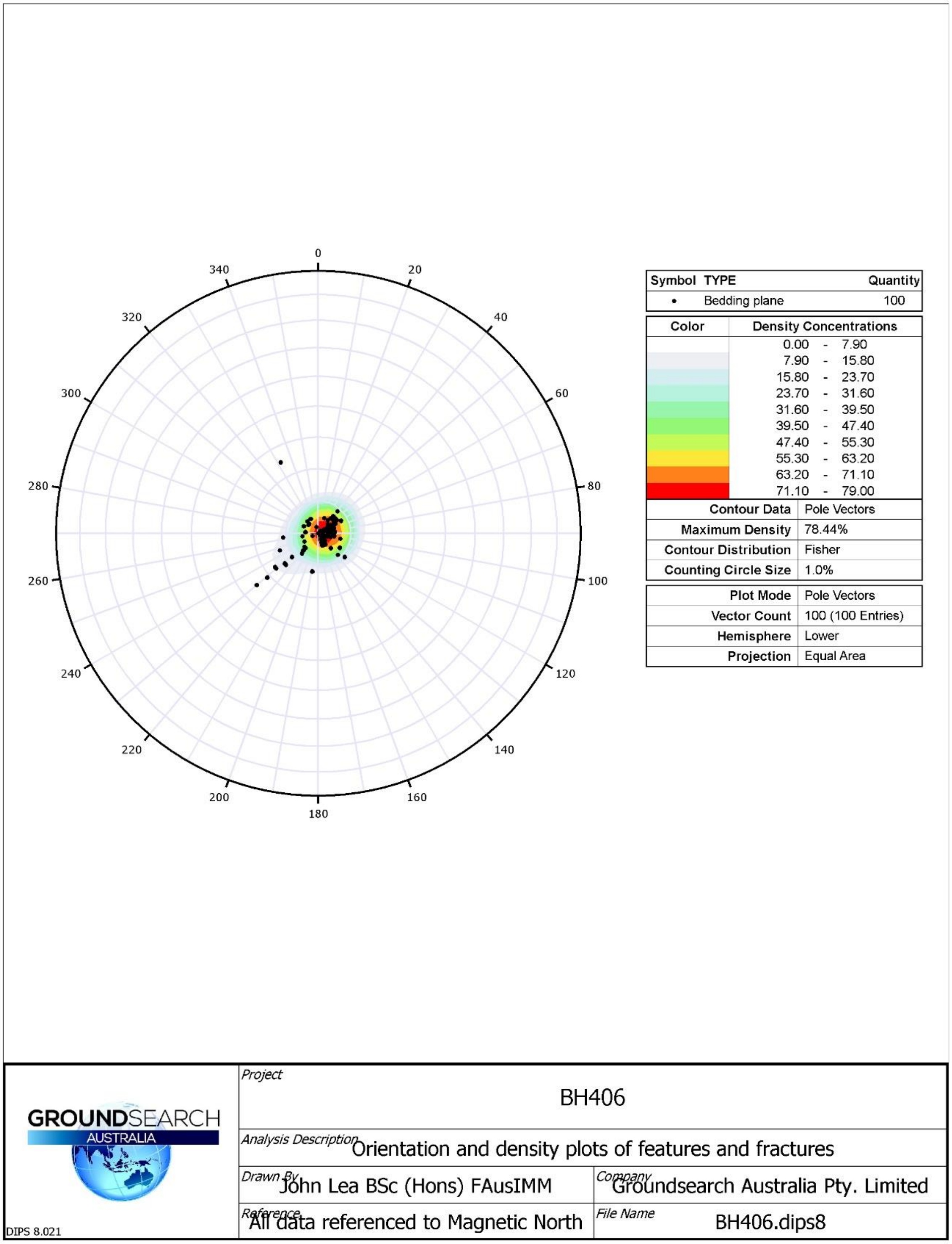


Figure 3 BH406 fractures orientation density contour plan – pole vectors, MN, lower hemisphere

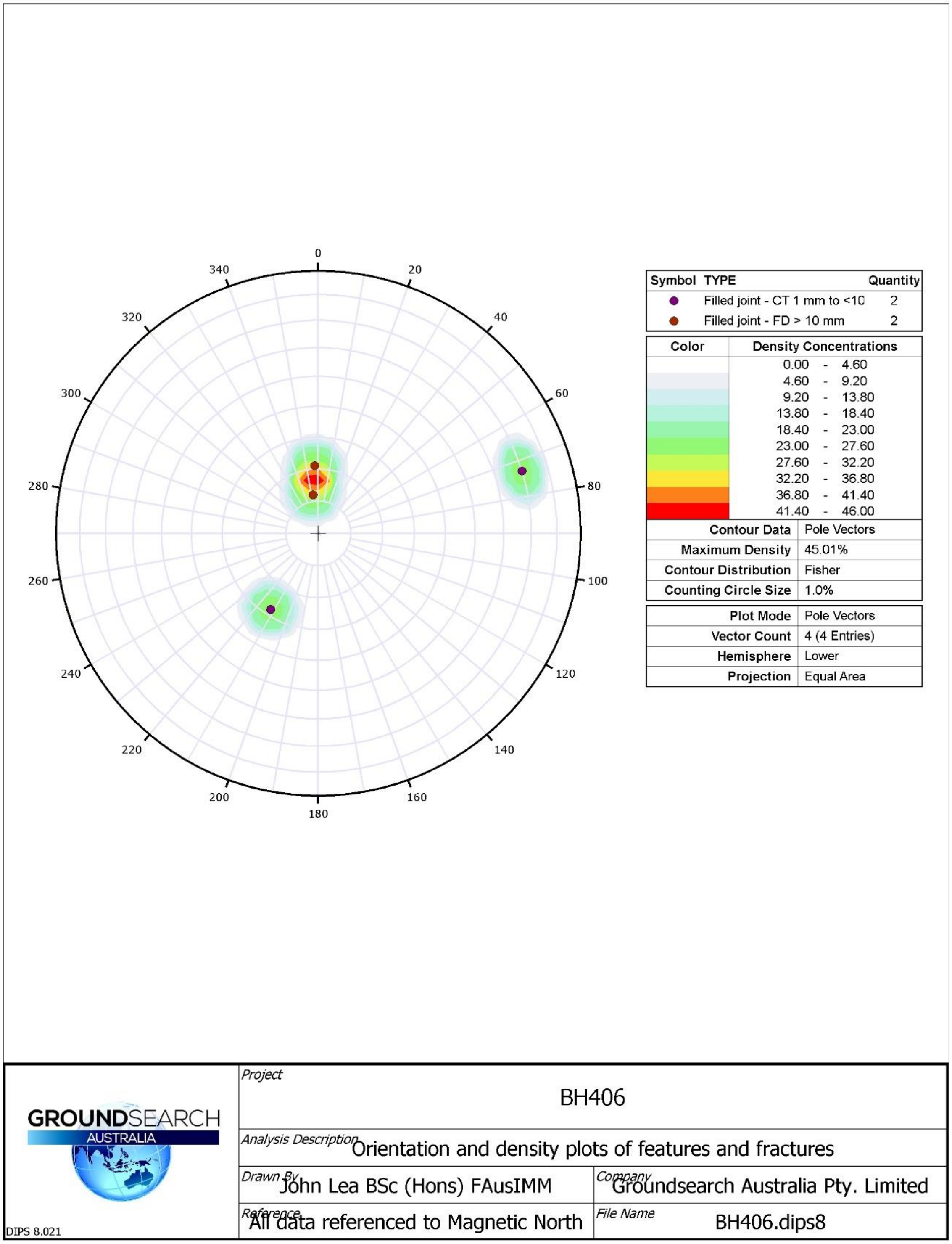


Figure 4 BH406 filled joint – CT 1mm to <10mm density contour plan - pole vectors, MN, lower hemisphere

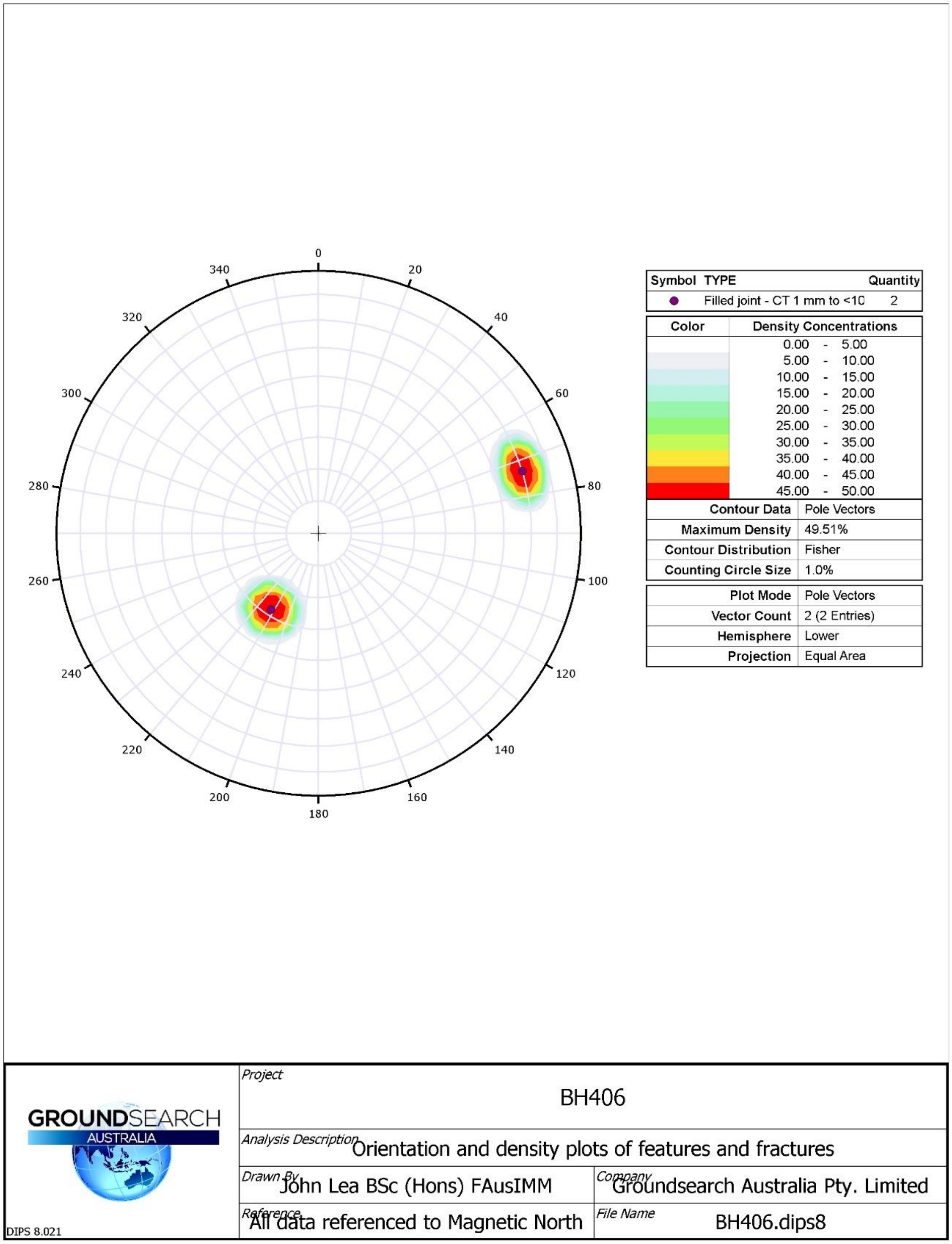
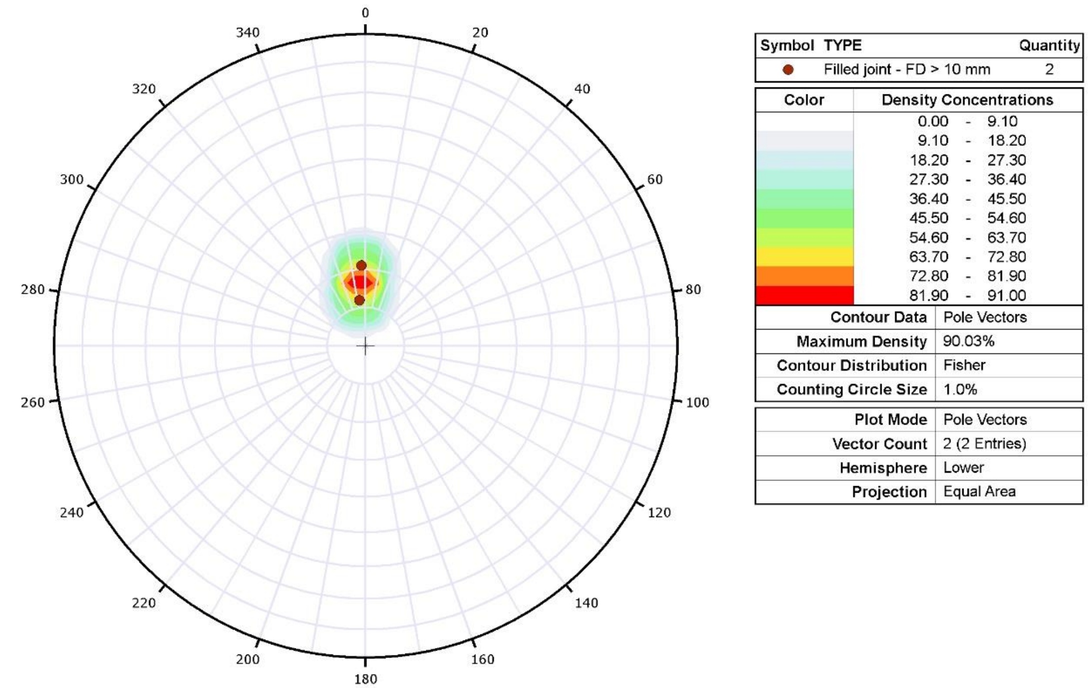


Figure 5 BH406 filled joint – FD >10mm density contour plan - pole vectors, MN, lower hemisphere



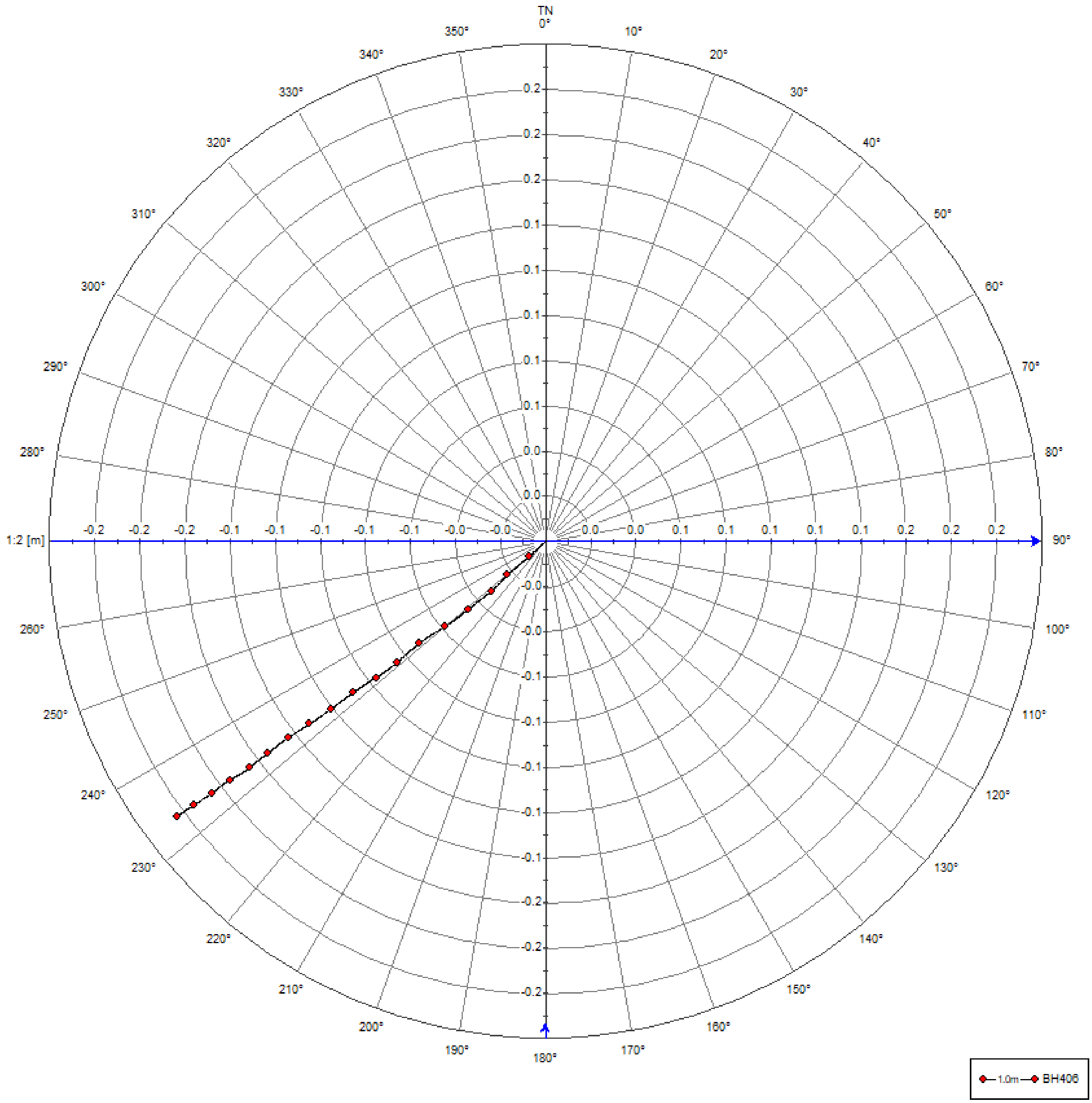
GROUNDSEARCH AUSTRALIA	Project: BH406		
	Analysis Description: Orientation and density plots of features and fractures		
	Drawn By: John Lea BSc (Hons) FAusIMM	Company: Groundsearch Australia Pty. Limited	
DIPS 8.021	Reference: All data referenced to Magnetic North	File Name: BH406.dips8	

4.0 BH406 borehole deviation data

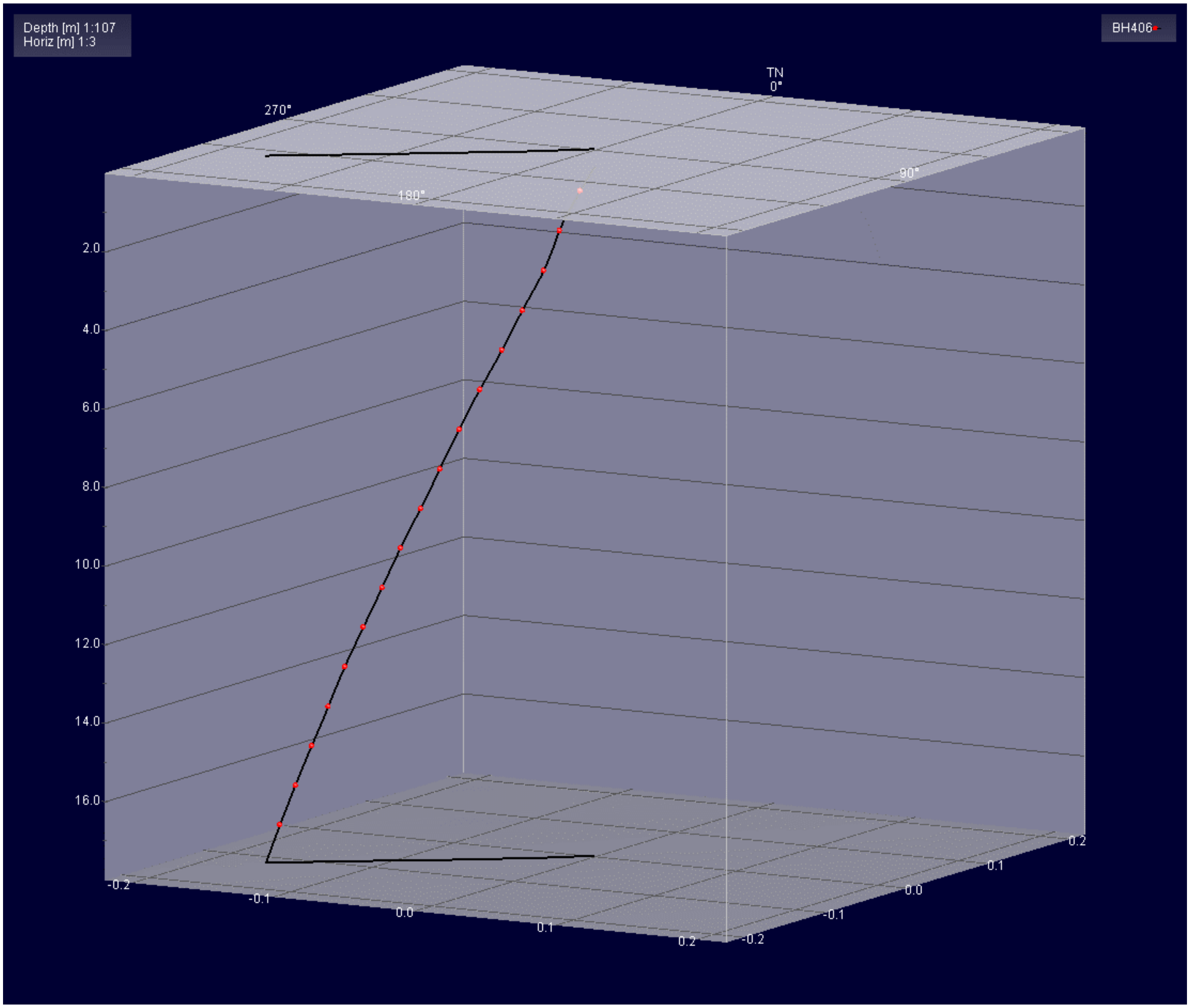
The data are presented in **Table 2** below.

Depth m	INCL DEGREE	AZ DEGREE	Easting [m]	Northing [m]	TVD [m]
0	0.84	227.31	0	0	0
1	0.84	229.15	-0.0109	-0.0099	0.999891
2	0.6	225.24	-0.0207	-0.01843	1.99981
3	0.66	229.01	-0.0278	-0.02543	2.99976
4	0.75	231.77	-0.0381	-0.03352	3.99967
5	0.73	237.64	-0.0484	-0.04107	4.99959
6	0.8	233.45	-0.0596	-0.04846	5.9995
7	0.73	229.78	-0.0695	-0.05686	6.99941
8	0.68	237.4	-0.0792	-0.06393	7.99934
9	0.71	234.49	-0.0891	-0.07038	8.99927
10	0.68	232.8	-0.0990	-0.07772	9.9992
11	0.64	236.88	-0.1084	-0.08417	10.9991
12	0.65	234.65	-0.1180	-0.09036	11.9991
13	0.61	232.29	-0.1272	-0.09729	12.999
14	0.55	231.3	-0.1353	-0.10355	13.9989
15	0.58	237.04	-0.1438	-0.10924	14.9989
16	0.56	234.35	-0.1520	-0.11493	15.9988
17	0.53	237.02	-0.1599	-0.12024	16.9988

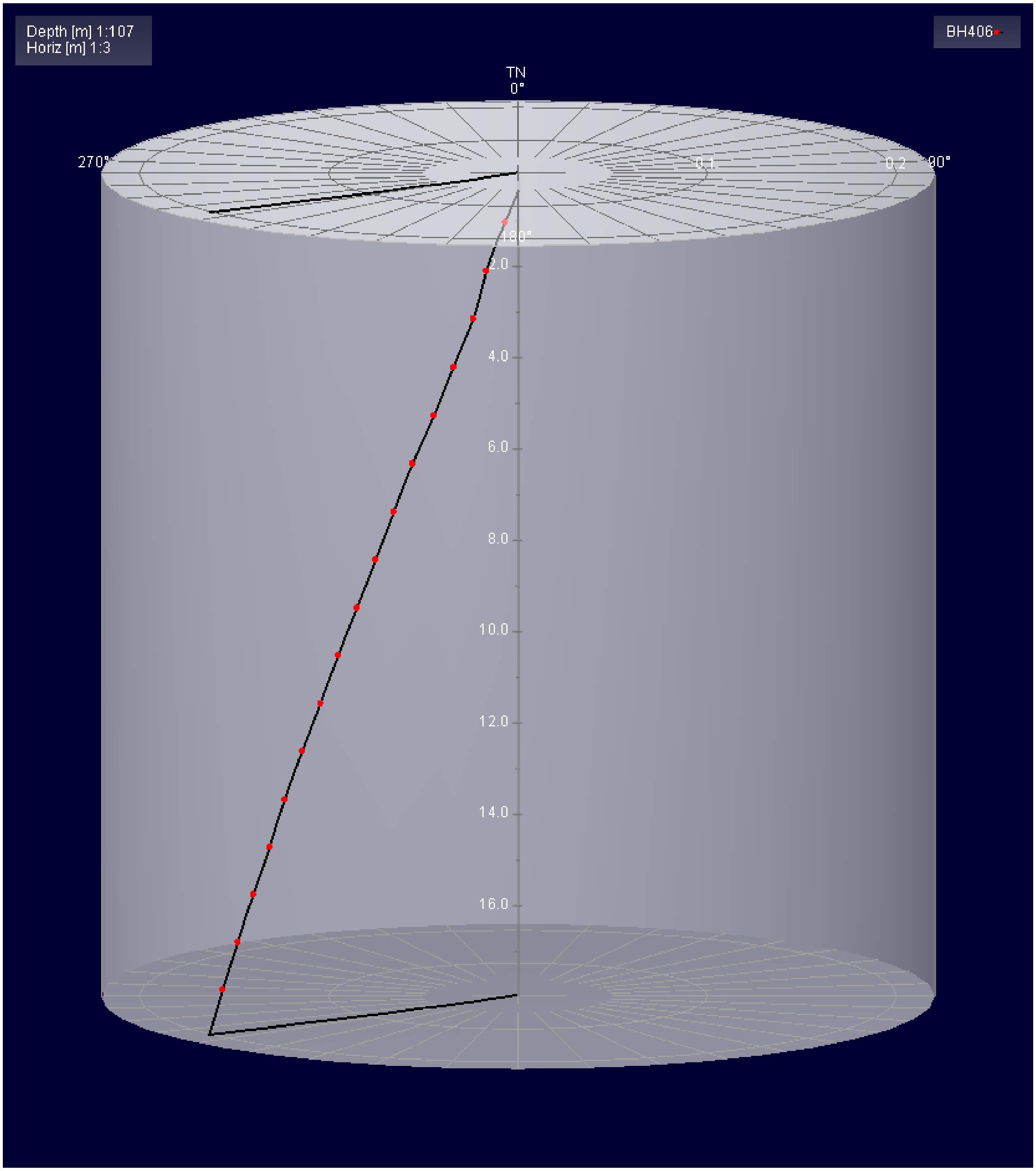
BH406 Bullseye Plot



BH406 Cubic Plot



BH406 Cylindrical Plot



Appendix 1

Tabulated interpreted features report for BH406

Feature ID	Midpoint mbgl	Dip deg.	Azimuth deg. MN	Interpreted feature description
1	4.15			Top of data
2	4.28	5	252	Bedding plane
3	4.84	2	163	Bedding plane
4	5.77	6	221	Bedding plane
5	5.78	7	228	Bedding plane
6	5.78	7	221	Bedding plane
7	5.80	7	234	Bedding plane
8	5.82	2	289	Bedding plane
9	5.83	4	258	Bedding plane
10	5.86	5	216	Bedding plane
11	5.87	5	238	Bedding plane
12	5.90	9	221	Bedding plane
13	5.91	6	221	Bedding plane
14	6.24	3	240	Bedding plane
15	6.26	1	223	Bedding plane
16	6.27	2	236	Bedding plane
17	6.34	3	253	Bedding plane
18	6.35	2	249	Bedding plane
19	6.45	4	241	Bedding plane
20	6.46	4	243	Bedding plane
21	6.51	4	253	Bedding plane
22	6.52	5	254	Bedding plane
23	6.81	1	228	Bedding plane
24	6.82	4	227	Bedding plane
25	6.92	6	231	Bedding plane
26	6.93	6	241	Bedding plane
27	7.01	5	247	Bedding plane
28	7.02	6	240	Bedding plane
29	7.11	8	241	Bedding plane
30	7.20	7	231	Bedding plane
31	7.42	17	50	Bedding plane
32	7.45	13	66	Bedding plane
33	7.47	21	49	Bedding plane
34	7.49	25	50	Bedding plane
35	7.75	5	251	Bedding plane
36	7.76	4	227	Bedding plane
37	7.79	21	177	Filled joint - FD > 10 mm
38	7.82	11	83	Bedding plane
39	7.83	4	95	Bedding plane

40	7.94	28	32	Filled joint - CT 1 mm to <10 mm
41	7.97	25	152	Bedding plane
42	8.55	8	39	Bedding plane
43	8.56	6	41	Bedding plane
44	8.59	11	48	Bedding plane
45	8.61	14	48	Bedding plane
46	8.63	17	52	Bedding plane
47	8.64	14	46	Bedding plane
48	8.78	12	9	Bedding plane
49	8.89	3	335	Bedding plane
50	8.92	2	320	Bedding plane
51	8.96	4	328	Bedding plane
52	9.27	4	249	Bedding plane
53	9.28	5	263	Bedding plane
54	9.33	4	342	Bedding plane
55	9.36	3	276	Bedding plane
56	9.42	4	233	Bedding plane
57	9.45	6	220	Bedding plane
58	9.63	5	59	Bedding plane
59	9.69	7	41	Bedding plane
60	9.71	6	46	Bedding plane
61	9.79	5	79	Bedding plane
62	9.80	2	66	Bedding plane
63	10.33	70	253	Filled joint - CT 1 mm to <10 mm
64	10.39	1	311	Bedding plane
65	10.47	7	284	Bedding plane
66	10.60	4	254	Bedding plane
67	10.73	5	201	Bedding plane
68	11.44	1	236	Bedding plane
69	11.45	2	247	Bedding plane
70	11.47	4	271	Bedding plane
71	11.48	3	278	Bedding plane
72	11.49	11	312	Bedding plane
73	11.51	9	318	Bedding plane
74	11.56	3	284	Bedding plane
75	11.86	5	267	Bedding plane
76	11.88	4	253	Bedding plane
77	11.95	1	273	Bedding plane
78	12.10	3	291	Bedding plane
79	12.10	2	300	Bedding plane
80	12.26	3	318	Bedding plane
81	12.28	6	320	Bedding plane
82	12.41	4	130	Bedding plane
83	12.42	5	116	Bedding plane
84	14.54	5	238	Bedding plane

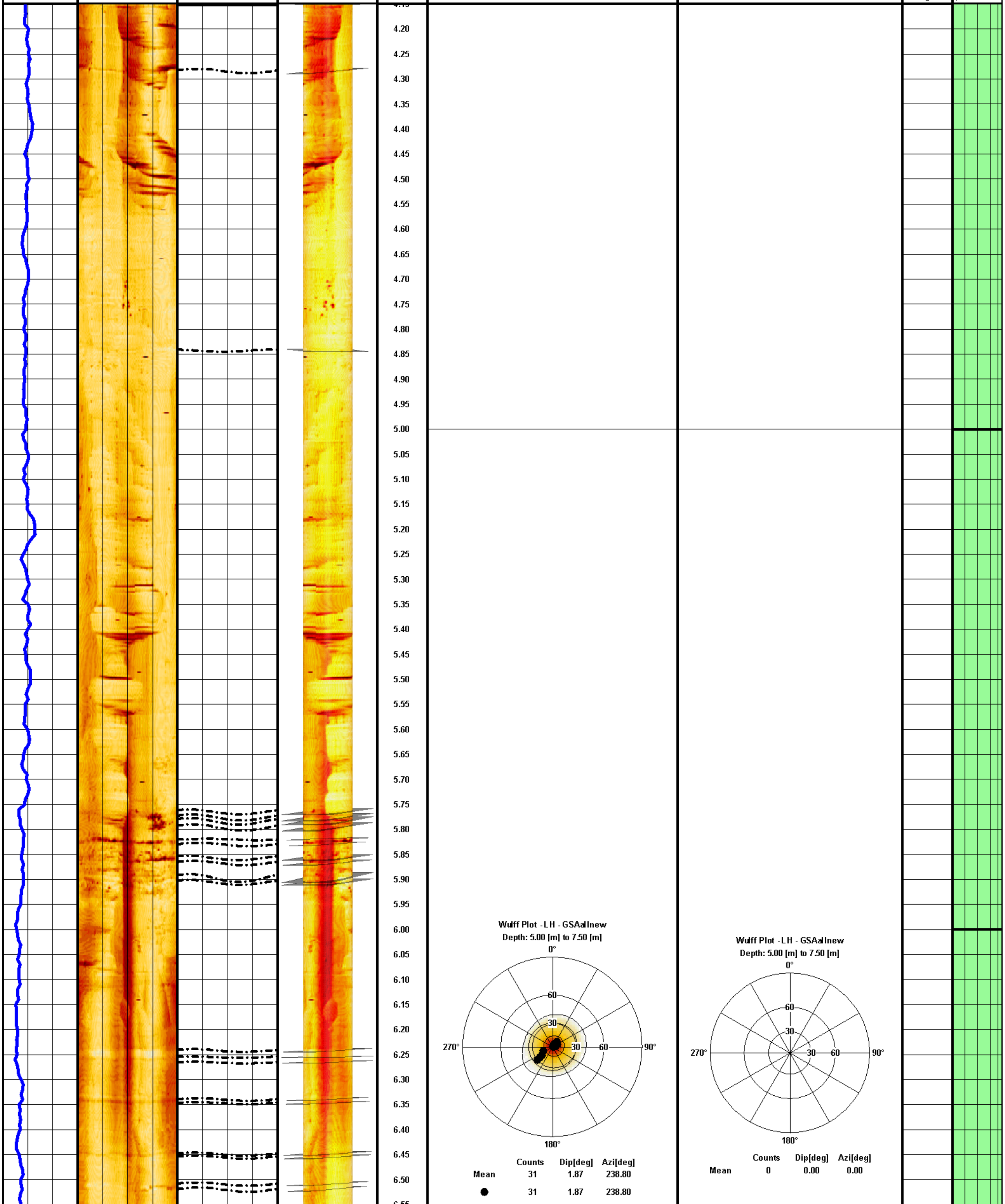
85	14.86	3	267	Bedding plane
86	15.32	3	284	Bedding plane
87	15.33	3	284	Bedding plane
88	15.51	8	304	Bedding plane
89	16.28	5	152	Bedding plane
90	16.30	12	172	Filled joint - FD > 10 mm
91	16.38	4	287	Bedding plane
92	16.39	4	280	Bedding plane
93	16.44	4	136	Bedding plane
94	16.45	5	137	Bedding plane
95	16.86	5	280	Bedding plane
96	16.88	1	265	Bedding plane
97	17.64	3	245	Bedding plane
98	17.89	3	342	Bedding plane
99	17.92	0	327	Bedding plane
100	17.92	0	305	Bedding plane
101	17.94	3	327	Bedding plane
102	17.95	1	304	Bedding plane
103	17.97	4	340	Bedding plane
104	17.98	4	327	Bedding plane
105	18.00	2	335	Bedding plane
106	19.33			Base of data
Feature ID	**Midpoint mbgl**	**Dip deg.**	**Azimuth deg. MN**	**Interpreted feature description**

Appendix 2

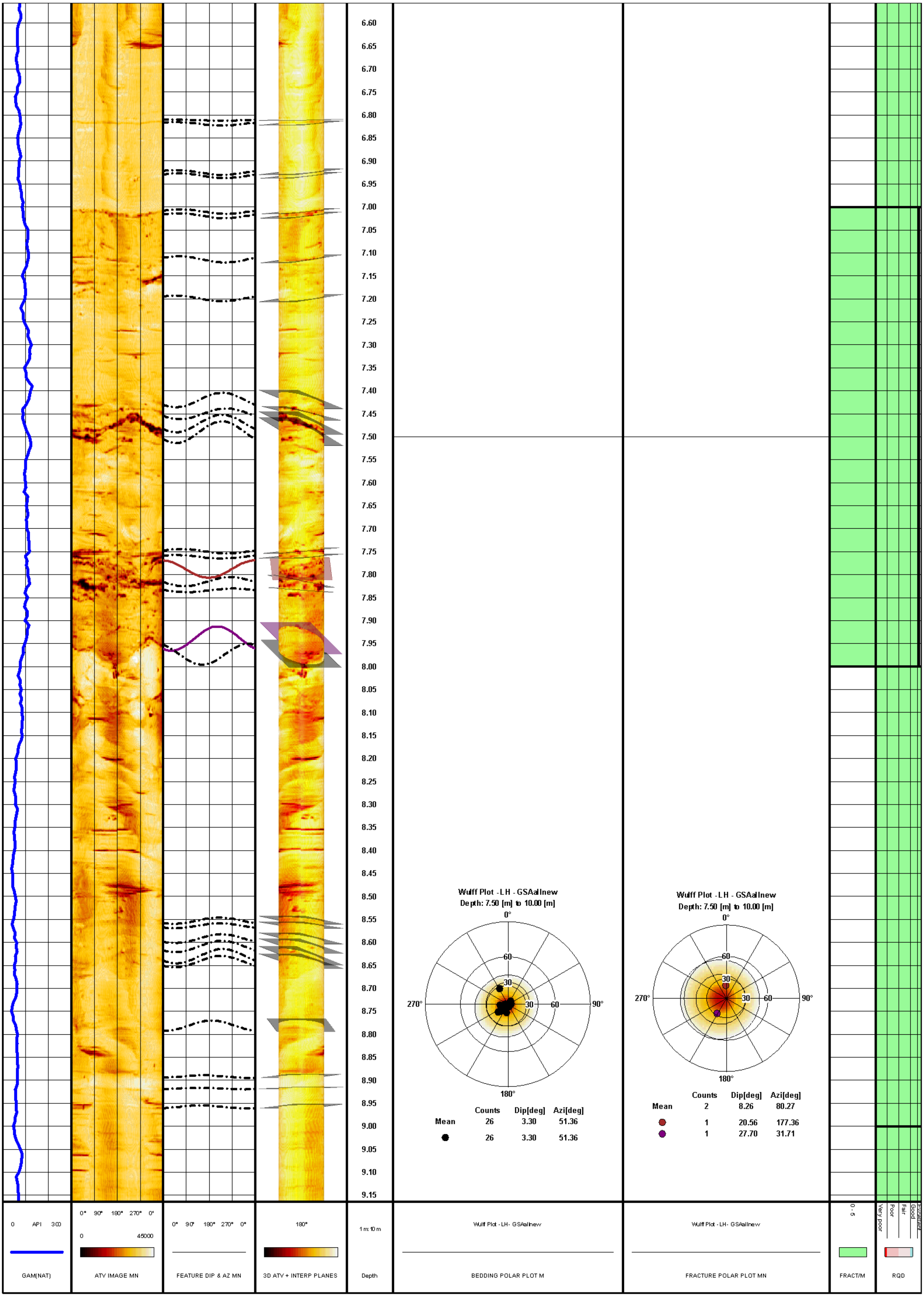
1:10 Interpretation logs

4.15 To 19.33 mbgl

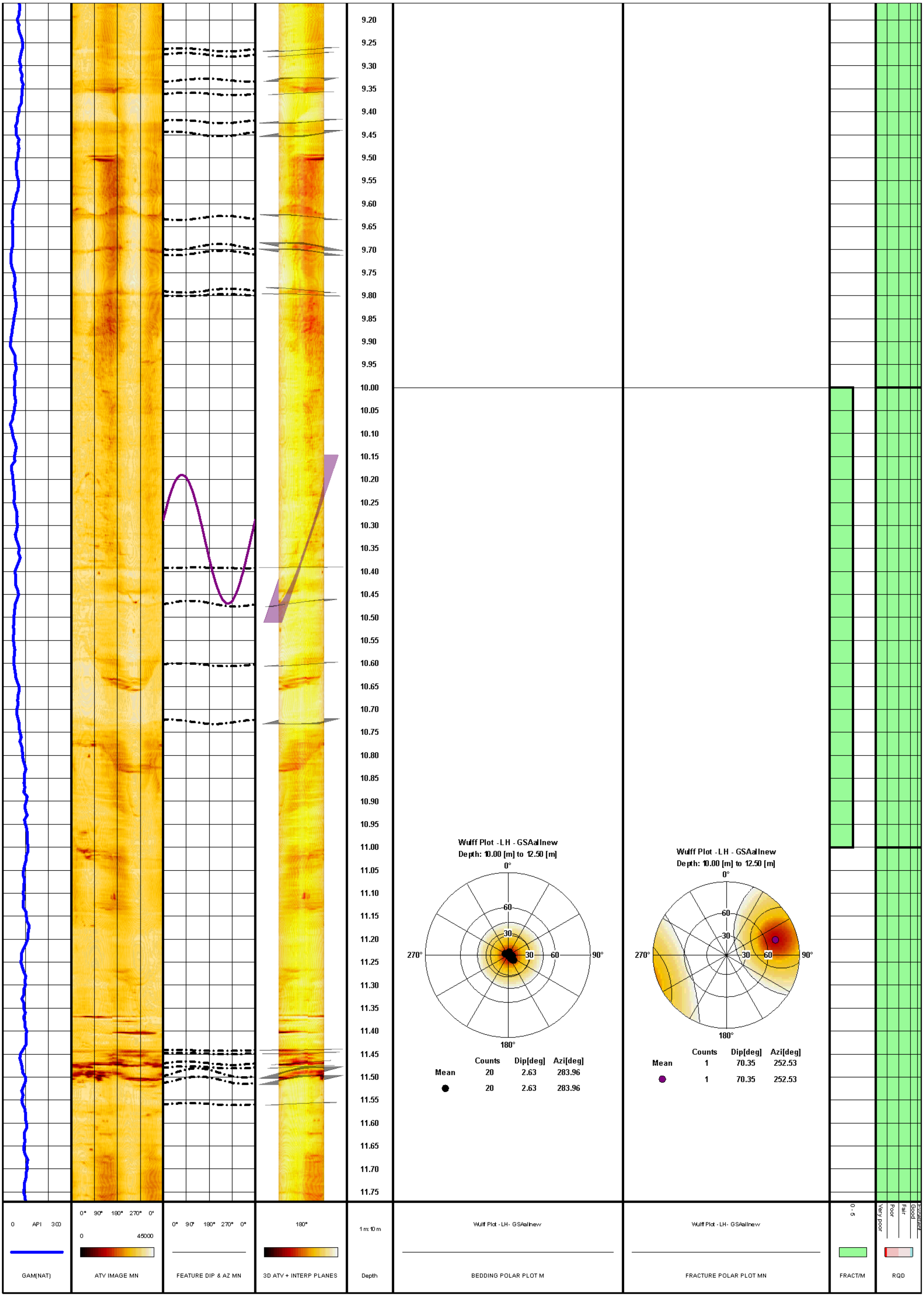
GAM(NAT)	ATV IMAGE MN	FEATURE DIP & AZ MN	3D ATV + INTERP PLANES	Depth	BEDDING POLAR PLOT M	FRACTURE POLAR PLOT MN	FRACT/M	RQD
0 API 300	0 45000 0° 90° 180° 270° 0°	0° 90° 180° 270° 0°	180°	1m:10m	Wulff Plot - LH - GSAallnew	Wulff Plot - LH - GSAallnew	0 - 5	Very poor Poor Fair Good Excellent

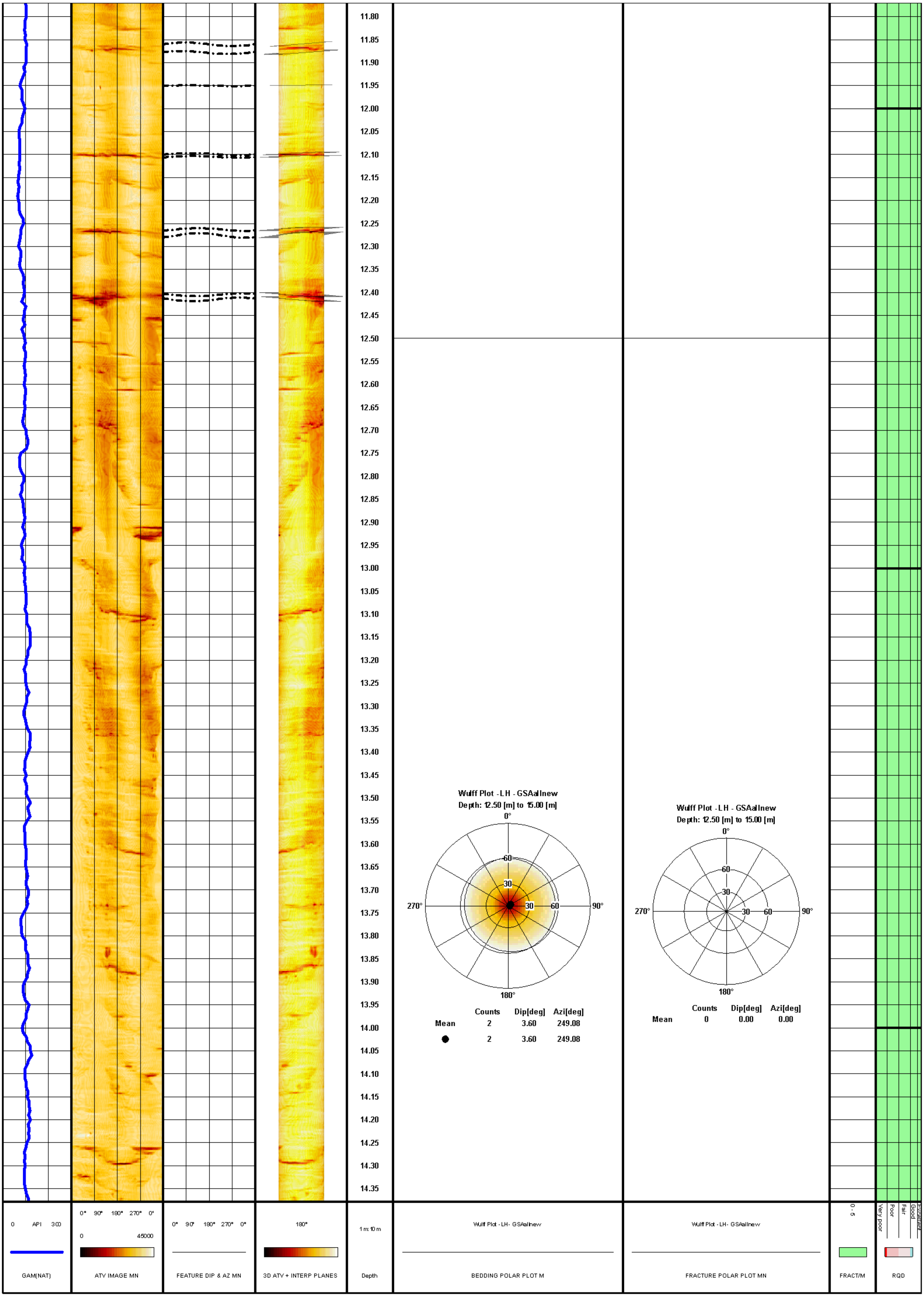


0 API 300	0° 90° 180° 270° 0° 0 45000	0° 90° 180° 270° 0°	180°	1m:10m	Wulff Plot - LH - GSAallnew	Wulff Plot - LH - GSAallnew	0 - 5	Very poor Poor Fair Good Excellent
GAM(NAT)	ATV IMAGE MN	FEATURE DIP & AZ MN	3D ATV + INTERP PLANES	Depth	BEDDING POLAR PLOT M	FRACTURE POLAR PLOT MN	FRACT/M	RQD



6.60
6.65
6.70
6.75
6.80
6.85
6.90
6.95
7.00
7.05
7.10
7.15
7.20
7.25
7.30
7.35
7.40
7.45
7.50
7.55
7.60
7.65
7.70
7.75
7.80
7.85
7.90
7.95
8.00
8.05
8.10
8.15
8.20
8.25
8.30
8.35
8.40
8.45
8.50
8.55
8.60
8.65
8.70
8.75
8.80
8.85
8.90
8.95
9.00
9.05
9.10
9.15
Wulff Plot - LH - GSAallnew
Depth: 7.50 [m] to 10.00 [m]
0°
90°
180°
270°
30
60
Mean
Counts 26
Dip[deg] 3.30
Azi[deg] 51.36
26 3.30 51.36
Wulff Plot - LH - GSAallnew
Depth: 7.50 [m] to 10.00 [m]
Mean
Counts 2
Dip[deg] 8.26
Azi[deg] 80.27
1 20.56 177.36
1 27.70 31.71
0 API 300
GAM(NAT)
0° 90° 180° 270° 0°
0 45000
ATV IMAGE MN
0° 90° 180° 270° 0°
FEATURE DIP & AZ MN
180°
3D ATV + INTERP PLANES
1 m:10 m
Depth
Wulff Plot - LH - GSAallnew
BEDDING POLAR PLOT M
Wulff Plot - LH - GSAallnew
FRACTURE POLAR PLOT MN
0 - 5
FRACT/M
Very poor
Poor
Fair
Good
Excellent
RQD


9.20
9.25
9.30
9.35
9.40
9.45
9.50
9.55
9.60
9.65
9.70
9.75
9.80
9.85
9.90
9.95
10.00
10.05
10.10
10.15
10.20
10.25
10.30
10.35
10.40
10.45
10.50
10.55
10.60
10.65
10.70
10.75
10.80
10.85
10.90
10.95
11.00
11.05
11.10
11.15
11.20
11.25
11.30
11.35
11.40
11.45
11.50
11.55
11.60
11.65
11.70
11.75
Wulff Plot - LH - GSAallnew
Depth: 10.00 [m] to 12.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 20 2.63 283.96
20 2.63 283.96
Wulff Plot - LH - GSAallnew
Depth: 10.00 [m] to 12.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 1 70.35 252.53
1 70.35 252.53
0 API 300
GAM(NAT)
0° 90° 180° 270° 0°
0 45000
ATV IMAGE MN
0° 90° 180° 270° 0°
FEATURE DIP & AZ MN
180°
3D ATV + INTERP PLANES
1m:10m
Depth
Wulff Plot - LH - GSAallnew
BEDDING POLAR PLOT M
Wulff Plot - LH - GSAallnew
FRACTURE POLAR PLOT MN
0 - 5
FRACT/M
Very poor
Poor
Fair
Good
Excellent
RQD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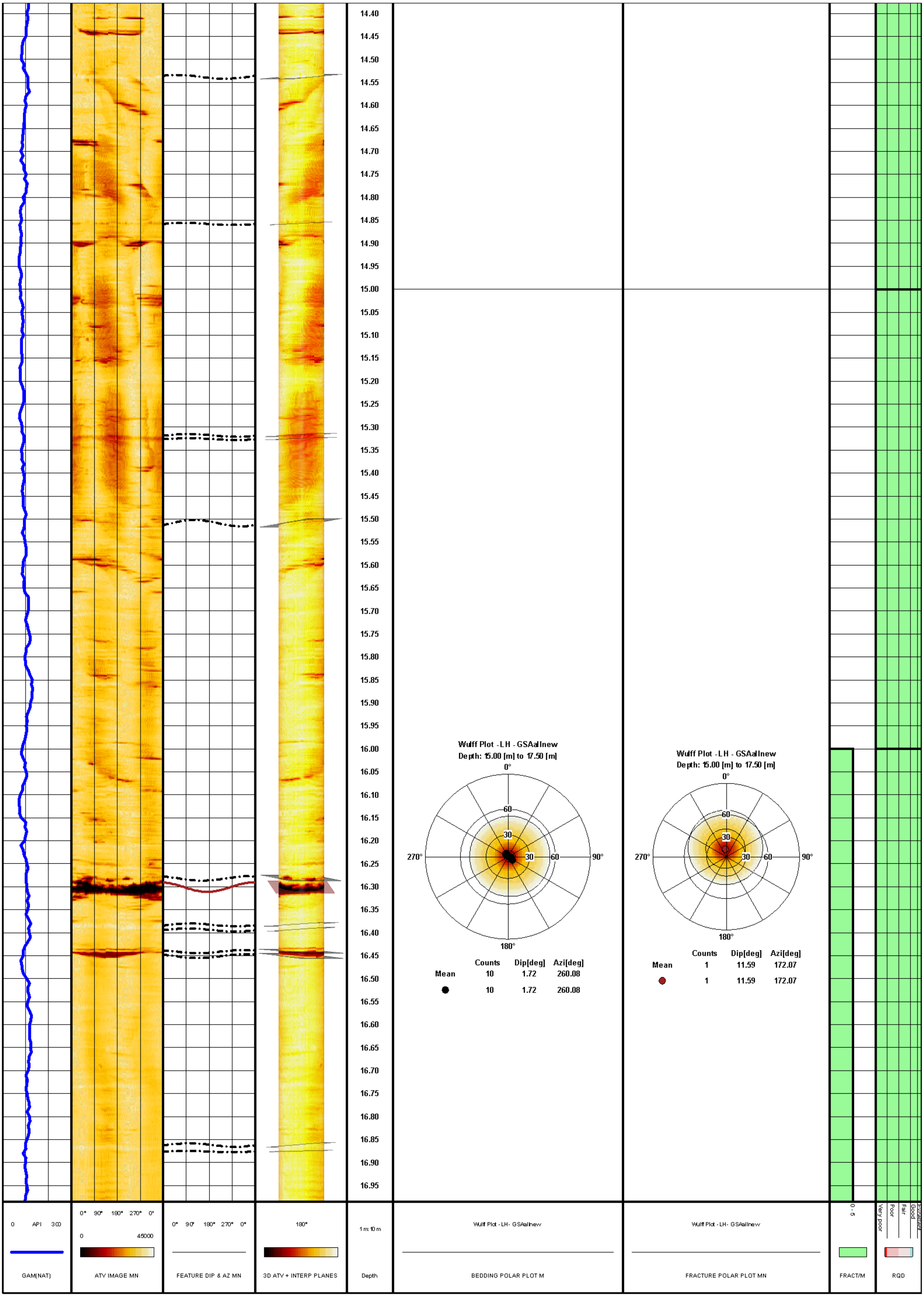
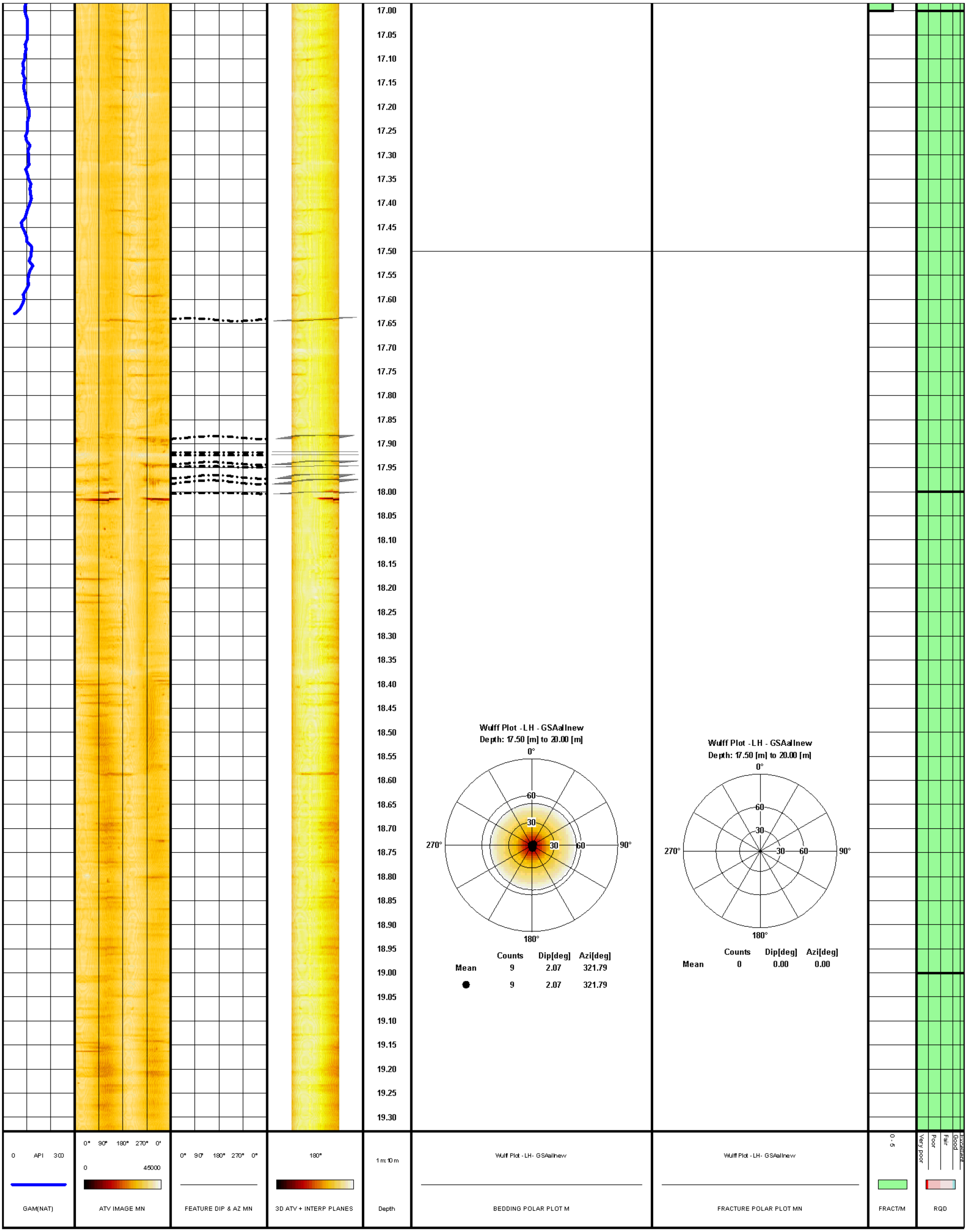
11.85
11.90
11.95
12.00
12.05
12.10
12.15
12.20
12.25
12.30
12.35
12.40
12.45
12.50
12.55
12.60
12.65
12.70
12.75
12.80
12.85
12.90
12.95
13.00
13.05
13.10
13.15
13.20
13.25
13.30
13.35
13.40
13.45
13.50
13.55
13.60
13.65
13.70
13.75
13.80
13.85
13.90
13.95
14.00
14.05
14.10
14.15
14.20
14.25
14.30
14.35
Wulff Plot - LH - GSAallnew
Depth: 12.50 [m] to 15.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 2 3.60 249.08
2 3.60 249.08
Wulff Plot - LH - GSAallnew
Depth: 12.50 [m] to 15.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 0 0.00 0.00
0 API 300
GAM(NAT)
0° 90° 180° 270° 0°
0 45000
ATV IMAGE MN
0° 90° 180° 270° 0°
FEATURE DIP & AZ MN
180°
3D ATV + INTERP PLANES
1 m:10 m
Depth
Wulff Plot - LH - GSAallnew
BEDDING POLAR PLOT M
Wulff Plot - LH - GSAallnew
FRACTURE POLAR PLOT MN
0 - 5
FRACT/M
Very poor
Poor
Fair
Good
Excellent
RQD


14.40
14.45
14.50
14.55
14.60
14.65
14.70
14.75
14.80
14.85
14.90
14.95
15.00
15.05
15.10
15.15
15.20
15.25
15.30
15.35
15.40
15.45
15.50
15.55
15.60
15.65
15.70
15.75
15.80
15.85
15.90
15.95
16.00
16.05
16.10
16.15
16.20
16.25
16.30
16.35
16.40
16.45
16.50
16.55
16.60
16.65
16.70
16.75
16.80
16.85
16.90
16.95
Wulff Plot - LH - GSAallnew
Depth: 15.00 [m] to 17.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 10 1.72 260.08
10 1.72 260.08
Wulff Plot - LH - GSAallnew
Depth: 15.00 [m] to 17.50 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 1 11.59 172.07
1 11.59 172.07
0 API 300
GAM(NAT)
0° 90° 180° 270° 0°
0 45000
ATV IMAGE MN
0° 90° 180° 270° 0°
FEATURE DIP & AZ MN
180°
3D ATV + INTERP PLANES
1m:10m
Depth
Wulf Plot - LH- GSAallnew
BEDDING POLAR PLOT M
Wulf Plot - LH- GSAallnew
FRACTURE POLAR PLOT MN
0 - 6
FRACT/M
Very poor
Poor
Fair
Good
Excellent
RQD


17.00
17.05
17.10
17.15
17.20
17.25
17.30
17.35
17.40
17.45
17.50
17.55
17.60
17.65
17.70
17.75
17.80
17.85
17.90
17.95
18.00
18.05
18.10
18.15
18.20
18.25
18.30
18.35
18.40
18.45
18.50
18.55
18.60
18.65
18.70
18.75
18.80
18.85
18.90
18.95
19.00
19.05
19.10
19.15
19.20
19.25
19.30
Wulff Plot - LH - GSAallnew
Depth: 17.50 [m] to 20.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 9 2.07 321.79
9 2.07 321.79
Wulff Plot - LH - GSAallnew
Depth: 17.50 [m] to 20.00 [m]
0°
90°
180°
270°
30
60
Counts Dip[deg] Azi[deg]
Mean 0 0.00 0.00
0 API 300
GAM(NAT)
0° 90° 180° 270° 0°
0 45000
ATV IMAGE MN
0° 90° 180° 270° 0°
FEATURE DIP & AZ MN
180°
3D ATV + INTERP PLANES
1 m:10 m
Depth
Wulff Plot - LH - GSAallnew
BEDDING POLAR PLOT M
Wulff Plot - LH - GSAallnew
FRACTURE POLAR PLOT MN
0 - 5
FRACT/M
Very poor
Poor
Fair
Good
Excellent
RQD

Appendix F

Laboratory Test Results

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 352830

Client Details

Client	Douglas Partners Pty Ltd
Attention	Luke James-Hall
Address	96 Hermitage Rd, West Ryde, NSW, 2114

Sample Details

Your Reference	**228571.00 Liverpool**
Number of Samples	3 Water
Date samples received	31/05/2024
Date completed instructions received	31/05/2024

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Please refer to the last page of this report for any comments relating to the results.

Report Details

Date results requested by	07/06/2024
Date of Issue	07/06/2024
NATA Accreditation Number 2901. This document shall not be reproduced except in full.	
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***	

Results Approved By
Diego Bigolin, Inorganics Supervisor
Dragana Tomas, Senior Chemist
Giovanni Agosti, Group Technical Manager
Sean McAlary, Chemist (FAS)
Tabitha Roberts, Chemist

Authorised By
Nancy Zhang, Laboratory Manager

VOCs in water				
Our Reference		352830-1	352830-2	352830-3
Your Reference	UNITS	BH301	BH304	BH405
Date Sampled		30/05/2024	30/05/2024	30/05/2024
Type of sample		Water	Water	Water
Date Extracted	-	03/06/2024	03/06/2024	03/06/2024
Date Analysed	-	04/06/2024	04/06/2024	04/06/2024
Dichlorodifluoromethane	µg/L	<10	<10	<10
Chloromethane	µg/L	<10	<10	<10
Vinyl Chloride	µg/L	<10	<10	<10
Bromomethane	µg/L	<10	<10	<10
Chloroethane	µg/L	<10	<10	<10
Trichlorofluoromethane	µg/L	<10	<10	<10
1,1-Dichloroethene	µg/L	<1	<1	<1
Trans-1,2-dichloroethene	µg/L	<1	<1	<1
1,1-dichloroethane	µg/L	<1	<1	<1
Cis-1,2-dichloroethene	µg/L	<1	<1	<1
Bromochloromethane	µg/L	<1	<1	<1
Chloroform	µg/L	1	4	<1
2,2-dichloropropane	µg/L	<1	<1	<1
1,2-dichloroethane	µg/L	<1	<1	<1
1,1,1-trichloroethane	µg/L	<1	<1	<1
1,1-dichloropropene	µg/L	<1	<1	<1
Cyclohexane	µg/L	<1	<1	<1
Carbon tetrachloride	µg/L	<1	<1	<1
Benzene	µg/L	<1	<1	<1
Dibromomethane	µg/L	<1	<1	<1
1,2-dichloropropane	µg/L	<1	<1	<1
Trichloroethene	µg/L	<1	<1	<1
Bromodichloromethane	µg/L	<1	<1	<1
trans-1,3-dichloropropene	µg/L	<1	<1	<1
cis-1,3-dichloropropene	µg/L	<1	<1	<1
1,1,2-trichloroethane	µg/L	<1	<1	<1
Toluene	µg/L	<1	<1	<1
1,3-dichloropropane	µg/L	<1	<1	<1
Dibromochloromethane	µg/L	<1	<1	<1
1,2-dibromoethane	µg/L	<1	<1	<1
Tetrachloroethene	µg/L	<1	<1	<1
1,1,1,2-tetrachloroethane	µg/L	<1	<1	<1
Chlorobenzene	µg/L	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1

VOCs in water				
Our Reference		352830-1	352830-2	352830-3
Your Reference	UNITS	BH301	BH304	BH405
Date Sampled		30/05/2024	30/05/2024	30/05/2024
Type of sample		Water	Water	Water
Bromoform	µg/L	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2
Styrene	µg/L	<1	<1	<1
1,1,2,2-tetrachloroethane	µg/L	<1	<1	<1
o-xylene	µg/L	<1	<1	<1
1,2,3-trichloropropane	µg/L	<1	<1	<1
Isopropylbenzene	µg/L	<1	<1	<1
Bromobenzene	µg/L	<1	<1	<1
n-propyl benzene	µg/L	<1	<1	<1
2-chlorotoluene	µg/L	<1	<1	<1
4-chlorotoluene	µg/L	<1	<1	<1
1,3,5-trimethyl benzene	µg/L	<1	<1	<1
Tert-butyl benzene	µg/L	<1	<1	<1
1,2,4-trimethyl benzene	µg/L	<1	<1	<1
1,3-dichlorobenzene	µg/L	<1	<1	<1
Sec-butyl benzene	µg/L	<1	<1	<1
1,4-dichlorobenzene	µg/L	<1	<1	<1
4-isopropyl toluene	µg/L	<1	<1	<1
1,2-dichlorobenzene	µg/L	<1	<1	<1
n-butyl benzene	µg/L	<1	<1	<1
1,2-dibromo-3-chloropropane	µg/L	<1	<1	<1
1,2,4-trichlorobenzene	µg/L	<1	<1	<1
Hexachlorobutadiene	µg/L	<1	<1	<1
1,2,3-trichlorobenzene	µg/L	<1	<1	<1
Surrogate Dibromofluoromethane	%	100	102	100
Surrogate Toluene-d8	%	98	98	97
Surrogate 4-Bromofluorobenzene	%	93	93	94

vTRH(C6-C10)/BTEXN in Water				
Our Reference		352830-1	352830-2	352830-3
Your Reference	UNITS	BH301	BH304	BH405
Date Sampled		30/05/2024	30/05/2024	30/05/2024
Type of sample		Water	Water	Water
Date extracted	-	03/06/2024	03/06/2024	03/06/2024
Date analysed	-	04/06/2024	04/06/2024	04/06/2024
TRH C_6 - C_9	µg/L	<10	<10	<10
TRH C_6 - C_{10}	µg/L	<10	<10	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	<10	<10
Benzene	µg/L	<1	<1	<1
Toluene	µg/L	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2
o-xylene	µg/L	<1	<1	<1
Naphthalene	µg/L	<1	<1	<1
Surrogate Dibromofluoromethane	%	100	102	100
Surrogate Toluene-d8	%	98	98	97
Surrogate 4-Bromofluorobenzene	%	93	93	94

svTRH (C10-C40) in Water				
Our Reference		352830-1	352830-2	352830-3
Your Reference	UNITS	BH301	BH304	BH405
Date Sampled		30/05/2024	30/05/2024	30/05/2024
Type of sample		Water	Water	Water
Date extracted	-	03/06/2024	03/06/2024	03/06/2024
Date analysed	-	04/06/2024	04/06/2024	04/06/2024
TRH C_{10} - C_{14}	µg/L	<50	<50	<50
TRH C_{15} - C_{28}	µg/L	<100	<100	<100
TRH C_{29} - C_{36}	µg/L	<100	<100	<100
Total +ve TRH (C10-C36)	µg/L	<50	<50	<50
TRH >C_{10} - C_{16}	µg/L	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50	<50	<50
TRH >C_{16} - C_{34}	µg/L	<100	<100	<100
TRH >C_{34} - C_{40}	µg/L	<100	<100	<100
Total +ve TRH (>C10-C40)	µg/L	<50	<50	<50
Surrogate o-Terphenyl	%	80	86	84

PAHs in Water				
Our Reference		352830-1	352830-2	352830-3
Your Reference	UNITS	BH301	BH304	BH405
Date Sampled		30/05/2024	30/05/2024	30/05/2024
Type of sample		Water	Water	Water
Date extracted	-	03/06/2024	03/06/2024	03/06/2024
Date analysed	-	04/06/2024	04/06/2024	04/06/2024
Naphthalene	µg/L	<0.1	<0.1	<0.1
Acenaphthylene	µg/L	<0.1	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1	<0.1
Phenanthrene	µg/L	<0.1	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5
Total +ve PAH's	µg/L	<0.1	<0.1	<0.1
Surrogate p-Terphenyl-d14	%	76	86	78

OCPs in Water - Trace Level				
Our Reference		352830-1	352830-2	352830-3
Your Reference	UNITS	BH301	BH304	BH405
Date Sampled		30/05/2024	30/05/2024	30/05/2024
Type of sample		Water	Water	Water
Date extracted	-	03/06/2024	03/06/2024	03/06/2024
Date analysed	-	04/06/2024	04/06/2024	04/06/2024
alpha-BHC	µg/L	<0.001	<0.001	<0.001
HCB	µg/L	<0.001	<0.001	<0.001
beta-BHC	µg/L	<0.001	<0.001	<0.001
gamma-BHC	µg/L	<0.001	<0.001	<0.001
Heptachlor	µg/L	<0.001	<0.001	<0.001
delta-BHC	µg/L	<0.001	<0.001	<0.001
Aldrin	µg/L	<0.001	<0.001	<0.001
Heptachlor Epoxide	µg/L	<0.001	<0.001	<0.001
gamma-Chlordane	µg/L	<0.001	<0.001	<0.001
alpha-Chlordane	µg/L	<0.001	<0.001	<0.001
Endosulfan I	µg/L	<0.002	<0.002	<0.002
pp-DDE	µg/L	<0.001	<0.001	<0.001
Dieldrin	µg/L	<0.001	<0.001	<0.001
Endrin	µg/L	<0.001	<0.001	<0.001
Endosulfan II	µg/L	<0.002	<0.002	<0.002
pp-DDD	µg/L	<0.001	<0.001	<0.001
Endrin Aldehyde	µg/L	<0.001	<0.001	<0.001
pp-DDT	µg/L	<0.001	<0.001	<0.001
Endosulfan Sulphate	µg/L	<0.001	<0.001	<0.001
Methoxychlor	µg/L	<0.001	<0.001	<0.001
Surrogate 4-Chloro-3-NBTF	%	79	89	80

OP in water LL ANZECCF/ADWG				
Our Reference		352830-1	352830-2	352830-3
Your Reference	UNITS	BH301	BH304	BH405
Date Sampled		30/05/2024	30/05/2024	30/05/2024
Type of sample		Water	Water	Water
Date extracted	-	03/06/2024	03/06/2024	03/06/2024
Date analysed	-	04/06/2024	04/06/2024	04/06/2024
Dichlorvos	µg/L	<0.05	<0.05	<0.05
Mevinphos	µg/L	<0.05	<0.05	<0.05
Phorate	µg/L	<0.05	<0.05	<0.05
Dimethoate	µg/L	<0.1	<0.1	<0.1
Diazinon	µg/L	<0.01	<0.01	<0.01
Disulfoton	µg/L	<0.05	<0.05	<0.05
Chlorpyriphos-methyl	µg/L	<0.05	<0.05	<0.05
Parathion-Methyl	µg/L	<0.05	<0.05	<0.05
Ronnel	µg/L	<0.05	<0.05	<0.05
Fenitrothion	µg/L	<0.05	<0.05	<0.05
Malathion	µg/L	<0.05	<0.05	<0.05
Chlorpyriphos	µg/L	<0.009	<0.009	<0.009
Fenthion	µg/L	<0.05	<0.05	<0.05
Parathion	µg/L	<0.004	<0.004	<0.004
Bromophos ethyl	µg/L	<0.05	<0.05	<0.05
Methidathion	µg/L	<0.05	<0.05	<0.05
Fenamiphos	µg/L	<0.05	<0.05	<0.05
Ethion	µg/L	<0.05	<0.05	<0.05
Phosalone	µg/L	<0.05	<0.05	<0.05
Azinphos-methyl (Guthion)	µg/L	<0.02	<0.02	<0.02
Coumaphos	µg/L	<0.05	<0.05	<0.05
Surrogate 4-Chloro-3-NBTF	%	79	89	80

PCBs in Water - Trace Level				
Our Reference		352830-1	352830-2	352830-3
Your Reference	UNITS	BH301	BH304	BH405
Date Sampled		30/05/2024	30/05/2024	30/05/2024
Type of sample		Water	Water	Water
Date extracted	-	03/06/2024	03/06/2024	03/06/2024
Date analysed	-	04/06/2024	04/06/2024	04/06/2024
Aroclor 1016	µg/L	<0.01	<0.01	<0.01
Aroclor 1221	µg/L	<0.01	<0.01	<0.01
Aroclor 1232	µg/L	<0.01	<0.01	<0.01
Aroclor 1242	µg/L	<0.01	<0.01	<0.01
Aroclor 1248	µg/L	<0.01	<0.01	<0.01
Aroclor 1254	µg/L	<0.01	<0.01	<0.01
Aroclor 1260	µg/L	<0.01	<0.01	<0.01
Surrogate TCMX	%	83	90	85

Total Phenolics in Water				
Our Reference		352830-1	352830-2	352830-3
Your Reference	UNITS	BH301	BH304	BH405
Date Sampled		30/05/2024	30/05/2024	30/05/2024
Type of sample		Water	Water	Water
Date extracted	-	04/06/2024	04/06/2024	04/06/2024
Date analysed	-	04/06/2024	04/06/2024	04/06/2024
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05	<0.05

HM in water - dissolved				
Our Reference		352830-1	352830-2	352830-3
Your Reference	UNITS	BH301	BH304	BH405
Date Sampled		30/05/2024	30/05/2024	30/05/2024
Type of sample		Water	Water	Water
Date prepared	-	04/06/2024	04/06/2024	04/06/2024
Date analysed	-	04/06/2024	04/06/2024	04/06/2024
Arsenic-Dissolved	µg/L	7	1	3
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1
Chromium-Dissolved	µg/L	<1	<1	<1
Copper-Dissolved	µg/L	3	11	7
Lead-Dissolved	µg/L	<1	10	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	6	50	24
Zinc-Dissolved	µg/L	6	34	100

Miscellaneous Inorganics				
Our Reference		352830-1	352830-2	352830-3
Your Reference	UNITS	BH301	BH304	BH405
Date Sampled		30/05/2024	30/05/2024	30/05/2024
Type of sample		Water	Water	Water
Date prepared	-	06/06/2024	06/06/2024	06/06/2024
Date analysed	-	06/06/2024	06/06/2024	06/06/2024
Total Suspended Solids	mg/L	180	97	62
Total Dissolved Solids (grav)	mg/L	2,000	3,700	2,600

PFAS in Water TRACE Short				
Our Reference		352830-1	352830-2	352830-3
Your Reference	UNITS	BH301	BH304	BH405
Date Sampled		30/05/2024	30/05/2024	30/05/2024
Type of sample		Water	Water	Water
Date prepared	-	05/06/2024	05/06/2024	05/06/2024
Date analysed	-	05/06/2024	05/06/2024	05/06/2024
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	<0.0002	0.0002
Perfluorooctanesulfonic acid PFOS	µg/L	0.0005	0.0002	0.0004
Perfluorooctanoic acid PFOA	µg/L	0.001	0.0007	<0.0002
6:2 FTS	µg/L	0.003	0.0005	0.003
8:2 FTS	µg/L	<0.0004	<0.0004	<0.0004
Surrogate $^{13}C_8$ *PFOS*	%	98	97	100
Surrogate $^{13}C_2$ *PFOA*	%	109	107	106
Extracted ISTD $^{18}O_2$ *PFHxS*	%	94	91	94
Extracted ISTD $^{13}C_4$ *PFOS*	%	83	76	77
Extracted ISTD $^{13}C_4$ *PFOA*	%	97	108	109
Extracted ISTD $^{13}C_2$ *6:2FTS*	%	#	#	#
Extracted ISTD $^{13}C_2$ *8:2FTS*	%	#	185	#
Total Positive PFHxS & PFOS	µg/L	0.0007	0.0002	0.0006
Total Positive PFOS & PFOA	µg/L	0.002	0.0009	0.0004
Total Positive PFAS	µg/L	0.0045	0.001	0.0032

Cations in water Dissolved				
Our Reference		352830-1	352830-2	352830-3
Your Reference	UNITS	BH301	BH304	BH405
Date Sampled		30/05/2024	30/05/2024	30/05/2024
Type of sample		Water	Water	Water
Date digested	-	04/06/2024	04/06/2024	04/06/2024
Date analysed	-	04/06/2024	04/06/2024	04/06/2024
Calcium - Dissolved	mg/L	20	74	28
Magnesium - Dissolved	mg/L	46	130	65
Hardness (calc) equivalent $CaCO_3$	mg/L	240	700	340

Method ID	Methodology Summary
Inorg-018	Total Dissolved Solids - determined gravimetrically. The solids are dried at 180+/-10°C. NOTE: Where the EC of the sample is <100µS/cm, the TDS will typically be below 70mg/L (as the sample is very likely to be at least drinking water quality). Therefore to ensure data quality for TDS, the TDS is typically calculated as per the equation below:- TDS = EC * 0.6
Inorg-019	Suspended Solids - determined gravimetricially by filtration of the sample. The samples are dried at 104+/-5°C.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS. Please note for Bromine and Iodine, any forms of these elements that are present are included together in the one result reported for each of these two elements. Salt forms (e.g. FeO, PbO, ZnO) are determined stoichiometrically from the base metal concentration.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-021/022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD and/or GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

Method ID	Methodology Summary
Org-029	Soil samples are extracted with basified Methanol. Waters and soil extracts are directly injected and/or concentrated/extracted using SPE. TCLPs/ASLP leachates are centrifuged, the supernatant is then analysed (including amendment with solvent) - as per the option in AS4439.3. Analysis is undertaken with LC-MS/MS. PFAS results include the sum of branched and linear isomers where applicable. Please note that PFAS results are corrected for Extracted Internal Standards (QSM 5.4 Table B-15 terminology), which are mass labelled analytes added prior to sample preparation to assess matrix effects and verify processing of the sample. PFAS analytes without a commercially available mass labelled analogue are corrected vs a closely eluting mass labelled PFAS compound. Surrogates are also reported, in this context they are mass labelled PFAS compounds added prior to extraction but are used as monitoring compounds only (not used for result correction). Envicarb (or similar) is used discretionally to remove interfering matrix components. Please contact the laboratory if estimates of Measurement Uncertainty are required as per WA DER.

QUALITY CONTROL: VOCs in water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date Extracted	-			03/06/2024	1	03/06/2024	04/06/2024		03/06/2024	[NT]
Date Analysed	-			04/06/2024	1	04/06/2024	05/06/2024		04/06/2024	[NT]
Dichlorodifluoromethane	µg/L	10	Org-023	<10	1	<10	<10	0	[NT]	[NT]
Chloromethane	µg/L	10	Org-023	<10	1	<10	<10	0	[NT]	[NT]
Vinyl Chloride	µg/L	10	Org-023	<10	1	<10	<10	0	[NT]	[NT]
Bromomethane	µg/L	10	Org-023	<10	1	<10	<10	0	[NT]	[NT]
Chloroethane	µg/L	10	Org-023	<10	1	<10	<10	0	[NT]	[NT]
Trichlorofluoromethane	µg/L	10	Org-023	<10	1	<10	<10	0	[NT]	[NT]
1,1-Dichloroethene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Trans-1,2-dichloroethene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,1-dichloroethane	µg/L	1	Org-023	<1	1	<1	<1	0	100	[NT]
Cis-1,2-dichloroethene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Bromochloromethane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Chloroform	µg/L	1	Org-023	<1	1	1	1	0	100	[NT]
2,2-dichloropropane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,2-dichloroethane	µg/L	1	Org-023	<1	1	<1	<1	0	104	[NT]
1,1,1-trichloroethane	µg/L	1	Org-023	<1	1	<1	<1	0	96	[NT]
1,1-dichloropropene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Cyclohexane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Carbon tetrachloride	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Benzene	µg/L	1	Org-023	<1	1	<1	<1	0	101	[NT]
Dibromomethane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,2-dichloropropane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Trichloroethene	µg/L	1	Org-023	<1	1	<1	<1	0	104	[NT]
Bromodichloromethane	µg/L	1	Org-023	<1	1	<1	<1	0	98	[NT]
trans-1,3-dichloropropene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
cis-1,3-dichloropropene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,1,2-trichloroethane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Toluene	µg/L	1	Org-023	<1	1	<1	<1	0	99	[NT]
1,3-dichloropropane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Dibromochloromethane	µg/L	1	Org-023	<1	1	<1	<1	0	94	[NT]
1,2-dibromoethane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Tetrachloroethene	µg/L	1	Org-023	<1	1	<1	<1	0	97	[NT]
1,1,1,2-tetrachloroethane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Chlorobenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	1	<1	<1	0	98	[NT]
Bromoform	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
m+p-xylene	µg/L	2	Org-023	<2	1	<2	<2	0	97	[NT]
Styrene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,1,2,2-tetrachloroethane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]

QUALITY CONTROL: VOCs in water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
o-xylene	µg/L	1	Org-023	<1	1	<1	<1	0	98	[NT]
1,2,3-trichloropropane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Isopropylbenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Bromobenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
n-propyl benzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
2-chlorotoluene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
4-chlorotoluene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,3,5-trimethyl benzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Tert-butyl benzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,2,4-trimethyl benzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,3-dichlorobenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Sec-butyl benzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,4-dichlorobenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
4-isopropyl toluene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,2-dichlorobenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
n-butyl benzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,2-dibromo-3-chloropropane	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,2,4-trichlorobenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Hexachlorobutadiene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
1,2,3-trichlorobenzene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	99	1	100	96	4	100	[NT]
Surrogate Toluene-d8	%		Org-023	98	1	98	100	2	99	[NT]
Surrogate 4-Bromofluorobenzene	%		Org-023	96	1	93	94	1	97	[NT]

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			03/06/2024	1	03/06/2024	04/06/2024		03/06/2024	[NT]
Date analysed	-			04/06/2024	1	04/06/2024	05/06/2024		04/06/2024	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	1	<10	<10	0	98	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	1	<10	<10	0	98	[NT]
Benzene	µg/L	1	Org-023	<1	1	<1	<1	0	101	[NT]
Toluene	µg/L	1	Org-023	<1	1	<1	<1	0	99	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	1	<1	<1	0	98	[NT]
m+p-xylene	µg/L	2	Org-023	<2	1	<2	<2	0	97	[NT]
o-xylene	µg/L	1	Org-023	<1	1	<1	<1	0	98	[NT]
Naphthalene	µg/L	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	99	1	100	96	4	100	[NT]
Surrogate Toluene-d8	%		Org-023	98	1	98	100	2	99	[NT]
Surrogate 4-Bromofluorobenzene	%		Org-023	96	1	93	94	1	97	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			03/06/2024	[NT]	[NT]	[NT]	[NT]	03/06/2024	[NT]
Date analysed	-			03/06/2024	[NT]	[NT]	[NT]	[NT]	03/06/2024	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	114	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	116	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	100	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	114	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	116	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate o-Terphenyl	%		Org-020	114	[NT]	[NT]	[NT]	[NT]	104	[NT]

QUALITY CONTROL: PAHs in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			03/06/2024	[NT]	[NT]	[NT]	[NT]	03/06/2024	[NT]
Date analysed	-			04/06/2024	[NT]	[NT]	[NT]	[NT]	04/06/2024	[NT]
Naphthalene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	90	[NT]
Acenaphthylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	87	[NT]
Fluorene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Phenanthrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	83	[NT]
Anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	86	[NT]
Pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	93	[NT]
Benzo(a)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	76	[NT]
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	83	[NT]	[NT]	[NT]	[NT]	81	[NT]

QUALITY CONTROL: OCPs in Water - Trace Level					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			03/06/2024	[NT]	[NT]	[NT]	[NT]	03/06/2024	[NT]
Date analysed	-			04/06/2024	[NT]	[NT]	[NT]	[NT]	04/06/2024	[NT]
alpha-BHC	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	81	[NT]
HCB	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
beta-BHC	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	80	[NT]
gamma-BHC	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Heptachlor	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	82	[NT]
delta-BHC	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aldrin	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	80	[NT]
Heptachlor Epoxide	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	86	[NT]
gamma-Chlordane	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
alpha-Chlordane	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan I	µg/L	0.002	Org-022/025	<0.002	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDE	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	82	[NT]
Dieldrin	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	90	[NT]
Endrin	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	86	[NT]
Endosulfan II	µg/L	0.002	Org-022/025	<0.002	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDD	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	76	[NT]
Endrin Aldehyde	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDT	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan Sulphate	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	81	[NT]
Methoxychlor	µg/L	0.001	Org-022/025	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	82	[NT]	[NT]	[NT]	[NT]	76	[NT]

QUALITY CONTROL: OP in water LL ANZECCF/ADWG					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			03/06/2024	[NT]	[NT]	[NT]	[NT]	03/06/2024	[NT]
Date analysed	-			04/06/2024	[NT]	[NT]	[NT]	[NT]	04/06/2024	[NT]
Dichlorvos	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	80	[NT]
Mevinphos	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Phorate	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dimethoate	µg/L	0.1	Org-022/025	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Diazinon	µg/L	0.01	Org-022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Disulfoton	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chlorpyriphos-methyl	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Parathion-Methyl	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ronnel	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	73	[NT]
Fenitrothion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	75	[NT]
Malathion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	90	[NT]
Chlorpyriphos	µg/L	0.009	Org-022/025	<0.009	[NT]	[NT]	[NT]	[NT]	89	[NT]
Fenthion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Parathion	µg/L	0.004	Org-022/025	<0.004	[NT]	[NT]	[NT]	[NT]	77	[NT]
Bromophos ethyl	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Methidathion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fenamiphos	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ethion	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	75	[NT]
Phosalone	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Azinphos-methyl (Guthion)	µg/L	0.02	Org-022/025	<0.02	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Coumaphos	µg/L	0.05	Org-022/025	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate 4-Chloro-3-NBTF	%		Org-022/025	82	[NT]	[NT]	[NT]	[NT]	76	[NT]

QUALITY CONTROL: PCBs in Water - Trace Level					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			03/06/2024	[NT]	[NT]	[NT]	[NT]	03/06/2024	[NT]
Date analysed	-			04/06/2024	[NT]	[NT]	[NT]	[NT]	04/06/2024	[NT]
Aroclor 1016	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1221	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1232	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1242	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1248	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1254	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	94	[NT]
Aroclor 1260	µg/L	0.01	Org-021/022/025	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-021/022/025	85	[NT]	[NT]	[NT]	[NT]	83	[NT]

QUALITY CONTROL: Total Phenolics in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			04/06/2024	1	04/06/2024	04/06/2024		04/06/2024	[NT]
Date analysed	-			04/06/2024	1	04/06/2024	04/06/2024		04/06/2024	[NT]
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	1	<0.05	<0.05	0	99	[NT]

QUALITY CONTROL: HM in water - dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			04/06/2024	[NT]	[NT]	[NT]	[NT]	04/06/2024	[NT]
Date analysed	-			04/06/2024	[NT]	[NT]	[NT]	[NT]	04/06/2024	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	109	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	97	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			06/06/2024	[NT]	[NT]	[NT]	[NT]	06/06/2024	[NT]
Date analysed	-			06/06/2024	[NT]	[NT]	[NT]	[NT]	06/06/2024	[NT]
Total Suspended Solids	mg/L	5	Inorg-019	<5	[NT]	[NT]	[NT]	[NT]	94	[NT]
Total Dissolved Solids (grav)	mg/L	5	Inorg-018	<5	[NT]	[NT]	[NT]	[NT]	85	[NT]

QUALITY CONTROL: PFAS in Water TRACE Short					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			05/06/2024	[NT]	[NT]	[NT]	[NT]	05/06/2024	[NT]
Date analysed	-			05/06/2024	[NT]	[NT]	[NT]	[NT]	05/06/2024	[NT]
Perfluorohexanesulfonic acid - PFHxS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	100	[NT]
Perfluorooctanesulfonic acid PFOS	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	102	[NT]
Perfluorooctanoic acid PFOA	µg/L	0.0002	Org-029	<0.0002	[NT]	[NT]	[NT]	[NT]	119	[NT]
6:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	96	[NT]
8:2 FTS	µg/L	0.0004	Org-029	<0.0004	[NT]	[NT]	[NT]	[NT]	98	[NT]
Surrogate $^{13}C_8$ PFOS	%		Org-029	98	[NT]	[NT]	[NT]	[NT]	96	[NT]
Surrogate $^{13}C_2$ PFOA	%		Org-029	88	[NT]	[NT]	[NT]	[NT]	121	[NT]
Extracted ISTD $^{18}O_2$ PFHxS	%		Org-029	90	[NT]	[NT]	[NT]	[NT]	89	[NT]
Extracted ISTD $^{13}C_4$ PFOS	%		Org-029	86	[NT]	[NT]	[NT]	[NT]	86	[NT]
Extracted ISTD $^{13}C_4$ PFOA	%		Org-029	125	[NT]	[NT]	[NT]	[NT]	99	[NT]
Extracted ISTD $^{13}C_2$ 6:2FTS	%		Org-029	192	[NT]	[NT]	[NT]	[NT]	173	[NT]
Extracted ISTD $^{13}C_2$ 8:2FTS	%		Org-029	197	[NT]	[NT]	[NT]	[NT]	199	[NT]

QUALITY CONTROL: Cations in water Dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	352830-2
Date digested	-			06/06/2024	1	04/06/2024	04/06/2024		06/06/2024	04/06/2024
Date analysed	-			06/06/2024	1	04/06/2024	04/06/2024		06/06/2024	04/06/2024
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	20	21	5	105	113
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	1	46	47	2	102	104
Hardness (calc) equivalent $CaCO_3$	mg/L	3	Metals-020	[NT]	1	240	240	0	[NT]	[NT]

Result Definitions	
NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Report Comments

For PFAS Extracted Internal Standards denoted with # or outside the 50-150% acceptance range, the respective target analyte results may be unaffected, in other circumstances the PQL has been raised to accommodate the outlier(s).