BC Geological Survey
Coal Assessment Report
1020

DMT Geosciences

Final Report

Coal Assessment Report for the Year 2015 for the Murray River Coal Property, Peace River Coalfield, British Columbia

Effective Date:	March 31, 2016
Report Date:	July 29, 2016
DMT File Number:	2012CMAA.038

Prepared for:

HD Mining International Ltd.
Vancouver, British Columbia

Prepared by:

DMT Geosciences Ltd.
Calgary, AB, Canada

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Section 2.3, Appendix 1, and Appendix 6 remain confidential under the terms of the Coal Act Regulation, and have been removed from the public version.

http://www.bclaws.ca/civix/document/id/complete/statreg/251_2004

COAL ASSESSMENT REPORT TITLE PAGE AND SUMMARY

Coal Assessment Report for the Year 2015 for the Murray River Coal Property, Peace River Coalfield, British Columbia

TOTAL COST:

$23,871,000

AUTHOR(S):

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The effective date of publication of this report is March 31, 2016. The date of publication is July 29, 2016

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NOTICE OF WORK PERMIT NUMBER(S)/DATE(S):

1. January-December 2015 CX.9.44

STATEMENT OF WORK EVENT NUMBER(S)/DATE(S):

1. January-December 2015

YEAR(S) OF WORK:

2015

PROPERTY NAME:

Murray River Coal Project

CLAIM NAME(S) (on which work was done):

417453, 417448

COMMODITIES SOUGHT:

COAL

MINERAL INVENTORY MINFILE NUMBER(S),IF KNOWN:

093I 035

MINING DIVISION:

Liard Mining Division

NTS / BCGS (at centre of work):

55°00’54”N, 121°02’38”E
UTM Zone 10 (NAD83), 622865E, 6104600N

OWNER AND OPERATOR:

HD MINING INTL. LTD.

MAILING ADDRESS:

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V6E 2K3

REPORT KEYWORDS

Murray River, Bituminous, Coal, Gates Formation, Underground bulk sample

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COAL LICENSE(S) IN PROJECT AREA ON WHICH NO PHYSICAL WORK WAS DONE OVER THE CURRENT REPORTING PERIOD:

417404, 417423, 417442, 417405, 417424, 417443, 417406, 417425, 417444, 417407, 417445, 417408, 417427, 417446, 417409, 417428, 417447, 417410, 417429, 417448, 417411, 417430, 417449, 417412, 417431, 417413, 417432, 417414, 417433, 417454, 417415, 417455, 417416, 417456, 417417, 417436, 417457, 417418, 417437, 417458, 417419, 417438, 417459, 417420, 417439, 417460, 417421, 417461, 417422, 417441, 417462

RATIONALE FOR NO PHYSICAL WORK DURING THE CURRENT REPORTING PERIOD:

Final stages of exploration and hydrogeological definition studies completed prior to submission of mine permit application before construction can start.

The bulk of the current work was conducted on licences containing the bulk sample decline and exploration boreholes.

Strata-bound tabular deposits do not generally require separate boreholes for each licence block – interpolation of resources across licences is the norm.

WORK PROPOSED OVER THE NEXT YEAR (SPECIFY WHICH TENURE BLOCKS WILL SEE PHYSICAL WORK, IF KNOWN):

(1) Hydrogeological drilling: 417426; and

(2) Test pitting and geophysical line survey: 417425, 417448, 417447, 417449, 417452, 417453

RATIONALE FOR NEXT YEAR'S PROGRAM:

(1) Continue the completion of 2015 hydrogeological drilling program, and

(2) Supplemental engineering for the CPP, CCR piles, vertical air return shaft area, auxiliary decline area, and water management structures.

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EXECUTIVE SUMMARY

The Murray River Coal Property lies to the southwest of Tumbler Ridge in the northeast of British Columbia. It was acquired by Canadian Dehua International Mines Group Inc. (Dehua) from Kennecott Canada Exploration Inc. (KCEI) in the summer of 2009. In that summer they drilled 11 boreholes and conducted an assessment of previous work. This drilling and assessment was summarized by Norwest (2010), and the Norwest report was accepted as the Coal Assessment Report required by the Coal Act for the 2010 exploration year.

In July 2009, Dehua signed an agreement with Huiyong Holding Group Co., Ltd (Huiyong) to develop the property and build a 6,000,000 tonne per year underground coal mine and associated infrastructure on the property. The property is now operated by HD (Huiyong Dehua) Mining International Ltd (HD) which is currently responsible for filing assessment reports on the property.

HD have retained DMT Geosciences Ltd. (DMT) of Calgary, AB to assist them with regulatory compliance and in late fall of 2014 DMT was requested to assist in the preparation of their coal assessment reports. This report is for the year 2015 and describes the following work:

- Completion of 356 m of rock tunnel (from Ch. 1000 to 1356) from surface towards the target coal seams as described in the notice of work for the bulk sample permit. During the year, the first target seam, D Seam, was reached and sample taken for metallurgical and hydrological testing. On completion of the sample, reclamation began at the site. Work on site was completed in 2016.

- Drilling and instrumenting of two deep holes for the purpose of refining the state of knowledge of the hydrogeological regime in the area. Testing included the measurement of the gas content of the coal seams. Drilling tasks also included the completion of a number of shallow monitoring and testing wells for hydrogeological data compilation.

- Improvements to the water treatment systems on site and water monitoring on and around the project site for compliance with BC guidelines and permit conditions.

Table 1 describes the work completed on the property and apportioned costs for the calendar year 2015.

The work was carried out by HD Mining International Ltd or their retained contractors and consultants.

Table 1: Summary of Work and Apportioned Costs

TYPE OF WORK IN THIS REPORT		EXTENT OF WORK (in metric units)	ON WHICH CLAIMS	PROJECT COSTS APPORTIONED (incl. support)
TUNNELING (total metres)				
Tunnel	Total meters: Width: Height: Azimuth Gradient Portal Northing(1) Portal Easting(1) Portal Elevation(1)	357 5.5 m 5 m N11.59.41E -16 degrees 6096895 624881 785.98 masl	417453	$20,327,231
			COST	**$20,327,231**
DRILLING (total metres, number of holes, size, storage location)				
Test Holes	Total meters: Number of holes: Size	311 9 92 – 102 mm	417434, 417440, 417426, 417437, 417452	
Core	Total meters: Number of holes: Size Storage location: Charlie Lake, Tumbler Ridge	18,335 2 HQ.		
			COST	**$2,497,903**
WATER TREATMENT				
	Temporary System New Pond New System	Rental Construction Installation	417453	$636,745 $227,640 $181,020
			COST	**$1,045,405**
			TOTAL COST	**$23,870,539**

Note (1) UTM Zone 10 NAD83

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APPENDICES

Appendices are attached at the end of the report, in the following order

1: Bulk Sample Permit CX-9-44

2: *"Review of an Application for a Coal Bulk Sample Project, Murray River Project, British Columbia."* prepared by DMT Geosciences Ltd of Calgary, AB for HD Mining international Ltd dated November 2012.

3: Shallow Borehole Logs

4: DH-01 Logs

5: DH-02 Logs

6: "*Gas Content and Composition, Wells DH-01 and DH-02"* report to HD Mining International, Vancouver, B.C. by Petrologic Services Inc. Calgary, AB., January 31, 2016.

1.0 INTRODUCTION

1.1 Location

The Project is located 12.5 km southwest of the town of Tumbler Ridge, British Columbia (Figure 1-1). The coordinates are W 120°57'48"-121°7'38", N 54°59'42"-55°5'4". The property consists of 57 coal licences covering an area of 16,024 hectares and is situated on Crown land within the Peace River Regional District (PRRD).

The central position of the project area can be arrived at through going south for about 15 km from Tumbler Ridge to the Monkman Park Road, going west for 9 km to the Quintette Mesa mining field road, and going west for 4 km to the Quintette coal washery.

1.2 Accessibility and Infrastructure

The Project falls within the PRRD. The region has well established regional infrastructure to support resource activities, including forestry, oil and gas exploration, coal mining, wind energy. Existing infrastructure in the immediate vicinity of the Project include: BC Hydro transmission line; Pacific Northern Gas distribution system; CN Rail line; and forest service roads. The District of Tumbler Ridge and other regional communities have capacity to support growth.

The Murray River Coal Property lies about 1,184 km northeast of Vancouver and in the administrative district of the Tumbler Ridge (this area is part of the Peace River basin). The adjacent coal mines include Quintette, Perry Creek and Bullmoose. The exploration and development of the petroleum and natural gas in this area are active, and production wells of the natural gas and natural gas pipelines are distributed everywhere in the area. Some infrastructures owned by Quintette coal mine are still preserved in the Murray River Coal Property, including 13 km of belt conveying corridor from the Mesa mining area to the Quintette coal-washing plant closed for standby currently.

There are two Provincial highways from the Murray River Coal Property to Tumbler Ridge: going to the south from Chetwynd, then passing through No. 29 highway (95 km), or going through No. 97 highway from Dawson Creek to the southwest direction first, then passing No. 25 highway (Feller's Heights Road). The population of Tumbler Ridge is about 3,500, however, the infrastructure can accommodate 6,000 people.

The roads of Monkman Park and Quintette Mesa are in good service condition, and the two roads serve for the production of natural gas within the region. The Mast Creek Road traverses the western boundary of the property.

1.3 Physiography

The Murray River Coal Property is situated within the eastern foothills (Inner Foothills Belt) of the Rocky Mountains. The topography is comprised of a belt of hills and low mountains dominated by a series of northeast to southwest elongated ridges. Two major water courses, namely the Murray River in the south and east, and the Wolverine River in the north, flow through the project area and bisect the Inner Foothills Belt (Figure 1-2).

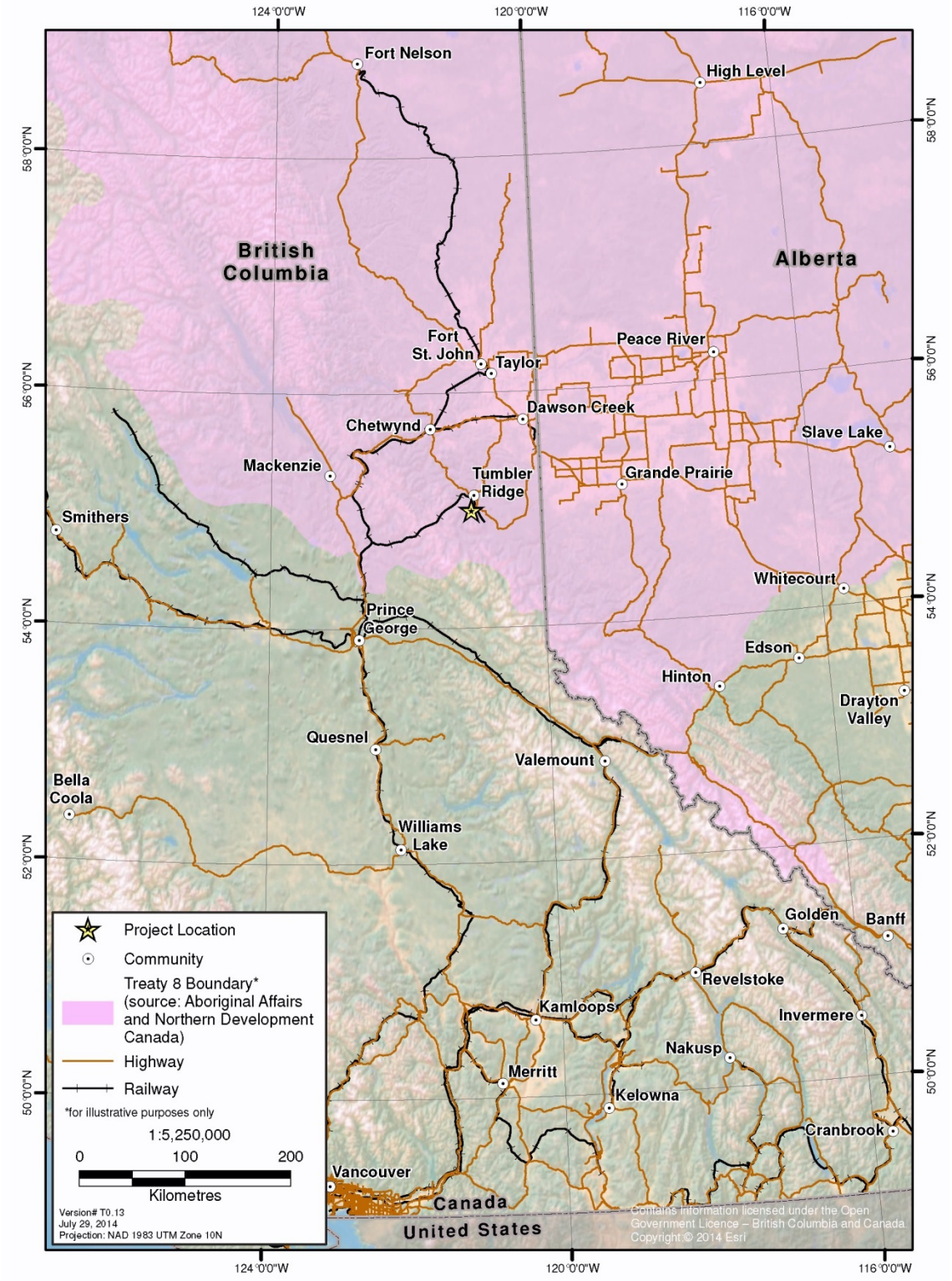

Figure 1-1: Project Location

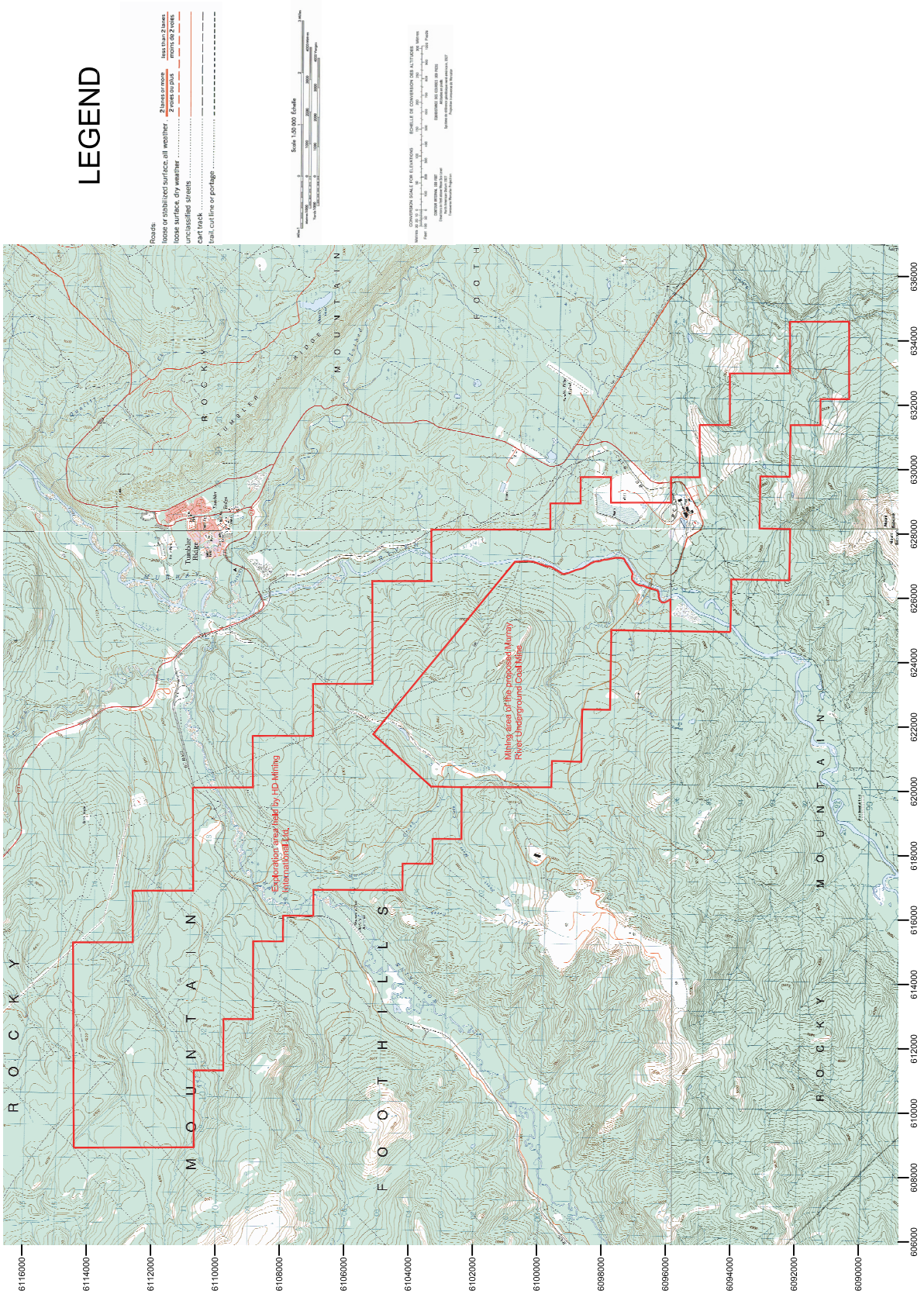

Figure 1-2: Topographic Map of the Exploration Area in the Murray River Coal Property

1.4 Climate

The climate in this area is characterized by a long, cold winter, a warm spring, and a short, cool summer because of the influences of the Rocky Mountains, the Pacific warm current, and the dry cold air from the northern polar region.

The average monthly temperature changes in the year are from -7.2°C to 15.2°C. The highest temperature recorded in history is 34°C and the lowest temperature of the year was -46.0°C, which are typical temperatures in the north east of British Columbia. The average temperatures in July and January in Tumbler Ridge are respectively 21°C and -5°C. Occasionally temperatures between -15 and -30°C occur in winter, generally from January to March.

The average annual rainfall in the area is 334 mm, and the snowfall is 1.85 m. Compared with the other regions in the Murray River Coal Property, the summer in the mountainous areas is cool and with heavy rainfall, and the winter is cold. Ice areas can be seen all year around, with continuous snow accumulation in winters between October and June. The dominant wind direction is southwest wind, and the wind with velocity of over 20 km/h is quite common in the top of the mountain ridge and the higher areas.

1.5 Mineral Tenure, Exploration and Permitting History

1.5.1 Mineral Tenure

The Murray River property consists of 57 coal licenses covering an area of 160 km2. The proposed underground mine and surface facilities are within 19 of the licence areas in the southeast portion of the licence block (Figure 1-2 and 1-3) with a total area of 37.45 km^2. As part of the Mines Act permitting process, HD Mining International Inc. (HD Mining) will seek to convert these licenses to a coal lease.

1.5.2 Exploration History

Previous exploration in the area was conducted by various major oil and gas companies in the 1970s (Lortie 2010), Quintette Coal Limited (Quintette) and more recently in 2006 and 2007 by Kennecott Coal Exploration Inc. (Kennecott). The exploration programs in the 1970s were generally regional in nature, comprised of widely spaced seismic lines and drilling of a small number of primarily oil and gas wells. These programs helped Quintette and Kennecott identify target areas for more detailed coal exploration and eventual mining. The target seams for the Project are part of the Gates Formation (Fort Saint John Group).

Kennecott's exploration program is the only known coal-specific exploration program previously conducted within the Murray River licence area. It consisted of one rotary (Lane 2006) and three core holes (BC MEMNG 2006) (two others were abandoned), surface mapping and interpretation of two seismic lines. Because of difficulties encountered during drilling, only one core hole was completed through the Gates Formation.

Du Pont completed two holes in 1979 west of the Murray River property as a preliminary investigation of the Gates Formation coal seams. One hole did not penetrate into the zone on contact between upper Gates and Hulcross formations due to the interception of a postulated fault zone (Du Pont of Canada Exploration Ltd. 1980).

Table 1-1: Claims Held by Dehua international forming the Murray River Coal Project

Coal Property No.	Map Sheet No.	Coal Property No.	Map Sheet No.	Coal Property No.	Map Sheet No.
417404	093P014	417423	093P005	417442	093P005
417405	093P014	417424	093P005	417443	093P005
417406	093P014	417425	093P005	417444	093P005
417407	093P014	417426	093P005	417445	093P005
417408	093P014	417427	093P005	417446	093P005
417409	093P014	417428	093P005	417447	093I095
417410	093P014	417429	093P005	417448	093P005
417411	093P014	417430	093P005	417449	093I095
417412	093P014	417431	093P005	417452	093I095
417413	093P014	417432	093P005	417453	093I095
417414	093P014	417433	093P005	417454	093I095
417415	093P014	417434	093P005	417455	093I095
417416	093P005	417435	093P005	417456	093I095
417417	093P015	417436	093P005	417457	093I095
417418	093P005	417437	093P005	417458	093I096
417419	093P005	417438	093P005	417459	093I096
417420	093P015	417439	093P005	417460	093I096
417421	093P005	417440	093P005	417461	093I096
417422	093P005	417441	093P005	417462	093I096

In 2009, Canadian Dehua International Mines Group Inc. obtained the Murray River coal property. Detailed exploration consisting of 12 drill holes was carried out in 2009 and 2010, focusing on the central part of the property (about 37.45 km^2). HD Mining took over responsibility for the exploration program in August 2010, and additional exploration was performed on the property. In total, 20 holes (17,850 m) have been drilled; two of the holes were tested for hydrogeologic properties.

1.5.3 Permitting History

As part of exploration of the coal deposit, HD Mining has received the following approvals from the BC Government to mine a 100,000 tonne bulk sample:

- Coal Exploration Permit CX-9-44 (BC Ministry of Energy, Mines, and Petroleum Resources), initially issued in December 2010, and amended in March 2012 to approve the Bulk Sample program;
- Occupant Licence to Cut (BC MFLNRO), issued in May 2011 to support exploration activities;
- Approval AE105825 under the BC Environmental Management Act (BC MOE), issued in February 2012, authorizes temporary discharge of effluent from the Murray River Bulk Sample initial surface preparation construction activity;

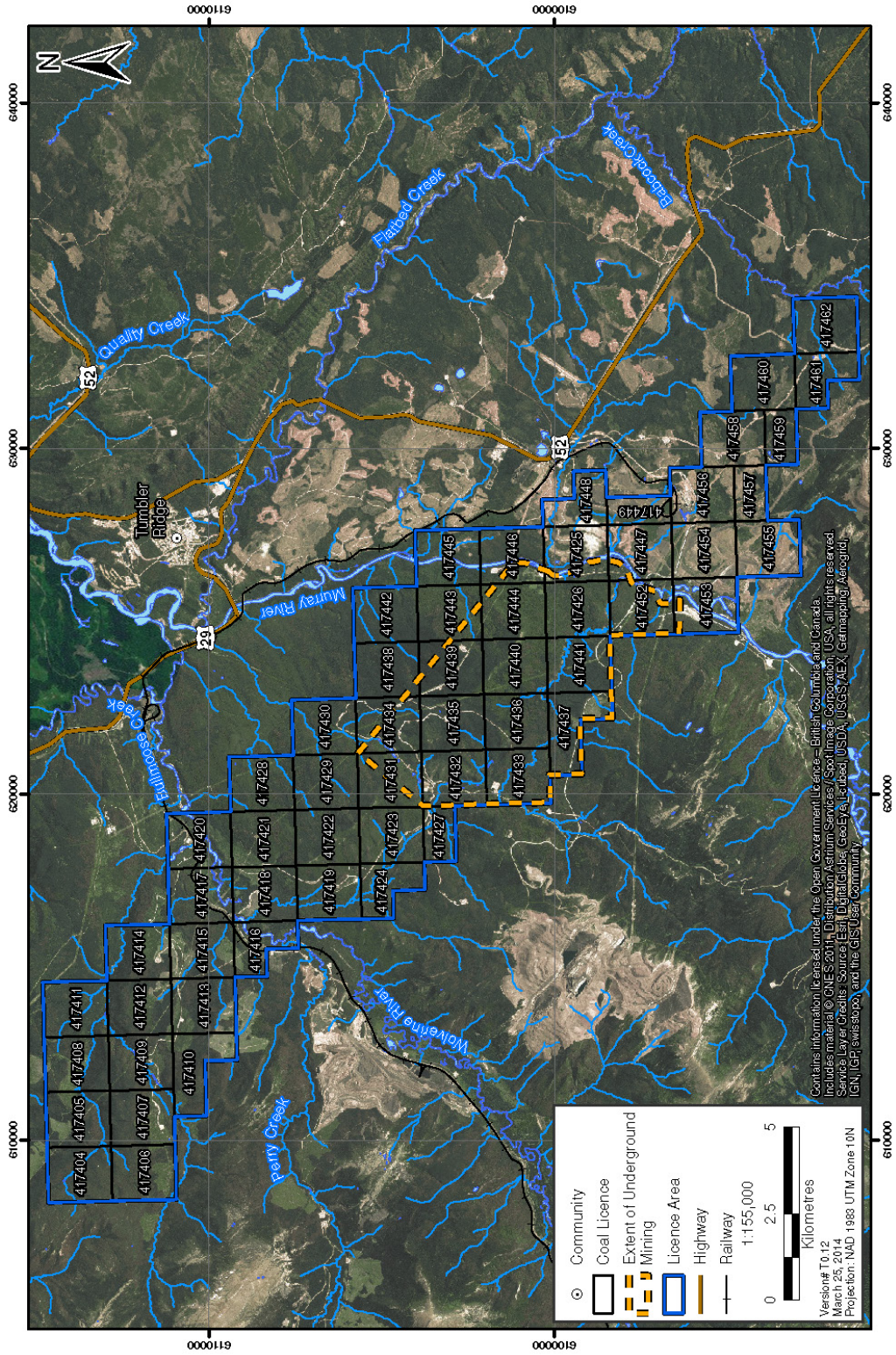

Figure 1-3: Murray River Coal Property and Proposed Underground Mining Area

- Approval AE105878 under the BC Environmental Management Act (BC MOE), issued in March 2012, authorizes discharge of effluents from the Murray River Bulk

- Sample construction and operation activities; and

- Permit 106666 under the BC Environmental Management Act (BC MOE), issued in October 2013, replacing Approval AE105878; authorizes discharge of effluents from the Murray River Bulk Sample construction and operation activities.

The purpose of the Bulk Sample program is to test the coal for use as a coking coal and to perform coal washability testing. The raw coal mined for the bulk sample will be shipped by train directly to the port in Prince Rupert for testing to be completed overseas.

In 2012 and into 2013, HD Mining completed surface preparations to mine the bulk sample. Following approval of mining equipment, underground development of a decline began in January 2014.

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2.0 GEOLOGY

2.1 Regional Setting

The Murray River property is located within the Peace River Coalfield (PRC) in the eastern foothills of the Canadian Rocky Mountains of northeastern BC. The western margin of the Foothills Belt is classified as the easternmost major thrust fault that emplaced Paleozoic strata over Mesozoic strata. The eastern margin is a series of echelon thrust faults that separate the Foothills from the gently dipping strata of the Alberta Plateau (Holland 1976). The Foothills Belt is characterized by folded and faulted Mesozoic sediments. The deformation within the Foothills Belt is variable – mostly decreasing in complexity toward the eastern margin. Deformation within the Rocky Mountains involves complicated folding and faulting. Regional axes for folding and faulting trend northwest, dipping to the southeast. In the Foothills Belt, dips tend to be 20° or less with local folds and undulations significantly modifying this value.

In the PRC there are two main coal-bearing units: the Gates Formation and the Gething Formation (British Columbia Geological Survey n.d.). Both Lower Cretaceous units were subjected to varying degrees of burial prior to the Laramide deformation and mountain-building episodes that took place approximately 40 to 70 million years ago when the Pacific and North American plates collided. The Laramide Orogeny increased the overall maturity of the coal seams. Based on drill core information from the neighbouring Quintette mine (immediately adjacent north of the Murray River Forest Service Road), coal seams of the Gates Formation can be comprised of up to 10 separate seams and the average cumulative thickness of the coal seams is as high as 17 metres.

2.2 Stratigraphy

The regional geology and stratigraphy of the PRC is provided in Figure 2-1 and Figure 2-2. Descriptions of the formations are provided below. The information is sourced primarily from Johnson (1985).

2.2.1 Moosebar Formation

The basal sequence of the Moosebar Formation is a dark grey to black marine shale with sideritic concretions, bentonite, and siltstone. The upper parts comprise banded or fissile sandy shale, very fine-grained sandstone, and sandstone intercalated shale. This transition is a pro-deltaic (highstand systems tract) transition from marine sediments to the massive continental sandstones that mark the overlying Gates Formation. The Bluesky Member is a chert pebble conglomerate that is found locally at the base of the Moosebar Formation.

2.2.2 Gates Formation (Fort St. John Group)

The Gates Formation conformably overlies the Moosebar Formation. The lower portion of the formation is termed the Quintette or Torrens member and consists of massive, light gray, mediumgrained sandstone, with minor carbonaceous and conglomeratic horizons.

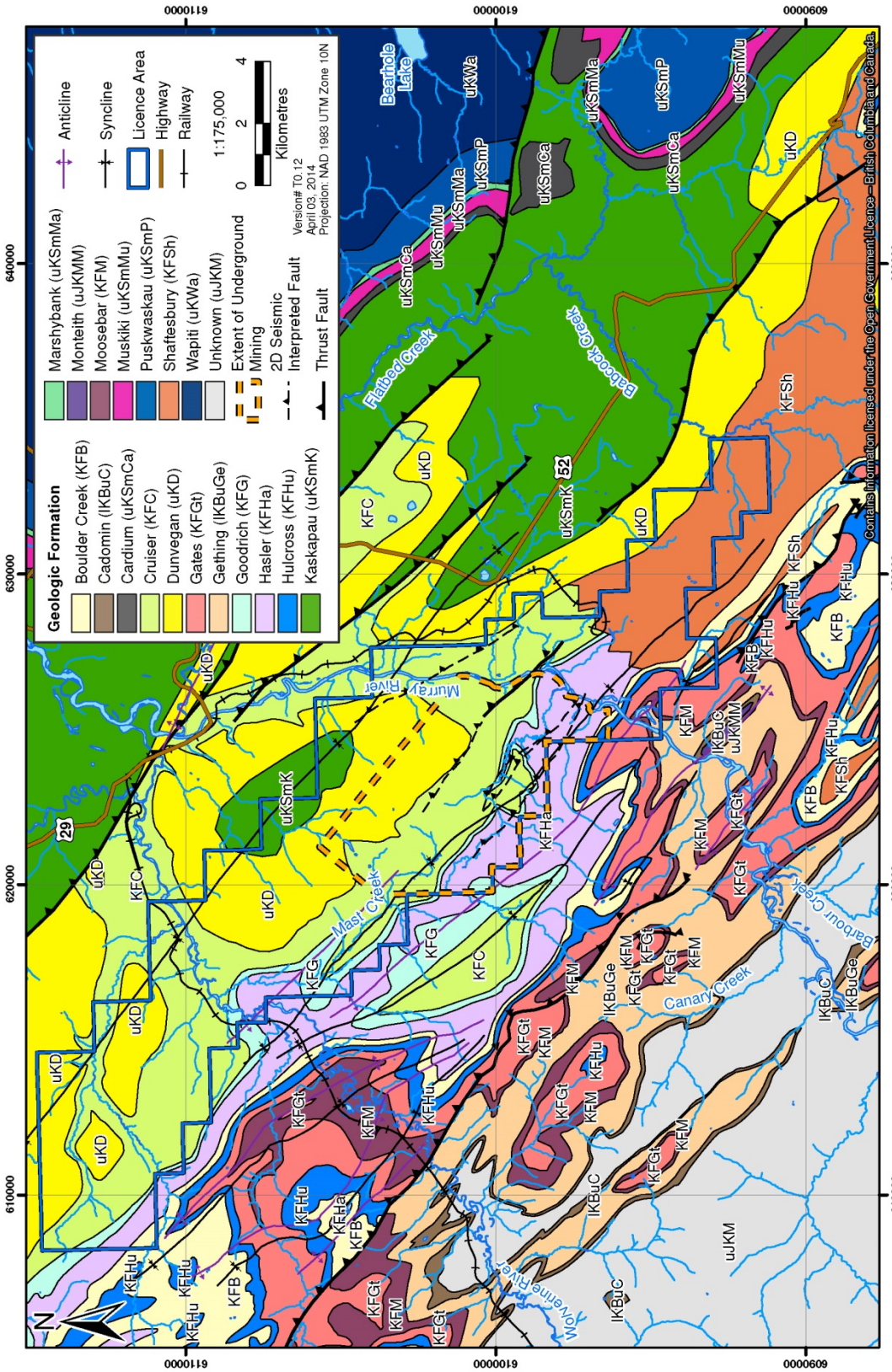

Figure 2-1: Regional Geological Setting of the Murray River Project

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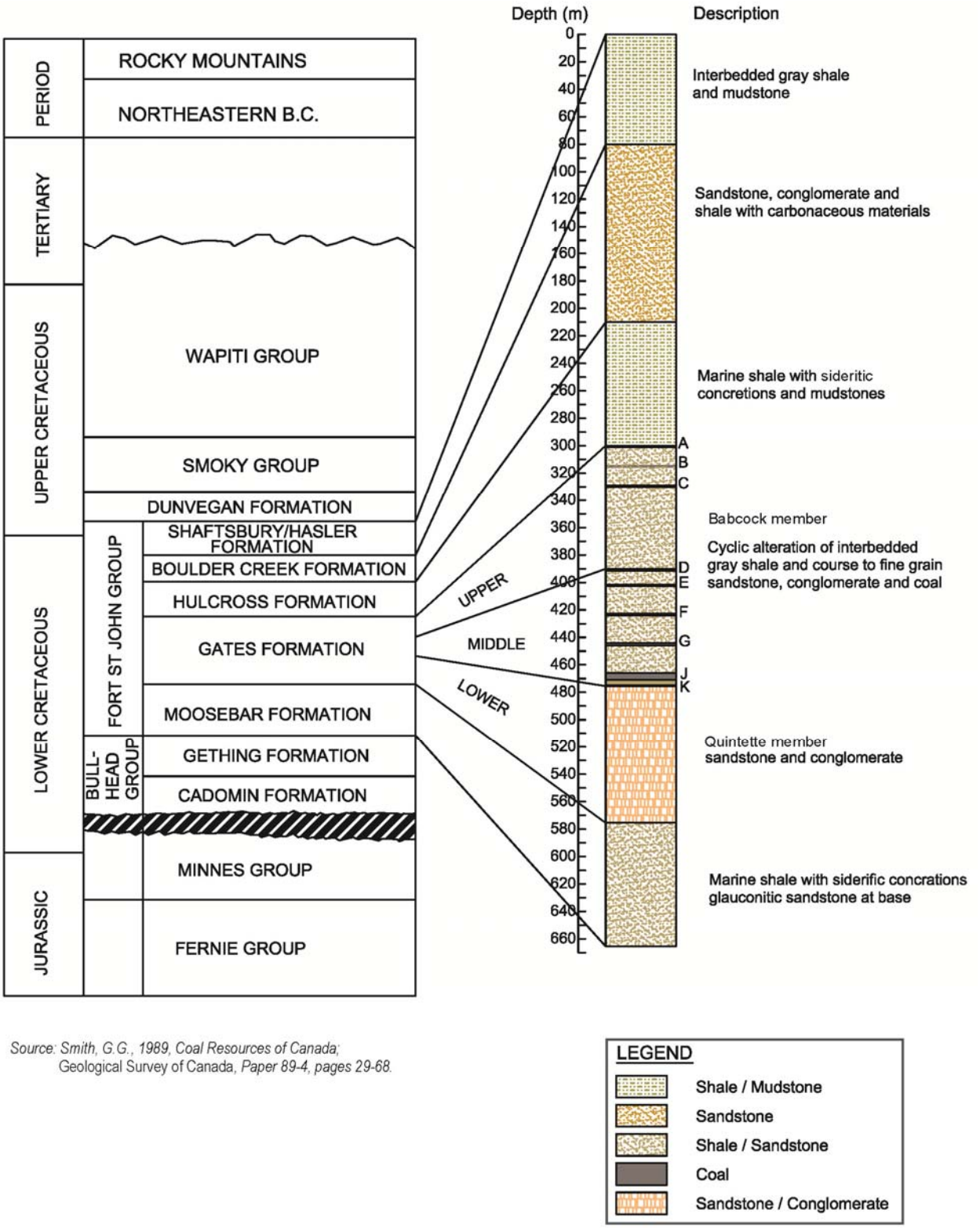


Source: Smith, G.G., 1989, Coal Resources of Canada; Geological Survey of Canada, Paper 89-4, pages 29-68.

Figure 2-2: Typical Stratigraphic Column in the Murray River Project Area

The Quintette member is overlain by several cyclical sequences of coal deposition that occur over a stratigraphic interval of approximately 80 m collectively referred to as the Middle Gates. Each cycle normally begins with laminated, medium- to fine-grained sandstone at the base, transitioning to carbonaceous shale and coal. Coal seams are thickest and more continuous in the lowermost cycle: the D through K seams are economical to mine. Individual coal seams within the higher cycles may coalesce to form a single seam, e.g., the G and I seams are typically referred to as the G/I seam. The lower portion of the Upper Gates is massive, medium- to coarse-grained sandstone and overlain by a predominantly shale sequence containing two to three poorly developed coal seams (A to C) intercalated with sandy shale and very fine sandstone. A very thin bed of chert pebbles with ferruginous cement marks the contact of the Upper Gates with the overlying marine sediments of the Hulcross Formation.

2.2.3 Hulcross Formation

The Hulcross Formation is comprised predominantly of dark grey marine shale approximately 100 metres thick. The base of the Formation is more homogeneous and arenaceous, and can contain sideritic concretions. The upper portion of the Formation is dominated by thinly laminated interbeds of siltstone and very fine-grained sandstone. A few kaolinitic beds have also been observed. The Hulcross Formation is usually distinguished from the Moosebar Formation by the absence of glauconitic sandstones at the base of the Hulcross.

2.2.4 Boulder Creek Formation

The Boulder Creek Formation is a 130 to 200 metre thick sequence of shale, greywacke, and conglomerate that conformably overlies the Hulcross Formation. The Boulder Creek Formation is a coarsening upward sequence with massive conglomerate and conglomeratic sandstone in the upper portions of the Formation and alternating medium- to fine-grained sandstones and shale in the middle of the Formation (Du Pont of Canada Exploration Ltd. 1980).

2.2.5 Hasler Formation

The Hasler Formation is predominantly dark grey marine shale with sideritic concretions and a minor sandstone and pebble conglomerate component; the basal layer is frequently pebbly (British Columbia Ministry of Energy and Mines 2011).

Above the Hasler Formation, the Goodrich and Cruiser Formations form the uppermost units in the Fort St. John Group. According to regional geology maps, the Hasler, Goodrich, and Dunvegan formations comprise the majority of bedrock outcrop on the property.

3.0 CONSTRUCTION OF THE AUXILIARY DECLINE

Table 3-1 shows the details of the construction of the auxiliary decline.

Table 3-1: Summary of the Details of the Auxiliary Decline Construction

Approval number	CX-9-44
Period	January to December, 2015
Claims	417453
Number of Tunnels	1
Total meters	357
Size	5.5 m wide, 4.5 m high, nominal
Core storage location	None
Cost	$20,327,231.29

Excavation began mid-January, 2015 and was undertaken according to the conditions set out in the Bulk Sample Permit CX-9-44 (attached as Appendix 1).

The work was conducted according to the procedures described in:

> *"Review of an Application for a Coal Bulk Sample Project, Murray River Project, British Columbia." prepared by DMT Geosciences Ltd of Calgary, AB for HD Mining international Ltd dated November 2012*

The report was required by MEM to satisfy the requirement that a professional engineer registered in BC had certified the proposed work. It is attached as Appendix 2

The decline was excavated by a Chinese-manufactured road-header. The broken rock was loaded out on a conveyor and trucked to the approved waste rock pile at the North site (Drawing 3-1, at the end of the report).

Details of monthly construction and cost are shown in Table 3-2 overleaf. Monthly advance is shown in Drawing 3-2 (at end of report).

Geological mapping of the face was carried out and in conjunction with the results of previous exploration boreholes an interpreted cross section of the geology along the decline was constructed (Drawing 3-3, at the end of the report)

The first 500 m of excavation (completed in 2014) was supported using steel arches set at a nominal spacing of 1.0 m. The remaining 500 m excavated in 2014 was supported using rock bolts, rib bolts, mesh and straps, augmented by cable bolts as required. All of the excavation completed in 2015 was supported using rock bolts and mesh, with straps and cable-bolts installed as required to augment the primary support in wider zones or in weaker ground.

Table 3-2: Summary of Expenditure, 2015

Canadian $ (000)	2015												
Description	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**	**Total**
Civil Engineering	79	33	160	60	24	77	75	35	42	65	87	134	872
Equipment Installation	0	51	3	91	0	68	57	57	52	34	6	105	523
Materials, Spare Parts &Maintenance	108	336	195	157	344	215	158	3,196	110	113	132	243	5,305
Surface Site Preparation & Portal	0	0	0	0	0	0	0	0	0	0	0	0	0
Onsite Environmental Monitoring	19	0	9	0	0	7	0	27	11	0	0	0	72
Field Review & Security	69	50	30	69	87	103	17	69	70	102	71	87	824
Onsite Mine Management Consulting	0	92	83	91	89	140	0	0	0	0	0	0	496
Wages & Direct Onsite Supervisory	574	574	574	574	574	574	574	574	574	574	574	574	6,893
Waste Disposal	31	31	0	17	48	140	36	0	0	1	0	47	351
Land Survey	0	0	0	0	0	0	0	0	0	0	0	4	4
Rent - onsite	53	53	53	53	53	53	53	53	53	53	53	53	639
Equipment Rental	167	156	10	152	10	123	1	0	0	1	42	18	679
General & Administration - Onsite	135	135	135	135	135	135	135	135	135	135	135	135	1,616
Supplies & Maintenance on site	168	168	168	168	168	168	168	168	168	168	168	209	2,052
Total Construction in Progress	1,402	1,678	1,420	1,568	1,531	1,804	1,273	4,313	1,215	1,245	1,268	1,610	20,327
Metres Advanced	37	26	0(1)	45	125	66	27	0(1)	0(1)	0(1)	17(1)	13(2)	**356**
Cumulative Metres	1037	1063	1063	1108	1233	1299	1326	1326	1326	1326	1343	1356	**1356**

Notes:
1 Decline sinking in this month halted for advance drilling.
2 Final 13 m to D Seam driven by drill and blast methods, after which sample was taken and clean-up began.

In order to monitor the performance of the roof support in the roof-bolted decline, a series of single-point wire extensometers, or “tell-tales” were installed in the roof at regular intervals (Drawing 3-4, at the end of report). Any movement of the roof indicating a weakness of the roof support and hence a potential hazard to the workforce could be detected from regular inspection. No unexpected movement of the roof was detected, indicating a satisfactory roof support design.

In addition to geological mapping, geotechnical mapping was also conducted, using the “Q” system of rock mass characterization[1]. The rock mass characteristics were regularly assessed by the HD geologist. The value of “Q” along the decline is shown in Drawing 3-5 (at end of report).

During decline development in 2014 a number of water inflows were encountered. No further inflows were encountered during 2015 and water flowing from previously exposed sites was pumped to surface, treated and discharged.

[1] Barton, N.R.; Lien, R.; Lunde, J. (1974). "Engineering classification of rock masses for the design of tunnel support". Rock Mechanics and Rock Engineering (Springer) **6** (4): 189–236.

4.0 HYDROGEOLOGICAL DRILLING

Table 4-1 shows the details of the hydrogeological drilling.

Table 4-1: Summary of the Details of the Hydrogeological Drilling

Approval number	1640459-201402
Period	January to December, 2015
Claims	417434, 417440, 417426, 417437, 417452
Number of Holes	11
Total metres drilled	2167
Total metres cored	1856
Size	HQ
Core storage location	Mine Site
Cost	$2,497,903.32

In 2015 hydrogeological drilling was conducted to obtain additional regional information on the hydrogeology and to install monitoring instruments to determine the behaviour of deep aquifer systems. This information is required to provide background information for the mine permit application currently being prepared.

Drawing 4-1 (at end of report) shows the locations of the boreholes drilled. Note that H20 was a check survey and DH-03 was drilled in 2016.

MW-01 bottomed in gravel at 24.2 m.

MW-02 finished in silt at 43 m.

MW-03 and MW-04 finished in sand at 71.6 m and 33.5 m respectively.

SH-01 encountered bedrock (mudstone) at 10.5 m and bottomed at 28.6 m.

SH-02 hit mudstone at 2.7 m and ended at 28.8 m.

SH-03 encountered mudstone at 4.3 m and was completed at 27.0 m.

SH-04 finished in gravel at 26.2 m.

SH-05 hit bedrock (mudstone) at 3.5 m and was completed at 28.0 m.

All of the above holes were drilled with a rotary air cooled drill. SPT testing was carried out in the unconsolidated material and weathered bedrock. Chip samples were collected for lithological recognition. No core was collected. Appendix 3 contains the borehole logs and monitoring well installation details for these holes.

DH-01 and DH02 were deep holes which were cored and logged from surface and samples collected for gas content analysis. DH-03 was completed in 2016 and will be reported next year.

DH-01 was 1004 m deep from surface and cored 996 m of rock. It was halted in F Seam due to problems keeping the hole open. Table 4-2 summarises the major units encountered.

Table 4-2: Major Units Encountered in DH-01

Formation	From	To	Thickness
Q	0	8	8.00
Hasler	8	604.07	596.07
Boulder Creek	604.07	735.92	131.85
Hulcross	735.92	843.9	107.98
Gates	843.9	1004	160.10
A Seam	843.9	843.93	0.03
B Seam	854.07	855.03	0.96
C Seam	875.42	875.48	0.06
D Seam	926.10	926.85	0.75
E Seam	985.45	986.00	0.55
F1 Seam	998	1003.50	5.50
EOH @ 1003.5			

Hole details, including logs, geophysics and details of the construction of the “Westbay” hydrogeological monitoring instrumentation, are presented in Appendix 4. Samples taken for geochemical analysis are listed in the borehole record and the results are included in Appendix 4.

DH-02 was 865 m deep and 860 m of rock core was recovered. It was halted 25 m below F Seam. Table 4-3 summarises the major units encountered.

Hole details, including logs, geophysics and details of the construction of the “Westbay” hydrogeological monitoring instrumentation, are presented in Appendix 5. Samples taken for geochemical and geotechnical testing were analysed in 2016.

Samples of each of the coal seams encountered were collected for gas content analysis by Petrologic of Calgary, AB. Results appear to be somewhat counter-intuitive, with the shallower hole giving the higher gas content, although the deeper hole was closer to the gas well at the NW end of the mining area. The Petrologic report is presented in Appendix 6.

Table 4-3: Major Units Encountered in DH-02

Formation	From	To	Thickness
Q	0	6	6
Hasler	6	389.71	383.71
Boulder Creek	389.71	520.55	130.84
Hulcross	520.55	626.66	106.11
Gates	626.66	865.5	238.84
A Seam	626.66	626.7	0.04
B Seam	629.74	629.95	0.21
C Seam	646.27	647.00	0.73
D Seam	704.93	706.00	1.07
E Seam			0
F1 Seam	759.45	761.00	1.55
F2 Seam	780.38	781.57	1.19
G/I Seam	807.68	808.50	0.82
J Seam	833.35	840.08	6.73
EOH @ 865.5			

5.0 WATER TREATMENT FACILITIES

Table 5-1 shows the details of the water treatment facility expenditures.

Table 5-1: Summary of the Details of the Water Treatment Facility Expenditures

Approval number	CX-9-44
Period	January to December, 2015
Claims	417453
Work	Rental and Operation of Interim Water Treatment Facility
	Build and Operate Second Pond and Treatment Facility
Cost	$1,045,405.23

During 2015 a modular water treatment facility was rented, with operators, from Veolia. In the latter part of 2015 this was replaced with an owned facility augmented by a second sedimentation pond to ensure that discharges were maintained within permit guidelines.

6.0 CERTIFICATES

6.1 Peter Cain, Ph.D., P.Eng.

As the co-author of this report entitled "Coal Assessment Report for the Year 2014 for the Murray River Coal Property, Peace River Coalfield, British Columbia" dated December 31, 2015 ("the Report"), I, Peter Cain, do hereby certify that:

1. I am employed by and carried out this assignment for:

   DMT Geosciences Ltd.,
   Suite 415 – 708 11th Avenue SW,
   Calgary, Alberta, T2R 0E4, Canada.
   Telephone: (403) 264-9496
   Fax: (403) 263-7641

2. I hold the following academic qualifications:

   - Bachelor of Science – University of Wales, University College Cardiff, 1977
   - Doctor of Philosophy – University of Wales, 1982

3. I am a registered member of the:

   - Association of Professional Engineers and Geoscientists of British Columbia, Licence - 37663.
   - Association of Professional Engineers, Geologists and Geophysicists of Alberta, Member - 63684.
   - Association of Professional Engineers and Geoscientists of Saskatchewan, Licence - 25843.

4. I have worked as a mining engineer for a total of 38 years since my undergraduate degree from university. I have worked in grassroots to advanced stage mining projects. I have experience with underground and open pit and quarry operations from the pre-production stage to closure. I have the following experience in coal and coal mining:

   - I hold a First Class Certificate of Competency – Underground Coal - from the Province of BC.
   - I hold an Underground Coal Mine Manager's Certificate from the Province of Alberta.
   - Preparation of a coal resource/coal reserve estimate of the PT Senemas Energindo Mineral coal mine in Kalimantan, Indonesia for Agritrade Resources Ltd (2012)
   - Completed a due diligence review of coal lands owned by Chugach Alaska Corporation in the Chugach hills for Canada Coal Inc.
   - Engineering work on the feasibility study for a new underground coal mine development near Cucuta in Norte de Santander Department in northwest Colombia for Compañia Minera Cerro Tasajero (2010-2011).
   - Engineering lead for DMT on the PT Indika Energy technical team working on the potential acquisition of PT Bayan Resources, Citibank as financial advisor (2010).

- Engineering lead for DMT on the PT Indika Energy technical team working on the potential acquisition of PT Berau, Citibank as financial advisor (2009).
- Due diligence review of certain coal assets in Cordoba Department, Colombia, on behalf of Prime Natural Resources.
- A technical review of various coal assets in Norte del Santander Department, Colombia on behalf of Vitol SA.
- Technical assistance to several coal mines in the Cucuta area in Norte del Santander Department, Colombia on behalf of a potential investor. Included safety audits and operational assistance as well as reviewing the design of exploration projects.
- Review of certain coal assets on the island of Borneo on behalf of Indika Energy Inc. (2007-2008) including the South Gobi and PT Berau properties.
- Technical due diligence on the assets of the Taiyuan Sanxing Coal Gasification (Group) Co Ltd. owned by China Coal Energy Holdings Ltd. of Hong Kong. Completed for Pine Street Capital (Elliott Advisors (HK) Ltd.

5. Prior to joining DMT I spent six months designing an underground coal mine in Iran and two months writing an NI 43-101 Technical Report on coal mining properties in Colombia.
6. From 2000 to 2004 I was Mine Manager for Grande Cache Coal Corporation responsible for all aspects of mine design, planning and costing for their No. 7 Mine, including preparation for a successful stock market launch in 2004. Prior work experience includes:

1998 – 2000	**Smoky River Coal Limited** Senior Geotechnical Engineer.
1993 – 1998	**NRCan – CANMET-CRL** Group Leader - Strata Control.
1987 – 1993	**Jacques Whitford and Associates Ltd.** Senior Mining Engineer.
1986 – 1987	**Webster Machine Company Ltd.** Mining Engineer.
1982 – 1986	**NRCan – CANMET-CRL** Research Scientist.

Dated at Calgary, AB. this 29th Day of July, 2016.

Peter Cain, Ph.D., P.Eng.
Director, Engineering and Consulting
DMT Geosciences Ltd.

600 800 625000 200 400 600 800 626000

N

P1R18(H15)
2.35(D) 416.40
3.70(E) 396.08
5.73(F) 367.62
6.68(J) 323.29

KMR06

Waste Rock Stockpile & Settling Pound in North Site

Dec 31, 2015
Nov 30, 2015
Jul 31 to Oct 30, 2015
Jan 30, 2014
May 31, 2014
Apr 30, 2015
Feb 28, March 31, 2015
Jan 31, 2015
Dec 31, 2014
SUMP #2
230kv Exist Power Line
Mast Rd

P1R39(H16)
-53.50 1.90(D)
-71.20 2.20(E)
P1R39(H16W) -103.41 4.23(F)

343.30 3.69(D)

P1C51
332.50 1.82(D)
311.87 3.57(E)
282.57 4.66(F)
220.63 5.46(J)

SUMP #1
Twenty Creek
Murray Forest Service Rd
MURRAY RIVER

Aux Decline Portal:
X=6,096,922.501
Y=624,870.966
Z=785.908
Azimuth: 11°59'41"
Dip: -16°, -28.87%

Parking Lot
Mine Office
Mine Dry
Mine Shop
Explosive Storage
Fuel Station
25 T Diesel Tank
15 T Diesel Tank
Wastewater
#1 Settlement Pond
#2Settlement Pond
emergency spillway
Bath Boundary
Cap Maz
Powder Maz

8003317
8014530

LEGEND

- The Boundary of Property
- The Boundary of Mining Area
- The Area of Planning on Surface
- The Area of Designed Mine Plan
- The Area of Designed Mine Plan in Laste Stage.
- The Entry Road of Mine Site
- S The Line of Water Supply
- V The Designed Power Line
- Exist Forest Service Road
- Exist 230kv Power Line
- Exist CN Railway
- Designed New Site Railway
- The Protect Zone of Gas Line
- River or Creek
- Swamp

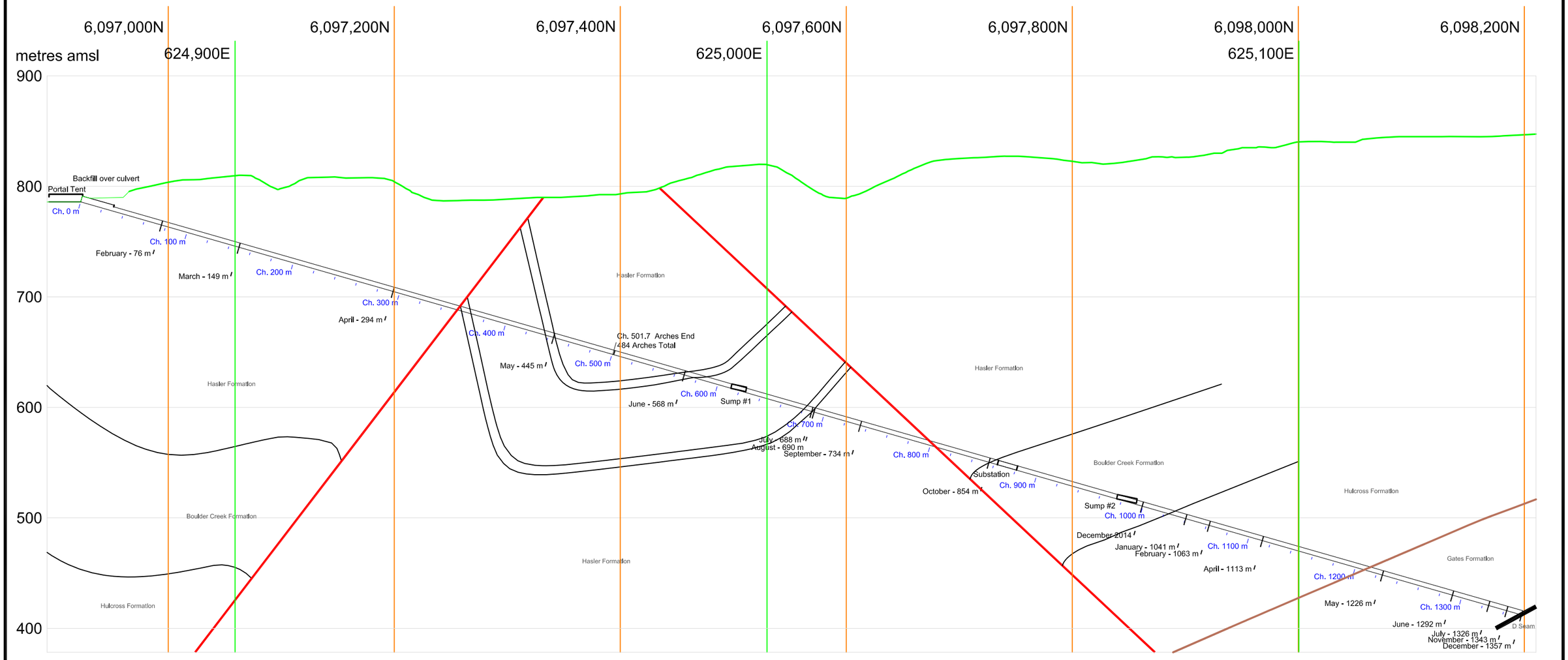
PROJECT
Coal Assessment Report for the Year 2015,
Murray River Coal Project, Tumbler Ridge, BC.

ENGINEERS APPROVAL

TITLE
SITE LAYOUT

HD Mining International Ltd.

PROJECT No.	2012CMAA.058		FILE No.	058-3020
DESIGN	PC	01-DEC-15	SCALE	1:5000
CADD	PC	01-JUL-16	Dwg 3-1	
CHECK	-	-		
REVIEW	-	-		



LEGEND

- Backfill
- Hasler Formation - undifferentiated mudstones, silty mudstones and siltstones with two sandstone markers as indicated
- Boulder Creek Formation - mudstones and siltstones
- Hulcross Formation - Not intercepted.
- Surface
- Fault, arrow indicates upthrow
- Inclination of bedding as mapped.

Portal Origin: 6096922.501N, 624870.966E
Elevation 785.908 masl, Azimuth:11°59'41"
Gradient: -16°

Metres
0 50 100 150 200 250
Scale 1:2500

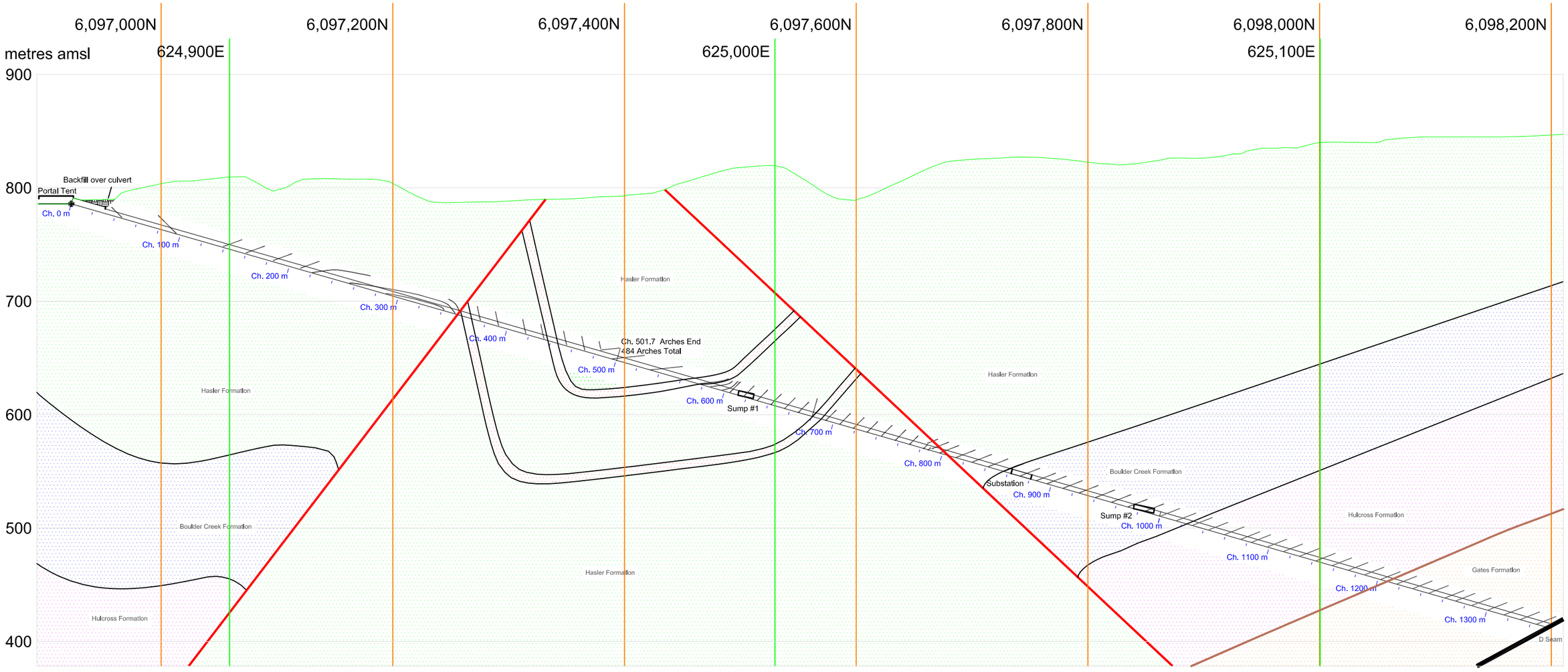
PROJECT
Coal Assessment Report for the Year 2015,
Murray River Coal Project, Tumbler Ridge, BC.

ENGINEERS APPROVAL

TITLE
SOUTH SITE DECLINE
ADVANCE BY MONTH

HD Mining International Ltd.

PROJECT No.	2012CMM.058		FILE No.	058-3020
DESIGN	PC	01-JUL-16	SCALE	1:2500 on 11 x 17
CADD	PC	01-JUL-16		
CHECK	-	-		Dwg 3-2
REVIEW	-	-		



LEGEND

- Backfill
- Hasler Formation - undifferentiated mudstones, silty mudstones and siltstones with two sandstone markers as indicated
- Boulder Creek Formation - mudstones and siltstones
- Hulcross Formation
- Gates Formation
- Surface
- Fault, arrow indicates upthrow
- Inclination of bedding as mapped.
- Portal Origin: 6096922.501N, 624870.966E
  Elevation 785.908 masl, Azimuth:11°59'41"
  Gradient: -16°

Metres
0 50 100 150 200 250
Scale 1:2500

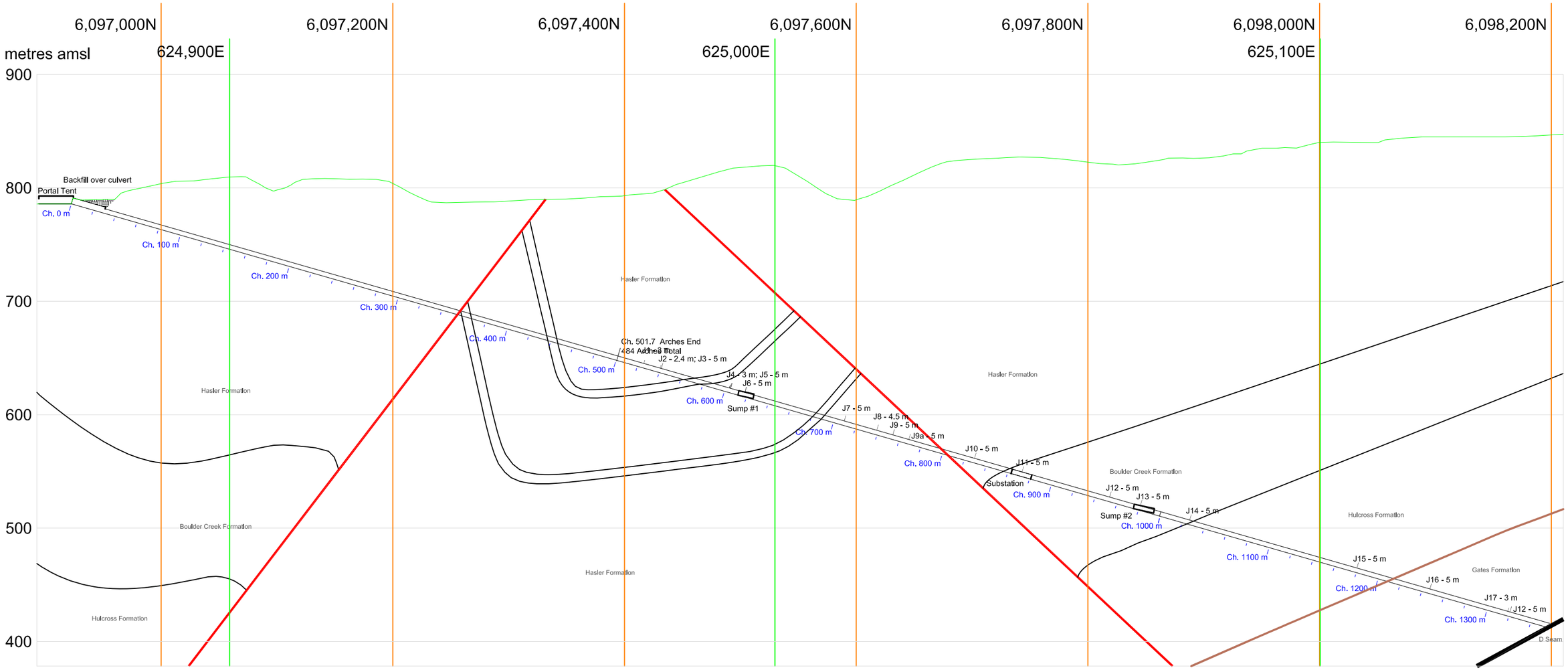
PROJECT
Coal Assessment Report for the Year 2015,
Murray River Coal Project, Tumbler Ridge, BC.

ENGINEERS APPROVAL

TITLE
GEOLOGICAL CROSS SECTION
OF THE SOUTH SITE DECLINE

HD Mining International Ltd.

PROJECT No.	2012CMAA058		FILE No.	058-3020
DESIGN	PC	01-JUL-16	SCALE	1:2500 on 11 x 17
CADD	PC	01-JUL-16		
CHECK	-	-		Dwg 3-3
REVIEW	-	-		



LEGEND

Surface

Fault, arrow indicates upthrow

Inclination of bedding as mapped.

Portal Origin: 6096922.501N, 624870.966E
Elevation 785.908 masl, Azimuth:11°59'41"
Gradient: -16°

Metres
0 50 100 150 200 250
Scale 1:2500

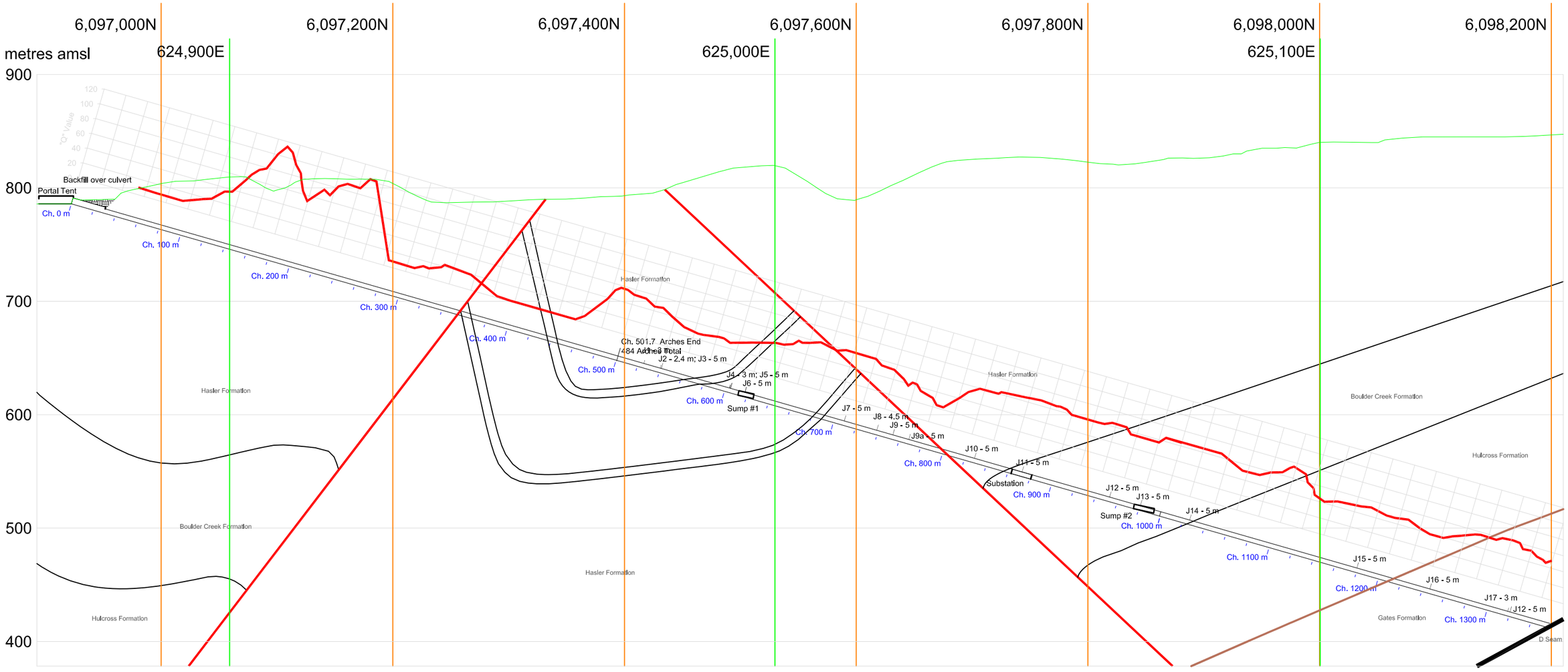
PROJECT
Coal Assessment Report for the Year 2015,
Murray River Coal Project, Tumbler Ridge, BC.

ENGINEERS APPROVAL

TITLE
SOUTH SITE DECLINE
EXTENSOMETER LOCATIONS

HD Mining International Ltd.

PROJECT No.	2012CMAA058		FILE No.	058-3020
DESIGN	PC	01-JUL-16	SCALE	1:2500 on 11 x 17
CADD	PC	01-JUL-16		
CHECK	-	-		Dwg 3-4
REVIEW	-	-		



LEGEND

Surface

Fault, arrow indicates upthrow

Inclination of bedding as mapped.

Portal Origin: 6096922.501N, 624870.966E
Elevation 785.908 masl, Azimuth:11°59'41"
Gradient: -16°

Metres
0 50 100 150 200 250
Scale 1:2500

PROJECT
Coal Assessment Report for the Year 2015,
Murray River Coal Project, Tumbler Ridge, BC.

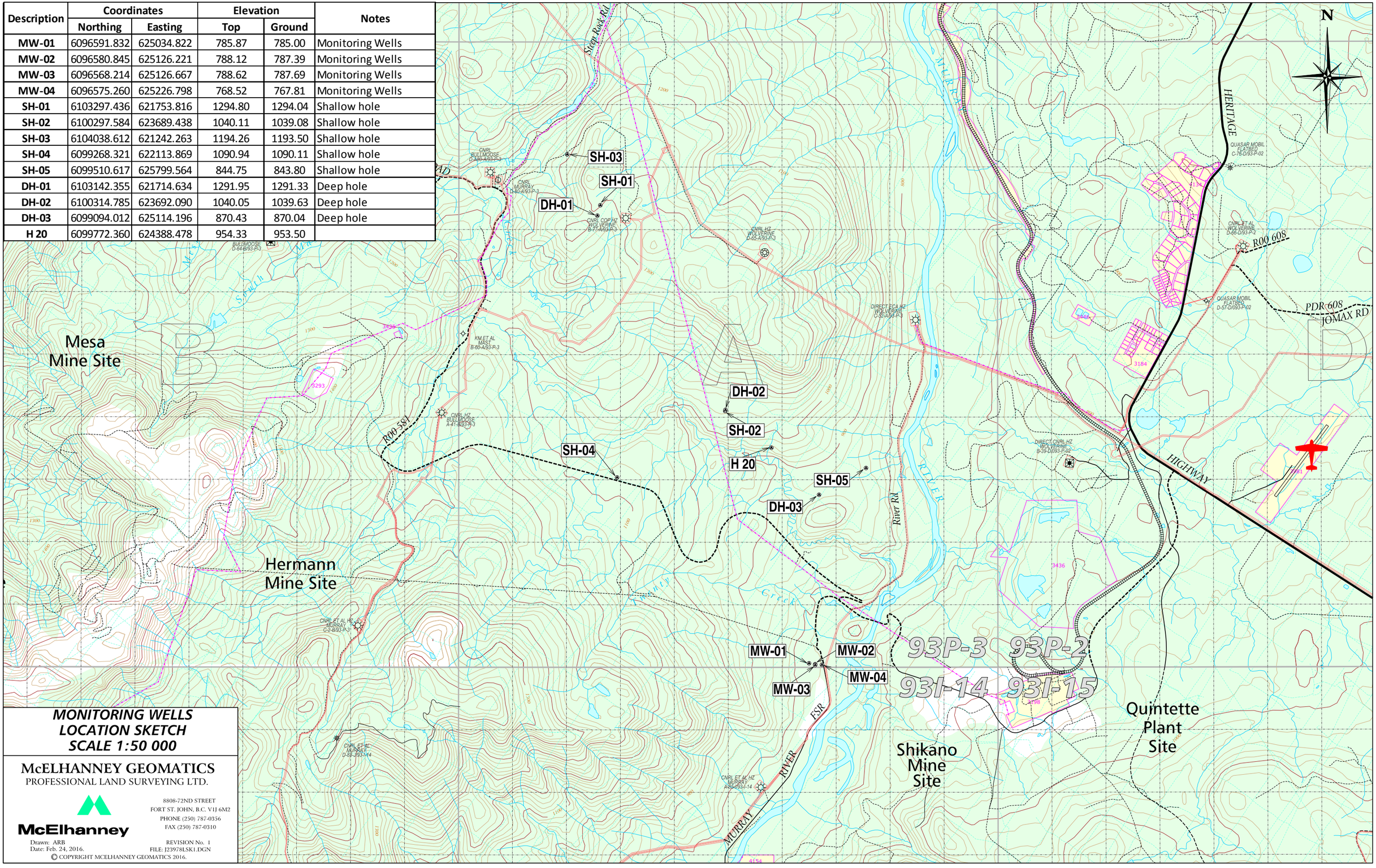
ENGINEERS APPROVAL

TITLE
SOUTH SITE DECLINE
ROCK MASS QUALITY

HD Mining International Ltd.

PROJECT No.	2012CMAA058		FILE No.	058-3020
DESIGN	PC	01-JUL-16	SCALE	1:2500 on 11 x 17
CADD	PC	01-JUL-16		Dwg 3-5
CHECK	-	-		
REVIEW	-	-		

Description	Coordinates		Elevation		Notes
	Northing	Easting	Top	Ground	
MW-01	6096591.832	625034.822	785.87	785.00	Monitoring Wells
MW-02	6096580.845	625126.221	788.12	787.39	Monitoring Wells
MW-03	6096568.214	625126.667	788.62	787.69	Monitoring Wells
MW-04	6096575.260	625226.798	768.52	767.81	Monitoring Wells
SH-01	6103297.436	621753.816	1294.80	1294.04	Shallow hole
SH-02	6100297.584	623689.438	1040.11	1039.08	Shallow hole
SH-03	6104038.612	621242.263	1194.26	1193.50	Shallow hole
SH-04	6099268.321	622113.869	1090.94	1090.11	Shallow hole
SH-05	6099510.617	625799.564	844.75	843.80	Shallow hole
DH-01	6103142.355	621714.634	1291.95	1291.33	Deep hole
DH-02	6100314.785	623692.090	1040.05	1039.63	Deep hole
DH-03	6099094.012	625114.196	870.43	870.04	Deep hole
H 20	6099772.360	624388.478	954.33	953.50	



MONITORING WELLS
LOCATION SKETCH
SCALE 1:50 000

McELHANNEY GEOMATICS
PROFESSIONAL LAND SURVEYING LTD.

McElhanney

8808-72ND STREET
FORT ST. JOHN, B.C. V1J 6M2
PHONE (250) 787-0356
FAX (250) 787-0310

Drawn: ARB
Date: Feb. 24, 2016.

REVISION No. 1
FILE: J23978LSK1.DGN

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Drawing 4-1: Location of Hydrogeological Boreholes

APPENDIX 2

"Review of an Application for a Coal Bulk Sample Project, Murray River Project, British Columbia." prepared by DMT Geosciences Ltd of Calgary, AB for HD Mining international Ltd dated November 2012.

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DMT Geosciences

Review of an Application for a Coal Bulk Sample Project, Murray River Project, British Columbia.

Prepared For:

HD Mining International Limited
Vancouver, British Columbia

Prepared By:

DMT Geosciences Ltd.
Calgary, Canada

November, 2012

DMT Geosciences Ltd.
Suite 415, 708-11th Avenue S.W.,
Calgary, Alberta,
CANADA, T2R 0E4

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Lingyun Zuo
General Manager
HD Mining International Ltd.
Suite-433 595 Burrard Street, P.O. Box 49161
Vancouver BC
Canada V7X 1J1

Dear Sir:

RE: Letter of Transmittal, General Arrangement Drawings, Murray River Property

HD Mining International Ltd. (HDMI) controls coal licenses for its Murray River Project near Tumbler Ridge, British Columbia. HD is owned by Huiyong Holdings (BC) Ltd., Canadian Dehua International Mines Inc. (Dehua), and Hong Kong Staray Investment Co. The Murray River coal is a coking coal. At this stage of the project definition, there are over 481 Million tonnes (Mt) of demonstrated coal resources in several seams.

In December 2010 HDMI was awarded a permit (CX-9-44) for coal exploration on the property by the British Columbia Ministry of Energy and Mines (MEM). Subsequent applications in May, August and December of 2011 for amendments to the permit for geotechnical drilling and approvals for surface site facilities at the North Shaft and South Decline Sites were granted.

In warly 2012 HD sought to obtain permission to extract a 100,000 t bulk sample of coal. This bulk sample would be used to test coal for use as a coking coal and assist in developing markets for this coal. Coal washability testing would also be performed on this coal. In order to obtain the bulk sample, HD was required by the BC Mines Act (RSBC 1996 c. 293) to obtain an amendment to their permit, prior to which a "..plan outlining the details of the proposed work…" had to be filed with an inspector.

HDMI retained Norwest Consultants of Utah to prepare a "..plan outlining the details of the proposed work…" at the mine site. The bulk sample operation was to consist of a decline containing a conveyor and a rail haulage and a shaft for men and material access with a small room and pillar section providing 100,000 t of coal for metallurgical testing.

After review of the application, including the Norwest submission, MEM suggested some changes, which were subsequently made and submitted by HDMI staff. While this amended application was accepted by MEM and a permit awarded for the proposed bulk sample operation (March 15, 2012), MEM noted that neither the original Norwest document nor the amended HDMI submission was certified by a professional engineer registered in British Columbia.

DMT Geosciences (DMT) of Calgary Alberta was commissioned by HD Mining International Ltd (HDMI) to assist with the development of their proposed Murray River Mine by the Ministry of Mines and Energy of British Columbia (MEM). DMT was asked to review the submissions and to certify them in accordance with MEM's requirements.

As a result of subsequent discussions between HDMI and MEM regarding equipment, HDMI made a decision to restrict the initial application to the decline portal and decline development. DMT has extracted the decline development general arrangements described by Norwest from the full permit application, as modified by HDMI's supplementary submission, in the following document.

DMT has reviewed the overall content of the submissions by HDMI for compliance with applicable legislative requirements at the permitting stage. Both HDMI and DMT undertand that additional documents, certified by a professional engineer registered in British Columbia, will have to be prepared as outlined in the permit conditions.

Please contact the undersigned if you have any questions.

Yours Truly
DMT Geosciences Ltd

// ORIGINAL SIGNED BY AUTHOR //

Peter Cain, Ph.D., P.Eng.
Head of Mining Engineering

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1 INTRODUCTION

1.1 Background

HD Mining International Ltd. (HD) controls coal licenses for its Murray River Project near Tumbler Ridge, British Columbia. Figure 1-1 shows the general location of the Murray River Project. Figure 1-2 shows the Murray River Project Coal Tenures within the Peace River Coalfield.

HD is owned by Huiyong Holdings (BC) Ltd., Canadian Dehua International Mines Inc. (Dehua), and Hong Kong Staray Investment Co. Dehua conducted exploration drilling on Murray River in 2009 and in 2011 completed an exploration program. The Murray River coal is a coking coal. At this stage of the project definition, there are over 481 million tonnes (Mt) of demonstrated coal resources in several seams.

HD sought to obtain a 100,000 t bulk sample of coal. This bulk sample would be used to test coal for use as a coking coal and to assist in developing markets for this coal. Coal washability testing would also be performed on this coal. In order to obtain the bulk sample, HD was required by the BC Mines Act (RSBC 1996 c. 293) to obtain a permit, prior to which a "..plan outlining the details of the proposed work…" had to be filed with an inspector.

HD asked Norwest Corporation (Norwest) to develop the bulk sample plan, which they did out of their Salt Lake City and West Virginia offices. The plan was based upon information provided by HD, the Shenyang Coal Mine Design Institute (Shenyang), Rescan Environmental Services Ltd., and Norwest. The following areas were described in the plan:

- Surface facilities
- Vertical Shaft and Inclined Shaft (Decline) access to the coal seam
- Bulk sample mining
- Construction and mining schedule.

Additional documents outlined the means to conserve cultural heritage resources and the protection and reclamation of the land.

Bulk sample collection using room and pillar mining methods was proposed. The target coal seam, F Seam, would be accessed by one inclined shaft (referred to in this plan as the "decline") and one vertical shaft.

The project was initially planned to occur in two phases; the first phase was to be the construction of the necessary temporary/portable surface facilities and the excavation and equipping of the two shafts, the second phase was to be the mining of the coal.

Norwest completed a plan for the two phases of the bulk sample collection and presented it to HD, who in turn submitted it to the BC Ministry of Energy and Mines

(MEM) in support of HD's application for a permit for the bulk sample program (Norwest, 2011).

HD was awarded an amendment to their Permit CX-9-44 on March 15, 2012 permitting the bulk sample collection program.

Subsequent to the award of the permit amendment, HD entered into discussions with MEM regarding the proposed use of surface and underground mining equipment manufactured in China. Discussions relating to the approval of this equipment for use in underground coal mines in British Columbia are ongoing, particularly with regard to the approval of electrical equipment and shaft sinking and hoisting equipment.

Because of the delays resulting from these discussions, the project schedule has been re-evaluated. The immediate emphasis is on the establishment on the surface facilities at the decline portal site and the commencement of decline construction. Shaft-sinking has been delayed until 2013.

Among the conditions attached to the amended permit were the following:

- The underground bulk sample shall not exceed 100,000 tonnes of mined coal under the terms of this permit.
- The proponent shall ensure that the following engineering drawings, stamped and approved by a P.Eng. licensed in British Columbia, are provided to the Senior Regional Permitting Inspector of Mines a minimum of 60 days prior to the commencement of:
    - Collaring the portal to the decline ramp,
    - Mine Shaft Development, and
    - Installation of any hoisting system, head frame, building or other permanent structure.
- All underground mine openings shall be sealed by the construction of engineered stopping that satisfy the requirements of the Code and the needs of the Province for reclamation at the time of permanent abandonment, or if the site is to be dormant for a period in excess of 18 months.
- Only approved explosives and detonators shall be utilized in decline developments within 30 metres of a coal seam. This does not apply if all workers are removed from the mine during blasting.
- In addition to the required ventilation plan, the manager shall provide a plan for the gas\air monitoring within the mine that includes the location and specification of all monitoring equipment in both intake and return airways. The plan shall also address the identification, monitoring and mitigation of potential spontaneous combustion. This plan shall also include the specification of all automated equipment shut downs associated with the monitoring system.

1.2 Scope of Work

HD Mining has retained DMT Geosciences Ltd. (DMT) of Calgary, AB to provide engineering design services in two stages.

The initial stage of the engineering work is to review the document prepared by Norwest in support of the permit application for the bulk sample program, to update it with respect to the decline construction only and to issue it certified by a professional engineer registered in the Province of British Columbia.

The second stage of work the work includes compiling the engineering drawings required to meet the conditions imposed by MEM on the permit, specifically:

- The proponent shall ensure that the following engineering drawings, stamped and approved by a P.Eng. licensed in British Columbia, are provided to the Senior Regional Permitting Inspector of Mines a minimum of 60 days prior to the commencement of:
  - Collaring the portal to the decline ramp,
  - Mine Shaft Development, and
  - Installation of any hoisting system, head frame, building or other permanent structure.

HD has also asked DMT to address the following engineering aspects of the decline development:

- Cross section;
- Support of the opening;
- Ventilation and safety;
- Power distribution;
- Haulage with extensible belt conveyor;
- Haulage with the winch and mine cars on tracks as well as safety measures;
- Water supply and dewatering system;
- Other components related to the inclined shaft construction.

All drawings are to be signed and certified by a professional engineer registered in BC and in accordance with the requirements of the BC Ministry of Energy and Mines.

This report completes Stage 1 of DMT's scope, the review and updating of the document prepared by Norwest with respect to the decline construction only and its issue over the certification of a professional engineer registered in the Province of British Columbia.

2 GEOLOGY OF THE AREA

The following was prepared by Norwest and is included for completeness. DMT believes that the descriptions provided below are accurate representations of the geology.

2.1 Geologic Setting

The proposed bulk sample site is located within the Peace River Coalfield (PRC) and forms part of the Rocky Mountain foothills structural belt which lies to the east of the Canadian Rocky Mountain Trend. The Foothills belt is characterized by folded and faulted Mesozoic age sediments that in places involve complex and severe faulting. Structural deformation is considerable near the western margin of the Foothills and diminishes in extent and complexity toward the eastern margin.

The two main coal-bearing units occurring throughout the Foothills region are the Gates formation and Gething formation. The Lower Cretaceous age coal seams from these two formations were subjected to varying depths of burial prior to Laramide deformation and mountain-building episodes. The subsequent structural deformation during the mountain-building episodes resulted in increased pressures and heat flows that have imparted metallurgical properties to the coal seams as evidenced from the vitrinite reflectance, swelling characteristics and overall maturity of the coal seams.

2.2 Stratigraphy

The coal seam of interest for the bulk sample program is the F Seam which is one of several coal seams contained within the Lower Cretaceous Gates formation of the Fort Saint John Group.

Table 2-1 summarizes the typical stratigraphy for the PRC in Northeast British Columbia. The primary units occurring within the Murray River property and planned bulk sample area range between the Hasler and Gething formations.

The coal-bearing horizons are found both within the Gates formation and Gething formation. This bulk sample plan only includes Gates formation coal due to these coal measures being relatively shallow (<800 m) in target areas and accessible for drilling and sampling. The target coal seam for the bulk sample program is the F Seam which is estimated to average 4.1 m thick within the planned bulk sample areas.

Table 2-1: Typical Peace River Coalfield Stratigraphy

Geologic Age	Group	Formation	Rock Descriptions
Upper Cretaceous		Dunvegan	Fine to course-grained sandstone; conglomerate; carbonaceous shale; coal
Lower Cretaceous	Fort St John	Cruiser	Dark grey marine shale with sideritic concretions; minor sandstone
		Goodrich	Fine-grained, cross-bedded sandstone; shale; mudstone
		Hasler	Silty dark grey marine shale with sideritic concretions; minor sandstone and pebble conglomerate; siltstone in lower part; basal pebble layer
		Boulder Creek	Fine-grained, well-sorted sandstone; carbonaceous sandstone; massive conglomerate; siltstone; marine and non-marine mudstone; minor coal
		Hulcross	Dark grey marine shale and siltstone, with sideritic concretions
		Gates	Fine-grained, well-sorted marine and nonmarine sandstones; carbonaceous sandstone and mudstone; coal; shale; minor conglomerate
		Moosebar	Dark grey marine shale with sideritic concretions; siltstone; glauconitic sandstone; chert pebble conglomerate at base (Bluesky Member)
	Bullhead	Gething	Fine to coarse-grained, brown, calcareous, carbonaceous sandstone; coal; carbonaceous shale and conglomerate; siltstone
		Cadomin	Massive conglomerate with chert and quartz pebbles; minor coarsegrained sandstone, carbonaceous shale, and coal
	Regional erosional Unconformity		
Jurassic	Minnes		Quartzose sandstone; fine-grained sandstone; silty shale; mudstone; minor carbonaceous sediments

3 PROJECT OVERVIEW

HD has compiled a resource assessment based on their exploration which has identified over 481 Million tonnes (Mt) of demonstrated coal resources in several seams. They have a permit from BC MEM to obtain a 100,000 t bulk sample from the F Seam in the Gates formation for metallurgical testing and to provide data on the mining conditions likely to be encountered in a full-scale operation.

The bulk sample program includes the development of a vertical shaft and an inclined shaft (decline) to access a portion of the resource identified for the bulk sample. Both the inclined shaft (decline), which will house a conveyor belt and a rail haulage, and the vertical shaft, have been sized for the full scale production mine, although initial equipment is designed for the bulk sample phase only.

Figure 3-1 shows the bulk sample project area including the bulk sample surface facilities boundary, the proposed north (vertical shaft) and south (inclined shaft) access locations and the surrounding area. These locations are at elevations above the Murray River. The Mast Creek road is adjacent to the North Shaft Site and provides access to this Site. The Murray River Forest Service Road provides access to the South Site. Travel between the two sites would be on the public roads. Figure 3-2 shows the South site in additional detail.

The bulk of the facilities and infrastructure shown in Figure 3-2 will all be temporary in nature, and will exist only for the duration of the construction of the inclined shaft:

- Temporary access roads will be reclaimed.
- The temporary portable buildings installed to support the development work will be removed and will be replaced with permanent buildings at the North Site; the site will be reclaimed.
- The rail turnout and marshaling yard will be dismantled and the hoist used only for intermittent access and conveyor belt inspection.
- The conveyor used for development will be entirely replaced with a conveyor and structure capable of sustaining a 6 Mtpa ROM coal output.
- The settling pond will remain to ensure long term environmental protection of the site.

The development of the shaft is expected to occur in 2013 after discussions with MEM regarding equipment have been concluded. The development of the decline is scheduled for late 2012 and comprises the following stages:

- Development of the portal cut and construction of the portal cover
- Development of surface facilities and infrastructure required for decline construction
- Decline construction.

4 DEVELOPMENT OF THE PORTAL CUT

The initial design reviewed by MEM was deficient in that it failed to address the variable thicknesses of overburden materials present and did not address the hazards associated with soil and rock slopes.

HD retained Golder Associates of Burnaby BC to assess surface geotechnical conditions, AMEC out of Vancouver to address foundation designs and Armtec of Edmonton to design, provide and supervise construction of a steel portal structure to protect the face-up of the decline.

These designs and construction drawings have been submitted to MEM and construction approval has been given.

The revised location of the start of the inclined shaft (overburden cut) is N6096895.1, E624880.85 at an elevation of 785.98 masl.

A surface cut 11 m wide dipping at 16° at an azimuth of 012° will host a 7 m wide corrugated sectional steel bridge culvert on a concrete foundation and solid concrete floor. Drainage provisions will ensure that water does not collect beneath the floor, but will flow into the tunnel for collection, pumping to the surface, treatment and ultimate release. The face-up point will be at an elevation of 771.73 masl, or lower as required to provide a competent face for initial tunnel development.

The design of the surface cut, foundations and steel portal have been completed by others and reviewed by MEM. DMT understands that construction is currently underway, including boundary water diversion water treatment ponds and the layout of stockpile areas.

5 DECLINE SURFACE FACILITIES

The temporary surface facilities associated with the decline include the following:

- Temporary electrical supply for mining equipment
- Temporary water supply
- Temporary mine nuisance water management facilities
- Temporary waste rock handling
- Temporary Offices and Warehousing
- Decline Tracked Haulage
- Temporary conveyor belt drive for the underground conveyor
- Temporary magazines for detonators and explosives

5.1 Temporary Electrical Supply

The electrical supply for the decline development will be provided by a suitably sized generator or generators. Discussions with MEM are ongoing regarding whether the surface supply for the mine should comply with the Canadian Electrical Code or with the more rigorous and mine-specific requirements of the CAN/CSA M421 “Use of Electricity in Mines” standard (M421) , which is followed in the rest of Canada. Unfortunately the Health Safety and Reclamation Code of British Columbia (HSRC) is badly formulated with regards to this aspect of mine design, establishing three mutually exclusive regulatory requirements.

DMT is of the opinion that M421 is the only logical standard and that this standard should apply to facilities within the surface perimeter. Where the proposed equipment does not exactly conform to the M421 requirements the “equivalent safety or safer than” provisions of M421 should be applied.

General Arrangement Drawings were presented for the electrical supply but these have been superseded by the current discussion son electrical standards. Detailed design drawings will be presented at a later date.

5.2 Temporary Water Supply

The general arangements for water supply, including firefighting water, are shown in Figure 5-1.

5.2.1 Process Water

A tank will be maintained at the portal with a minimum quantity of 100,000 L of water available at all times. This water will be filtered and pumped from the surface settling pond and made up with tankered water as required.

An electric water pump will provide the pressure required for dust abatement and other process uses in the decline development. It will be backed up with an emergency diesel powered pump capable of ensuring sufficient water pressure for fire-fighting.

5.2.2 Firefighting Water

The process water tank will ensure that the volume requirements of Section 3.11.2, HSRC, are met. The stand-by pump will ensure that firefighting pressures can be achieved even in the event of a generator failure.

The firefighting provisions of Sections 3.11.1 to 3.11.6 will be met in addition to the other relevant provisions of the HSRC.

5.3 Temporary Nuisance Water Management

During the development of the decline there will be some out-flow of water from the strata, although this is not anticipated to be of great quantity. The underground outflow of water will be collected at intermediate sumps along the length of the decline and at the face of the decline and pumped to the surface through the intermediate sumps by electric powered submersible pumps (Figure 5-1). If warranted by the pumping quantities, automatic control of these pumps will be installed.

Water pumped from underground will be pumped into a surface holding pond where it will initially settle. Some of the water will be filtered and pumped back into the water tank while the overflow, if any, will enter the surface water management scheme.

DMT understands that the surface water control features for the two sites, designed by Rescan and already reported to MEM (*"Murray River Bulk Sample Waste Discharge Permit Application Technical Assessment Report and Notice of Work - Addendum: Comments and Responses"*, prepared for HD Mining International Ltd. by Rescan Environmental Services Ltd., January 2012), have been constructed and are ready to operate.

5.4 Temporary Waste Rock Handling

During construction of the decline all waste rock will be conveyed to the surface on the temporary conveyor and then hauled by truck to the engineered waste rock disposal areas at the North Site. The truck route will be on the public roads between the Sites.

Figure 5-2 is a basic diagram of the surface materials flow handling system for the construction and bulk sample mining. The bulk sample coal will be stored on site until it is transported for coal processing at a local coal processing facility and/or trucked to a rail load out for shipment to China. No coal processing would be conducted on site except crushing and screening.

An Acid Rock Drainage and Metal Leaching plan and rock disposal plan has been developed by Rescan. This information may be found in the Rescan report mentioned above. Potentially acid generating materials will be stockpiled separately from inert materials and will be hauled by truck to a lined dump at the North Site for permanent disposal.

5.5 Temporary Offices and Warehousing

Temporary modular or portable type buildings to the extent possible will be used for the office, mine change house, shop, warehouse, air compressor and other functions, generally arranged as in Figure 3-2. Roads and other miscellaneous features on the site are shown.

Warehousing for small parts which are not temperature sensitive will be provided in containers established on grade within the perimeter.

Roof-bolt and cable-bolt resins do not install, mix or set properly if they are allowed to cool or to freeze. Temperature controlled storage for the resins and other temperature-sensitive materials will be required.

Trailer mounted units complying with BC construction standards utilizing oil furnace heating or electric heating are envisaged, the exact details to be determined later.

5.6 Decline Tracked Haulage

A tracked haulage has been specified for men and materials transportation in the decline. The gradient of the decline may exceed the braking capability required to arrest man-riding conveyances or materials wagons under emergency conditions. HDMI is currently exploring options to ensure that the system can be operated safely. Trapped rail haulage is a potential alternative to an open rail system. In either case the haulage system will have the following characteristics:

- Single rope drop haulage with a haulage engine located in a temporary surface structure.
- Track from the winch house to the portal set on a gentle (3°) slope into the mine to allow the conveyances to run rope off the drum easily.
- A 90° right hand turn-out (looking north) into the marshaling yard comprising two or three tracks for materials wagons and man-trip storage arranged for easy loading of materials
- Materials and man-trip operated with a manned guard car under radio communication with the haulage engine driver
- Interlocked barrier gates at the portal and inby

Other safety features will be considered as the design proceeds.

General surface arrangements are shown in Figure 3-2.

5.7 Temporary Underground Conveyor

A temporary belt conveyor will be installed in the decline for clearing the decline waste rock and for loading the bulk sample coal to the surface. The conveyor will consist of the following major elements:

- A delivery jib to deliver waste rock, and later coal, onto the ground or into trucks for transport.
- An engineered steel frame head-set at the portal designed to resist the tensions required for correct belt operation and secured with an engineered foundation
- A twin motor/gearbox drive acting on the return belt
- A belt splicing unit to allow for the replacement and repair of belt segments and joints.
- An an intermediate elevating section to raise the belt from the floor mounted stands to the steel frame head set.
- A tail section with a track for the traveling end of the stage loader
- A stage loader between the road-header and the main belt.

Where there is the potential for adverse contact, the conveyor structure will be enclosed in mesh guards.

An emergency stop pull-wire with lock-out switches will be installed on the travel side of the conveyor. A tannoy connected to the surface communications centre will be positioned at each lock-out box and will broadcast a pre-start warning whenever the belt is started. The belt will not operate if the emergency cord is pulled until after the lock-out has been removed.

Proper design and installation and operation of the conveyor system are the primary means to minimize the cleanup of muck from the decline construction and coal from the bulk mining. A properly designed, installed, maintained and tracked conveyor should have minimum spillage.

For most of the decline the belt will run on floor mounted metal stands on the rock floor at a height which allows debris to be cleared from beneath the rollers and from around the belt. Since the decline is in rock, there is not expected to be a significant quantity of coal dust in the debris during development. For production operations the decline floor will be concreted and any accumulations of coal dust will be easily washed from the conveyor.

The belt drive has been designed to allow a single lift within the decline, so there will not be any transfer points in the decline itself.

HD does appreciate the importance to prevent material spillage and clean up as necessary accumulations of material. HD will comply with clean up type requirements as stated on in Part 6.44.1 of the Code.

The belt conveyor will be provided with an anti-rollback device to hold the conveyor belt in place when the conveyor is stopped. Construction design will be provided, which will be signed by a professional engineer.

5.8 Temporary Magazines

Extensive use of explosives is not anticipated during the decline development. However, limited quantities of both explosives and detonators may be required to assist in mining through hard units and in the excavation of intermediate sumps in the decline.

The proposed location of the magazines for explosives and detonators at the North Site meet the requirements of both MEM and NRCan regulations pertaining to magazines.

The construction, lighting, monitoring and inspection of the magazines will comply with regulatory standards. Consideration will be given to remote monitoring of the magazines in addition to regular inspection by mine officials.

The locations of the magazines were determined by applying the distances from the “Quantity-Distance Table for Hazard Divisions 1.1&1.5” which is a part of the “Explosives Magazine and Use Permit Application for Mining Purposes” from the British Columbia Ministry of Energy, Mines, and Petroleum Resources Mining and Minerals Division.

In addition to the above distances, the Natural Resources Canada publication “Blasting Explosives and Initiation Systems Storage, Possession, Transportation, Destruction and Sale” requires a distance of 400 m from building where 20 or more people may assemble. All the magazines are at least 400 m from public roads.

6 DECLINE DESIGN AND CONSTRUCTION

6.1 Design

The conveyor decline will be driven at a 16 degree angle, which is the maximum angle for efficient operation of a belt conveyor carrying run-of-mine bituminous coal. The steep angle is required to reduce the decline length to the target coal seam. Even so, the planned length is approximately 1,700 m. The approximate length of the decline in each formation is shown in Table 6-1. Finished dimensions will be 5.5 m wide and 4.35 m high with a flat top and rounded corners to mitigate stress concentration problems.

Table 6.1: Decline Rock Volume Summary

Formation	Meters	LCM
Overburden(till)	63	24,251
Hasler	915	32,180
Boulder Creek	160	5,627
Hulcross	83	2,919
Gates	467	16,424
Totals	**1,688**	**81,401**

Waste rock from the decline construction would total approximately 81,000 loose cubic meters (LCM). This waste rock would be permanently stored at the construction rock disposal site at the North Shaft site.

Figure 6-1 shows a section along the decline. The different geological formations are outlined, as interpreted for the boreholes shown. The properties of the strata on which the roof support categories are based (see later section) are also shown.

6.2 Construction in Overburden

The details of the excavation of the surface overburden materials to the face-up point of the rock tunnel and the construction of the portal protection structure has previously been supplied to MEM. DMT understands that this work is now underway and should be complete in the near future.

The initial portion of the decline will be housed in a prefabricated steel cover which will be set on concrete foundations and concreted up to the rock face at the start of the rock heading. The steel cover will ultimately be covered and then backfilled with the material removed during the construction of the portal.

Figure 6-2 shows a cross section through the steel structure and its relationship to the finished tunnel profile.

6.3 Construction in Rock

6.3.1 Cuttable Rock – Road-header

In the sections of the decline where the rock is suitable for cutting by mechanical means it will be excavated by a road-header. The cutter head is able to slew and elevate to cut the required profile. The rock falls on to the apron and is loaded onto the clearing belt by gathering arms. The rock passes through the machine and onto a stage loader connecting the back of the road-header to the 1 m wide main belt in the decline which raises it to the portal. From the portal the rock is hauled by truck to the rock disposal pile at the North Shaft site.

6.3.2 Hard Material – Drill/Blast

Where the rock is too hard to be excavated effectively by the road header, the traditional drill and blast method is proposed. Prior to drilling out each round the road-header will be backed away from the face.

Drilling will be by using hand-held pneumatic drilling machines. Drill holes would be 43 mm diameter in a 22 mm diameter drill steel and 3.2 m in length. The spacing between blast holes will be about 0.3 m, subject to detailed drill pattern design by the explosives contractor. All holes will be drilled with water for dust suppression and cleaned with compressed air before charging.

After drilling, the blast holes will be charged with explosives and stemmed using clay or water-gel capsules. In blast holes with water, water-resistant explosives must be used or water-resistant sheaths shall be used to avoid detonation problems by water.

HD intends to use a blasting contractor for the supply of explosives, management of magazines, charging of shot-holes and shot-firing. HD mining will ensure that the contractor fulfills all the legislative requirements and conducts blasting operations safely and in compliance with the applicable legislation.

The most convenient method of clearing the blasted material is to use the gathering arms/apron of the road-header once the blast has cleared and inspection reveals that it is safe to re-enter the workplace. The blast pattern will need to be optimised to generate small material without projecting it too far from the face. An alternative to using the road-header to clear the material would be to introduce a bucket loader, although this would probably only be efficient if the length of roadway to be blasted was significant.

6.4 Utilities

Utility lines (water supply pipeline, water drainage pipeline, compressed air line, and communications/monitoring cables) are to be suspended along the side of the decline supported on a steel frame work attached to the decline rib. The water and air lines are 108 mm in diameter. The water supply line is designed to provide 15 m^3 per hour (/hr). A water supply line for firefighting is also located in the decline.

The drainage system is sized for 53 m^3/hr. Small pumps will be used to gather mine waste water. The small pumps will transfer water to large pumps which will be located in

the side of the declines (Figure 5-1). The size of the dewatering pump stations will depend upon capacity of the pumps.

The compressed air system is designed for 30 m^3 per minute (/min).

The communication and monitoring lines are also on the steel support framework on the along the side of the decline. These provide phone service to the decline and mine and also link monitoring systems for equipment and atmospheric monitoring.

The electrical power cables are suspended on insulated cable hooks which are hung from the roof of the decline.

6.5 Roof Support and Ground Control

The roof support design is based on the current understanding of the properties of the strata that the decline will pass through. It ranges from roof bolted support to steel arch support supplemented with roof bolts. The designs are based on empirical relationships observed between roof support and the rock properties expressed as a Protodyakonov Index (PI), a Russian rock strength index that is not widely used in the West.

In the base rock section, support will be by a combination of rock bolts, mesh, and shotcrete. The rock bolts will be installed using rotary pneumatic drills with water flush and will have the following characteristics:

- Fully resin grouted tensioned ribbed G60 or G75 rebar
- Installed using fast/slow set resin combination and torque nut
- Drill bit and bolt size calbrated for an annulus of no more than 6 mm
- 2.4 m length with 1 m between bolts and bolt rows.

Figure 6-1 shows the PI value of the rock intersections in the decline. Figure 6-3 and 6-4 show the variation in support design for the various rock property index values.

In weaker ground, rock bolts will be augmented by shotcrete, cable bolts and/or steel arches. In stronger ground the base case can be relaxed with wider bolt spacing and thinner shotcrete.

DMT has been asked to advise on the rook support design in Stage 2 of their work. DMT will be recommendaing that HD conduct core drilling, geotechnical testing and monitoring of support installations to ensure that adequate levels of safety and security are maintained during all aspects of the bulk sample program.

6.6 Ventilation

During the development of the decline, ventilation will be supplied to the decline from a fan installation located on the surface. The proposed fan installation is a twin-fan contra-rotating design with an installed power of 110 kW. Both forcing and exhausting configurations are being considered, although it is expected that a forcing configuration

will be selected as this will assist in heating and managing the dust. An xhausting configuration could be implemented if any significant length of development was required using blasting as the main development method; an exhausting system would all

Figure 6-5 shows in more detail the location of the fan on the surface, in this case in the exhausting configuration. The fan is offset from the decline by 5 m and the ducting includes a pressure relief panel. In both the forcing and exhausting configuration steel ductwork of 1.25 m diameter will be used to maintain adequate air velocities and sufficient fan capacity to cope with leaks and obstructions. The ducting will be hung from the back on specially installed hangers by chain or cable of sufficient load-bearing capacity.

The main ventilation fan shall be capable of reversing the air in an emergency.

6.7 Men and Materials Transportation

A floor based rail system will be installed in the decline for men and materials transportation. HD has researched the possibility of using an open rail system but, at the gradients envisaged, the braking capability may not be sufficient to stop a runaway man-trip or materials trip. While braking options are currently being researched, DMT believes that a closed rail system, similar to the Becker trapped rail system, might provide a safer option.

BC regulations require two means of egress from the mine, and DMT believes that this will apply from the moment the shaft and decline are connected and during the extraction of the bulk sample. The decline will have to be equipped with a means of hauling men to the surface in the event the shaft is blocked, so sufficient man-cars will be required to enable the entire workforce to be hauled out in an emergency.

At no time will men be allowed to walk in the decline while the haulage is operating. The haulage will at all times be under the control of a guard, communicating via leaky feeder radio to the surface winch. Gates at the brow and at the inby end of the rail will prevent the cars from entering the decline or from endangering the workers at the face.

Material cars will be unloaded as close to the face as possible and the materials man-handled to the face.

6.8 Emergency Response

As mentioned above, there will be sufficient man cars to allow evacuation of the mine through the decline if required.

Safety in the decline will be provided by both engineering (barriers, lockouts and safety bays) and administrative means. The communications system mounted on the conveyor as part of the conveyor operating system will allow men in the decline to be alerted of haulage movement in the event of an emergency and safety bays will be provided in the rib on the man-walking side every 100 m. The safety bays will be 1.5 m wide (measured from the rib), 2 m long (along the decline) and 2.0 m high.

Section 6.13.1 of the Code states:

> *"Where a workplace in an underground mine is more than 300 m from a mine portal or from a shaft station which is used to access that workplace, the manager shall provide and maintain, in a suitable location for that workplace, a refuge station in accordance with section 6.13.3."*

Section 6.13.2 of the Code exempts a mine from the requirement to install a refuge station during adit development or shaft sinking. HD will comply with the the Code by installing a portable, prefabricated refuge station as soon as required by the Code and maintaining it within 300 m of the working face. In addition, HD will comply with section 6.13.3(5) by establishing at appropriate locations storage facilities with suitable equipment to allow for emergency exit from the mine.

7 EQUIPMENT AND REGULATORY APPROVAL

7.1 Equipment

HD mining has developed a list of the major equipment that it intends to use for the Murray River bulk sample project. The principal equipment list to deployed at the surface of the decline includes, but may not be limited to:

- Hoist, enclosed in a hoist house, and including safety controls, interlocks and communications equipment.
- A single lift extensible conveyor belt with twin drives/gearboxes to be used only for the decline development and bulk sample mining. It will be replaced with a higher rated belt and structure for production purposes.
- A water tank, with main and standby pumps (electric and diesel) for the provision of process and firefighting water at sufficient pressure to meet BC Code standards.
- A 10 kV generator to supply the underground through a cable and the surface through a step down transformer.
- A surface mine fan to provide forced ventilation air into the decline development.

Underground equipment includes, but may not be limited to:

- Transformer and switchgear to step down the power supply from the surface.
- An auxiliary fan/dust extractor for ventilation of the face.
- An electrically powered road-header of Chinese design and manufacture for development of the decline.
- An electrically powered stage loader to move waste rock from the road-header to the belt conveyor
- A underground air compressor to provide motive power for auxiliary equipment and possibly dust suppressing fogging sprays at the face.
- Pneumatic shotcrete machine and pneumatic drills for the installation of rock bolts, as well as chippers and pluggers for additional trimming and drilling work

7.2 Regulatory Requirements

All equipment, including the equipment mentioned above must, and will, comply with the following major regulations and/or standards:

- British Columbia Mine Act, Regulation and the Health Safety and Reclamation Code, 2009.
- CAN/CSA-M422-M87 Fire-Performance and Antistatic Requirements for Conveyor Belting
- CAN/CSA-M421-00 Use of Electricity in Mines
- NFPA 120 Standard for Fire Prevention and Control in Coal Mines.

The Canadian Standards Association is abbreviated by CSA and CAN stands for a standard of Canada.

There is currently some debate over the standards to be applied to the development of the decline.

HD Mining and their advisors believe that the greatest level of safety that can be achieved to protect the workforce is to adopt a hazardous location zoning approach to the decline. DMT agrees with this entirely. DMT believes that the entire decline should be zoned Class 1 Zone 2 using the CEC definitions and that electrical and other equipment suited to this zoning category should be deployed accordingly.

In an April 19, 2011 meeting between BC MEM, HD Mining and their advisors, HD were advised by MEM that all equipment used for the mine development and the mining of the bulk sample needed to be flameproof. This was re-iterated at a subsequent meeting on June 14, 2011 attended by the same parties.

HD Mining has chosen to specify equipment which has been approved as flameproof for use in underground coal mines in China. DMT has reviewed a report certified by a professional engineer registered in British Columbia which asserts that equipment approved for use in Chinese underground coal mines meets or exceeds the international standards for flameproof equipment. The author of the report has visited equipment manufacturers and equipment certification and testing facilities in China. DMT believes that the conclusions of this report should be accepted.

HD Mining and their advisors have also argued that CAN/CSA M421 “Use of electricity in Mines” applies to all installations at a mine whether surface or underground as the surface facilities, particularly power supplies and transformers, are intractably connected to the underground reticulation and must therefore provide the same degree of safety. Since the highest hazard is associated with the underground workings, any departure from M421 for surface or underground installations at an underground mine demanded by regulators must be carefully considered and justified.

7.3 Explosives

HD has designed locations of magazines which meet Federal standards and will select an explosives contractor who will provide the transportation from the magazines to the site and the qualified blasters for shot firing.

HD has been advised by MEM that non-permissible explosives can be used in the decline, but that permissible explosives must be used within 30 m of a coal seam unless workers are all evacuated before shot firing. When shot firing in the decline all men will be withdrawn and access will be restricted thereafter until the atmosphere is safe.

LEGEND

- HIGHWAY
- RAILWAY
- CITY

Reviewed by
Peter Cain, PhD., P.Eng

November 10, 2012

N

0 125 250

Kilometers

FIGURE 1.1

MURRAY RIVER PROJECT

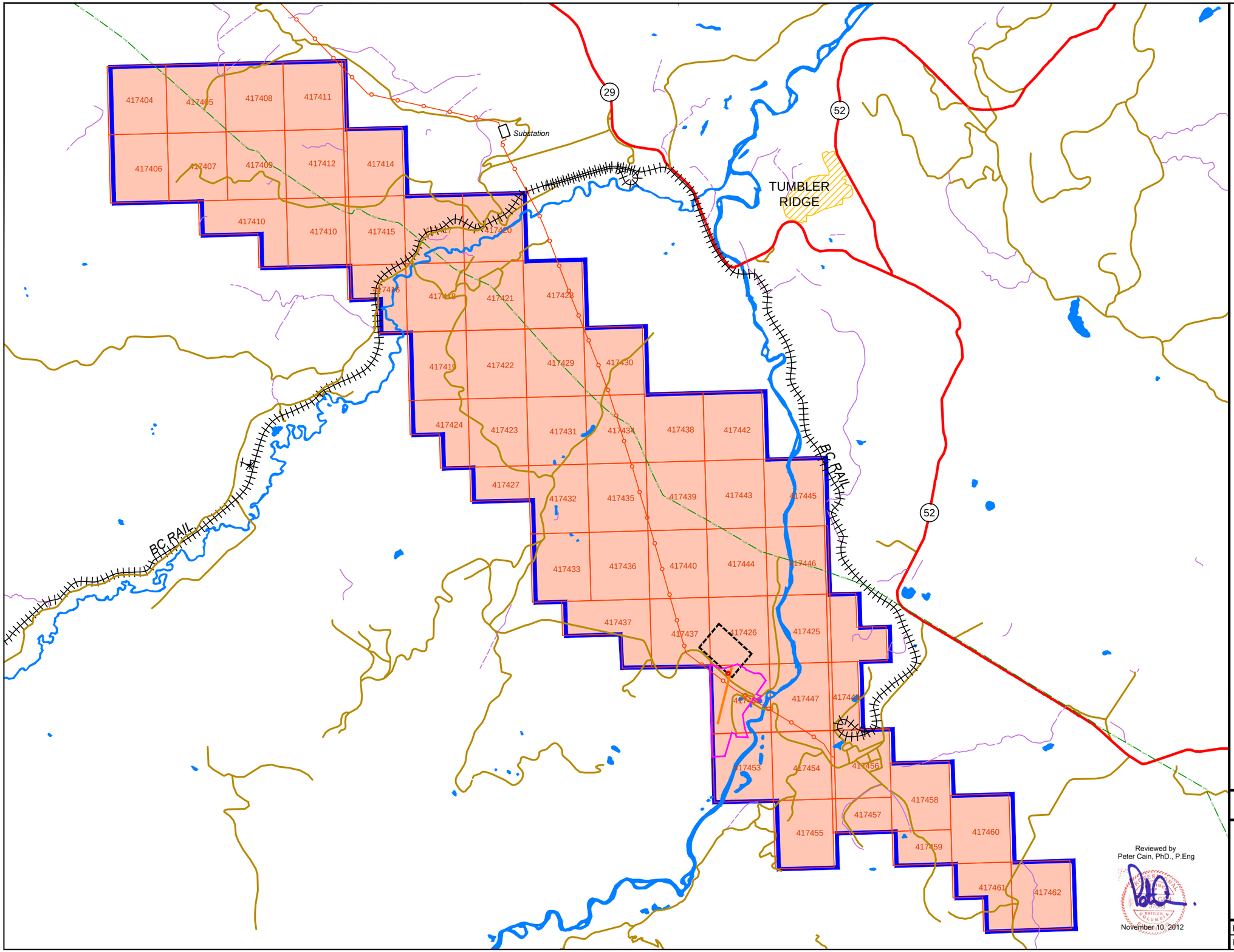
GENERAL LOCATION

DATE: 06/09/2011

FILE: 4827\FIG-1

SCALE: 1:210000

NORWEST CORPORATION



LEGEND

- LICENSE AREA
- COAL TENURE AREA
- MAJOR ROAD
- MINOR ROAD
- TRAIL
- RAILWAY
- TRANSMISSION LINE
- GAS PIPELINE
- WATER BODY
- POPULATED AREA
- CONVEYOR DECLINE
- SHAFT
- BULK SAMPLE SURFACE FACILITIES AREA
- BULK SAMPLE AREA

Coal Tenure Map as required by Section 3.1 of Mineral and Coal Exploration Notice of Work Application

Map Projection:
UTM NAD 83
Zone 10, meters

0 1 2 3 4 5
Kilometers

093P03	093P02
093I14	093I15

N

Base mapping data assembled from the above listed dataset blocks according to the National Topographic Data Base. www.geogratis.com

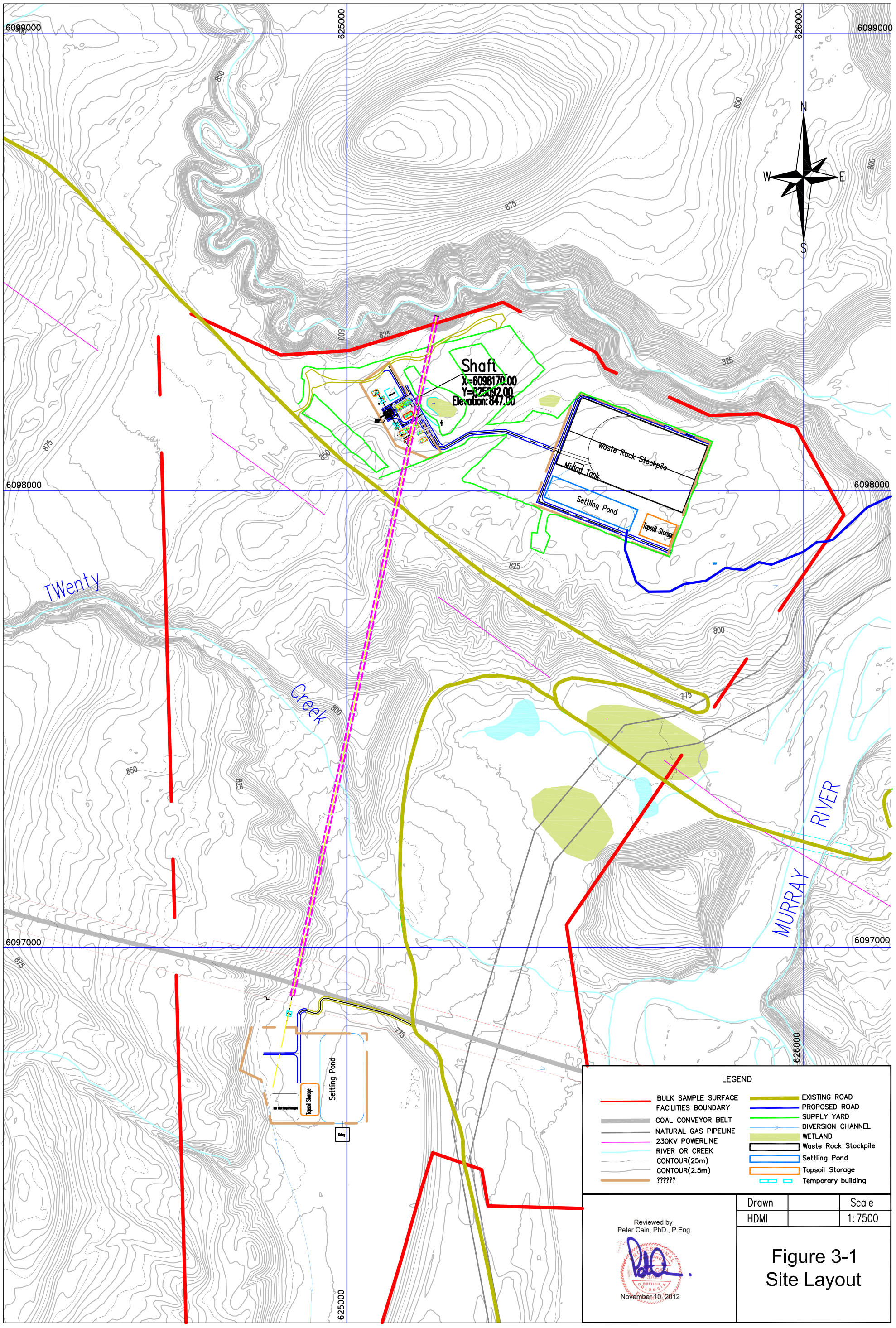
Reviewed by
Peter Cain, PhD., P.Eng

November 10, 2012

FIGURE 1.3

MURRAY RIVER PROJECT
COAL TENURE
MAP

DATE: 06/21/2011	SCALE: 1:2500	NORWEST CORPORATION
FILE: 4827\TENURE		


6099000
625000
626000
6098000
6097000
N
W
E
S
Shaft
X=6098170.00
Y=625092.00
Elevation: 847.00
Waste Rock Stockpile
Mixing Tank
Settling Pond
Topsoil Storage
TWenty
Creek
MURRAY RIVER
Settling Pond
Topsoil Storage
LEGEND
BULK SAMPLE SURFACE FACILITIES BOUNDARY
COAL CONVEYOR BELT
NATURAL GAS PIPELINE
230KV POWERLINE
RIVER OR CREEK
CONTOUR(25m)
CONTOUR(2.5m)
??????
EXISTING ROAD
PROPOSED ROAD
SUPPLY YARD
DIVERSION CHANNEL
WETLAND
Waste Rock Stockpile
Settling Pond
Topsoil Storage
Temporary building
Drawn
HDMI
Scale
1:7500
Reviewed by
Peter Cain, PhD., P.Eng
November 10, 2012
Figure 3-1
Site Layout

Conveyor
Dump Point

Track Turnout and
Marshalling Yard

Hoist
Room

Transformer
Room

High Voltage
Electrical
Room

Low Voltage
Electrical and
Compressor Room

Generator
Room

Mine Offices, Dry
and Storage

Settling Pond

LEGEND

- TECK RIGHT OF WAY
- COAL CONVEYOR BELT
- NATURAL GAS PIPELINE
- 230KV POWERLINE
- RIVER OR CREEK
- CONTOUR(25m)
- CONTOUR(2.5m)
- EXISTING ROAD
- PROPOSED ROAD
- SUPPLY YARD
- DIVERSION CHANNEL
- WETLAND
- Waste Rock Stockpile
- Settling Pond
- Topsoil Storage
- Temporary building

REV.	DATE	REVISION DESCRIPTION	DES	CADD	CHK
01	01OCT12		PC	PC	
00	27JUN11				

PROJECT

MURRAY RIVER BULK SAMPLE DECLINE - GENERAL ARRANGEMENT

ENGINEERS APPROVAL

Reviewed by
Peter Cain, PhD., P.Eng

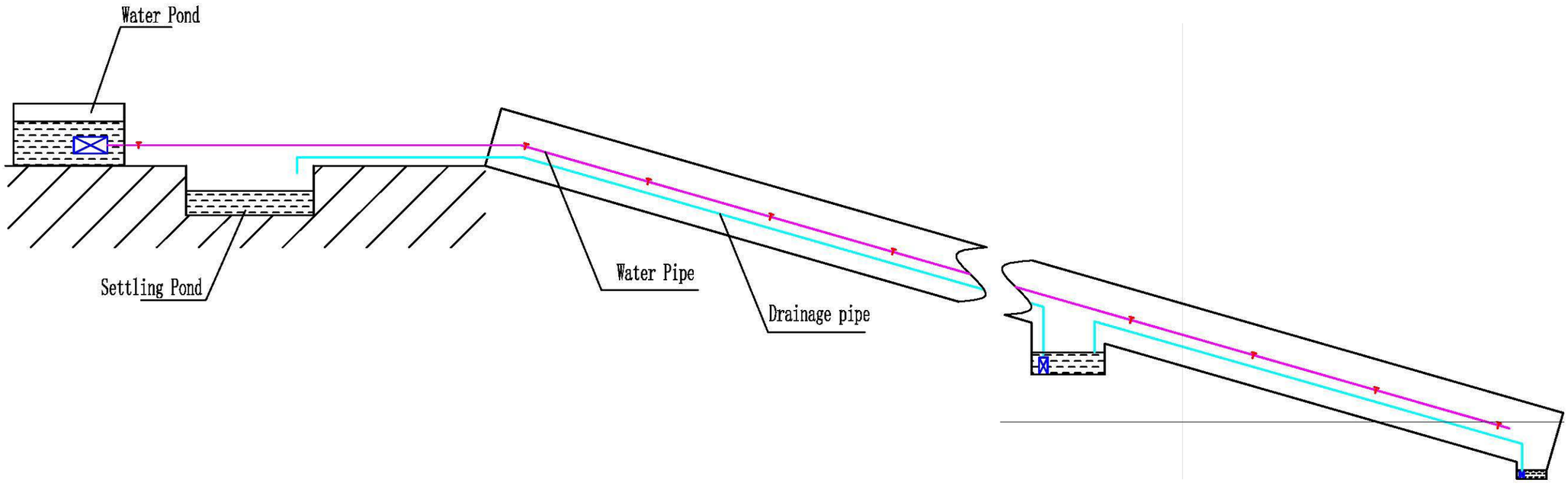
November 10, 2012

TITLE

GENERAL ARRANGEMENT OF SOUTH SITE (INCLINED SHAFT)

PROJECT No.	2012CMAA.038		FILE No.	038-3020
DESIGN	PC	01-OCT-12	SCALE	1:750 on 11 x 17
CADD	PC	01-OCT-12		
CHECK	-	-		
REVIEW	-	-		

FIGURE 3-2



LEGEND

Water Pump

Valve

Bulk Sample Mining Design of Murray Coal Mine, BC, Canada

Water Supply and Drainage System of Decline (Conceptual)

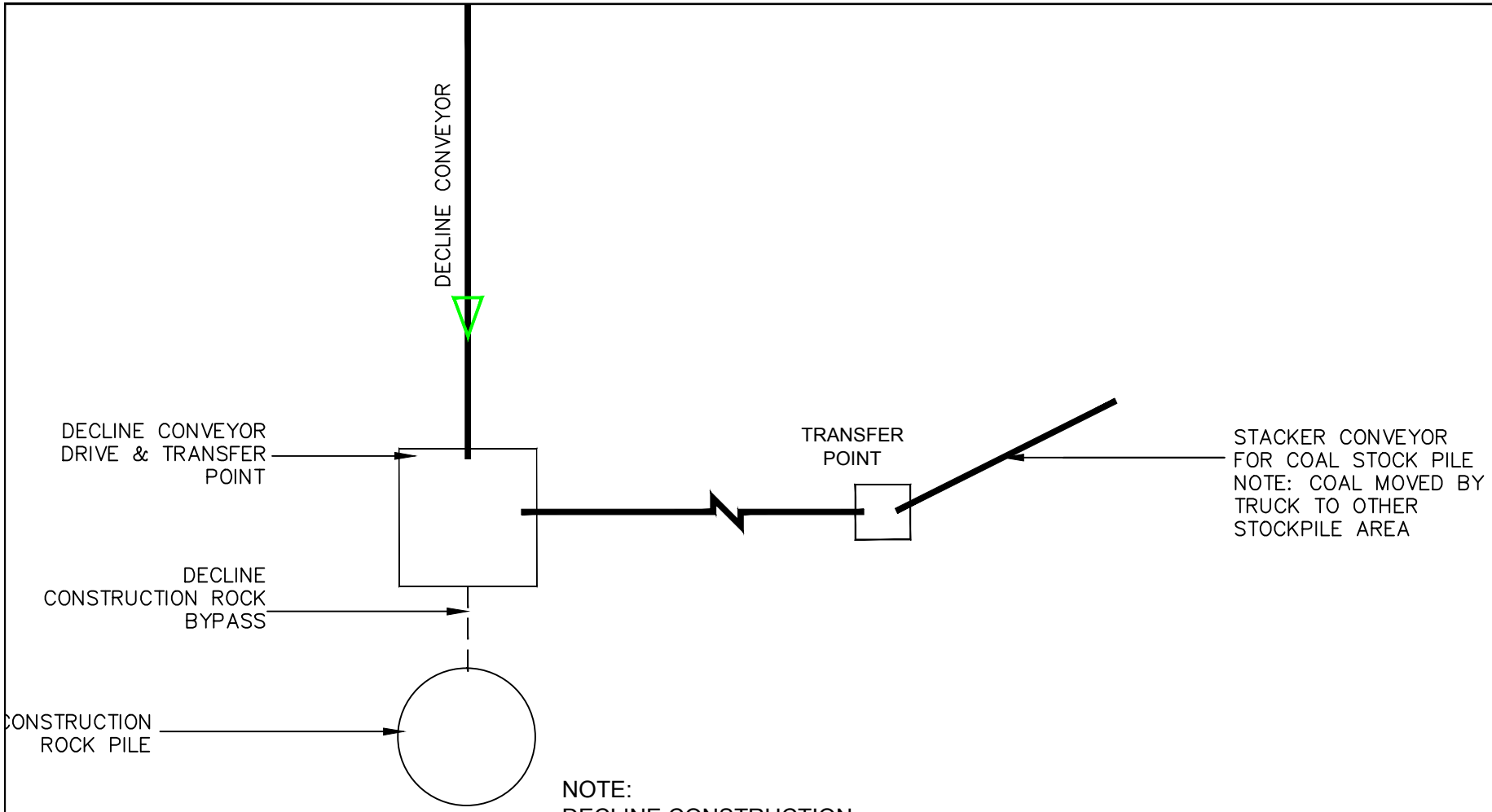
Figure 5-1
Water Supply and Pumping GA

Designed by	Checked by	Scale

Date: Dec. 2011

Sino-coal International Engineering Group
Shenyang Design and Research Institute

Reviewed by
Peter Cain, PhD., P.Eng
November 10, 2012



Reviewed by
Peter Cain, PhD., P.Eng

November 10, 2012

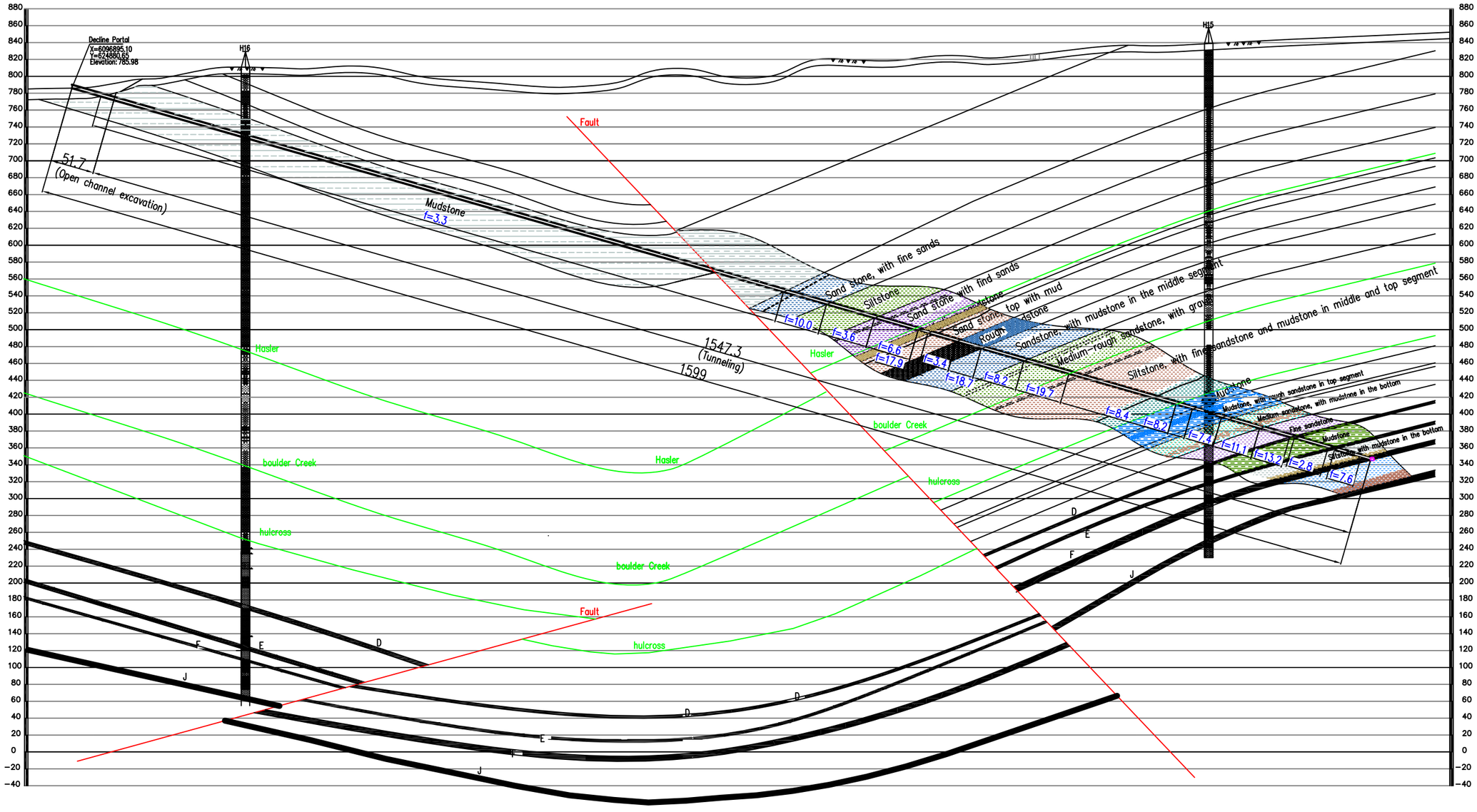
NOT TO SCALE

FIGURE 5-2

SOUTH DECLINE
MATERIAL HANDLING
FLOW DIAGRAM

DATE: 06/23/2011 | PROJECT: 4827 | NORWEST CORPORATION

FILE: 4827FIG-2-09

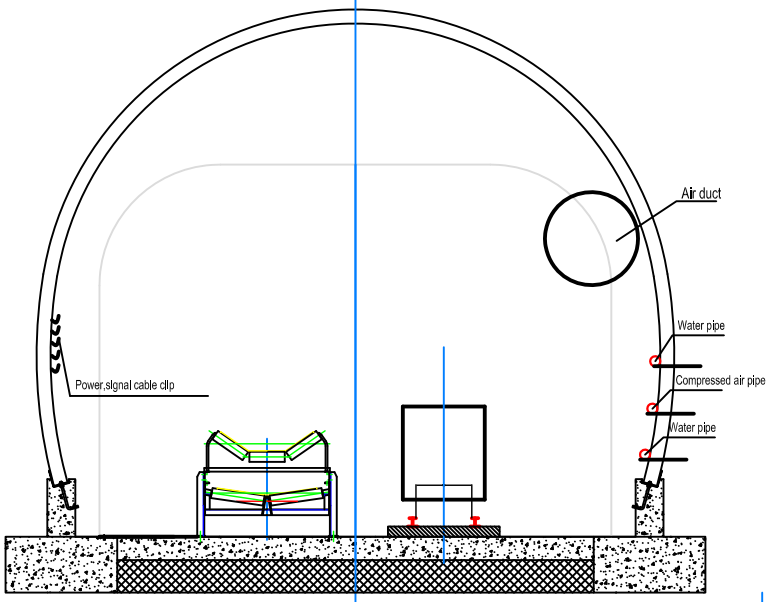


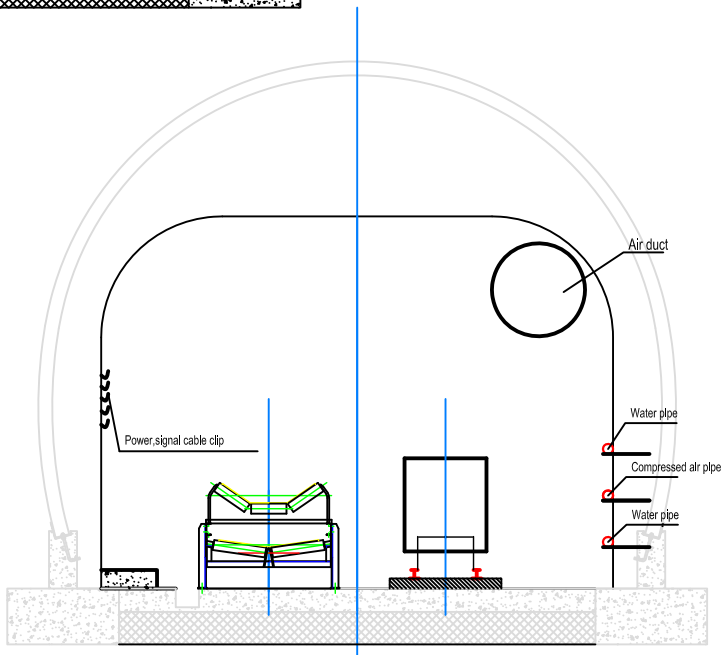
Reviewed by
Peter Cain, PhD., P.Eng

November 10, 2012

Figure 6-1: Section Along Decline

Designed		Scale
HDMI		1:5000





0 1 2 3 4

SCALE (metres)

REV.	DATE	REVISION DESCRIPTION	DES	CADD	CHK	RVW
01	01OCT12		PC	PC		
00	27JUN11					

PROJECT

MURRAY RIVER BULK SAMPLE DECLINE - GENERAL ARRANGEMENT

ENGINEERS APPROVAL

Reviewed by
Peter Cain, PhD., P.Eng

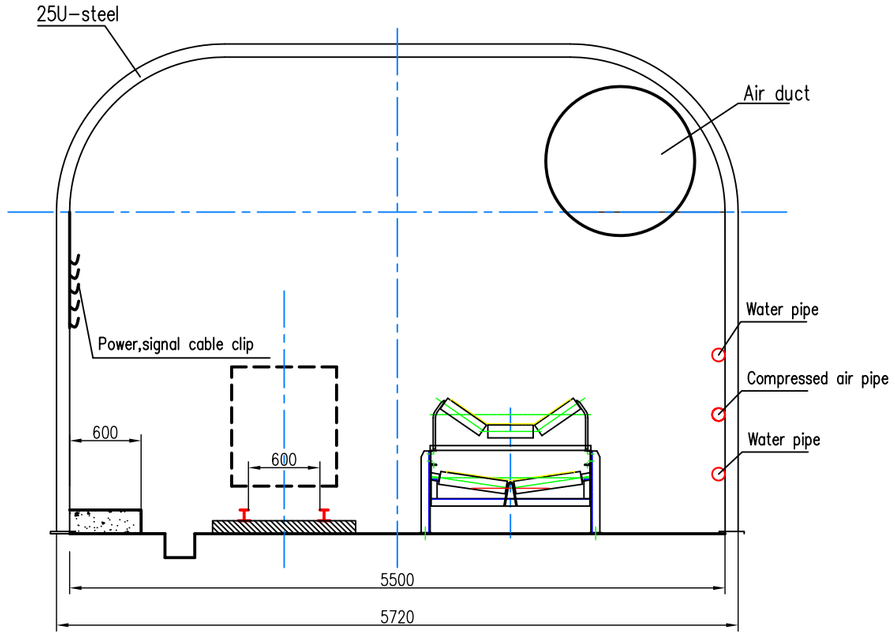
November 10, 2012

TITLE

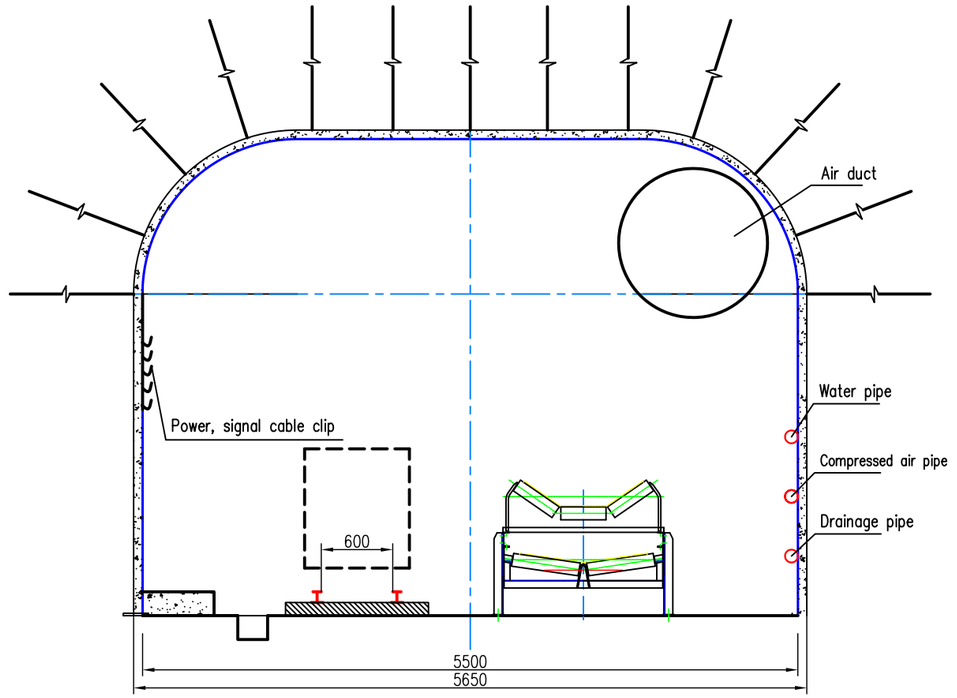
Decline Cross Sections

PROJECT No.	2012CMAA,058		FILE No.	058-1020
DESIGN	PC	01-OCT-12	SCALE	As Shown
CADD	PC	01-OCT-12		
CHECK	-	-		
REVIEW	-	-		

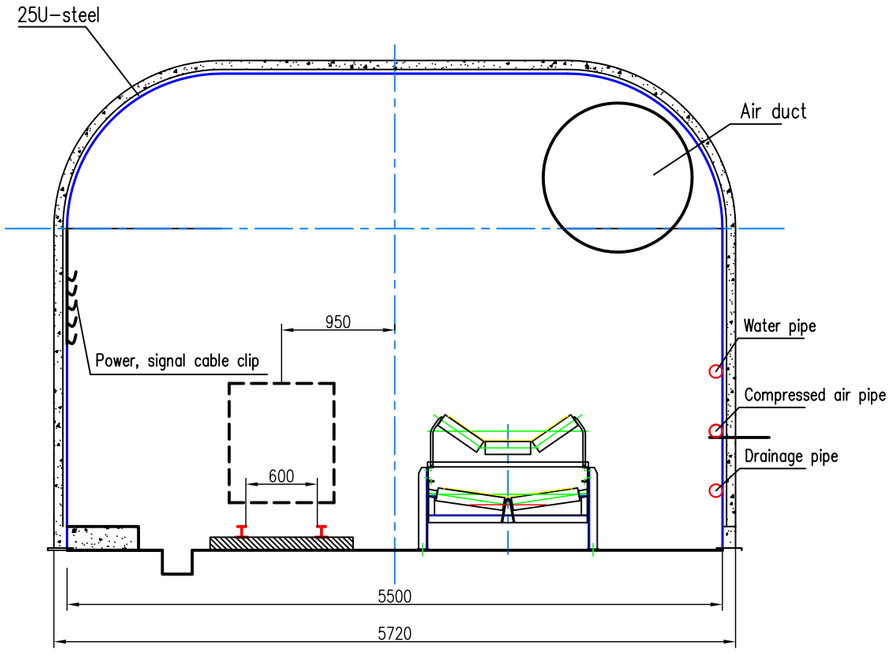
FIGURE 6-2



1-1



2-2



3-3

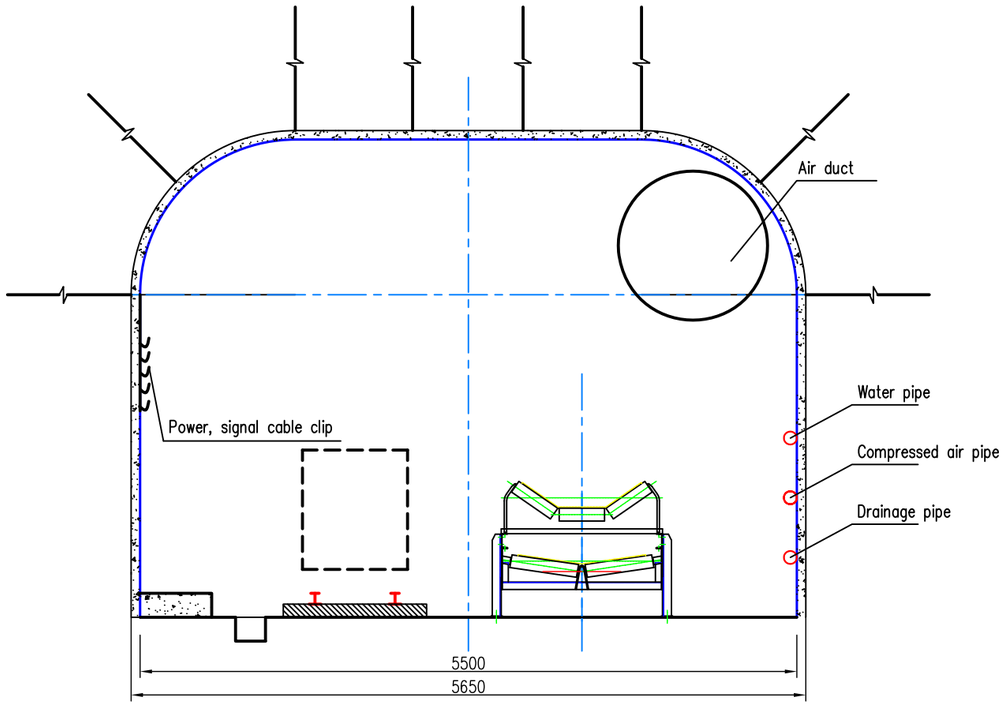
Code	Features	Conditions of surrounding rock
1-1	Support with U-Steel(1m spacing)	Surrounding rock is mudstone,f=3-4,complete and stable
2-2	Support with anchor bolts (0.8m spacing) + metal mesh + shotcreting	Surrounding rock are mudstone,f=4-5 and siltstone,f=3-5
3-3	Support with U-steel(1m spacing) + metal mesh + shotcreting	Surrounding rock is mudstone,f=3-4,with well developed fissures

Conveyor and track may be on opposite sides

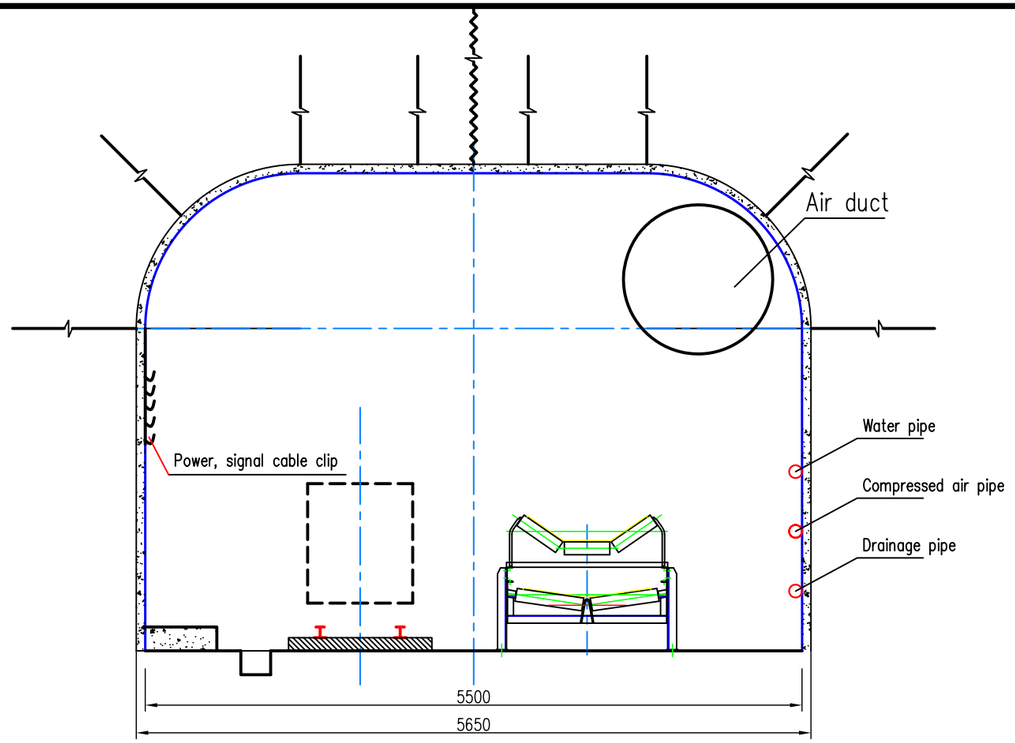
Reviewed by
Peter Cain, PhD., P.Eng
November 10, 2012

Figure 6-3: Roof Support Variations

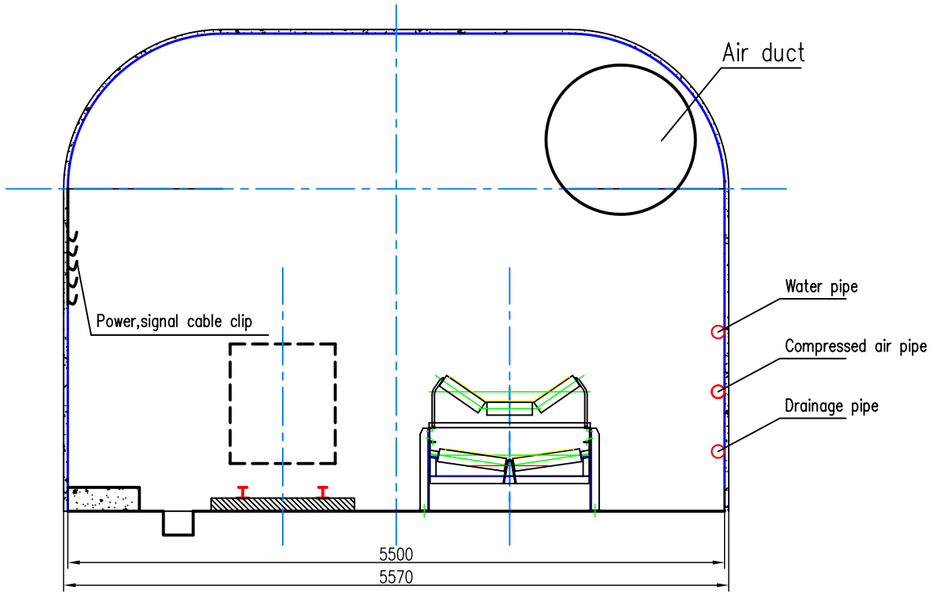
Designed		Scale
HDMI		1:50



4–4



5–5



6–6

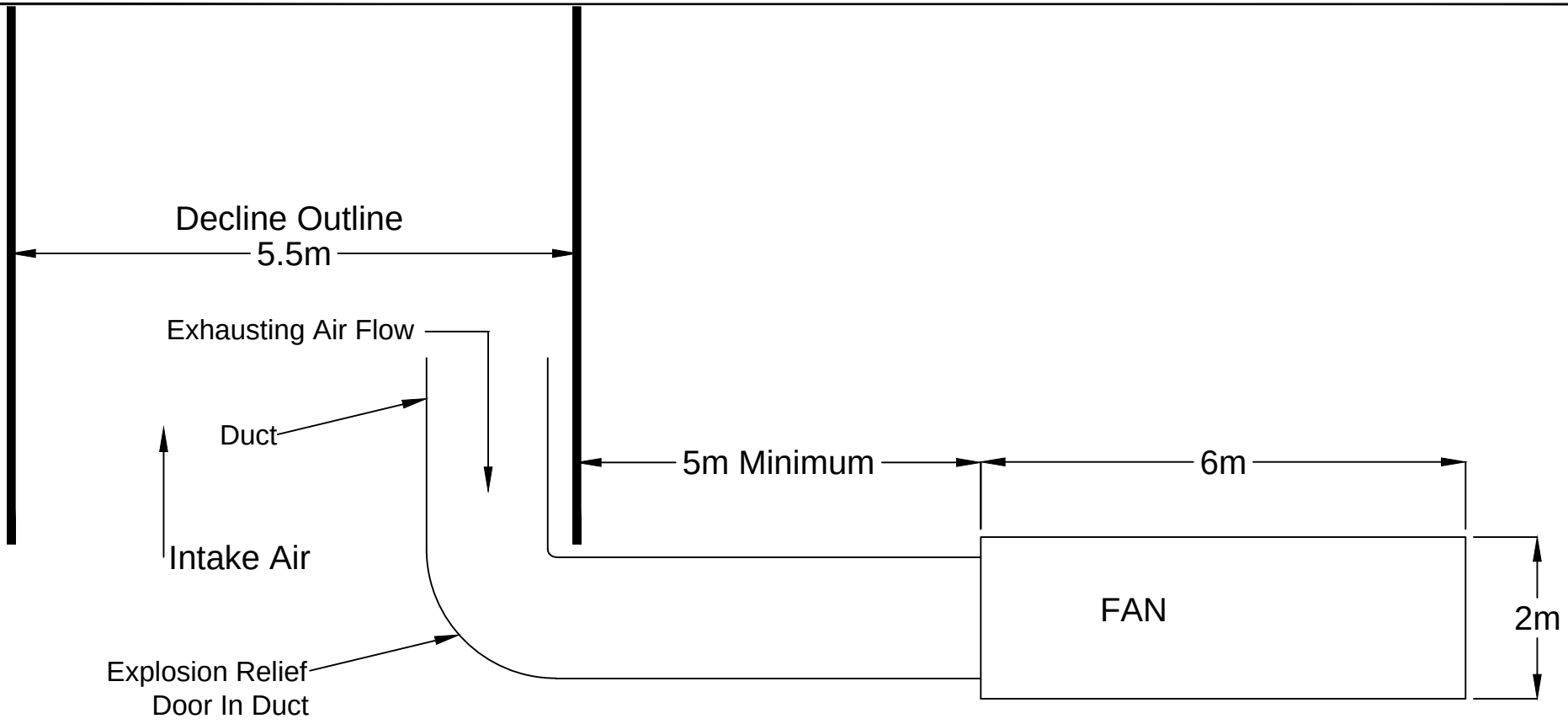
Section	Type of supporting	Conditions of surrounding rocks
4–4	Bolt (spacing1.0m?1.0m)+mesh+shotcreting	sandstone,f=5–8,rather stable; f>8,unstable
5–5	Bolt(spacing1.0m?1.0m)+cable(sapcing1m)+mesh+shotcreting	sandstone,f=5–8,unstable
6–6	shotcreting	sandstone,f>8, stable and integrate

Conveyor and track may be on opposite sides

Reviewed by
Peter Cain, PhD., P.Eng
November 10, 2012

Figure 6-4: Roof Support Variations

Designed		Scale
HDMI		1:50



Note: Mirror image may apply

Note: Approximate Dimensions

Reviewed by
Peter Cain, PhD., P.Eng

November 10, 2012

SCALE: AS SHOWN

FIGURE 4.3

DECLINE CONSTRUCTION
FAN LOCATION
PLAN VIEW

DATE: 05/03/2011 | PROJECT: 4827 | NORWEST CORPORATION

FILE: 4827DECL-FAN

APPENDIX 3

Construction Logs, Hydrogeological Test Holes, 2015

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ERM Canada Inc.
15th Floor 1111 W. Hastings St.
Vancouver, BC, V6E 2J4
Telephone: 604-689-9460

BOREHOLE NO. MW-01 (MW-01D & MW-01M & MW-01S)

CLIENT HD Mining International Ltd.
PROJECT NAME Murray River Coal Hydrogeologic Site Investigation
PROJECT NUMBER 0194106-0010
PROJECT LOCATION 12 km south of Tumbler Ridge, BC
DATE STARTED 7/18/15 **COMPLETED** 7/20/15
GROUND ELEVATION 785.87 m **HOLE DIAMETER** 102 mm
DRILLING CONTRACTOR Geotech Drilling
WELL COMPLETION NOTES 3 nested 1" sched. 40 PVC monitoring wells
DRILLING METHOD ODEX Air Rotary
GROUNDWATER LEVEL RANGE Identified beside screens in well diagram
LOGGED BY T. Gale **CHECKED BY** Y. Chen
NOTES Water injected frequently to facilitate cuttings removal.

DEPTH (m)	SAMPLES	SPT BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					0.87 m Stickup
	CU			Sandy GRAVEL, trace silt. Frequent cobbles likely. Well graded, brown, dry to damp.	
	SPT	4-8-13			Bentonite Pellets 0 - 6.2 m
	CU				
5					
	SPT	10-12-7			
	CU				MW-01S: water level 7.62 to 8.31 mbg when exfiltrating regularily, dry under natural conditions
				7.3 — 778.6	
				Medium SAND, some fine and coarse sand, trace silt. Poorly graded, brown.	
				8.2 — 777.7	
	SPT	4-6-9		SILT and fine SAND. Poorly graded, brown.	
	CU			Hole yielded water in circulation and saturated samples 8.9 - 12 m.	Bentonite Pellets 9.6 - 10.1 m
10				10.5 — 775.4	
	SPT	9-10-7		Fine and medium SAND, trace silt. Poorly graded, brown-grey.	
	CU				
	SPT	7-12-15			
	CU				
	CU				
15				15.0 — 770.9	
	SPT	4-11-22		Well-graded SAND, trace to some gravel, trace silt. Brown-grey.	
	CU				
	CU				
				18.1 — 767.8	
	SPT	5-10-10		Fine and medium SAND, trace coarse sand (platy black particles), trace silt. Poorly to moderately graded, brown-grey. Laminated.	Natural Collapse 10.1 - 26.7 m (fine-medium sand, some silt and gravel)
	CU				
20	CU			Saturated zone encountered at about 18.4 m as indicated by regular water level measurements in cased hole after SPTs.	
	SPT	4-8-11			
	CU				
	CU				
	SPT	7-12-14			
25	CU				
					Bentonite Pellets 26.7 - 27.9 m
	SPT	4-8-15			
	CU				MW-01M: water level 21.02 to 24.95 mbg
	CU				
30					

(Continued Next Page)

ENVIRONMENTAL BH - GINT STD US LAB.GDT - 6/29/16 11:24 - C:\PROJECTS\MURRAY RIVER\SHALLOW BOREHOLES\SHALLOW_BH_LOGS\MURRAY RIVER_GINT\MURRAY RIVER_FINAL.GPJ

ERM Canada Inc.
15th Floor 1111 W. Hastings St.
Vancouver, BC, V6E 2J4
Telephone: 604-689-9460

BOREHOLE NO. MW-01 (MW-01D & MW-01M & MW-01S)

CLIENT HD Mining International Ltd.
PROJECT NAME Murray River Coal Hydrogeologic Site Investigation
PROJECT NUMBER 0194106-0010
PROJECT LOCATION 12 km south of Tumbler Ridge, BC

DEPTH (m)	SAMPLES	SPT BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
30					
	SPT	8-3-5			
	CU				
	CU				
	CU				
35	CU			35.0 GRAVEL, some silt to silty, some sand. Well graded to gap graded. Saturated throughout. 750.9	Bentonite Pellets 32.4 - 38.2 m
	SPT	12-25-21			
	CU				
	CU				
40	SPT	22-26-21-21			MW-01D: water level 21.32 to 24.21 mbg
	CU				

Bottom of borehole at 40.9 m.

ENVIRONMENTAL BH - GINT STD US LAB.GDT - 6/29/16 11:24 - C:\PROJECTS\MURRAY RIVER\SHALLOW BOREHOLES\SHALLOW_BH_LOGS\MURRAY RIVER_GINT\MURRAY RIVER_FINAL.GPJ

ERM Canada Inc.
15th Floor 1111 W. Hastings St.
Vancouver, BC, V6E 2J4
Telephone: 604-689-9460

BOREHOLE NO. MW-02 (Test Well)

CLIENT HD Mining International Ltd.
PROJECT NAME Murray River Coal Hydrogeologic Site Investigation
PROJECT NUMBER 0194106-0010
PROJECT LOCATION 12 km south of Tumbler Ridge, BC
DATE STARTED 8/6/15 **COMPLETED** 8/9/15
GROUND ELEVATION 788.12 m **HOLE DIAMETER** 8 inches
DRILLING CONTRACTOR Geotech Drilling
WELL COMPLETION NOTES Steel nom. 7" dia. well with nom. 8" casing.
DRILLING METHOD ODEX Air Rotary
GROUNDWATER LEVEL RANGE 26.81 to 28.12 mbg
LOGGED BY P. Rzepecki **CHECKED BY** Y. Chen
NOTES Well casing advanced with hammer, lifted to expose slotted pipe.

DEPTH (m)	SAMPLES	SPT BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					0.73 m Stickup
				Sandy GRAVEL to gravelly SAND, trace silt. Frequent cobbles likely. Well graded, brown. Subround to angular (likely crushed) particles.	
				Dry to damp at top, moist at bottom.	
5					
10					
15					
20	CU				No backfill material: well casing advanced in place of drill casing.
				22.7 765.4	
				Fine to medium SAND, trace silt. Poorly graded, brown.	
				22.7 - 25.7 m: silty	
25	CU				
	CU				
				28.8 - 31.5 m: silty	
30					

(Continued Next Page)

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ERM Canada Inc.
15th Floor 1111 W. Hastings St.
Vancouver, BC, V6E 2J4
Telephone: 604-689-9460

BOREHOLE NO. MW-02 (Test Well)

CLIENT HD Mining International Ltd.
PROJECT NAME Murray River Coal Hydrogeologic Site Investigation
PROJECT NUMBER 0194106-0010
PROJECT LOCATION 12 km south of Tumbler Ridge, BC

DEPTH (m)	SAMPLES	SPT BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION		WELL DIAGRAM
30						
	CU			28.8 - 31.5 m: silty *(continued)*		
	CU			31.5 - 31.8 m: lense of well-graded sand and gravel.		
				32.4 31.8 - 32.4 m: silty	755.7	
				Well graded SAND, some gravel to gravelly. Salt and pepper colour		
35	CU					Slot 10 screen 33.2 - 38.2 m
	CU			37.9	750.2	
				Fine SAND, some silt. Poorly graded, grey, saturated.		
40	CU					
	CU			43.1	745.0	
	SPT	7-15-28-38		Sandy (fine) SILT. Poorly graded, grey, saturated.		

Bottom of borehole at 43.7 m.

ENVIRONMENTAL BH - GINT STD US LAB.GDT - 6/29/16 11:24 - C:\PROJECTS\MURRAY RIVER\SHALLOW BOREHOLES\SHALLOW_BH_LOGS\MURRAY RIVER_GINT\MURRAY RIVER_FINAL.GPJ

ERM Canada Inc.
15th Floor 1111 W. Hastings St.
Vancouver, BC, V6E 2J4
Telephone: 604-689-9460

BOREHOLE NO. MW-03

CLIENT HD Mining International Ltd.
PROJECT NAME Murray River Coal Hydrogeologic Site Investigation
PROJECT NUMBER 0194106-0010
PROJECT LOCATION 12 km south of Tumbler Ridge, BC
DATE STARTED 7/10/15 **COMPLETED** 7/17/15
GROUND ELEVATION 788.62 m **HOLE DIAMETER** 102 mm
DRILLING CONTRACTOR Geotech Drilling
WELL COMPLETION NOTES 2" schedule 40 PVC monitoring well
DRILLING METHOD ODEX Air Rotary
GROUNDWATER LEVEL RANGE 26.40 to 28.46 mbg
LOGGED BY T. Gale **CHECKED BY** Y. Chen
NOTES Hole re-drilled after drilling complete due to broken casing down hole.

DEPTH (m)	SAMPLES	SPT BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					0.93 m Stickup
	CU			Sandy GRAVEL, trace silt. Frequent cobbles likely. Well graded, brown. Subround to angular (likely crushed) particles.	
	SPT	9-10-10		Dry to damp at top, moist at bottom.	
	CU				
	SPT	6-11-14			
	CU				
5	SPT	5-7-6			
	CU				
	SPT	5-5-10			
	CU				
	SPT	8-17-18			
	CU				
	SPT	7-10-10			
10	CU				
	SPT	3-3-9			
	CU				
	SPT	7-13-14			
	CU				
	SPT	8-10-14			
	CU				
15	SPT	8-11-9			
	CU				
	CU				Grout 0 - 34.4 m
				17.6 / 771.0	
	SPT	6-11-11		Fine and medium SAND, trace coarse sand and silt. Poorly to moderately graded, subround to angular particles, brown. Moist throughout.	
	CU				
20	CU				
				21.2 / 767.4	
	SPT	24-33-29		Fine to medium GRAVEL, some sand, some silt. Frequent cobbles likely. Well-graded, subround to round particles, multi-coloured gravel, brown, moist	
	CU			22.7 / 765.9	
	CU			Silty fine SAND. Poorly graded, brown, moist. Laminated.	
	SPT	15-18-24			
25	CU				
				25.7 / 762.9	
	CU			Fine to medium SAND, trace to some silt. Poorly to moderately graded, brown. Moist.	
	SPT	17-18-14		Likely laminated and/or bedded throughout with gradation ranging from clean medium sand to silty fine sand. Indicated by seggragation in cuttings samples but not captured in SPTs.	
	CU				
	CU				
30					

(Continued Next Page)

ENVIRONMENTAL BH - GINT STD US LAB.GDT - 6/29/16 11:24 - C:\PROJECTS\MURRAY RIVER\SHALLOW BOREHOLES\SHALLOW_BH_LOGS\MURRAY RIVER_GINT\MURRAY RIVER_FINAL.GPJ

ERM Canada Inc.
15th Floor 1111 W. Hastings St.
Vancouver, BC, V6E 2J4
Telephone: 604-689-9460

BOREHOLE NO. MW-03

CLIENT HD Mining International Ltd.
PROJECT NAME Murray River Coal Hydrogeologic Site Investigation
PROJECT NUMBER 0194106-0010
PROJECT LOCATION 12 km south of Tumbler Ridge, BC

DEPTH (m)	SAMPLES	SPT BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
30	SPT	5-12-17		32.3 - 32.4 m: lense of well-graded sand and gravel. 33.3 m: groundwater first observed in circulation. Samples saturated below.	Bentonite 34.4 - 36.7 m Filter Sand 36.7 - 41.1 m Slotted pipe 37.2 - 40.3 m Well installed in re-drill hole with termination depth 41.1 m.
	CU				
	CU				
	CU				
35	SPT			35.3 m: heaving sand first detected.	
	CU				
	CU				
	CU				
40	CU				
	CU				
	CU			42.8 745.8 SILT, some fine sand to sandy (fine), trace medium sand. Poorly graded, brown-grey, saturated. Not heaving.	
	CU				
45				45.5 743.1	
	SPT			Fine to medium SAND, isolated coarse sand and fine gravel particles (angular - broken), trace silt to silty. Poorly to moderately graded, grey, saturated. Heaving. 44 - 52 m: produced water has grey-black film.	
	CU				
	CU				
	CU				
50				50.1 738.5	
	CU			SILT, trace fine sand possibly some clay. Grey, saturated.	
	CU			52.4 736.2	
				Well-graded SAND, some gravel, trace to some silt. Round to angular (likely crushed) particles, grey, saturated.	
55				56.7 731.9	
				SILT and fine SAND. Poorly graded, grey, saturated.	
				59.4 729.2	
60	CU			Well-graded SAND, some gravel and silt. subround-angular (likely crushed) particles, salt and pepper colour, saturated. Coase sand dominant at top.	
	CU				
	CU			62.5 - 67.1 m: fine-medium sand dominant.	

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ERM Canada Inc.
15th Floor 1111 W. Hastings St.
Vancouver, BC, V6E 2J4
Telephone: 604-689-9460

BOREHOLE NO. MW-03

CLIENT HD Mining International Ltd. **PROJECT NAME** Murray River Coal Hydrogeologic Site Investigation

PROJECT NUMBER 0194106-0010 **PROJECT LOCATION** 12 km south of Tumbler Ridge, BC

DEPTH (m)	SAMPLES	SPT BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
65	CU			62.5 - 67.1 m: fine-medium sand dominant. *(continued)*	
	CU				
	CU			67.1 - 70.1 m: coarse sand dominant.	
70				70.1 - 71.6 m: medium sand dominant.	

Bottom of borehole at 71.6 m.

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BOREHOLE NO. MW-04

CLIENT HD Mining International Ltd.
PROJECT NAME Murray River Coal Hydrogeologic Site Investigation
PROJECT NUMBER 0194106-0010
PROJECT LOCATION 12 km south of Tumbler Ridge, BC
DATE STARTED 7/8/15 **COMPLETED** 7/9/15
GROUND ELEVATION 768.52 m **HOLE DIAMETER** 102 mm
DRILLING CONTRACTOR Geotech Drilling
WELL COMPLETION NOTES 2" schedule 40 PVC monitoring well
DRILLING METHOD ODEX Air Rotary
GROUNDWATER LEVEL RANGE 7.86 to 9.17 mbg
LOGGED BY T. Gale **CHECKED BY** Y. Chen
NOTES

DEPTH (m)	SAMPLES	SPT BLOW COUNTS	MATERIAL DESCRIPTION		WELL DIAGRAM
0					0.71 m Stickup
	CU		Sandy GRAVEL to gravelly SAND, trace silt. Frequent cobbles likely. Well graded, brown. Subround to angular (likely crushed) particles.		
	SPT	1-1-2			
	CU		Dry to damp at top, moist at bottom.		
			2.8	765.7	
	SPT	3-5-8	SAND, well graded, moist, brown, damp.		
	CU		4.4	764.1	
5	SPT	9-27-29	Sandy GRAVEL to gravelly SAND, trace silt. Frequent cobbles likely. Well graded, brown. Subround to angular (likely crushed) particles.		
	SPT	11-13-17			
	CU		Dry to damp at top, moist at bottom.		
			7.4	761.1	
	SPT	7-8-13	Silty fine SAND. Poorly-graded, brown. Moist at top, increasing moisture to saturated at bottom.		
	CU				
	SPT	5-11-15			
10	CU				
			10.5	758.0	
	SPT	4-9-16	Fine to medium SAND. Poorly graded, brown, saturated.		
	CU		11.3	757.2	
			Well graded SAND, trace to some silt, trace gravel to gravelly. Subangular to subround particles, brown, saturated.		Grout 0 - 25.2 m
	SPT	5-7-9			
	CU				
	SPT	7-15-19			
15	CU				
			15.0	753.5	
	SPT	3-4-7	15.5 Sandy SILT. Poorly graded, grey, saturated.	753.0	
	CU		Fine SAND, some silt. Poorly graded, grey, saturated.		
	SPT	13-25-33			
	CU				
	SPT				
			19.7	748.8	
20	SPT		Sandy SILT. Poorly graded, grey, saturated.		
	CU				
	SPT		21.4	747.1	
	CU		Fine to medium SAND, some silt. Poorly graded, grey, saturated.		
	CU		Modest coarsening and decreasing silt fraction with depth.		
	SPT				
25	CU				
	SPT				Bentonite 25.2 - 26.3 m
	CU				
					Filter Sand 26.3 - 33.5 m
	CU				
30					

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BOREHOLE NO. MW-04

CLIENT HD Mining International Ltd.
PROJECT NAME Murray River Coal Hydrogeologic Site Investigation
PROJECT NUMBER 0194106-0010
PROJECT LOCATION 12 km south of Tumbler Ridge, BC

DEPTH (m)	SAMPLES	SPT BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
30	SPT			30.3 m: Medium SAND, trace silt.	Slotted pipe 30.5 - 33.5 m

Bottom of borehole at 33.5 m.

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BOREHOLE NO. SH-01

CLIENT HD Mining International Ltd.
PROJECT NAME Murray River Coal Hydrogeologic Site Investigation
PROJECT NUMBER 0194106-0010
PROJECT LOCATION 12 km south of Tumbler Ridge, BC
DATE STARTED 7/21/15 **COMPLETED** 7/22/15
GROUND ELEVATION 1294.8 m **HOLE DIAMETER** 92 - 102 mm
DRILLING CONTRACTOR Geotech Drilling
WELL COMPLETION NOTES 2" schedule 40 PVC monitoring well
DRILLING METHOD ODEX Air Rotary
GROUNDWATER LEVEL RANGE 2.97 to 3.83 mbg
LOGGED BY T. Gale **CHECKED BY** Y. Chen
NOTES

DEPTH (m)	SAMPLES	SPT BLOW COUNTS	MATERIAL DESCRIPTION
0	CU		FINES, occasional to frequent fine-coarse subround to subangular gravel particles. Poorly graded to gap-graded. Glacial till.
	SPT	2-4-5	
	CU		Increasing compactness with depth to very dense at bottom. Subtle transition into bedrock at about 10.0 m.
	SPT	50	
	CU		
5	SPT	11-12-13	
	CU		
	SPT	17-24-42	
	CU		
	SPT	17-22-14	
	CU		
	SPT	50	
10	CU		10.0 / 1284.8 MUDSTONE. Soft and flakey. 10.5 m: water accumulating in borehole but not sustained in circulation.
	CU		
	CU		
15			
	CU		16.5 m: Circulation yielding multiple litres per second. Sustained to end of hole.
	CU		
20	CU		
	CU		
25			
	CU		

WELL DIAGRAM: 0.76 m Stickup; Grout 0 - 22.8 m; Bentonite 22.8 - 24.5 m; Filter Sand 24.5 - 28.6 m; Slotted pipe 25.3 - 28.4 m

Bottom of borehole at 28.6 m.

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ERM Canada Inc.
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Telephone: 604-689-9460

BOREHOLE NO. SH-02

CLIENT HD Mining International Ltd.
PROJECT NAME Murray River Coal Hydrogeologic Site Investigation
PROJECT NUMBER 0194106-0010
PROJECT LOCATION 12 km south of Tumbler Ridge, BC
DATE STARTED 8/14/15 **COMPLETED** 8/17/15
GROUND ELEVATION 1040.11 m **HOLE DIAMETER** 92 - 102 mm
DRILLING CONTRACTOR Geotech Drilling
WELL COMPLETION NOTES 2" schedule 40 PVC monitoring well
DRILLING METHOD ODEX Air Rotary
GROUNDWATER LEVEL RANGE 6.52 to 6.89 mbg
LOGGED BY T. Gale / Piotr Rzepecki **CHECKED BY** Y. Chen
NOTES

DEPTH (m)	SAMPLES	SPT BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					1.03 m Stickup
	CU			FINES. Poorly graded, brown. Dry at top, wet at bottom. Increasing compactness to very dense at bottom. Glacial Till	
	SPT	26-51-68			
	CU				
				2.7 1037.4	
	SPT	90		MUDSTONE. Recovered as soft platy chip cuttings at top. 2.7 - 4.3 m: frequent iron oxide staining on chip surface.	
	CU				
5	CU				
	CU				
					Grout 0 - 17.7 m
10	CU			9.5 m: water first observed in circulation	
	CU			12.2 m: circulated water accumulating on ground, flow rate measured 2-3 L/min.	
	CU				
	CU			Platy chip cuttings becoming harder.	
15	CU			14.0 - 15.7 m: water accumulation prgressively increasing from 6 to 10 L/min over this interval.	
	CU			Strong angular gravel size chip cuttings.	
	CU			16.5 - 22.6 m: occasional oxidation staining on chip surfaces.	Bentonite 17.7 - 19.7 m
20	CU			17.2 - 21.0 m: Water accumulation increased progressively from 10 L/min to 1 L/sec as drilling progressed through this interval. Contributions below 21.0 m less than measurement precision (e.g. > 30 L/min).	Filter Sand 19.7 - 28.8 m
	CU				
	CU				Slotted pipe 20.1 - 26.2 m
25	CU				
	CU				

Bottom of borehole at 28.8 m.

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ERM Canada Inc.
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Telephone: 604-689-9460

BOREHOLE NO. SH-03

CLIENT HD Mining International Ltd.
PROJECT NAME Murray River Coal Hydrogeologic Site Investigation
PROJECT NUMBER 0194106-0010
PROJECT LOCATION 12 km south of Tumbler Ridge, BC
DATE STARTED 7/3/15 **COMPLETED** 7/4/15
GROUND ELEVATION 1194.26 m **HOLE DIAMETER** 92 - 102 mm
DRILLING CONTRACTOR Geotech Drilling
WELL COMPLETION NOTES 2" schedule 40 PVC monitoring well
DRILLING METHOD ODEX Air Rotary
GROUNDWATER LEVEL RANGE 1.96 to 4.07 mbg
LOGGED BY T. Gale **CHECKED BY** Y. Chen
NOTES

DEPTH (m)	SAMPLES	SPT BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	CU			FINES, some sand and gravel. Low plasticity, fractured.Subround to angular (likely crushed) particles. Moderately graded, dark brown, damp. Glacial till.	0.76 m Stickup
	SPT	5-6-6			
	CU				
	SPT	5-10-12			
	CU				
				4.3 / 1190.0	
5	SPT	50		MUDSTONE. Recovered as soft flakey chip cuttings. Dark grey to black.	
	SPT	50		6.3 m: cuttings recovered wet/clumpy	
	CU			9.8 m: groundwater first observed in circulation. Trickle accumulating on ground.	
10	CU			Mudstone recovered as hard angular sand and gravel size chips.	Grout 0 - 21.4 m
	CU			13.7 m: water accumulation on ground measured 0.5 L/min.	
15	CU			15.2 m: water accumulation 1.3 L/min 16.8 - 19.8 m: water accumulation increased progressively from 5 to 20 L/min over this interval.	
	CU			17.0 m: Swtiched from air hammer to wing bit. Advanced with wing bit to end of hole.	
20	CU				Bentonite 21.4 - 22.4 m
	CU				Filter Sand 22.4 - 27.0 m
25				24.4 - 27.4 m: water accumulation > 30 L/min, increasing progressively.	Slotted pipe 23.9 - 27.0 m

Bottom of borehole at 27.0 m.

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BOREHOLE NO. SH-04

CLIENT HD Mining International Ltd.
PROJECT NAME Murray River Coal Hydrogeologic Site Investigation
PROJECT NUMBER 0194106-0010
PROJECT LOCATION 12 km south of Tumbler Ridge, BC
DATE STARTED 7/5/15 **COMPLETED** 7/7/15
GROUND ELEVATION 1090.94 m **HOLE DIAMETER** 102 mm
DRILLING CONTRACTOR Geotech Drilling
WELL COMPLETION NOTES 2" schedule 40 PVC monitoring well
DRILLING METHOD ODEX Air Rotary
GROUNDWATER LEVEL RANGE 3.94 to 4.26 mbg
LOGGED BY T. Gale **CHECKED BY** Y. Chen
NOTES Hole diameter wider than hammer due to sediment washing

DEPTH (m)	SAMPLES	SPT BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0					0.83 m Stickup
	CU			FINES, trace to some sand, trace gravel to gravelly. Likely isolated to frequent cobbles. Poorly graded to gap graded, subround to subangular particles. Glacial Till.	
	SPT	9-9-9			
	CU			Dark brown, damp at top.	
	SPT	4-5-7			
	CU				
5	SPT	9-6-6		6 m: samples recovered moist	
	CU				
	SPT	17-26-27			
	CU				
	SPT	28-32-19			
	CU				
	SPT	28-43-33			
10	CU				Grout 0 - 20.0 m
	SPT	16-20-26			
	CU			11.7 m: Water accumulating in hole, water level measured 3.7 m when cased to bottom after hole undisturbed overnight.	
	SPT	28-46-41			
	CU			13.5 m: samples recovered saturated	
	SPT	27-42-43			
15	CU				
	SPT	50			
	CU				
	SPT	32-51		12.2 - 22.3 m: Borehole advanced with wing bit, casing not advanced. Returned to ODEX air hammer from 22.3 m and advanced casing.	
	CU				
	SPT	25-39-50			
	CU				
20	SPT	21-54			Bentonite 20.0 - 21.0 m
	CU				
	SPT	24-59		21.6 m: circulation yielding 5-10 L/min, sustained to end of hole.	Filter Sand 21.0 - 26.2 m
	CU				
				22.7 — 1068.2	
	SPT	17-27-52		Silty SAND and GRAVEL. Well graded, subangular to angular (likely crushed) particles, grey-brown, saturated.	Slotted pipe 21.9 - 24.9 m
	CU				
	SPT	30-44-46		24.6 — 1066.3	
25	CU			FINES, some sand and gravel. Subround particles, brown-grey, saturated. Poorly to well graded. Glacial Till.	
	SPT	20-34-30			Final 0.5 m advanced by SPT only.

Bottom of borehole at 26.2 m.

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Vancouver, BC, V6E 2J4
Telephone: 604-689-9460

BOREHOLE NO. SH-05

CLIENT HD Mining International Ltd.
PROJECT NAME Murray River Coal Hydrogeologic Site Investigation
PROJECT NUMBER 0194106-0010
PROJECT LOCATION 12 km south of Tumbler Ridge, BC
DATE STARTED 7/23/15 **COMPLETED** 7/24/15
GROUND ELEVATION 844.75 m **HOLE DIAMETER** 92 - 102 mm
DRILLING CONTRACTOR Geotech Drilling
WELL COMPLETION NOTES 2" schedule 40 PVC monitoring well
DRILLING METHOD ODEX Air Rotary
GROUNDWATER LEVEL RANGE 15.69 to 17.98 mbg
LOGGED BY P. Rzepecki **CHECKED BY** Y. Chen
NOTES

DEPTH (m)	SAMPLES	SPT BLOW COUNTS	GRAPHIC LOG	MATERIAL DESCRIPTION	WELL DIAGRAM
0	CU			FINES, some fine sand. Poorly graded, dark brown, dry. Glacial Till.	0.95 m Stickup
	SPT	11-12-13			
	SPT	10-17-17		3.5 841.3 MUDSTONE. Recovered as soft platy chip cuttings. Frequent iron oxide staining on chip surfaces.	
5	SPT	48-80			
	CU				
	CU				
	CU				
	CU				
10					
	CU			Mudstone recovered as hard angular sand to gravel size particles.	Grout 0 - 22.6 m
	CU				
	CU				
15					
	CU				
	CU				
	CU				
20					
	CU				
	CU				Bentonite 22.6 - 23.5 m
	CU				Filter sand 23.3 - 28.0 m
25				24 m: water observed in circulation, not accumulating on ground.	
	CU				Slotted pipe 23.5 - 28.0 m
	CU				

Bottom of borehole at 28.0 m.

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APPENDIX 4

Drilling Logs, DH-01

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Drillhole DH-01 Final Report In Murray River Project

墨玉河项目 DH-01 井完井报告

HD Mining International Inc.
HD 国际矿业股份有限公司

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WELL DATA 基本参数

Well Name 井名: DH-01

Surface Location 位置: E: 621714.634 N: 6103142.355

Operator 承钻: Geotech Drilling Services Ltd

Licence No.许可证号:

Ground Elevation 地面标高: 1291.33

R.S. Elevation 实测标高： 1291.33

Designed Depth 设计井深: 1150

Total Depth 实际井深: 1004.00

-Start Date 开钻日期: 2015-07-29

Completed date 完井日期: 2015-09-10(Drilling), 2015-10-09(Installation)

Objective Formation 目的层: 15m below K seam, stopped at F seam

Westbay 系统安装: 安装深度 980m(9m packer string left in the bottom of hole)

COMPANY & CONTRACTOR 甲方与乙方

Company 甲方: HD Mining International Ltd.

Company 乙方: Drilling Contractor 钻井公司: Geotech Drilling Services Ltd

Drilling Fluid Contractor 钻井液公司:

CBM Detector Contractor 瓦斯检测公司:Petro-Logic Services

Wireline Logging Contractor 测井公司: Century Wireline Services

Aquifer Formation Testing 水层测试公司：Environmental Resources Management (ERM)

Westbay System Westbay 系统多层监测安装： Westbay Instruments

HOLE SIZE 井眼尺寸

Hole Section 井段	Size 尺寸	Depth 深度(m)
0-57	HWT	57
0-1004	HQ	1004

CASING 套管数据

Type 类 型	Make 制 造	Size (OD) 尺 寸	Grade 钢 级	Depth(m) 下 深	Weight(kg/m) 重 量
PWT	Di-Corp	122.6mm		42	
HWT	Di-Corp	114.3mm		57	17.4
HQ	used			500	For westbay

DRILL BIT RECORD 钻头尺寸

No. 序号	Size (mm)	Type 类型	Make 制造	Jets 喷嘴(mm)	In 下人 (m)	Out提出 (m)	Progress 纯钻(m)	Hours 小时
	96mm							

DRILLING FLUID DATA 钻井液参数

Date 日 期	Depth 深 度	Type 类 型	Density 密 度	Viscosity 粘 度	Water Loss 失 水	PH 酸碱度
		Kion				
		Penetrol				

		Synvis				
		Linseed Soap				
		Turbo-Cut				

WATER SHOWS RECORD 水显示记录

No.序号	Depth 深 度（m）	Layer 层 位	Aquifer Yield 水 量 （m^3）	Remark 备 注
	650-720	BC	See ERM Report， 见 ERM 水文报告	钻进 710 时漏浆严重无循 环，后在 683-734 段水泥注浆，恢复循环

AQUIFER FORMATION TEST 水层测试 记录

Date 日期	Interval 井段	Type 类型	Choke 水嘴(mm)	Pressure 压力	Yield 水量	Salinity 矿化度
					See ERM Report	

ABNORMAL GAS RECORD 异常气体气显示记录

GAS TYPE 气体类型	Depth 深 度（m）	Layer 层 位	Gas Yield 气量（m^3）	Remark 备 注
				钻进过程中无明显异常

WIRELINE LOGGING DATA 测井数据

Run # 测次	Log Type 测井项目	BHT 温度	Logged Interval 井 段	Date Run Ends 日 期
	Thru-rods Neutron, Thru-Density			2015-09-12
	Openhole Neutron,Density			2015-09-13
	Gamma,SP,Dipmeter,Caliper,temperature			
	Televiewer			2015-09-14

GEOCHEMICAL SAMPLES COLLECTION RECORD 地化样品采样记录

Sample ID 样号	Box No. 箱号	From 从 (m)	To 到 (m)	Thickness 厚度	Sample Date 采样时间	Remark 备注
662601	Box 358	1002.29	1004		2015-10-08	F coal
662602	Box 358	1001	1002.29		2015-10-08	F coal
662603	Box 357	999.55	1001		2015-10-08	F coal
662604	Box 357	998	999.55		2015-10-08	F coal
662605	Box 356	996.5	998		2015-10-08	F parting
662606	Box 356	995.15	996.5		2015-10-08	F parting
662607	Box 355	993.8	995.15		2015-10-08	F parting
662608	Box 355	992.29	993.8		2015-10-08	F parting
662609	Box 354	991.07	992.29		2015-10-08	F parting
662610	Box 354	989.57	991.07		2015-10-08	F parting
662611	Box 353	988.4	989.57		2015-10-08	F parting
662612	Box 353	986.9	988.4		2015-10-08	F coal/parting
662613	Box 352	985.44	986.9		2015-10-08	F coal/parting
662614	Box 352	983.94	985.44		2015-10-08	F seam roof
662615	Box 351	983	983.94		2015-10-08	F seam roof
662616	Box 351	982	983		2015-10-08	F seam roof
662617	Box 351	981.2	982		2015-10-08	F seam roof
662618	Box 350	980.2	981.2		2015-10-08	F seam roof
662619	Box 350	979.1	980.2		2015-10-08	F seam roof
662620	Box 350	978.35	979.1		2015-10-08	F seam roof
662621	Box 349	977.35	978.35		2015-10-08	F seam roof
662622	Box 349	976.45	977.35		2015-10-08	F seam roof
662623	Box 349	975.45	976.45		2015-10-08	F seam roof
662624	Box 348	974.45	975.45		2015-10-08	F seam roof

662625	Box 348	973.55	974.45		2015-10-08	F seam roof
662626	Box 348	972.55	973.55		2015-10-08	F seam roof
662627	Box 347	971.55	972.55		2015-10-08	F seam roof
662628	Box 347	970.65	971.55		2015-10-08	F seam roof
662629	Box 347	969.82	970.65		2015-10-08	F seam roof
662630	Box 346	969	969.82		2015-10-08	F seam roof
662631	Box 346	968	969		2015-10-09	F seam roof
662632	Box 346	967.06	968		2015-10-09	F seam roof
662633	Box 345	966.06	967.06		2015-10-09	F seam roof
662634	Box 345	965.06	966.06		2015-10-09	F seam roof
662635	Box 345	964.32	965.06		2015-10-09	F seam roof
662636	Box 344	961.57	964.32		2015-10-09	F seam roof
662637	Box 344	962.32	963.32		2015-10-09	F seam roof
662638	Box 344	961.57	962.32		2015-10-09	F seam roof
662639	Box 343	960.57	961.57		2015-10-09	F seam roof
662640	Box343	959.57	960.57		2015-10-09	F seam roof
662641	Box 343	958.85	959.57		2015-10-09	F seam roof
662642	Box 331	926.43	926.85		2015-10-09	D coal
662643	Box 331	925.11	926		2015-10-09	D seam roof
662644	Box 330	924.11	925.11		2015-10-09	D seam roof
662645	Box 330	923.11	924.11		2015-10-09	D seam roof
662646	Box 1	7.4	8		2015-10-09	overburden
662647	Box 1	8	11		2015-10-09	Hasler
662648	Box5-9	22	33		2015-10-09	Hasler
662649	Box 206	574.11	575		2015-10-09	Hasler
662650	Box 134	373	374		2015-10-09	Hasler

GT SAMPLE COLLECTION RECORD GT 样品采集记录

No. 序号	Box 箱号	Interval 井段(m)	Remark 备注

			No Sampled 没有采

CBM SAMPLES COLLECTION RECORD 煤层气样品采集记录

No. 序号	Box 箱号	Interval 井段	Remark 备注
1	Box 331	926.15-926.52	D Seam
2	Box 352	985.70-986.00	E Seam
3	Box 353	987.62-987.96	Coal
4	Box 356	997.00-997.30	Coal
5	Box 357	998.25-998.55	F Seam
6	Box 357	998.95-999.30	F Seam
7	Box 357	999.30-999.55	F Seam
8	Box 358	1001.24-1001.52	F Seam
9	Box 358	1002.01-1002.29	F Seam

FINAL FORMATION TOPS 层位顶界

NAME 名称	PROGNOSIS 设计		ACTUAL 实际			
	TVD 深度	SS 海拔深度	MD 中深	TVD 深度	SS 海拔深度	+/- TO PROG 误差

Q				0		
Hasler				8		
Boulder Creek				604.07		
Hulcross				735.92		
Gates				843.90		

CORE DESCRIPTION 岩芯描述

Box or Tube 箱号或样槽	Interval 井 段(m)	Lithology Description 岩性描述

CEMENTING RECORD 封井记录

Date 日期	Cement type 水泥型号	Consumption 用量（Kg）	Plug Depth 段塞深度（m）	Hours 小时(Hr)	Remark 备注
					安装 Westbay, 没有封井

GEOCHEMICAL TEST RESULTS

DH-01

SAMPLE_ID	STATION	DRILLHOLE GOVT ID	FROM	TO	INTERVAL	FORMATION	COAL SEAM	DESCRIPTION	LITHOLOGY	WEIGHT kg	LAB	LAB_CERT	DATE
NJ8492	662601	DH-01	1002.29	1004.00	1.71	Middle Gates	F	Raw Coal	Coal	3.66	Maxxam	B591266	November, 2015
NJ8493	662602	DH-01	1001.00	1002.29	1.29	Middle Gates	F	Raw Coal	Coal	2.51	Maxxam	B591266	November, 2015
NJ8494	662603	DH-01	999.55	1001.00	1.45	Middle Gates	F	Raw Coal	Coal	2.39	Maxxam	B591266	November, 2015
NJ8495	662604	DH-01	998.00	999.55	1.55	Middle Gates	F	Raw Coal	Coal	2.16	Maxxam	B591266	November, 2015
NJ8496	662605	DH-01	996.50	998.00	1.50	Middle Gates	F	Parting	Coal	3.33	Maxxam	B591266	November, 2015
NJ8497	662606	DH-01	995.15	996.50	1.35	Middle Gates	F	Parting	Coal	3.36	Maxxam	B591266	November, 2015
NJ8498	662607	DH-01	993.80	995.15	1.35	Middle Gates	F	Parting	Coal	3.86	Maxxam	B591266	November, 2015
NJ8499	662608	DH-01	992.29	993.80	1.51	Middle Gates	F	Parting	Coal	3.78	Maxxam	B591266	November, 2015
NJ8500	662609	DH-01	991.07	992.29	1.22	Middle Gates	F	Parting	Coal	4.56	Maxxam	B591266	November, 2015
NJ8501	662610	DH-01	989.57	991.07	1.50	Middle Gates	F	Parting	Coal	3.97	Maxxam	B591266	November, 2015
NJ8502	662611	DH-01	988.40	989.57	1.17	Middle Gates	F	Parting	Coal	4.41	Maxxam	B591266	November, 2015
NJ8503	662612	DH-01	986.90	988.40	1.50	Middle Gates	F	coal/parting	Coal	4.03	Maxxam	B591266	November, 2015
NJ8504	662613	DH-01	985.44	986.90	1.46	Middle Gates	F	coal/parting	Coal	3.86	Maxxam	B591266	November, 2015
NJ8505	662614	DH-01	983.94	985.44	1.50	Middles Gates	F	Roof	Carbonaceous Mudstone	3.19	Maxxam	B591266	November, 2015
NJ8506	662615	DH-01	983.00	983.94	0.94	Middles Gates	F	Roof	Mudstone and sandstone	3.53	Maxxam	B591266	November, 2015
NJ8507	662616	DH-01	982.00	983.00	1.00	Middles Gates	F	Roof	mudstone, siltstone, sandstone, conglomerate	3.06	Maxxam	B591266	November, 2015
NJ8508	662617	DH-01	981.20	982.00	0.80	Middles Gates	F	Roof	sandstone, conglomerate	3.10	Maxxam	B591266	November, 2015
NJ8509	662618	DH-01	980.20	981.20	1.00	Middles Gates	F	Roof	sandstone, conglomerate	3.48	Maxxam	B591266	November, 2015
NJ8510	662619	DH-01	979.10	980.20	1.10	Middles Gates	F	Roof	conglomerate	2.66	Maxxam	B591266	November, 2015
NJ8511	662620	DH-01	978.35	979.10	0.75	Middles Gates	F	Roof	conglomerate, sandstone	3.27	Maxxam	B591266	November, 2015
NJ8512	662621	DH-01	977.35	978.35	1.00	Middles Gates	F	Roof	sandstone, coaly mudstone, conglomerate	3.03	Maxxam	B591266	November, 2015
NJ8513	662622	DH-01	976.45	977.35	0.90	Middles Gates	F	Roof	sandstone	3.19	Maxxam	B591266	November, 2015
NJ8514	662623	DH-01	975.45	976.45	1.00	Middles Gates	F	Roof	sandstone	3.12	Maxxam	B591266	November, 2015
NJ8515	662624	DH-01	974.45	975.45	1.00	Middles Gates	F	Roof	sandstone	3.18	Maxxam	B591266	November, 2015
NJ8516	662625	DH-01	973.55	974.45	0.90	Middles Gates	F	Roof	sandstone with coal	3.44	Maxxam	B591266	November, 2015
NJ8517	662626	DH-01	972.55	973.55	1.00	Middles Gates	F	Roof	sandstone, minor coal, minor conglomerate	2.85	Maxxam	B591266	November, 2015
NJ8518	662627	DH-01	971.55	972.55	1.00	Middles Gates	F	Roof	sandstone, minor coal, minor conglomerate	3.49	Maxxam	B591266	November, 2015
NJ8519	662628	DH-01	970.65	971.55	0.90	Middles Gates	F	Roof	mixed sandstone, coal, conglomerate	3.14	Maxxam	B591266	November, 2015
NJ8520	662629	DH-01	969.82	970.65	0.83	Middles Gates	F	Roof	sandstone with coal	3.93	Maxxam	B591266	November, 2015
NJ8521	662630	DH-01	969.00	969.82	0.82	Middles Gates	F	Roof	mixed coaly sandstone and conglomerate	3.14	Maxxam	B591266	November, 2015
NJ8522	662631	DH-01	968.00	969.00	1.00	Middles Gates	F	Roof	sandstone with coal	3.85	Maxxam	B591266	November, 2015
NJ8523	662632	DH-01	967.06	968.00	0.94	Middles Gates	F	Roof	sandstone	2.87	Maxxam	B591266	November, 2015
NJ8524	662633	DH-01	966.06	967.06	1.00	Middles Gates	F	Roof	sandstone with minor coal	3.36	Maxxam	B591266	November, 2015
NJ8525	662634	DH-01	965.06	966.06	1.00	Middles Gates	F	Roof	sandstone mixed with coal	3.51	Maxxam	B591266	November, 2015
NJ8526	662635	DH-01	964.32	965.06	0.74	Middles Gates	F	Roof	sandstone, coal, mudstone	3.95	Maxxam	B591266	November, 2015
NJ8527	662636	DH-01	961.57	964.32	2.75	Middles Gates	F	Roof	sandstone, minor coal	2.74	Maxxam	B591266	November, 2015
NJ8528	662637	DH-01	962.32	963.32	1.00	Middles Gates	F	Roof	sandstone, minor coal, conglomerate	2.83	Maxxam	B591266	November, 2015
NJ8529	662638	DH-01	961.57	962.32	0.75	Middles Gates	F	Roof	mixed sandstone, coal, conglomerate	3.09	Maxxam	B591266	November, 2015
NJ8530	662639	DH-01	960.57	961.57	1.00	Middles Gates	F	Roof	conglomerate with coal	3.17	Maxxam	B591266	November, 2015
NJ8531	662640	DH-01	959.57	960.57	1.00	Middles Gates	F	Roof	conglomerate mixed with sandstone and coal	3.60	Maxxam	B591266	November, 2015
NJ8532	662641	DH-01	958.85	959.57	0.72	Middles Gates	F	Roof	conglomerate mixed with sandstone and coal	3.25	Maxxam	B591266	November, 2015
NJ8533	662642	DH-01	926.43	926.85	0.42	Middle Gates	D	Raw Coal	Coal	3.12	Maxxam	B591266	November, 2015
NJ8534	662643	DH-01	925.11	926.00	0.89	Middles Gates	D	Roof	Mudstone	3.79	Maxxam	B591266	November, 2015
NJ8535	662644	DH-01	924.11	925.11	1.00	Middles Gates	D	Roof	Mudstone with conglomerate	4.10	Maxxam	B591266	November, 2015
NJ8536	662645	DH-01	923.11	924.11	1.00	Middles Gates	D	Roof	Mudstone and sandstone	3.06	Maxxam	B591266	November, 2015
NJ8537	662646	DH-01	7.40	8.00	0.60	Overburden		till	sand/gravel/cobbles	3.48	Maxxam	B591266	November, 2015
NJ8538	662647	DH-01	7.40	8.00	0.60	Hasler		Upper Hasler	Mudstone	2.88	Maxxam	B591266	November, 2015
NJ8539	662648	DH-01	22.00	33.00	11.00	Hasler		Upper Hasler	Mudstone	2.58	Maxxam	B591266	November, 2015
NJ8540	662649	DH-01	574.11	575.00	0.89	Hasler		Lower Hasler	Mudstone	2.65	Maxxam	B591266	November, 2015
NJ8541	662650	DH-01	373.00	374.00	1.00	Hasler		Middle Hasler	Mudstone	3.25	Maxxam	B591266	November, 2015

SAMPLE_ID	STATION	PASTE pH	S_TOTAL	Sulphate S (HCl extraction)	Sulphide Sulphur (HNO3 extraction)	Modified NP	Standard Sobek NP	Siderite Corrected NP	C_TOTAL	C_INORG	C_ORGANIC	FIZZ
		pH Unit	%	%	%	kg CaCO3 / t	kg CaCO3 / t	kg CaCO3 / t	%	%	%	
NJ8492	662601	9.72	0.15	0.01	0.04	3.8	10	n.a.	16.02	0.09	4.45	1
NJ8493	662602	9.77	0.18	0.01	0.02	8.0	9	n.a.	30.56	0.09	5.36	1
NJ8494	662603	9.64	0.21	0.01	0.01	9.8	13	n.a.	57.66	0.14	5.70	1
NJ8495	662604	9.71	0.35	0.01	0.01	10.0	11	n.a.	64.86	0.11	9.05	1
NJ8496	662605	9.27	0.48	0.01	0.27	7.8	15	n.a.	14.48	0.07	3.10	1
NJ8497	662606	9.55	0.06	0.01	0.02	129.0	161	n.a.	4.52	2.10	0.68	3
NJ8498	662607	9.64	0.06	0.01	0.02	198.0	239	n.a.	4.49	2.92	0.67	3
NJ8499	662608	9.58	0.05	0.01	0.01	176.0	230	n.a.	4.89	2.87	0.66	3
NJ8500	662609	9.61	0.07	0.01	0.02	298.0	324	n.a.	5.91	4.12	0.67	4
NJ8501	662610	9.69	0.06	0.01	0.02	298.0	266	n.a.	4.97	3.34	0.60	3
NJ8502	662611	9.57	0.06	0.01	0.01	212.0	244	n.a.	4.67	2.99	0.69	3
NJ8503	662612	9.42	0.45	0.01	0.29	101.0	126	n.a.	7.99	1.38	1.89	3
NJ8504	662613	9.40	0.07	0.01	0.02	102.0	148	n.a.	4.73	1.63	0.85	3
NJ8505	662614	9.32	0.07	0.01	0.02	13.3	28	n.a.	3.74	0.55	0.86	1
NJ8506	662615	9.65	0.05	0.01	0.01	154.0	179	n.a.	3.50	2.29	0.53	3
NJ8507	662616	9.59	0.05	0.01	0.01	155.0	166	n.a.	3.12	2.06	0.49	3
NJ8508	662617	9.61	0.04	0.01	0.01	152.0	166	n.a.	2.52	2.03	0.25	4
NJ8509	662618	9.55	0.05	0.01	0.01	128.0	149	n.a.	2.36	1.84	0.26	4
NJ8510	662619	9.71	0.08	0.01	0.02	97.3	106	n.a.	1.82	1.25	0.25	3
NJ8511	662620	9.66	0.10	0.01	0.04	87.5	91	n.a.	2.28	1.08	0.52	3
NJ8512	662621	8.28	0.26	0.01	0.13	30.8	34	n.a.	2.03	0.41	0.57	2
NJ8513	662622	8.40	0.24	0.01	0.12	52.8	58	n.a.	1.48	0.69	0.28	2
NJ8514	662623	8.31	0.38	0.01	0.21	51.0	58	n.a.	1.10	0.62	0.18	2
NJ8515	662624	8.54	0.30	0.01	0.16	90.8	91	n.a.	1.54	1.10	0.19	2
NJ8516	662625	8.34	0.63	0.01	0.42	161.0	164	n.a.	4.02	1.98	0.87	3
NJ8517	662626	8.62	0.11	0.01	0.07	94.5	105	n.a.	1.76	1.11	0.31	3
NJ8518	662627	9.65	0.12	0.01	0.06	93.8	99	n.a.	2.83	1.17	0.62	3
NJ8519	662628	9.70	0.14	0.01	0.06	91.3	95	n.a.	3.58	1.10	1.25	3
NJ8520	662629	9.71	0.08	0.01	0.03	100.0	109	n.a.	3.19	1.22	0.81	3
NJ8521	662630	9.11	0.20	0.01	0.08	29.5	31	n.a.	3.81	0.37	1.38	2
NJ8522	662631	9.37	0.22	0.01	0.09	36.5	41	n.a.	2.17	0.46	0.60	2
NJ8523	662632	8.05	0.34	0.01	0.18	41.8	43	n.a.	0.99	0.50	0.12	2
NJ8524	662633	7.44	0.68	0.02	0.45	30.3	33	n.a.	1.02	0.41	0.18	2
NJ8525	662634	9.30	0.14	0.01	0.09	85.8	86	n.a.	3.02	1.83	0.46	2
NJ8526	662635	8.79	0.07	0.01	0.03	68.3	322	n.a.	5.25	4.27	0.61	3
NJ8527	662636	8.17	0.13	0.01	0.06	110.0	114	n.a.	2.01	1.36	0.29	3
NJ8528	662637	9.57	0.18	0.01	0.07	62.0	70	n.a.	2.24	0.78	0.55	3
NJ8529	662638	9.38	0.38	0.01	0.19	115.0	116	n.a.	3.81	1.42	0.92	3
NJ8530	662639	9.67	0.18	0.01	0.08	96.8	104	n.a.	3.44	1.19	0.88	3
NJ8531	662640	9.62	0.17	0.01	0.06	86.8	91	n.a.	3.22	1.10	0.82	3
NJ8532	662641	9.09	0.10	0.01	0.07	63.3	65	n.a.	1.57	0.81	0.28	3
NJ8533	662642	9.38	0.82	0.01	0.58	4.3	11	n.a.	12.06	0.01	2.54	1
NJ8534	662643	9.36	0.69	0.01	0.50	11.5	17	n.a.	8.74	0.14	1.98	1
NJ8535	662644	8.92	2.53	0.01	1.57	20.8	25	n.a.	2.97	0.24	0.80	2
NJ8536	662645	9.28	0.62	0.01	0.42	17.5	21	n.a.	1.14	0.24	0.30	2
NJ8537	662646	8.62	0.11	0.01	0.07	128.0	131	n.a.	2.24	1.57	0.32	4
NJ8538	662647	6.38	1.85	0.03	1.25	6.8	13	n.a.	1.53	0.06	0.48	1
NJ8539	662648	7.56	2.11	0.02	1.46	9.3	14	n.a.	1.65	0.11	0.45	1
NJ8540	662649	9.53	1.18	0.01	0.84	6.0	11	n.a.	1.73	0.03	0.46	1
NJ8541	662650	9.78	0.45	0.01	0.36	14.0	25	n.a.	1.99	0.50	0.46	1

SAMPLE_ID	STATION	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li	Mg
		ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	%
NJ8492	662601	195	0.32	1.8	0.1	10	421	n.a.	0.21	0.06	0.76	n.a.	3.8	20.5	n.a.	23.3	0.56	0.8	n.a.	n.a.	42	n.a.	0.12	4.2	n.a.	0.19
NJ8493	662602	238	0.19	2.3	0.1	10	1010	n.a.	0.24	0.17	0.81	n.a.	5.8	6.1	n.a.	33.1	0.17	0.4	n.a.	n.a.	75	n.a.	0.12	1.5	n.a.	0.07
NJ8494	662603	77	0.21	0.2	0.1	10	826	n.a.	0.43	0.42	0.05	n.a.	0.3	2.3	n.a.	10.8	0.14	0.5	n.a.	n.a.	15	n.a.	0.01	10.2	n.a.	0.06
NJ8495	662604	83	0.13	1	0.1	10	383	n.a.	0.56	0.31	0.29	n.a.	1.2	3.7	n.a.	13.1	0.11	0.5	n.a.	n.a.	160	n.a.	0.03	6.3	n.a.	0.06
NJ8496	662605	343	0.5	12.5	0.1	10	567	n.a.	0.25	0.24	2.12	n.a.	14.6	9.6	n.a.	42.7	0.72	1.4	n.a.	n.a.	262	n.a.	0.19	2	n.a.	0.22
NJ8497	662606	337	0.43	1.4	0.1	10	443	n.a.	0.18	3.07	1.59	n.a.	9.4	22.9	n.a.	31.8	3.02	1.4	n.a.	n.a.	51	n.a.	0.17	4.7	n.a.	1.49
NJ8498	662607	254	0.32	2.3	0.1	10	345	n.a.	0.1	6.29	1.01	n.a.	7.8	33.3	n.a.	19.3	2.38	0.9	n.a.	n.a.	45	n.a.	0.13	5.2	n.a.	1.61
NJ8499	662608	349	0.37	1.4	0.1	10	431	n.a.	0.16	6.06	1.41	n.a.	13.8	21.6	n.a.	30.5	2.74	1.2	n.a.	n.a.	44	n.a.	0.15	5.2	n.a.	1.45
NJ8500	662609	242	0.26	2.4	0.5	10	881	n.a.	0.09	9.6	0.91	n.a.	7.8	24	n.a.	18.2	2.56	0.9	n.a.	n.a.	32	n.a.	0.11	4.4	n.a.	1.9
NJ8501	662610	245	0.33	2.4	0.5	10	357	n.a.	0.11	7.74	1.18	n.a.	7	26.6	n.a.	19.5	2.41	1	n.a.	n.a.	31	n.a.	0.13	5.3	n.a.	1.58
NJ8502	662611	273	0.36	2.5	0.1	10	370	n.a.	0.11	6.82	1.23	n.a.	8.3	28.5	n.a.	22.3	2.41	1.1	n.a.	n.a.	41	n.a.	0.13	5.4	n.a.	1.52
NJ8503	662612	385	0.47	45.2	0.1	10	459	n.a.	0.24	2.73	1.64	n.a.	10.3	12.4	n.a.	35.7	1.66	1.4	n.a.	n.a.	201	n.a.	0.18	3.2	n.a.	0.97
NJ8504	662613	393	0.46	1.2	0.1	10	531	n.a.	0.24	2.91	1.74	n.a.	8.7	14.1	n.a.	38.2	2.6	1.4	n.a.	n.a.	53	n.a.	0.18	4.5	n.a.	0.81
NJ8505	662614	342	0.45	2.5	0.1	10	706	n.a.	0.22	0.43	2.25	n.a.	11.1	10.7	n.a.	23.3	2.36	1.4	n.a.	n.a.	57	n.a.	0.2	4.2	n.a.	0.18
NJ8506	662615	357	0.33	2	0.1	10	373	n.a.	0.13	4.29	1.26	n.a.	19.2	28.9	n.a.	22.9	2.52	0.9	n.a.	n.a.	30	n.a.	0.14	4.5	n.a.	1.48
NJ8507	662616	339	0.25	5.4	0.1	10	261	n.a.	0.1	4.13	0.93	n.a.	16.4	35.4	n.a.	18	1.38	0.7	n.a.	n.a.	51	n.a.	0.11	4	n.a.	1.52
NJ8508	662617	169	0.11	4	0.1	10	111	n.a.	0.03	4.32	0.27	n.a.	4.2	51.9	n.a.	6.9	1.34	0.3	n.a.	n.a.	31	n.a.	0.05	2.4	n.a.	1.23
NJ8509	662618	189	0.11	4	0.1	10	120	n.a.	0.03	3.66	0.32	n.a.	3.4	69.9	n.a.	7.77	1.48	0.4	n.a.	n.a.	35	n.a.	0.06	2.5	n.a.	1.13
NJ8510	662619	254	0.08	7.2	0.1	10	112	n.a.	0.03	2.51	0.32	n.a.	4.1	68	n.a.	7.64	0.93	0.2	n.a.	n.a.	44	n.a.	0.04	1.6	n.a.	0.8
NJ8511	662620	265	0.09	8.9	0.3	10	101	n.a.	0.03	2.06	0.44	n.a.	3.9	80.5	n.a.	9.08	0.65	0.3	n.a.	n.a.	58	n.a.	0.05	1.7	n.a.	0.8
NJ8512	662621	406	0.07	16.7	0.3	10	71.8	n.a.	0.04	0.75	0.4	n.a.	4.4	74.7	n.a.	11.9	0.67	0.4	n.a.	n.a.	76	n.a.	0.04	1.2	n.a.	0.3
NJ8513	662622	345	0.08	16.9	0.1	10	84.6	n.a.	0.04	1.26	0.31	n.a.	4	63.9	n.a.	8.17	0.78	0.3	n.a.	n.a.	73	n.a.	0.04	1.4	n.a.	0.57
NJ8514	662623	359	0.09	31.2	0.1	10	86.6	n.a.	0.04	1.2	0.29	n.a.	4.1	88.8	n.a.	9.12	0.71	0.3	n.a.	n.a.	64	n.a.	0.04	1.5	n.a.	0.52
NJ8515	662624	257	0.08	16.4	0.1	10	118	n.a.	0.03	2.13	0.28	n.a.	3.9	60.7	n.a.	8.06	0.74	0.3	n.a.	n.a.	74	n.a.	0.05	1.8	n.a.	0.89
NJ8516	662625	287	0.15	10.9	0.1	10	172	n.a.	0.07	4.03	0.55	n.a.	5.8	69.7	n.a.	11.9	1.09	0.4	n.a.	n.a.	131	n.a.	0.08	2.9	n.a.	1.57
NJ8517	662626	228	0.09	5.7	0.4	10	90.9	n.a.	0.05	2.48	0.34	n.a.	3.8	59.4	n.a.	8.32	0.51	0.3	n.a.	n.a.	47	n.a.	0.05	1.8	n.a.	0.79
NJ8518	662627	380	0.09	11.5	0.1	10	113	n.a.	0.06	2.28	0.6	n.a.	5.8	62.5	n.a.	11	0.67	0.3	n.a.	n.a.	72	n.a.	0.05	1.9	n.a.	0.85
NJ8519	662628	340	0.11	9.4	0.1	10	123	n.a.	0.05	2.17	0.67	n.a.	7	73.4	n.a.	11.1	0.6	0.4	n.a.	n.a.	70	n.a.	0.06	1.9	n.a.	0.87
NJ8520	662629	292	0.14	6.7	0.1	10	176	n.a.	0.07	2.37	0.78	n.a.	4.8	67.6	n.a.	14.4	0.59	0.5	n.a.	n.a.	45	n.a.	0.08	2.1	n.a.	0.96
NJ8521	662630	394	0.08	16.8	0.1	10	84	n.a.	0.05	0.76	0.52	n.a.	5.1	71.2	n.a.	10.5	0.46	0.3	n.a.	n.a.	69	n.a.	0.04	1.2	n.a.	0.24
NJ8522	662631	374	0.08	34.4	0.1	10	124	n.a.	0.04	0.95	0.54	n.a.	4.4	72.8	n.a.	9.28	0.54	0.3	n.a.	n.a.	66	n.a.	0.04	1.4	n.a.	0.33
NJ8523	662632	300	0.07	32.4	0.3	10	71.4	n.a.	0.04	1.04	0.35	n.a.	3.8	65.7	n.a.	8.15	0.6	0.2	n.a.	n.a.	69	n.a.	0.04	1.3	n.a.	0.36
NJ8524	662633	438	0.06	51.2	0.1	10	58	n.a.	0.05	0.86	0.39	n.a.	4.3	75.4	n.a.	11.5	0.96	0.2	n.a.	n.a.	116	n.a.	0.03	1	n.a.	0.26
NJ8525	662634	359	0.24	10.2	0.1	10	450	n.a.	0.17	2.24	1.08	n.a.	7.6	45.1	n.a.	25.1	4.23	0.8	n.a.	n.a.	69	n.a.	0.13	3.9	n.a.	0.94
NJ8526	662635	201	0.11	5.7	0.1	10	382	n.a.	0.05	2.25	0.26	n.a.	3.1	43.8	n.a.	7.92	15.8	0.5	n.a.	n.a.	44	n.a.	0.06	3.1	n.a.	0.73
NJ8527	662636	286	0.09	10.8	0.1	10	140	n.a.	0.04	2.71	0.44	n.a.	5.3	55.8	n.a.	9.26	0.71	0.3	n.a.	n.a.	77	n.a.	0.05	1.9	n.a.	1.01
NJ8528	662637	241	0.07	11.6	1.3	10	80.2	n.a.	0.05	1.59	0.47	n.a.	4.3	66.3	n.a.	8.83	0.49	0.2	n.a.	n.a.	79	n.a.	0.04	1.3	n.a.	0.56
NJ8529	662638	282	0.09	12.8	0.6	10	104	n.a.	0.05	2.83	0.49	n.a.	4.7	63.7	n.a.	9.05	0.84	0.3	n.a.	n.a.	82	n.a.	0.05	1.9	n.a.	1.03
NJ8530	662639	299	0.11	6.6	1.1	10	119	n.a.	0.06	2.34	0.55	n.a.	5.7	81.6	n.a.	12.2	0.65	0.4	n.a.	n.a.	60	n.a.	0.06	1.7	n.a.	0.9
NJ8531	662640	331	0.09	7.6	0.6	10	96.2	n.a.	0.05	2.08	0.7	n.a.	5.2	61.1	n.a.	10.7	0.66	0.4	n.a.	n.a.	66	n.a.	0.05	1.7	n.a.	0.82
NJ8532	662641	345	0.07	6.6	0.1	10	57.3	n.a.	0.04	1.53	0.36	n.a.	4.7	67.9	n.a.	8.66	0.69	0.3	n.a.	n.a.	52	n.a.	0.04	1.3	n.a.	0.59
NJ8533	662642	379	0.72	17.7	0.1	10	421	n.a.	0.29	0.13	1.88	n.a.	11.6	14.8	n.a.	44	1.29	2.1	n.a.	n.a.	357	n.a.	0.18	1.7	n.a.	0.31
NJ8534	662643	367	0.64	36.7	0.9	10	421	n.a.	0.27	0.31	1.66	n.a.	14.3	14.8	n.a.	36.5	1.33	1.9	n.a.	n.a.	299	n.a.	0.15	2.1	n.a.	0.37
NJ8535	662644	344	0.39	27.4	0.2	10	234	n.a.	0.19	0.52	1.1	n.a.	12	39.7	n.a.	25.4	2.29	1.2	n.a.	n.a.	394	n.a.	0.13	2.1	n.a.	0.34
NJ8536	662645	291	0.27	18.9	0.1	10	299	n.a.	0.09	0.52	0.19	n.a.	4.6	44.2	n.a.	10.8	0.97	0.9	n.a.	n.a.	214	n.a.	0.1	3.5	n.a.	0.23
NJ8537	662646	196	0.16	6.6	0.5	10	111	n.a.	0.05	4.24	0.32	n.a.	4.6	71.5	n.a.	8.23	0.86	0.5	n.a.	n.a.	82	n.a.	0.06	2.3	n.a.	0.73
NJ8538	662647	481	0.53	8.3	0.1	10	200	n.a.	0.24	0.36	0.57	n.a.	7.4	20.6	n.a.	29.8	2.18	1.4	n.a.	n.a.	121	n.a.	0.16	2.7	n.a.	0.25
NJ8539	662648	477	0.55	10.3	0.7	10	178	n.a.	0.26	0.45	0.63	n.a.	7.9	19.3	n.a.	31.1	2.3	1.4	n.a.	n.a.	106	n.a.	0.18	2.7	n.a.	0.28
NJ8540	662649	408	0.6	7.2	0.1	10	425	n.a.	0.24	0.22	0.23	n.a.	5	20.9	n.a.	27.7	1.44	1.6	n.a.	n.a.	123	n.a.	0.19	2.5	n.a.	0.21
NJ8541	662650	351	0.73	7.7	0.1	10	750	n.a.	0.3	0.47	0.32	n.a.	8.3	20.2	n.a.	27.2	2.75	2	n.a.	n.a.	66	n.a.	0.18	3.6	n.a.	0.48

SAMPLE_ID	STATION	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn
		ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
NJ8492	662601	21	0.85	0.068	n.a.	12.7	0.003	12.3	n.a.	n.a.	0.04	0.24	1.2	1	n.a.	30.2	n.a.	0.04	1.5	0.0005	0.02	0.5	6	0.05	n.a.	66.7
NJ8493	662602	4	1.44	0.09	n.a.	21.3	0.003	14.7	n.a.	n.a.	0.05	0.45	1.2	2.6	n.a.	127	n.a.	0.06	0.7	0.0005	0.01	0.7	7	0.05	n.a.	26
NJ8494	662603	5	0.76	0.035	n.a.	0.8	0.037	12.8	n.a.	n.a.	0.01	0.08	1	1	n.a.	146	n.a.	0.08	8.1	0.001	0.01	1	5	0.05	n.a.	2.2
NJ8495	662604	6	1.12	0.026	n.a.	5.6	0.012	16.1	n.a.	n.a.	0.05	0.24	1.5	2.9	n.a.	51.2	n.a.	0.04	2.9	0.0005	0.01	1.7	4	0.05	n.a.	36.6
NJ8496	662605	18	4.53	0.081	n.a.	70.9	0.048	19.7	n.a.	n.a.	0.36	2.43	2.7	7.1	n.a.	54.2	n.a.	0.11	2.9	0.001	0.12	1.6	27	0.05	n.a.	232
NJ8497	662606	525	1.73	0.062	n.a.	31.5	0.084	15	n.a.	n.a.	0.04	0.51	7.3	1.4	n.a.	58.1	n.a.	0.04	4.3	0.001	0.07	0.8	28	0.05	n.a.	141
NJ8498	662607	463	1.9	0.042	n.a.	27.5	0.09	9.26	n.a.	n.a.	0.04	0.55	4.8	0.8	n.a.	88	n.a.	0.04	3.8	0.0005	0.05	0.7	21	0.05	n.a.	84.6
NJ8499	662608	570	2.24	0.054	n.a.	55	0.09	14.1	n.a.	n.a.	0.03	0.54	6.4	1.2	n.a.	98.8	n.a.	0.05	4.4	0.0005	0.06	0.7	24	0.05	n.a.	121
NJ8500	662609	491	1.39	0.039	n.a.	25.4	0.08	8.16	n.a.	n.a.	0.06	0.7	4.2	0.8	n.a.	130	n.a.	0.03	3	0.0005	0.05	0.6	21	0.05	n.a.	78.1
NJ8501	662610	471	1.37	0.043	n.a.	21.7	0.082	9.46	n.a.	n.a.	0.05	0.43	4.9	1.1	n.a.	102	n.a.	0.04	3.7	0.0005	0.05	0.6	21	0.05	n.a.	88.3
NJ8502	662611	517	1.48	0.045	n.a.	27.5	0.088	10.9	n.a.	n.a.	0.05	0.43	5.2	1	n.a.	108	n.a.	0.04	3.5	0.001	0.06	0.7	21	0.05	n.a.	101
NJ8503	662612	287	3.04	0.081	n.a.	43.6	0.062	19.3	n.a.	n.a.	0.36	1.75	5.2	3.4	n.a.	76.3	n.a.	0.09	3.4	0.001	0.26	1	28	0.05	n.a.	140
NJ8504	662613	670	1.44	0.08	n.a.	38.8	0.087	18.8	n.a.	n.a.	0.04	0.51	6.1	2.2	n.a.	86.9	n.a.	0.07	4.1	0.001	0.07	0.8	30	0.05	n.a.	159
NJ8505	662614	614	1.44	0.102	n.a.	38.9	0.068	15.2	n.a.	n.a.	0.05	0.41	4.4	1.8	n.a.	76.9	n.a.	0.06	4	0.0005	0.07	0.8	22	0.05	n.a.	231
NJ8506	662615	499	2.37	0.053	n.a.	54.9	0.089	12.2	n.a.	n.a.	0.04	0.3	4.6	0.8	n.a.	70.5	n.a.	0.04	3.5	0.0005	0.07	0.7	19	0.05	n.a.	108
NJ8507	662616	357	3.49	0.04	n.a.	49.8	0.084	10.9	n.a.	n.a.	0.05	0.51	3.9	0.8	n.a.	55.6	n.a.	0.07	3	0.0005	0.08	0.6	15	0.05	n.a.	82.2
NJ8508	662617	396	1.31	0.019	n.a.	17.3	0.076	3.94	n.a.	n.a.	0.04	0.3	2.1	0.2	n.a.	52.1	n.a.	0.01	1.4	0.0005	0.04	0.5	11	0.05	n.a.	32.2
NJ8509	662618	361	0.71	0.02	n.a.	11	0.07	3.86	n.a.	n.a.	0.04	0.3	3.4	0.3	n.a.	47.6	n.a.	0.01	1.4	0.0005	0.04	0.5	14	0.05	n.a.	37.2
NJ8510	662619	240	0.76	0.02	n.a.	16.1	0.052	4.99	n.a.	n.a.	0.07	0.47	1.7	0.3	n.a.	33.9	n.a.	0.03	1.1	0.0005	0.07	0.4	9	0.05	n.a.	31.5
NJ8511	662620	162	1.08	0.019	n.a.	18.3	0.053	5.01	n.a.	n.a.	0.08	0.63	2	0.3	n.a.	28.6	n.a.	0.03	1.2	0.0005	0.07	0.4	12	0.05	n.a.	36.4
NJ8512	662621	113	1.93	0.018	n.a.	20.6	0.049	6.32	n.a.	n.a.	0.21	0.99	2	0.3	n.a.	14.1	n.a.	0.03	0.8	0.0005	0.12	0.4	16	0.05	n.a.	36.2
NJ8513	662622	142	2.44	0.018	n.a.	15.3	0.062	5.81	n.a.	n.a.	0.2	0.8	1.9	0.3	n.a.	17.2	n.a.	0.02	0.9	0.0005	0.08	0.4	14	0.05	n.a.	35.3
NJ8514	662623	123	3.81	0.017	n.a.	18.3	0.054	6.29	n.a.	n.a.	0.3	0.84	1.6	0.5	n.a.	17.7	n.a.	0.02	0.9	0.0005	0.11	0.5	12	0.05	n.a.	34.7
NJ8515	662624	135	3.17	0.019	n.a.	16.4	0.056	5.22	n.a.	n.a.	0.26	0.8	1.5	0.5	n.a.	25.5	n.a.	0.01	1.1	0.0005	0.09	0.5	11	0.05	n.a.	36.5
NJ8516	662625	173	1.95	0.025	n.a.	25.5	0.072	8.67	n.a.	n.a.	0.54	0.9	2.2	0.7	n.a.	41.2	n.a.	0.01	2.4	0.0005	0.1	0.5	15	0.05	n.a.	53.8
NJ8517	662626	119	0.58	0.018	n.a.	13.6	0.062	5.14	n.a.	n.a.	0.1	0.38	1.5	0.4	n.a.	35.1	n.a.	0.03	1.4	0.0005	0.07	0.5	9	0.05	n.a.	32.6
NJ8518	662627	147	1.2	0.022	n.a.	21.1	0.062	8.73	n.a.	n.a.	0.1	0.6	2.3	0.6	n.a.	32.3	n.a.	0.03	1.7	0.0005	0.07	0.5	13	0.05	n.a.	48.2
NJ8519	662628	130	1.38	0.023	n.a.	21.3	0.057	8.3	n.a.	n.a.	0.11	0.56	2.3	0.6	n.a.	30.3	n.a.	0.03	1.8	0.0005	0.07	0.5	23	0.05	n.a.	56.1
NJ8520	662629	146	0.91	0.031	n.a.	12.9	0.06	5.13	n.a.	n.a.	0.06	0.31	2.6	0.3	n.a.	35	n.a.	0.05	2	0.0005	0.05	0.5	20	0.05	n.a.	59
NJ8521	662630	83	1.28	0.017	n.a.	19.8	0.053	7.56	n.a.	n.a.	0.13	0.74	1.6	0.3	n.a.	15.8	n.a.	0.01	0.9	0.0005	0.09	0.4	14	0.05	n.a.	42.3
NJ8522	662631	96	2.17	0.017	n.a.	17.5	0.067	7.46	n.a.	n.a.	0.18	0.88	1.7	0.2	n.a.	16.4	n.a.	0.01	1	0.0005	0.1	0.5	19	0.05	n.a.	42.8
NJ8523	662632	95	3.42	0.016	n.a.	14.1	0.056	6.52	n.a.	n.a.	0.3	0.84	1.6	0.3	n.a.	16.7	n.a.	0.01	1	0.0005	0.12	0.6	11	0.05	n.a.	30.1
NJ8524	662633	103	6.36	0.017	n.a.	23.9	0.041	10.2	n.a.	n.a.	0.6	1.5	1.4	0.6	n.a.	14.6	n.a.	0.03	0.8	0.0005	0.27	0.7	12	0.05	n.a.	35.6
NJ8525	662634	517	2.02	0.055	n.a.	18.6	0.094	8.11	n.a.	n.a.	0.11	0.31	6.7	0.7	n.a.	55.5	n.a.	0.04	3.7	0.0005	0.07	0.9	26	0.05	n.a.	110
NJ8526	662635	1790	0.87	0.024	n.a.	12.3	0.107	5.48	n.a.	n.a.	0.05	0.38	3.4	0.2	n.a.	32.1	n.a.	0.01	1.3	0.001	0.04	0.5	20	0.05	n.a.	37.7
NJ8527	662636	172	1.47	0.021	n.a.	21.8	0.058	8	n.a.	n.a.	0.11	0.74	1.8	0.4	n.a.	34.4	n.a.	0.03	1.6	0.0005	0.09	0.5	12	0.05	n.a.	47.4
NJ8528	662637	101	1.25	0.017	n.a.	21.4	0.046	6.01	n.a.	n.a.	0.12	0.83	1.4	0.7	n.a.	23.1	n.a.	0.01	1	0.0005	0.13	0.4	12	0.05	n.a.	42.2
NJ8529	662638	161	2.69	0.02	n.a.	24.7	0.054	7.02	n.a.	n.a.	0.3	1.01	1.9	0.6	n.a.	33.8	n.a.	0.01	1.4	0.0005	0.16	0.4	15	0.05	n.a.	38.6
NJ8530	662639	144	1.19	0.024	n.a.	20.3	0.051	6.43	n.a.	n.a.	0.13	0.66	2.3	0.6	n.a.	33.1	n.a.	0.03	1.6	0.0005	0.08	0.5	19	0.05	n.a.	42.3
NJ8531	662640	145	1.1	0.021	n.a.	21.5	0.049	7.58	n.a.	n.a.	0.11	0.89	2	0.7	n.a.	28.7	n.a.	0.01	1.3	0.0005	0.1	0.6	16	0.05	n.a.	40.6
NJ8532	662641	150	0.96	0.017	n.a.	20.1	0.049	6.91	n.a.	n.a.	0.08	0.8	1.5	0.5	n.a.	20.3	n.a.	0.01	0.8	0.0005	0.09	0.4	13	0.05	n.a.	30.8
NJ8533	662642	26	3.53	0.091	n.a.	56.7	0.034	20.7	n.a.	n.a.	0.64	1.46	3.2	6.4	n.a.	66.4	n.a.	0.08	2.4	0.002	0.15	1.5	28	0.05	n.a.	146
NJ8534	662643	47	2.61	0.104	n.a.	67.4	0.034	24	n.a.	n.a.	0.57	1.97	3.3	2.9	n.a.	82.4	n.a.	0.02	2.6	0.001	0.23	0.9	18	0.05	n.a.	178
NJ8535	662644	64	2.43	0.079	n.a.	45.3	0.034	16.2	n.a.	n.a.	2.05	1.16	3.2	1.5	n.a.	68	n.a.	0.05	2.5	0.0005	0.3	0.7	11	0.05	n.a.	116
NJ8536	662645	61	1.16	0.059	n.a.	19.7	0.082	11.7	n.a.	n.a.	0.48	0.58	2.7	0.7	n.a.	62.1	n.a.	0.02	4.8	0.001	0.15	0.8	11	0.05	n.a.	60.2
NJ8537	662646	203	1.23	0.004	n.a.	20.3	0.05	6.97	n.a.	n.a.	0.09	0.52	1.9	0.4	n.a.	58.7	n.a.	0.01	1.5	0.0005	0.09	0.5	9	0.5	n.a.	34.1
NJ8538	662647	118	1.59	0.01	n.a.	31.5	0.073	15.6	n.a.	n.a.	1.72	0.4	3.6	1.5	n.a.	23.3	n.a.	0.06	4.7	0.0005	0.13	1.2	14	0.05	n.a.	118
NJ8539	662648	144	2.18	0.008	n.a.	32.4	0.06	16.9	n.a.	n.a.	1.98	0.44	3.6	1.2	n.a.	30.9	n.a.	0.06	4.6	0.0005	0.15	1.2	15	0.05	n.a.	138
NJ8540	662649	47	1.41	0.115	n.a.	21.5	0.075	15.3	n.a.	n.a.	0.97	0.26	3	0.8	n.a.	46.3	n.a.	0.04	4.6	0.001	0.09	0.8	16	0.05	n.a.	80.7
NJ8541	662650	157	0.91	0.15	n.a.	25.1	0.097	13.4	n.a.	n.a.	0.37	0.36	4.1	1.3	n.a.	67	n.a.	0.05	5.5	0.001	0.07	1.3	19	0.05	n.a.	122

SAMPLE_ID	STATION	DRILLHOLE GOVT ID	FROM	TO	INTERVAL	FORMATION	COAL SEAM	DESCRIPTION	LITHOLOGY	WEIGHT kg	LAB	LAB_CERT	DATE
NJ8492	662601	DH-01	1002.29	1004.00	1.71	Middle Gates	F	Raw Coal	Coal	3.66	Maxxam	B591266	November, 2015
NJ8493	662602	DH-01	1001.00	1002.29	1.29	Middle Gates	F	Raw Coal	Coal	2.51	Maxxam	B591266	November, 2015
NJ8494	662603	DH-01	999.55	1001.00	1.45	Middle Gates	F	Raw Coal	Coal	2.39	Maxxam	B591266	November, 2015
NJ8495	662604	DH-01	998.00	999.55	1.55	Middle Gates	F	Raw Coal	Coal	2.16	Maxxam	B591266	November, 2015
NJ8496	662605	DH-01	996.50	998.00	1.50	Middle Gates	F	Parting	Coal	3.33	Maxxam	B591266	November, 2015
NJ8497	662606	DH-01	995.15	996.50	1.35	Middle Gates	F	Parting	Coal	3.36	Maxxam	B591266	November, 2015
NJ8498	662607	DH-01	993.80	995.15	1.35	Middle Gates	F	Parting	Coal	3.86	Maxxam	B591266	November, 2015
NJ8499	662608	DH-01	992.29	993.80	1.51	Middle Gates	F	Parting	Coal	3.78	Maxxam	B591266	November, 2015
NJ8500	662609	DH-01	991.07	992.29	1.22	Middle Gates	F	Parting	Coal	4.56	Maxxam	B591266	November, 2015
NJ8501	662610	DH-01	989.57	991.07	1.50	Middle Gates	F	Parting	Coal	3.97	Maxxam	B591266	November, 2015
NJ8502	662611	DH-01	988.40	989.57	1.17	Middle Gates	F	Parting	Coal	4.41	Maxxam	B591266	November, 2015
NJ8503	662612	DH-01	986.90	988.40	1.50	Middle Gates	F	coal/parting	Coal	4.03	Maxxam	B591266	November, 2015
NJ8504	662613	DH-01	985.44	986.90	1.46	Middle Gates	F	coal/parting	Coal	3.86	Maxxam	B591266	November, 2015
NJ8505	662614	DH-01	983.94	985.44	1.50	Middles Gates	F	Roof	Carbonaceous Mudstone	3.19	Maxxam	B591266	November, 2015
NJ8506	662615	DH-01	983.00	983.94	0.94	Middles Gates	F	Roof	Mudstone and sandstone	3.53	Maxxam	B591266	November, 2015
NJ8507	662616	DH-01	982.00	983.00	1.00	Middles Gates	F	Roof	mudstone, siltstone, sandstone, conglomerate	3.06	Maxxam	B591266	November, 2015
NJ8508	662617	DH-01	981.20	982.00	0.80	Middles Gates	F	Roof	sandstone, conglomerate	3.10	Maxxam	B591266	November, 2015
NJ8509	662618	DH-01	980.20	981.20	1.00	Middles Gates	F	Roof	sandstone, conglomerate	3.48	Maxxam	B591266	November, 2015
NJ8510	662619	DH-01	979.10	980.20	1.10	Middles Gates	F	Roof	conglomerate	2.66	Maxxam	B591266	November, 2015
NJ8511	662620	DH-01	978.35	979.10	0.75	Middles Gates	F	Roof	conglomerate, sandstone	3.27	Maxxam	B591266	November, 2015
NJ8512	662621	DH-01	977.35	978.35	1.00	Middles Gates	F	Roof	sandstone, coaly mudstone, conglomerate	3.03	Maxxam	B591266	November, 2015
NJ8513	662622	DH-01	976.45	977.35	0.90	Middles Gates	F	Roof	sandstone	3.19	Maxxam	B591266	November, 2015
NJ8514	662623	DH-01	975.45	976.45	1.00	Middles Gates	F	Roof	sandstone	3.12	Maxxam	B591266	November, 2015
NJ8515	662624	DH-01	974.45	975.45	1.00	Middles Gates	F	Roof	sandstone	3.18	Maxxam	B591266	November, 2015
NJ8516	662625	DH-01	973.55	974.45	0.90	Middles Gates	F	Roof	sandstone with coal	3.44	Maxxam	B591266	November, 2015
NJ8517	662626	DH-01	972.55	973.55	1.00	Middles Gates	F	Roof	sandstone, minor coal, minor conglomerate	2.85	Maxxam	B591266	November, 2015
NJ8518	662627	DH-01	971.55	972.55	1.00	Middles Gates	F	Roof	sandstone, minor coal, minor conglomerate	3.49	Maxxam	B591266	November, 2015
NJ8519	662628	DH-01	970.65	971.55	0.90	Middles Gates	F	Roof	mixed sandstone, coal, conglomerate	3.14	Maxxam	B591266	November, 2015
NJ8520	662629	DH-01	969.82	970.65	0.83	Middles Gates	F	Roof	sandstone with coal	3.93	Maxxam	B591266	November, 2015
NJ8521	662630	DH-01	969.00	969.82	0.82	Middles Gates	F	Roof	mixed coaly sandstone and conglomerate	3.14	Maxxam	B591266	November, 2015
NJ8522	662631	DH-01	968.00	969.00	1.00	Middles Gates	F	Roof	sandstone with coal	3.85	Maxxam	B591266	November, 2015
NJ8523	662632	DH-01	967.06	968.00	0.94	Middles Gates	F	Roof	sandstone	2.87	Maxxam	B591266	November, 2015
NJ8524	662633	DH-01	966.06	967.06	1.00	Middles Gates	F	Roof	sandstone with minor coal	3.36	Maxxam	B591266	November, 2015
NJ8525	662634	DH-01	965.06	966.06	1.00	Middles Gates	F	Roof	sandstone mixed with coal	3.51	Maxxam	B591266	November, 2015
NJ8526	662635	DH-01	964.32	965.06	0.74	Middles Gates	F	Roof	sandstone, coal, mudstone	3.95	Maxxam	B591266	November, 2015
NJ8527	662636	DH-01	961.57	964.32	2.75	Middles Gates	F	Roof	sandstone, minor coal	2.74	Maxxam	B591266	November, 2015
NJ8528	662637	DH-01	962.32	963.32	1.00	Middles Gates	F	Roof	sandstone, minor coal, conglomerate	2.83	Maxxam	B591266	November, 2015
NJ8529	662638	DH-01	961.57	962.32	0.75	Middles Gates	F	Roof	mixed sandstone, coal, conglomerate	3.09	Maxxam	B591266	November, 2015
NJ8530	662639	DH-01	960.57	961.57	1.00	Middles Gates	F	Roof	conglomerate with coal	3.17	Maxxam	B591266	November, 2015
NJ8531	662640	DH-01	959.57	960.57	1.00	Middles Gates	F	Roof	conglomerate mixed with sandstone and coal	3.60	Maxxam	B591266	November, 2015
NJ8532	662641	DH-01	958.85	959.57	0.72	Middles Gates	F	Roof	conglomerate mixed with sandstone and coal	3.25	Maxxam	B591266	November, 2015
NJ8533	662642	DH-01	926.43	926.85	0.42	Middle Gates	D	Raw Coal	Coal	3.12	Maxxam	B591266	November, 2015
NJ8534	662643	DH-01	925.11	926.00	0.89	Middles Gates	D	Roof	Mudstone	3.79	Maxxam	B591266	November, 2015
NJ8535	662644	DH-01	924.11	925.11	1.00	Middles Gates	D	Roof	Mudstone with conglomerate	4.10	Maxxam	B591266	November, 2015
NJ8536	662645	DH-01	923.11	924.11	1.00	Middles Gates	D	Roof	Mudstone and sandstone	3.06	Maxxam	B591266	November, 2015
NJ8537	662646	DH-01	7.40	8.00	0.60	Overburden		till	sand/gravel/cobbles	3.48	Maxxam	B591266	November, 2015
NJ8538	662647	DH-01	7.40	8.00	0.60	Hasler		Upper Hasler	Mudstone	2.88	Maxxam	B591266	November, 2015
NJ8539	662648	DH-01	22.00	33.00	11.00	Hasler		Upper Hasler	Mudstone	2.58	Maxxam	B591266	November, 2015
NJ8540	662649	DH-01	574.11	575.00	0.89	Hasler		Lower Hasler	Mudstone	2.65	Maxxam	B591266	November, 2015
NJ8541	662650	DH-01	373.00	374.00	1.00	Hasler		Middle Hasler	Mudstone	3.25	Maxxam	B591266	November, 2015

SAMPLE_ID	STATION	PASTE pH	S_TOTAL	Sulphate S (HCl extraction)	Sulphide Sulphur (HNO3 extraction)	Modified NP	Standard Sobek NP	Siderite Corrected NP	C_TOTAL	C_INORG	C_ORGANIC	FIZZ
		pH Unit	%	%	%	kg CaCO3 / t	kg CaCO3 / t	kg CaCO3 / t	%	%	%	
NJ8492	662601	9.72	0.15	0.01	0.04	3.8	10	n.a.	16.02	0.09	4.45	1
NJ8493	662602	9.77	0.18	0.01	0.02	8.0	9	n.a.	30.56	0.09	5.36	1
NJ8494	662603	9.64	0.21	0.01	0.01	9.8	13	n.a.	57.66	0.14	5.70	1
NJ8495	662604	9.71	0.35	0.01	0.01	10.0	11	n.a.	64.86	0.11	9.05	1
NJ8496	662605	9.27	0.48	0.01	0.27	7.8	15	n.a.	14.48	0.07	3.10	1
NJ8497	662606	9.55	0.06	0.01	0.02	129.0	161	n.a.	4.52	2.10	0.68	3
NJ8498	662607	9.64	0.06	0.01	0.02	198.0	239	n.a.	4.49	2.92	0.67	3
NJ8499	662608	9.58	0.05	0.01	0.01	176.0	230	n.a.	4.89	2.87	0.66	3
NJ8500	662609	9.61	0.07	0.01	0.02	298.0	324	n.a.	5.91	4.12	0.67	4
NJ8501	662610	9.69	0.06	0.01	0.02	298.0	266	n.a.	4.97	3.34	0.60	3
NJ8502	662611	9.57	0.06	0.01	0.01	212.0	244	n.a.	4.67	2.99	0.69	3
NJ8503	662612	9.42	0.45	0.01	0.29	101.0	126	n.a.	7.99	1.38	1.89	3
NJ8504	662613	9.40	0.07	0.01	0.02	102.0	148	n.a.	4.73	1.63	0.85	3
NJ8505	662614	9.32	0.07	0.01	0.02	13.3	28	n.a.	3.74	0.55	0.86	1
NJ8506	662615	9.65	0.05	0.01	0.01	154.0	179	n.a.	3.50	2.29	0.53	3
NJ8507	662616	9.59	0.05	0.01	0.01	155.0	166	n.a.	3.12	2.06	0.49	3
NJ8508	662617	9.61	0.04	0.01	0.01	152.0	166	n.a.	2.52	2.03	0.25	4
NJ8509	662618	9.55	0.05	0.01	0.01	128.0	149	n.a.	2.36	1.84	0.26	4
NJ8510	662619	9.71	0.08	0.01	0.02	97.3	106	n.a.	1.82	1.25	0.25	3
NJ8511	662620	9.66	0.10	0.01	0.04	87.5	91	n.a.	2.28	1.08	0.52	3
NJ8512	662621	8.28	0.26	0.01	0.13	30.8	34	n.a.	2.03	0.41	0.57	2
NJ8513	662622	8.40	0.24	0.01	0.12	52.8	58	n.a.	1.48	0.69	0.28	2
NJ8514	662623	8.31	0.38	0.01	0.21	51.0	58	n.a.	1.10	0.62	0.18	2
NJ8515	662624	8.54	0.30	0.01	0.16	90.8	91	n.a.	1.54	1.10	0.19	2
NJ8516	662625	8.34	0.63	0.01	0.42	161.0	164	n.a.	4.02	1.98	0.87	3
NJ8517	662626	8.62	0.11	0.01	0.07	94.5	105	n.a.	1.76	1.11	0.31	3
NJ8518	662627	9.65	0.12	0.01	0.06	93.8	99	n.a.	2.83	1.17	0.62	3
NJ8519	662628	9.70	0.14	0.01	0.06	91.3	95	n.a.	3.58	1.10	1.25	3
NJ8520	662629	9.71	0.08	0.01	0.03	100.0	109	n.a.	3.19	1.22	0.81	3
NJ8521	662630	9.11	0.20	0.01	0.08	29.5	31	n.a.	3.81	0.37	1.38	2
NJ8522	662631	9.37	0.22	0.01	0.09	36.5	41	n.a.	2.17	0.46	0.60	2
NJ8523	662632	8.05	0.34	0.01	0.18	41.8	43	n.a.	0.99	0.50	0.12	2
NJ8524	662633	7.44	0.68	0.02	0.45	30.3	33	n.a.	1.02	0.41	0.18	2
NJ8525	662634	9.30	0.14	0.01	0.09	85.8	86	n.a.	3.02	1.83	0.46	2
NJ8526	662635	8.79	0.07	0.01	0.03	68.3	322	n.a.	5.25	4.27	0.61	3
NJ8527	662636	8.17	0.13	0.01	0.06	110.0	114	n.a.	2.01	1.36	0.29	3
NJ8528	662637	9.57	0.18	0.01	0.07	62.0	70	n.a.	2.24	0.78	0.55	3
NJ8529	662638	9.38	0.38	0.01	0.19	115.0	116	n.a.	3.81	1.42	0.92	3
NJ8530	662639	9.67	0.18	0.01	0.08	96.8	104	n.a.	3.44	1.19	0.88	3
NJ8531	662640	9.62	0.17	0.01	0.06	86.8	91	n.a.	3.22	1.10	0.82	3
NJ8532	662641	9.09	0.10	0.01	0.07	63.3	65	n.a.	1.57	0.81	0.28	3
NJ8533	662642	9.38	0.82	0.01	0.58	4.3	11	n.a.	12.06	0.01	2.54	1
NJ8534	662643	9.36	0.69	0.01	0.50	11.5	17	n.a.	8.74	0.14	1.98	1
NJ8535	662644	8.92	2.53	0.01	1.57	20.8	25	n.a.	2.97	0.24	0.80	2
NJ8536	662645	9.28	0.62	0.01	0.42	17.5	21	n.a.	1.14	0.24	0.30	2
NJ8537	662646	8.62	0.11	0.01	0.07	128.0	131	n.a.	2.24	1.57	0.32	4
NJ8538	662647	6.38	1.85	0.03	1.25	6.8	13	n.a.	1.53	0.06	0.48	1
NJ8539	662648	7.56	2.11	0.02	1.46	9.3	14	n.a.	1.65	0.11	0.45	1
NJ8540	662649	9.53	1.18	0.01	0.84	6.0	11	n.a.	1.73	0.03	0.46	1
NJ8541	662650	9.78	0.45	0.01	0.36	14.0	25	n.a.	1.99	0.50	0.46	1

SAMPLE_ID	STATION	Ag	Al	As	Au	B	Ba	Be	Bi	Ca	Cd	Ce	Co	Cr	Cs	Cu	Fe	Ga	Ge	Hf	Hg	In	K	La	Li	Mg
		ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	%
NJ8492	662601	195	0.32	1.8	0.1	10	421	n.a.	0.21	0.06	0.76	n.a.	3.8	20.5	n.a.	23.3	0.56	0.8	n.a.	n.a.	42	n.a.	0.12	4.2	n.a.	0.19
NJ8493	662602	238	0.19	2.3	0.1	10	1010	n.a.	0.24	0.17	0.81	n.a.	5.8	6.1	n.a.	33.1	0.17	0.4	n.a.	n.a.	75	n.a.	0.12	1.5	n.a.	0.07
NJ8494	662603	77	0.21	0.2	0.1	10	826	n.a.	0.43	0.42	0.05	n.a.	0.3	2.3	n.a.	10.8	0.14	0.5	n.a.	n.a.	15	n.a.	0.01	10.2	n.a.	0.06
NJ8495	662604	83	0.13	1	0.1	10	383	n.a.	0.56	0.31	0.29	n.a.	1.2	3.7	n.a.	13.1	0.11	0.5	n.a.	n.a.	160	n.a.	0.03	6.3	n.a.	0.06
NJ8496	662605	343	0.5	12.5	0.1	10	567	n.a.	0.25	0.24	2.12	n.a.	14.6	9.6	n.a.	42.7	0.72	1.4	n.a.	n.a.	262	n.a.	0.19	2	n.a.	0.22
NJ8497	662606	337	0.43	1.4	0.1	10	443	n.a.	0.18	3.07	1.59	n.a.	9.4	22.9	n.a.	31.8	3.02	1.4	n.a.	n.a.	51	n.a.	0.17	4.7	n.a.	1.49
NJ8498	662607	254	0.32	2.3	0.1	10	345	n.a.	0.1	6.29	1.01	n.a.	7.8	33.3	n.a.	19.3	2.38	0.9	n.a.	n.a.	45	n.a.	0.13	5.2	n.a.	1.61
NJ8499	662608	349	0.37	1.4	0.1	10	431	n.a.	0.16	6.06	1.41	n.a.	13.8	21.6	n.a.	30.5	2.74	1.2	n.a.	n.a.	44	n.a.	0.15	5.2	n.a.	1.45
NJ8500	662609	242	0.26	2.4	0.5	10	881	n.a.	0.09	9.6	0.91	n.a.	7.8	24	n.a.	18.2	2.56	0.9	n.a.	n.a.	32	n.a.	0.11	4.4	n.a.	1.9
NJ8501	662610	245	0.33	2.4	0.5	10	357	n.a.	0.11	7.74	1.18	n.a.	7	26.6	n.a.	19.5	2.41	1	n.a.	n.a.	31	n.a.	0.13	5.3	n.a.	1.58
NJ8502	662611	273	0.36	2.5	0.1	10	370	n.a.	0.11	6.82	1.23	n.a.	8.3	28.5	n.a.	22.3	2.41	1.1	n.a.	n.a.	41	n.a.	0.13	5.4	n.a.	1.52
NJ8503	662612	385	0.47	45.2	0.1	10	459	n.a.	0.24	2.73	1.64	n.a.	10.3	12.4	n.a.	35.7	1.66	1.4	n.a.	n.a.	201	n.a.	0.18	3.2	n.a.	0.97
NJ8504	662613	393	0.46	1.2	0.1	10	531	n.a.	0.24	2.91	1.74	n.a.	8.7	14.1	n.a.	38.2	2.6	1.4	n.a.	n.a.	53	n.a.	0.18	4.5	n.a.	0.81
NJ8505	662614	342	0.45	2.5	0.1	10	706	n.a.	0.22	0.43	2.25	n.a.	11.1	10.7	n.a.	23.3	2.36	1.4	n.a.	n.a.	57	n.a.	0.2	4.2	n.a.	0.18
NJ8506	662615	357	0.33	2	0.1	10	373	n.a.	0.13	4.29	1.26	n.a.	19.2	28.9	n.a.	22.9	2.52	0.9	n.a.	n.a.	30	n.a.	0.14	4.5	n.a.	1.48
NJ8507	662616	339	0.25	5.4	0.1	10	261	n.a.	0.1	4.13	0.93	n.a.	16.4	35.4	n.a.	18	1.38	0.7	n.a.	n.a.	51	n.a.	0.11	4	n.a.	1.52
NJ8508	662617	169	0.11	4	0.1	10	111	n.a.	0.03	4.32	0.27	n.a.	4.2	51.9	n.a.	6.9	1.34	0.3	n.a.	n.a.	31	n.a.	0.05	2.4	n.a.	1.23
NJ8509	662618	189	0.11	4	0.1	10	120	n.a.	0.03	3.66	0.32	n.a.	3.4	69.9	n.a.	7.77	1.48	0.4	n.a.	n.a.	35	n.a.	0.06	2.5	n.a.	1.13
NJ8510	662619	254	0.08	7.2	0.1	10	112	n.a.	0.03	2.51	0.32	n.a.	4.1	68	n.a.	7.64	0.93	0.2	n.a.	n.a.	44	n.a.	0.04	1.6	n.a.	0.8
NJ8511	662620	265	0.09	8.9	0.3	10	101	n.a.	0.03	2.06	0.44	n.a.	3.9	80.5	n.a.	9.08	0.65	0.3	n.a.	n.a.	58	n.a.	0.05	1.7	n.a.	0.8
NJ8512	662621	406	0.07	16.7	0.3	10	71.8	n.a.	0.04	0.75	0.4	n.a.	4.4	74.7	n.a.	11.9	0.67	0.4	n.a.	n.a.	76	n.a.	0.04	1.2	n.a.	0.3
NJ8513	662622	345	0.08	16.9	0.1	10	84.6	n.a.	0.04	1.26	0.31	n.a.	4	63.9	n.a.	8.17	0.78	0.3	n.a.	n.a.	73	n.a.	0.04	1.4	n.a.	0.57
NJ8514	662623	359	0.09	31.2	0.1	10	86.6	n.a.	0.04	1.2	0.29	n.a.	4.1	88.8	n.a.	9.12	0.71	0.3	n.a.	n.a.	64	n.a.	0.04	1.5	n.a.	0.52
NJ8515	662624	257	0.08	16.4	0.1	10	118	n.a.	0.03	2.13	0.28	n.a.	3.9	60.7	n.a.	8.06	0.74	0.3	n.a.	n.a.	74	n.a.	0.05	1.8	n.a.	0.89
NJ8516	662625	287	0.15	10.9	0.1	10	172	n.a.	0.07	4.03	0.55	n.a.	5.8	69.7	n.a.	11.9	1.09	0.4	n.a.	n.a.	131	n.a.	0.08	2.9	n.a.	1.57
NJ8517	662626	228	0.09	5.7	0.4	10	90.9	n.a.	0.05	2.48	0.34	n.a.	3.8	59.4	n.a.	8.32	0.51	0.3	n.a.	n.a.	47	n.a.	0.05	1.8	n.a.	0.79
NJ8518	662627	380	0.09	11.5	0.1	10	113	n.a.	0.06	2.28	0.6	n.a.	5.8	62.5	n.a.	11	0.67	0.3	n.a.	n.a.	72	n.a.	0.05	1.9	n.a.	0.85
NJ8519	662628	340	0.11	9.4	0.1	10	123	n.a.	0.05	2.17	0.67	n.a.	7	73.4	n.a.	11.1	0.6	0.4	n.a.	n.a.	70	n.a.	0.06	1.9	n.a.	0.87
NJ8520	662629	292	0.14	6.7	0.1	10	176	n.a.	0.07	2.37	0.78	n.a.	4.8	67.6	n.a.	14.4	0.59	0.5	n.a.	n.a.	45	n.a.	0.08	2.1	n.a.	0.96
NJ8521	662630	394	0.08	16.8	0.1	10	84	n.a.	0.05	0.76	0.52	n.a.	5.1	71.2	n.a.	10.5	0.46	0.3	n.a.	n.a.	69	n.a.	0.04	1.2	n.a.	0.24
NJ8522	662631	374	0.08	34.4	0.1	10	124	n.a.	0.04	0.95	0.54	n.a.	4.4	72.8	n.a.	9.28	0.54	0.3	n.a.	n.a.	66	n.a.	0.04	1.4	n.a.	0.33
NJ8523	662632	300	0.07	32.4	0.3	10	71.4	n.a.	0.04	1.04	0.35	n.a.	3.8	65.7	n.a.	8.15	0.6	0.2	n.a.	n.a.	69	n.a.	0.04	1.3	n.a.	0.36
NJ8524	662633	438	0.06	51.2	0.1	10	58	n.a.	0.05	0.86	0.39	n.a.	4.3	75.4	n.a.	11.5	0.96	0.2	n.a.	n.a.	116	n.a.	0.03	1	n.a.	0.26
NJ8525	662634	359	0.24	10.2	0.1	10	450	n.a.	0.17	2.24	1.08	n.a.	7.6	45.1	n.a.	25.1	4.23	0.8	n.a.	n.a.	69	n.a.	0.13	3.9	n.a.	0.94
NJ8526	662635	201	0.11	5.7	0.1	10	382	n.a.	0.05	2.25	0.26	n.a.	3.1	43.8	n.a.	7.92	15.8	0.5	n.a.	n.a.	44	n.a.	0.06	3.1	n.a.	0.73
NJ8527	662636	286	0.09	10.8	0.1	10	140	n.a.	0.04	2.71	0.44	n.a.	5.3	55.8	n.a.	9.26	0.71	0.3	n.a.	n.a.	77	n.a.	0.05	1.9	n.a.	1.01
NJ8528	662637	241	0.07	11.6	1.3	10	80.2	n.a.	0.05	1.59	0.47	n.a.	4.3	66.3	n.a.	8.83	0.49	0.2	n.a.	n.a.	79	n.a.	0.04	1.3	n.a.	0.56
NJ8529	662638	282	0.09	12.8	0.6	10	104	n.a.	0.05	2.83	0.49	n.a.	4.7	63.7	n.a.	9.05	0.84	0.3	n.a.	n.a.	82	n.a.	0.05	1.9	n.a.	1.03
NJ8530	662639	299	0.11	6.6	1.1	10	119	n.a.	0.06	2.34	0.55	n.a.	5.7	81.6	n.a.	12.2	0.65	0.4	n.a.	n.a.	60	n.a.	0.06	1.7	n.a.	0.9
NJ8531	662640	331	0.09	7.6	0.6	10	96.2	n.a.	0.05	2.08	0.7	n.a.	5.2	61.1	n.a.	10.7	0.66	0.4	n.a.	n.a.	66	n.a.	0.05	1.7	n.a.	0.82
NJ8532	662641	345	0.07	6.6	0.1	10	57.3	n.a.	0.04	1.53	0.36	n.a.	4.7	67.9	n.a.	8.66	0.69	0.3	n.a.	n.a.	52	n.a.	0.04	1.3	n.a.	0.59
NJ8533	662642	379	0.72	17.7	0.1	10	421	n.a.	0.29	0.13	1.88	n.a.	11.6	14.8	n.a.	44	1.29	2.1	n.a.	n.a.	357	n.a.	0.18	1.7	n.a.	0.31
NJ8534	662643	367	0.64	36.7	0.9	10	421	n.a.	0.27	0.31	1.66	n.a.	14.3	14.8	n.a.	36.5	1.33	1.9	n.a.	n.a.	299	n.a.	0.15	2.1	n.a.	0.37
NJ8535	662644	344	0.39	27.4	0.2	10	234	n.a.	0.19	0.52	1.1	n.a.	12	39.7	n.a.	25.4	2.29	1.2	n.a.	n.a.	394	n.a.	0.13	2.1	n.a.	0.34
NJ8536	662645	291	0.27	18.9	0.1	10	299	n.a.	0.09	0.52	0.19	n.a.	4.6	44.2	n.a.	10.8	0.97	0.9	n.a.	n.a.	214	n.a.	0.1	3.5	n.a.	0.23
NJ8537	662646	196	0.16	6.6	0.5	10	111	n.a.	0.05	4.24	0.32	n.a.	4.6	71.5	n.a.	8.23	0.86	0.5	n.a.	n.a.	82	n.a.	0.06	2.3	n.a.	0.73
NJ8538	662647	481	0.53	8.3	0.1	10	200	n.a.	0.24	0.36	0.57	n.a.	7.4	20.6	n.a.	29.8	2.18	1.4	n.a.	n.a.	121	n.a.	0.16	2.7	n.a.	0.25
NJ8539	662648	477	0.55	10.3	0.7	10	178	n.a.	0.26	0.45	0.63	n.a.	7.9	19.3	n.a.	31.1	2.3	1.4	n.a.	n.a.	106	n.a.	0.18	2.7	n.a.	0.28
NJ8540	662649	408	0.6	7.2	0.1	10	425	n.a.	0.24	0.22	0.23	n.a.	5	20.9	n.a.	27.7	1.44	1.6	n.a.	n.a.	123	n.a.	0.19	2.5	n.a.	0.21
NJ8541	662650	351	0.73	7.7	0.1	10	750	n.a.	0.3	0.47	0.32	n.a.	8.3	20.2	n.a.	27.2	2.75	2	n.a.	n.a.	66	n.a.	0.18	3.6	n.a.	0.48

SAMPLE_ID	STATION	Mn	Mo	Na	Nb	Ni	P	Pb	Rb	Re	S	Sb	Sc	Se	Sn	Sr	Ta	Te	Th	Ti	Tl	U	V	W	Y	Zn
		ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	ppm	ppm
NJ8492	662601	21	0.85	0.068	n.a.	12.7	0.003	12.3	n.a.	n.a.	0.04	0.24	1.2	1	n.a.	30.2	n.a.	0.04	1.5	0.0005	0.02	0.5	6	0.05	n.a.	66.7
NJ8493	662602	4	1.44	0.09	n.a.	21.3	0.003	14.7	n.a.	n.a.	0.05	0.45	1.2	2.6	n.a.	127	n.a.	0.06	0.7	0.0005	0.01	0.7	7	0.05	n.a.	26
NJ8494	662603	5	0.76	0.035	n.a.	0.8	0.037	12.8	n.a.	n.a.	0.01	0.08	1	1	n.a.	146	n.a.	0.08	8.1	0.001	0.01	1	5	0.05	n.a.	2.2
NJ8495	662604	6	1.12	0.026	n.a.	5.6	0.012	16.1	n.a.	n.a.	0.05	0.24	1.5	2.9	n.a.	51.2	n.a.	0.04	2.9	0.0005	0.01	1.7	4	0.05	n.a.	36.6
NJ8496	662605	18	4.53	0.081	n.a.	70.9	0.048	19.7	n.a.	n.a.	0.36	2.43	2.7	7.1	n.a.	54.2	n.a.	0.11	2.9	0.001	0.12	1.6	27	0.05	n.a.	232
NJ8497	662606	525	1.73	0.062	n.a.	31.5	0.084	15	n.a.	n.a.	0.04	0.51	7.3	1.4	n.a.	58.1	n.a.	0.04	4.3	0.001	0.07	0.8	28	0.05	n.a.	141
NJ8498	662607	463	1.9	0.042	n.a.	27.5	0.09	9.26	n.a.	n.a.	0.04	0.55	4.8	0.8	n.a.	88	n.a.	0.04	3.8	0.0005	0.05	0.7	21	0.05	n.a.	84.6
NJ8499	662608	570	2.24	0.054	n.a.	55	0.09	14.1	n.a.	n.a.	0.03	0.54	6.4	1.2	n.a.	98.8	n.a.	0.05	4.4	0.0005	0.06	0.7	24	0.05	n.a.	121
NJ8500	662609	491	1.39	0.039	n.a.	25.4	0.08	8.16	n.a.	n.a.	0.06	0.7	4.2	0.8	n.a.	130	n.a.	0.03	3	0.0005	0.05	0.6	21	0.05	n.a.	78.1
NJ8501	662610	471	1.37	0.043	n.a.	21.7	0.082	9.46	n.a.	n.a.	0.05	0.43	4.9	1.1	n.a.	102	n.a.	0.04	3.7	0.0005	0.05	0.6	21	0.05	n.a.	88.3
NJ8502	662611	517	1.48	0.045	n.a.	27.5	0.088	10.9	n.a.	n.a.	0.05	0.43	5.2	1	n.a.	108	n.a.	0.04	3.5	0.001	0.06	0.7	21	0.05	n.a.	101
NJ8503	662612	287	3.04	0.081	n.a.	43.6	0.062	19.3	n.a.	n.a.	0.36	1.75	5.2	3.4	n.a.	76.3	n.a.	0.09	3.4	0.001	0.26	1	28	0.05	n.a.	140
NJ8504	662613	670	1.44	0.08	n.a.	38.8	0.087	18.8	n.a.	n.a.	0.04	0.51	6.1	2.2	n.a.	86.9	n.a.	0.07	4.1	0.001	0.07	0.8	30	0.05	n.a.	159
NJ8505	662614	614	1.44	0.102	n.a.	38.9	0.068	15.2	n.a.	n.a.	0.05	0.41	4.4	1.8	n.a.	76.9	n.a.	0.06	4	0.0005	0.07	0.8	22	0.05	n.a.	231
NJ8506	662615	499	2.37	0.053	n.a.	54.9	0.089	12.2	n.a.	n.a.	0.04	0.3	4.6	0.8	n.a.	70.5	n.a.	0.04	3.5	0.0005	0.07	0.7	19	0.05	n.a.	108
NJ8507	662616	357	3.49	0.04	n.a.	49.8	0.084	10.9	n.a.	n.a.	0.05	0.51	3.9	0.8	n.a.	55.6	n.a.	0.07	3	0.0005	0.08	0.6	15	0.05	n.a.	82.2
NJ8508	662617	396	1.31	0.019	n.a.	17.3	0.076	3.94	n.a.	n.a.	0.04	0.3	2.1	0.2	n.a.	52.1	n.a.	0.01	1.4	0.0005	0.04	0.5	11	0.05	n.a.	32.2
NJ8509	662618	361	0.71	0.02	n.a.	11	0.07	3.86	n.a.	n.a.	0.04	0.3	3.4	0.3	n.a.	47.6	n.a.	0.01	1.4	0.0005	0.04	0.5	14	0.05	n.a.	37.2
NJ8510	662619	240	0.76	0.02	n.a.	16.1	0.052	4.99	n.a.	n.a.	0.07	0.47	1.7	0.3	n.a.	33.9	n.a.	0.03	1.1	0.0005	0.07	0.4	9	0.05	n.a.	31.5
NJ8511	662620	162	1.08	0.019	n.a.	18.3	0.053	5.01	n.a.	n.a.	0.08	0.63	2	0.3	n.a.	28.6	n.a.	0.03	1.2	0.0005	0.07	0.4	12	0.05	n.a.	36.4
NJ8512	662621	113	1.93	0.018	n.a.	20.6	0.049	6.32	n.a.	n.a.	0.21	0.99	2	0.3	n.a.	14.1	n.a.	0.03	0.8	0.0005	0.12	0.4	16	0.05	n.a.	36.2
NJ8513	662622	142	2.44	0.018	n.a.	15.3	0.062	5.81	n.a.	n.a.	0.2	0.8	1.9	0.3	n.a.	17.2	n.a.	0.02	0.9	0.0005	0.08	0.4	14	0.05	n.a.	35.3
NJ8514	662623	123	3.81	0.017	n.a.	18.3	0.054	6.29	n.a.	n.a.	0.3	0.84	1.6	0.5	n.a.	17.7	n.a.	0.02	0.9	0.0005	0.11	0.5	12	0.05	n.a.	34.7
NJ8515	662624	135	3.17	0.019	n.a.	16.4	0.056	5.22	n.a.	n.a.	0.26	0.8	1.5	0.5	n.a.	25.5	n.a.	0.01	1.1	0.0005	0.09	0.5	11	0.05	n.a.	36.5
NJ8516	662625	173	1.95	0.025	n.a.	25.5	0.072	8.67	n.a.	n.a.	0.54	0.9	2.2	0.7	n.a.	41.2	n.a.	0.01	2.4	0.0005	0.1	0.5	15	0.05	n.a.	53.8
NJ8517	662626	119	0.58	0.018	n.a.	13.6	0.062	5.14	n.a.	n.a.	0.1	0.38	1.5	0.4	n.a.	35.1	n.a.	0.03	1.4	0.0005	0.07	0.5	9	0.05	n.a.	32.6
NJ8518	662627	147	1.2	0.022	n.a.	21.1	0.062	8.73	n.a.	n.a.	0.1	0.6	2.3	0.6	n.a.	32.3	n.a.	0.03	1.7	0.0005	0.07	0.5	13	0.05	n.a.	48.2
NJ8519	662628	130	1.38	0.023	n.a.	21.3	0.057	8.3	n.a.	n.a.	0.11	0.56	2.3	0.6	n.a.	30.3	n.a.	0.03	1.8	0.0005	0.07	0.5	23	0.05	n.a.	56.1
NJ8520	662629	146	0.91	0.031	n.a.	12.9	0.06	5.13	n.a.	n.a.	0.06	0.31	2.6	0.3	n.a.	35	n.a.	0.05	2	0.0005	0.05	0.5	20	0.05	n.a.	59
NJ8521	662630	83	1.28	0.017	n.a.	19.8	0.053	7.56	n.a.	n.a.	0.13	0.74	1.6	0.3	n.a.	15.8	n.a.	0.01	0.9	0.0005	0.09	0.4	14	0.05	n.a.	42.3
NJ8522	662631	96	2.17	0.017	n.a.	17.5	0.067	7.46	n.a.	n.a.	0.18	0.88	1.7	0.2	n.a.	16.4	n.a.	0.01	1	0.0005	0.1	0.5	19	0.05	n.a.	42.8
NJ8523	662632	95	3.42	0.016	n.a.	14.1	0.056	6.52	n.a.	n.a.	0.3	0.84	1.6	0.3	n.a.	16.7	n.a.	0.01	1	0.0005	0.12	0.6	11	0.05	n.a.	30.1
NJ8524	662633	103	6.36	0.017	n.a.	23.9	0.041	10.2	n.a.	n.a.	0.6	1.5	1.4	0.6	n.a.	14.6	n.a.	0.03	0.8	0.0005	0.27	0.7	12	0.05	n.a.	35.6
NJ8525	662634	517	2.02	0.055	n.a.	18.6	0.094	8.11	n.a.	n.a.	0.11	0.31	6.7	0.7	n.a.	55.5	n.a.	0.04	3.7	0.0005	0.07	0.9	26	0.05	n.a.	110
NJ8526	662635	1790	0.87	0.024	n.a.	12.3	0.107	5.48	n.a.	n.a.	0.05	0.38	3.4	0.2	n.a.	32.1	n.a.	0.01	1.3	0.001	0.04	0.5	20	0.05	n.a.	37.7
NJ8527	662636	172	1.47	0.021	n.a.	21.8	0.058	8	n.a.	n.a.	0.11	0.74	1.8	0.4	n.a.	34.4	n.a.	0.03	1.6	0.0005	0.09	0.5	12	0.05	n.a.	47.4
NJ8528	662637	101	1.25	0.017	n.a.	21.4	0.046	6.01	n.a.	n.a.	0.12	0.83	1.4	0.7	n.a.	23.1	n.a.	0.01	1	0.0005	0.13	0.4	12	0.05	n.a.	42.2
NJ8529	662638	161	2.69	0.02	n.a.	24.7	0.054	7.02	n.a.	n.a.	0.3	1.01	1.9	0.6	n.a.	33.8	n.a.	0.01	1.4	0.0005	0.16	0.4	15	0.05	n.a.	38.6
NJ8530	662639	144	1.19	0.024	n.a.	20.3	0.051	6.43	n.a.	n.a.	0.13	0.66	2.3	0.6	n.a.	33.1	n.a.	0.03	1.6	0.0005	0.08	0.5	19	0.05	n.a.	42.3
NJ8531	662640	145	1.1	0.021	n.a.	21.5	0.049	7.58	n.a.	n.a.	0.11	0.89	2	0.7	n.a.	28.7	n.a.	0.01	1.3	0.0005	0.1	0.6	16	0.05	n.a.	40.6
NJ8532	662641	150	0.96	0.017	n.a.	20.1	0.049	6.91	n.a.	n.a.	0.08	0.8	1.5	0.5	n.a.	20.3	n.a.	0.01	0.8	0.0005	0.09	0.4	13	0.05	n.a.	30.8
NJ8533	662642	26	3.53	0.091	n.a.	56.7	0.034	20.7	n.a.	n.a.	0.64	1.46	3.2	6.4	n.a.	66.4	n.a.	0.08	2.4	0.002	0.15	1.5	28	0.05	n.a.	146
NJ8534	662643	47	2.61	0.104	n.a.	67.4	0.034	24	n.a.	n.a.	0.57	1.97	3.3	2.9	n.a.	82.4	n.a.	0.02	2.6	0.001	0.23	0.9	18	0.05	n.a.	178
NJ8535	662644	64	2.43	0.079	n.a.	45.3	0.034	16.2	n.a.	n.a.	2.05	1.16	3.2	1.5	n.a.	68	n.a.	0.05	2.5	0.0005	0.3	0.7	11	0.05	n.a.	116
NJ8536	662645	61	1.16	0.059	n.a.	19.7	0.082	11.7	n.a.	n.a.	0.48	0.58	2.7	0.7	n.a.	62.1	n.a.	0.02	4.8	0.001	0.15	0.8	11	0.05	n.a.	60.2
NJ8537	662646	203	1.23	0.004	n.a.	20.3	0.05	6.97	n.a.	n.a.	0.09	0.52	1.9	0.4	n.a.	58.7	n.a.	0.01	1.5	0.0005	0.09	0.5	9	0.5	n.a.	34.1
NJ8538	662647	118	1.59	0.01	n.a.	31.5	0.073	15.6	n.a.	n.a.	1.72	0.4	3.6	1.5	n.a.	23.3	n.a.	0.06	4.7	0.0005	0.13	1.2	14	0.05	n.a.	118
NJ8539	662648	144	2.18	0.008	n.a.	32.4	0.06	16.9	n.a.	n.a.	1.98	0.44	3.6	1.2	n.a.	30.9	n.a.	0.06	4.6	0.0005	0.15	1.2	15	0.05	n.a.	138
NJ8540	662649	47	1.41	0.115	n.a.	21.5	0.075	15.3	n.a.	n.a.	0.97	0.26	3	0.8	n.a.	46.3	n.a.	0.04	4.6	0.001	0.09	0.8	16	0.05	n.a.	80.7
NJ8541	662650	157	0.91	0.15	n.a.	25.1	0.097	13.4	n.a.	n.a.	0.37	0.36	4.1	1.3	n.a.	67	n.a.	0.05	5.5	0.001	0.07	1.3	19	0.05	n.a.	122

HD Mining International Ltd.

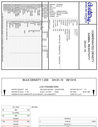
Drilling Company: Geotech Drilling Services Ltd
Hole No.: DH-01
Rig Type: A 5
Collar Elevation: 1291.33
Total Depth: 1004.00
Northing: 6103142.355
Start Date: 2015-07-29
Easting: 621714.634
Finished Date: 2015-09-10
Logging Geologist: George, Kevin
Core Size: HQ
Note: Hydrogeology logged sampled by ERM staff seperately, this log for charactering resource

Strata	Coal Seam	Interval (m)		Thickness(m)		Dip	Rock Name	Lithology Description
		From	To	Thick	TRUE			
Q		0	8.00	8.00			Overburden	sandstone, cobbles
Hasler		8.00	14.00	6.00			Mudstone	grey weathered mudstone
		14.00	17.10	3.10		<5	Mudstone	dark grey, broken pieces
		17.10	20.40	3.30			Mudstone	Dark grey mudstone
		20.40	52.80	32.40			Mudstone	dark grey mudstone laminated with grey siltstone, broken locally
		52.80	73.45	20.65			Mudstone	Grey mudstone laminated with sandstone, sand increase from top to bot to 50%
		73.45	86.44	12.99			Mudstone	Grey mudstone laminated with sandstone, broken
		86.44	96.40	9.96			Mudstone	grey mudstone, broken pieces locally
		96.40	98.81	2.41			Mudstone	dark grey mudstone laminated with grey siltstone
		98.81	101.62	2.81			Mudstone	dark grey mudstone
		101.62	110.00	8.38			Mudstone	dark grey mudstone, waved cross bedding
		110.00	140.16	30.16		10	Mudstone	dark grey mudstone laminated with sandstone cross bedding
		140.16	148.67	8.51			Mudstone	dark grey interbeded with sandstone, cross bedding
		148.67	158.00	9.33			Siltstone	grey, sand increase, siltstone 60%
		158.00	170.41	12.41		10	Mudstone	dark grey mudstone
		170.41	192.80	22.39		8	Mudstone	dark grey mudstone with 30% grey siltstone
		192.80	193.12	0.32			Siltstone	grey siltsone with grey fine sandstone
		193.12	195.89	2.77		10	Sandstone	grey Fine sandstone, massive
		195.89	197.60	1.71			Sandstone	grey, fines grained, slickenside @197.05m sandstone above, black mudstone below
		197.60	204.45	6.85			Mudstone	Black, horizontal bedding
		204.45	211.60	7.15			Mudstone	black, massive, undulating bedding, white muddy infilled fracture at 206.17-206.25m
		211.60	234.87	23.27			Mudstone	black mudstone
		234.87	278.94	44.07		10	Mudstone	black mudstone laminated with grey siltstone
		278.94	282.47	3.53		10	Mudstone	dark grey
		282.47	285.23	2.76			Mudstone	dark grey, slickenside visible, silt increase to 30%
		285.23	286.14	0.91			Siltstone	dark grey siltstone with fine sandstone, broken locally
		286.14	286.30	0.16			Sandstone	grey, fines- medium grained, minor siderite stains, siliceous matrix
		286.30	291.30	5.00			Sandstone	grey fine sandstone, massive, muddy increase downward
		291.30	306.04	14.74			Mudstone	dark grey mudstone laminated with grey siltstone,undulation bedding
		306.04	314.87	8.83		10	Siltstone	grey, slickenside visible
		314.87	331.52	16.65			Mudstone	dark grey mudstone laminated with grey siltstone, undulation at top, horizontal bedding at deeper
		331.52	339.68	8.16		0	Mudstone	dark grey, more mechanical break
		339.68	359.36	19.68			Mudstone	dark grey mudstone, grey siltstone at bottom, two breaks near vertical
		359.36	364.85	5.49			Mudstone	dark grey mudstone, interbeded with grey silt at deeper, near vertical break visible
		364.85	381.54	16.69			Mudstone	dark grey mudstone, 374.18-374.78 interbeded with silt, undulation bedding
		381.54	409.31	27.77		0	Mudstone	dark grey mudstone, silt increase with depth
		409.31	428.40	19.09			Mudstone	dark grey MS laminated with grey silt. Slickenside visible, 20 mm sulphide bleb at422.88, 4cm conglomerate at 427.33-427.37
		428.40	458.85	30.45		10	Mudstone	Black mudstone laminated with grey siltstone, broken pieces locally
		458.85	512.00	53.15		15	Mudstone	dark grey mudstone laminated with grey siltstone. Fractures along bedding, slickenside, moderate
		512.00	526.10	14.10			Mudstone	dark grey mudstone
		526.10	576.75	50.65			Mudstone	dark grey mudstone laminated with grey siltstone, 1.5cm*3cm sulphide, quartz infilled fractures
		576.75	588.00	11.25		20	Mudstone	dark grey mudstone laminated with grey siltstone. Carbonate veins along fractures, 5.5cm sulphide bleb
		588.00	604.07	16.07		11	Mudstone	dark grey mudstone, silt increase with depth

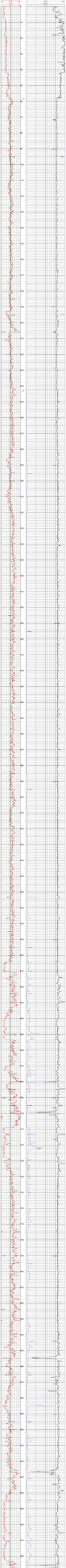
Strata	Coal Seam	Interval (m)		Thickness(m)		Dip	Rock Name	Lithology Description
		From	To	Thick	TRUE			
		604.07	604.60	0.53			Conglomerate	grey conglomerat with minor coal stinger,0.6-1.5cm, poorly sorting
		604.60	610.70	6.10			Sandstone	Grey fine-coarse grained sandstone, conglomerate with minor coal stringer locally
		610.70	612.15	1.45			Mudstone	grey bauxitic mudstone with siltstone
		612.15	615.40	3.25			Siltstone	grey siltsone
		615.40	616.15	0.75			Mustone	grey mudstone
		616.15	624.13	7.98		15	Mustone	grey bauxitic mudstone with siltstone
		624.13	624.56	0.43			Siltstone	grey bauxitic siltstone
		624.56	633.31	8.75			Mudstone	grey mudstone with silt, massive
		633.31	636.37	3.06			Siltstone	grey siltstone, massive
		636.37	639.64	3.27			Sandstone	grey fine-medium sandstone, massive
		639.64	641.15	1.51			Sandstone	grey coarse sandstone, well sorting
		641.15	642.74	1.59			Conglomerate	grey conglomerate with minor coal stinger, 1-4mm grain size
		642.74	644.55	1.81		10	Sandstone	grey coarse sandstone with conglomerate
		644.55	645.45	0.90			Conglomerate	2-3mm size, well sorted, sub-angular
		645.45	646.85	1.40		15	Sandstone	grey midium-xoarse sandstone
		646.85	648.26	1.41			Sandstone	grey coarse sandstone with conglomerate
		648.26	649.44	1.18			Conglomerate	grey, 3mm size, well sorted, sub-angular, with minor coal stringer
		649.44	649.48	0.04			coal	black coal stringer
		649.48	651.47	1.99			Mudstone	dark brown bauxitic mudstone
		651.47	652.24	0.77			Sandstone	grey medium-coarse sandstone
		652.24	653.62	1.38			Conglomerate	grey conglomerate, grain size 4-5mm, max:25mm. Slickenside dip at 45 degree visible
		653.62	663.65	10.03			Mudstone	dark grey ms laminated with grey silt
		663.65	664.05	0.40			Sandstone	grey medium sandstone with conglomerate, grain size 7mm.
		664.05	664.85	0.80			Mudstone	dark grey MS laminated with siltstone
		664.85	665.00	0.15			Sandstone	coarse sandstone with conglomerate
Boulder Ceeek		665.00	667.38	2.38			Siltstone	grey siltstone laminated with mudstone, sandy increase
		667.38	670.98	3.60		12	Siltstone	grey siltstone
		670.98	672.98	2.00			Sandstone	grey medium sandstone graduate into coarse sandstone
		672.98	674.66	1.68			Siltstone	grey siltstone laminated with mudstone
		674.66	675.42	0.76			Mudstone	dark grey
		675.42	676.80	1.38			Siltstone	grey siltstone laminated with mudstone
		676.80	680.44	3.64			Mudstone	dark grey mudstone, 680.27-680.44: blak carb shale with 4cm bony coal
		680.44	684.24	3.80			Sandstone	grey silt-fine sandstone
		684.24	686.43	2.19			Siltstone	grey siltstone, carbonate matrix
		686.43	687.67	1.24			Siltstone	grey siltstone with mudstone
		687.67	689.35	1.68			Mudstone	dark grey mudstone
		689.35	690.58	1.23			Mudstone	grey bauxitic mudstone
		690.58	691.68	1.10			Siltstone	grey
		691.68	693.63	1.95			Mudstone	grey bauxitic mudstone, broken pieces locally
		693.63	694.18	0.55			Siltstone	grey
		694.18	699.10	4.92			Mudstone	black carbonaceous mudstone
		699.10	699.39	0.29			coal	black bony coal
		699.39	700.82	1.43			Mudstone	black carbonaceous mudstone, slickenside visible
		700.82	701.00	0.18			coal	black bony coal
		701.00	709.03	8.03			Mudstone	dark grey
		709.03	710.73	1.70		21	Sandstone	Grey coarse sandstone with conglomerate, 3-4mm. 70degree break present
		710.73	712.36	1.63			Conglomerate	grey congl, 3-6mm, poor sorted, sub angular, 70-80 degree break present
		712.36	713.00	0.64		10	Conglomerate	grey conglomerate with minor coal stringer, well sorted
		713.00	713.70	0.70			Mudstone	dark grey, gradual to pure mudstone,
		713.70	713.83	0.13		20	Conglomerate	poor sorted
		713.83	714.50	0.67			Sandstone	grey coarse sandstone, massive, 2mm grain scattered
		714.50	714.95	0.45			Conglomerate	grey, 70 degree break

Strata	Coal Seam	Interval (m)		Thickness(m)		Dip	Rock Name	Lithology Description
		From	To	Thick	TRUE			
Boulder Ceeek		714.95	715.75	0.80		20	Sandstone	grey coarse sandstone, massive, well sorted, sub rounded, 75 degree break
		715.75	717.77	2.02			Sandstone	Grey coarse sanstone with conglomerate grain size up to 5mm, poor sorted
		717.77	723.00	5.23			Conglomerate	grain size up to 4cm, mudstone, sub angular
		723.00	728.35	5.35			Sandstone	grey medium grain sandstone
		728.35	729.00	0.65			Mudstone	dark grey mudstone laminated with grey silt. Broken core
		729.00	731.92	2.92			Sandstone	grey fine sandstone with mudstone and conglomerate. Sulphide visible
		731.92	735.92	4.00		28	Sandstone	grey fine sandstone with black mudstone conglomerate. Carbonate veins
Hulcross		735.92	785.45	49.53		25	Mudstone	dark grey mudstone laminated with grey sandstone, 4-5cm sulphide bleb, slickenside at 40-70 degree, shearing at 773.2-773.3 and 774.9-775
		785.45	796.50	11.05			Mudstone	dark grey mudstone with grey siltstone. Slickensides. cross bedding
		796.50	797.00	0.50			Siltstone	grey siltstone with mudstone
		797.00	811.40	14.40			Mudstone	dark grey mudstone with grey siltstone(up to 40%), cross bedding
		811.40	812.47	1.07		25	Siltstone	grey siltstone with mudstone, micro-horizontal bedding
		812.47	833.00	20.53		30	Mudstone	dark grey mudstone with grey siltstone. Sulphide along beddign face present at 824m
		833.00	837.53	4.53			Siltstone	grey siltstone, silt increase with depth
		837.53	837.78	0.25			Siltstone	grey
		837.78	838.15	0.37		25	Siltstone	grey siltstone with dark grey mudstone, and coal stringers
		838.15	843.90	5.75			Mudstone	dark grey mudstone
Gates	A	843.90	843.93	0.03			coal	
		843.93	844.18	0.25			Mudstone	black carbonaceous mudstone
		844.18	847.09	2.91			Siltstone	Grey siltstone with mudstone, slickenside
		847.09	848.34	1.25			Sandstone	grey fine sandstone
		848.34	854.07	5.73		30	Mudstone	dark grey mudstone with grey siltstone
	B	854.07	855.03	0.96			Coal	black, bright coal
		855.03	855.56	0.53			Mudstone	dark grey
		855.56	856.32	0.76			Sandstone	grey fine sandstone
		856.32	857.15	0.83			Siltstone	grey siltstone with mudstone
		857.15	860.32	3.17			Sandstone	grey fine sandstone, 70% core broken
		860.32	865.12	4.80			Siltstone	grey siltstone with mudstone, silt increase locally
		865.12	871.87	6.75		30	Mudstone	dark grey mudstone, near vertical break visible
		871.87	875.24	3.37			Siltstone	grey siltstone with mudstone
		875.24	875.42	0.18			Mudstone	black carb shale
	C	875.42	875.48	0.06		35	coal	black
		875.48	875.53	0.05			Mudstone	black MS, pyrite visible
		875.53	877.90	2.37			Sandstone	grey fine sandstone with silt, mudstone
		877.90	882.98	5.08			Sandstone	grey medium grain sandstone with coarse sandstone, pyrite present
		882.98	889.60	6.62		30	Sandstone	grey medium-fine sandstone
		889.60	896.75	7.15			Siltstone	grey siltstone with mudstone
		896.75	901.95	5.20		28	Mudstone	dark grey
		901.95	924.10	22.15		40	Siltstone	grey siltstone, siliconized, core broken pieces. 914.10-914.27 congl to 3cm, poor sorted, sub angular. Slickenside visible
		924.10	924.82	0.72			Sandstone	grey
		924.82	926.00	1.18		35	Mudstone	black, broken
		926.00	926.10	0.10			Mudstone	black carbonaceous mudstone
	D	926.10	926.85	0.75			coal	black, bright coal
		926.85	932.70	5.85		40	Mudstone	black carbonaceous mudstone with grey sandstone
		932.70	935.00	2.30			Mudstone	black mudstone with 2cm coal stringer
		935.00	937.85	2.85			Mudstone	grey mudstone
		937.85	941.00	3.15			Siltstone	grey siltstone, carbonate matrix
		941.00	945.20	4.20		35	Sandstone	grey fine sandstone, core very broken, fracures, carbonate veins 1-2%
		945.20	953.18	7.98		45	Sandstone	grey midium -coarse sandstone
		953.18	956.00	2.82			Sandstone	grey coarse sandstone
		956.00	959.00	3.00			Sandstone	grey coarse sandstone, poor sorted, sub angular, slickenside present
		959.00	963.48	4.48		50	Conglomerate	grey with coarse sandstone, minor coal stringers, slickensides, vertical breaks.

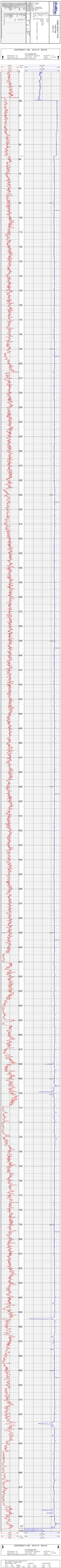
Strata	Coal Seam	Interval (m)		Thickness(m)		Dip	Rock Name	Lithology Description
		From	To	Thick	TRUE			
		963.48	969.42	5.94			Sandstone	grey coarse sandstone, core breaks at- degree
		969.42	970.38	0.96			Conglomerate	grey congl with coarse sandstone
		970.38	970.68	0.30			Mudstone	dark grey mudstone with coal stringers along fractures
		970.68	972.30	1.62			Conglomerate	grey with minor coal stringers along break faces at 70 degree
		972.30	977.54	5.24			Sandstone	grey coarse sandstone
		977.54	980.28	2.74			Conglomerate	3mm grain size up to 10mm diameter
		980.28	982.53	2.25			Sandstone	grey coarse sandstone with conglomerate up to 30mm diameter
		982.53	985.45	2.92		45	Mudstone	black mudstone
	E	985.45	986.00	0.55			coal	recover 0.3m
		986.00	986.90	0.90			Mudstone	dark grey
		986.90	987.62	0.72			Mudstone	black carb mudstone
Gates		987.62	987.96	0.34			coal	recover 0.24m
		987.96	988.75	0.79			Mudstone	dark grey
		988.75	991.50	2.75			Siltstone	grey siltstone with mudstone
		991.50	993.40	1.90			Mudstone	black mudstone
		993.40	994.85	1.45			Siltstone	grey silt-fine sandstone
		994.85	997.00	2.15		40	Mudstone	dark grey mudsotne with black carb mudstone
		997.00	997.30	0.30			coal	
		997.30	998.00	0.70			Mudstone	black carb mudstone
		998.00	1001.71	3.71			coal	black bright coal,
	F	1001.71	1002.01	0.30			mudstone	black
		1002.01	1003.50	1.49			Coal	black bright coal, 1002.45-1002.51 mudstone(partings)
		1003.50	1004.00	0.50			mudstone	1001-1004: core 77% recovery. Coal recovery 1.47/2.14=68%



BLUE CANYON 7 13D - 50-131-20...



BLUE CANYON 7 13D - 50-131-20...


Schlumberger
Array Induction Imager Tool
AIT-H
Dual Burst Thermal Neutron Tool
TNPH
Hostile Accelerator Porosity Sonde
HNGS
Natural Gamma Ray Spectrometry Tool
HSGR
Platform Express
Three Detector Lithology Density Tool
HALS
HRLA
HDIL
HLDS
HCAL
HTEM
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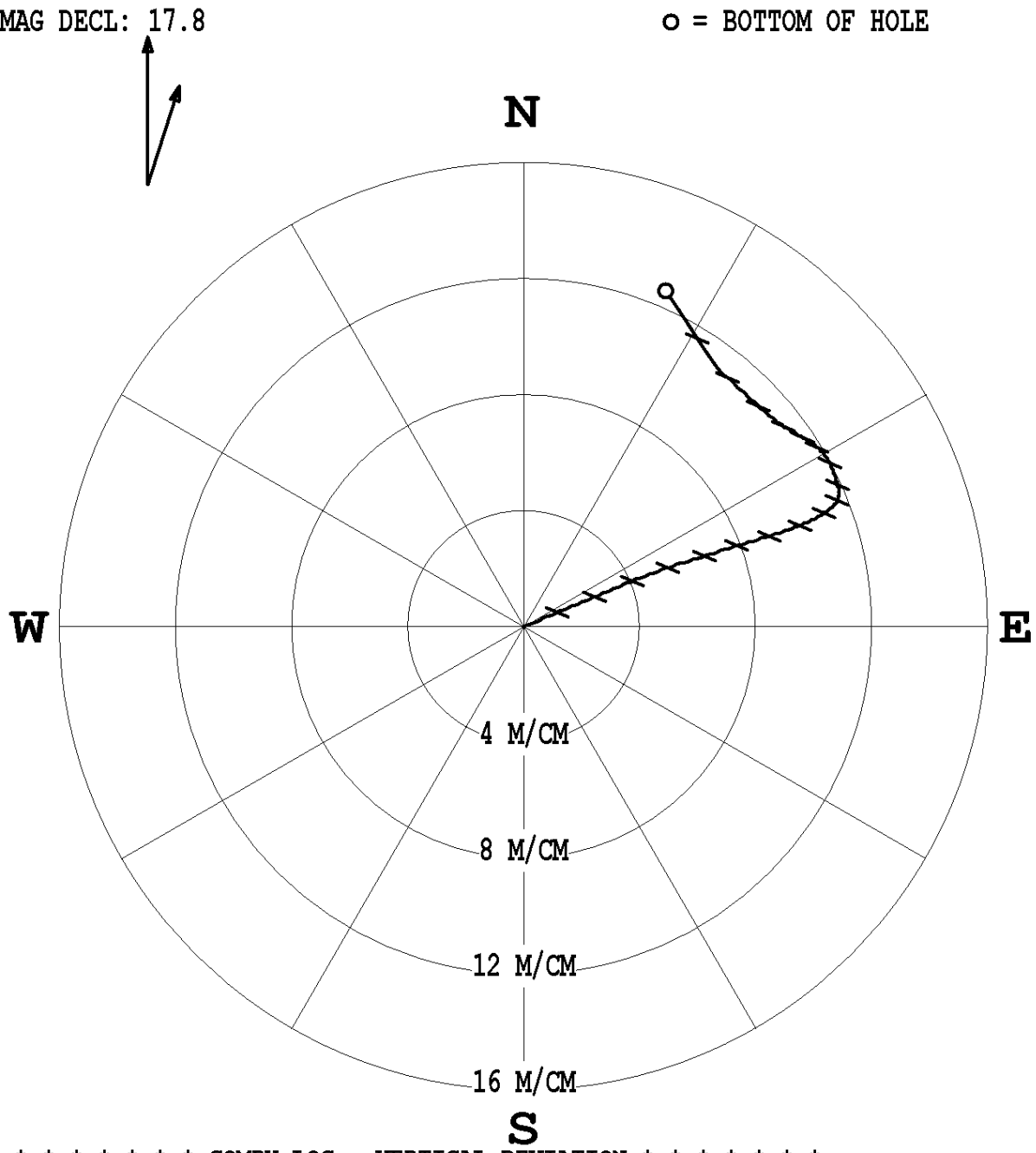
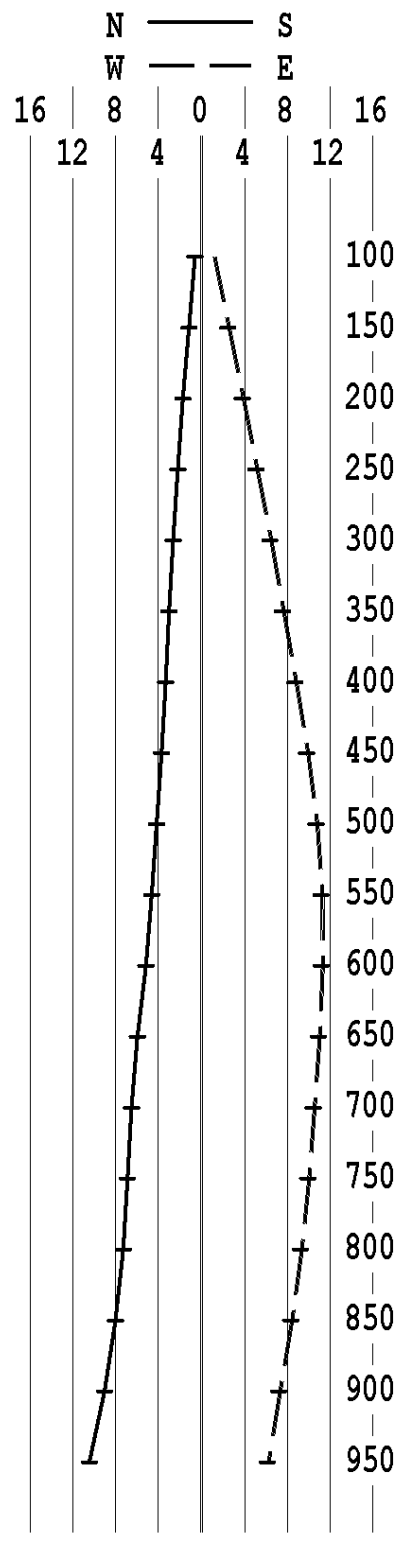
Run 20
Run

PLAN VIEW
COMPU-LOG DEVIATION

CLIENT: HD MINING
LOCATION:
HOLE ID: DH-01-15
DATE OF LOG: 09/14/15
PROBE: 9411A 2372
MAG DECL: 17.8

SCALE: 2 M/CM
TRUE DEPTH: 997.57 M
AZIMUTH: 23.0
DISTANCE: 12.6 M
+ = 50 M INCR
o = BOTTOM OF HOLE

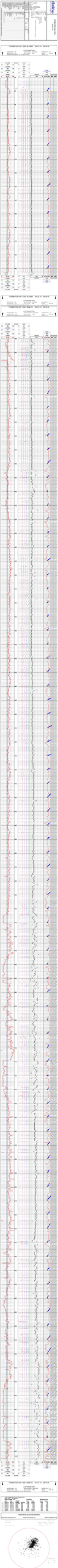




* * * * * * * COMPU-LOG - VERTICAL DEVIATION * * * * * * *

CLIENT : HD MINING
FIELD OFFICE : CENTURY
DATA FROM : N/A
MAG. DECL. : 17.800
HOLE ID. : DH-01-15
DATE OF LOG : 09/14/15
PROBE : 9411A , 2372
DEPTH UNITS : METERS
LOG: DH-01-15_09-14-15_07-22_9411A_005_60.000_997.850_DEVI.log

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
60.00	60.00	-0.00	-0.00	0.0	214.8	1.6	54.2
70.00	70.00	0.10	0.25	0.3	68.3	1.7	72.3
80.00	80.00	0.24	0.58	0.6	67.6	2.2	55.6
90.00	90.00	0.36	0.83	0.9	66.4	1.7	78.5
100.00	99.99	0.50	1.15	1.2	66.6	1.8	53.2
110.00	109.99	0.58	1.39	1.5	67.3	1.9	75.4
120.00	119.99	0.72	1.66	1.8	66.5	1.2	77.4
130.00	129.98	0.83	1.95	2.1	67.0	1.7	53.0
140.00	139.98	0.91	2.19	2.4	67.5	2.0	68.7
150.00	149.97	1.03	2.43	2.6	67.1	1.5	81.4
160.00	159.97	1.16	2.71	2.9	66.9	1.3	55.6
170.00	169.96	1.24	2.98	3.2	67.3	2.0	59.2
180.00	179.96	1.35	3.21	3.5	67.3	1.8	76.7
190.00	189.96	1.49	3.47	3.8	66.8	1.2	65.3
200.00	199.95	1.57	3.73	4.0	67.2	2.0	59.2
210.00	209.95	1.66	3.95	4.3	67.2	1.5	81.4
220.00	219.94	1.77	4.25	4.6	67.3	1.6	55.6
230.00	229.94	1.84	4.47	4.8	67.6	1.7	78.4
240.00	239.94	1.97	4.75	5.1	67.4	1.3	58.7
250.00	249.93	2.03	4.96	5.4	67.8	1.7	80.4
260.00	259.93	2.14	5.24	5.7	67.7	1.3	61.3
270.00	269.93	2.19	5.44	5.9	68.1	1.5	86.2
280.00	279.92	2.28	5.74	6.2	68.4	1.8	60.0
290.00	289.92	2.35	5.94	6.4	68.4	1.4	85.3
300.00	299.92	2.43	6.22	6.7	68.6	1.6	58.3
310.00	309.91	2.50	6.42	6.9	68.7	1.3	86.9
320.00	319.91	2.58	6.69	7.2	68.9	1.6	58.3
330.00	329.91	2.66	6.87	7.4	68.8	1.2	84.9
340.00	339.90	2.72	7.13	7.6	69.2	1.8	63.8
350.00	349.90	2.80	7.33	7.8	69.1	1.2	85.8
360.00	359.90	2.84	7.59	8.1	69.4	1.7	68.1
370.00	369.89	2.93	7.79	8.3	69.4	1.0	86.0
380.00	379.89	2.99	8.04	8.6	69.6	1.7	62.4
390.00	389.89	3.08	8.22	8.8	69.5	0.9	81.5
400.00	399.89	3.11	8.46	9.0	69.8	1.7	72.3
410.00	409.88	3.21	8.66	9.2	69.7	0.9	82.3
420.00	419.88	3.26	8.90	9.5	69.9	1.7	61.1
430.00	429.88	3.33	9.08	9.7	69.9	1.4	87.0
440.00	439.87	3.43	9.32	9.9	69.8	1.0	54.5
450.00	449.87	3.48	9.51	10.1	69.9	1.6	67.2
460.00	459.87	3.57	9.68	10.3	69.7	0.9	86.0
470.00	469.87	3.66	9.88	10.5	69.6	1.0	44.5
480.00	479.87	3.71	10.03	10.7	69.7	1.4	64.9
490.00	489.86	3.82	10.17	10.9	69.4	0.7	79.9
500.00	499.86	3.92	10.33	11.0	69.2	0.8	40.7
510.00	509.86	3.98	10.46	11.2	69.2	1.4	53.0
520.00	519.86	4.09	10.55	11.3	68.8	0.6	75.4
530.00	529.86	4.19	10.68	11.5	68.6	0.8	13.3
540.00	539.86	4.26	10.76	11.6	68.4	1.0	36.1
550.00	549.86	4.35	10.79	11.6	68.0	0.4	65.7
560.00	559.86	4.47	10.83	11.7	67.6	0.5	335.6
570.00	569.86	4.54	10.86	11.8	67.3	0.9	10.7
580.00	579.85	4.64	10.84	11.8	66.8	0.3	24.9
590.00	589.85	4.79	10.84	11.8	66.2	1.0	329.7
600.00	599.85	4.88	10.81	11.9	65.7	1.0	0.1
610.00	609.85	5.04	10.75	11.9	64.9	0.5	326.6
620.00	619.85	5.20	10.73	11.9	64.1	1.3	338.4
630.00	629.85	5.32	10.67	11.9	63.5	0.9	2.4
640.00	639.85	5.48	10.59	11.9	62.6	0.6	316.6
650.00	649.85	5.64	10.55	12.0	61.9	1.3	325.1
660.00	659.84	5.75	10.47	11.9	61.2	0.9	352.4
670.00	669.84	5.88	10.36	11.9	60.4	0.6	293.6
680.00	679.84	6.01	10.30	11.9	59.7	1.2	320.7
690.00	689.84	6.07	10.20	11.9	59.3	0.5	323.4
700.00	699.84	6.18	10.10	11.8	58.5	0.6	270.4
710.00	709.84	6.25	10.03	11.8	58.1	1.1	324.0
720.00	719.84	6.30	9.92	11.8	57.6	0.6	333.3
730.00	729.84	6.38	9.80	11.7	56.9	0.7	265.0
740.00	739.83	6.47	9.70	11.7	56.3	1.0	287.8
750.00	749.83	6.52	9.60	11.6	55.8	1.0	323.2
760.00	759.83	6.58	9.45	11.5	55.1	0.4	279.1
770.00	769.83	6.68	9.35	11.5	54.4	1.2	302.6
780.00	779.83	6.72	9.21	11.4	53.9	0.6	313.9
790.00	789.83	6.84	9.07	11.4	52.9	1.3	287.9
800.00	799.83	6.90	8.94	11.3	52.3	1.0	322.9
810.00	809.82	7.03	8.76	11.2	51.3	0.9	284.7
820.00	819.82	7.16	8.63	11.2	50.3	1.6	316.3
830.00	829.82	7.27	8.43	11.1	49.2	1.0	314.8
840.00	839.82	7.46	8.25	11.1	47.9	1.6	299.9
850.00	849.81	7.60	8.08	11.1	46.8	1.6	324.8
860.00	859.81	7.80	7.85	11.1	45.2	1.4	298.5
870.00	869.81	7.96	7.69	11.1	44.0	1.7	324.2
880.00	879.80	8.17	7.45	11.1	42.4	1.3	300.7
890.00	889.80	8.35	7.27	11.1	41.1	1.8	323.7
900.00	899.79	8.58	7.01	11.1	39.3	1.7	298.9
910.00	909.79	8.74	6.81	11.1	37.9	1.5	317.8
920.00	919.78	8.98	6.62	11.2	36.4	1.9	323.7
930.00	929.78	9.27	6.42	11.3	34.7	2.1	324.7
940.00	939.77	9.59	6.20	11.4	32.9	2.3	326.3
950.00	949.76	9.93	5.98	11.6	31.1	2.3	327.1
960.00	959.75	10.27	5.76	11.8	29.3	2.3	327.7
970.00	969.74	10.61	5.54	12.0	27.6	2.3	325.6
980.00	979.74	10.95	5.31	12.2	25.9	2.4	326.5
990.00	989.73	11.29	5.08	12.4	24.2	2.3	326.1
997.85	997.56	11.56	4.90	12.6	23.0	2.3	326.3


Schlumberger
FORMATION DIP LOG
GEOLOGY
DIP
RESISTIVITY
GAMMA RAY
CALIPER
DEPTH
FORMATION DIP LOG
GEOLOGY
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GAMMA RAY
CALIPER
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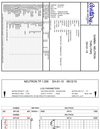
Schlumberger
Array Induction Imager Tool
Gamma Ray and Cable Head Tension
Measured Depth Log
Well Name: NEELAM-1
Field: NEELAM
Company: ONGC
Country: INDIA
Service Order: 1234567
Log Date: 30-Oct-15
Run Number: ONE
Depth Reference: KB
Elevation: 0 m
Permanent Datum: MSL
Log Measured From: KB
Drilling Measured From: KB
Logging Unit Number: 1
Logging Engineer: SHARMA
Witness: MEHTA
Max Temperature: 175 degC
Mud Type: WBM
Mud Density: 1.12 g/cm3
Mud Resistivity: 0.18 ohm-m
Mud Salinity: 12000 ppm
Rm @ Meas Temp: 0.18 ohm-m
Rmf @ Meas Temp: 0.15 ohm-m
Rmc @ Meas Temp: 0.22 ohm-m
Source of Rmf: Measured
Source of Rmc: Measured
Rm @ BHT: 0.12 ohm-m
Time Since Circulation: 6 hr
Time on Bottom: 30-Oct-15 14:30
Bit Size: 8.5 in
Casing Depth: 1200 m
Casing Size: 9.625 in
Top Log Interval: 1200 m
Bottom Log Interval: 3000 m
Logging Speed: 1800 m/hr
Tool String: AIT-H
Tool Length: 32.5 m
Tool Weight: 1250 kg
Max Tool OD: 8.25 in
Standoff: 0.5 in
Centralizer: Yes
Recorded By: SHARMA
Checked By: MEHTA
Remarks: Run 1 - Main Pass
Run 2 - Repeat Section
Run 3 - Main Pass
Run 4 - Repeat Section
Run 5 - Main Pass
Run 6 - Repeat Section
Run 7 - Main Pass
Run 8 - Repeat Section
Run 9 - Main Pass
Run 10 - Repeat Section
Run 11 - Main Pass
Run 12 - Repeat Section
Run 13 - Main Pass
Run 14 - Repeat Section
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Run 1000 - Repeat Section

NEELAM-1 WELL
Array Induction Imager Tool
Gamma Ray and Cable Head Tension
Measured Depth Log
Schlumberger
GR (API)
0
150
CHT (LBF)
0
5000
MD (M)
1200
3000

NEELAM-1 WELL
Array Induction Imager Tool
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1200
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Halliburton Energy Services
2135 S. 1200 E.
Vernal, UT 84078
Tel: (435) 789-1735

Well Name: Ute Tribal 16-20-4-2E
Job Number: 8213
Run Number: 1
Job Purpose: Temperature Log
Date: 2010-01-18

TEMPERATURE LOG 1.000 - 2010-01-18 - 08:31:51

Temperature 1 - 1.000	Temperature 2 - 1.000
Temperature Gradient - 1.000	

Ute Tribal 16-20-4-2E
Sec. 20 T4S R2E
Duchesne County, Utah

API No. - 43-013-50446	Drilling Fluid - Water
Spud Date - 01/13/10	Rig - Ensign 116

Temperature (°F)
Depth (ft)

TEMPERATURE LOG 1.000 - 2010-01-18 - 08:31:51

Temperature 1 - 1.000	Temperature 2 - 1.000
Temperature Gradient - 1.000	

Ute Tribal 16-20-4-2E
Sec. 20 T4S R2E
Duchesne County, Utah

API No. - 43-013-50446	Drilling Fluid - Water
Spud Date - 01/13/10	Rig - Ensign 116

Temperature (°F)
Depth (ft)

Completion Report

Well Name: DH-01

January 20, 2016

Completion Report

Well Name: DH-01

Project Number: WB946

Prepared for:

HD Mining International Ltd.

Prepared by:

Mark Lessard
A Division of Nova Metrix Ground Monitoring (Canada) Limited.
3480 Gilmore Way
Suite110
Burnaby, BC
V5G 4Y1

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APPENDICES

APPENDIX: Monitoring Well: DH-01

1. Introduction

This report and the attached Appendix document the technical services carried out by Westbay Instruments (Westbay) under HD Mining International Ltd. (HD Mining) P.O. HDPO-150135 dated July 7, 2015. A Westbay System completion was installed in borehole DH-01 at the Murray River site near Tumbler Ridge, BC, Canada.

Westbay technical services representative Mr. Mark Lessard was on site for installation of the Westbay System from September 27 to October 9, 2015. ERM representative Mr. Piotr Rzepecki was on-site to supervise the installation of the Westbay System.

This report documents the installation tasks and related QA checks.

2. Pre-Installation Activities

A nominal 4 inch borehole was drilled to TD using a diamond rotary method. Water with polymer additives was used as a lubricant during drilling.

Hydrogeologic logging of recovered core and geophysical survey (caliper, acoustic televiewer, gamma, density, dip meter, neutron, borehole deviation) logging were performed in the borehole.

Following arrival at terminal depth, the borehole was flushed with clear water (no polymer additives) until it circulated to surface. Falling-head packer testing was conducted at key intervals along the borehole following flushing and prior to installation of the Westbay system.

A string of nominal 4 inch HQ rods was cemented in place to a depth of 500 m to isolate higher head formation pressures in the upper half of the borehole. This isolation of higher head pressures was to accommodate the differential pressure limits of the Westbay System.

3. Installation

Westbay Instruments technical services representative Mr. Mark Lessard and Mr. Piotr Rzepecki of ERM were on site to install the Westbay System in DH-01 as indicated below in Table 1.

(Note: Monitoring well reference elevation was not available at the time of writing).

Table 1: Summary of Westbay System Installation

Well Name.	Field Installation Dates	Total Depth (m)	MP38 Tubing Length (m)	No. Monitoring Zones
DH-01	Sept 27 – Oct 8	1004	979.8	21

The Westbay System in DH-01 was installed according to the procedure described below.

3.1 Preparation of Westbay System Design

Packer depths for the borehole were provided to Westbay by Mr. Piotr Rzepecki of ERM. A well design was created based on these depths. The well design was used to prepare Westbay Completion Log, which specifies the location of the Westbay System components in the well. This log was reviewed and approved in the field by Mr. Rzepecki prior to installation of the Westbay System. The Westbay Completion Log as approved was used as an installation guide in the field. A field copy of the log is in the Appendix.

A measurement port coupling was included in each monitoring zone to provide the capability to measure fluid pressures and collect fluid samples. Measurement port couplings were also included in QA zones to provide QA testing capabilities and to permit operation of squeeze relief venting capabilities of the Westbay Model No. 6055 vented inflation tool. A Model 0206 hydraulic pumping port coupling was also included in ten selected monitoring zones to provide purging and hydraulic conductivity testing capabilities. Mr. Rzepecki requested that optional synthetic (PET) filters were to be installed over all measurement port couplings.

A summary of the installed Westbay System components are shown on Table 2 below and in the Summary Completion Log Legend in the Appendix.

Table 2: Summary of Installed Westbay System Components

Well Name	Packers (0238)	Measurement Ports (0205)	Pumping Ports (0206)
DH-01	26	27	10

3.2 Layout of Westbay System Tubing Components

Prior to the installation, the Westbay System components were set out at the borehole according to the sequence indicated on the Westbay Completion Log. Each casing length was numbered beginning with the lowermost as an aid to confirming the proper sequence of components. The appropriate Westbay System couplings were attached to each casing section. Magnetic location collars were attached 0.6-metres below the top of all measurement port couplings. Locations of key components are listed in Tables 4 and 5 in the Appendix.

Each component was visually inspected. Serial numbers for each packer, pumping port and measurement port coupling were recorded on the Westbay Completion Log. The component layout was confirmed with the log before the components were lowered into the borehole.

3.3 Lowering of Westbay System Components

The Westbay System components were lowered into the borehole by hand and later with a hoist rig. Each joint was tested with a minimum internal hydraulic pressure of 150-psi for one minute to confirm hydraulic seals. A record of each successful joint test and the placement of each component are noted by check marks on the Westbay Completion Log. Clean water supplied by Geotech Drilling was added to the Westbay System when necessary to counter buoyancy effects while components were lowered into the borehole and was used for testing of joint seals during lowering. The fluid level in the cemented HQ rods was maintained at TOC by adding water as necessary.

3.4 Hydraulic Integrity Testing

After the Westbay System string was lowered into the borehole, the water level inside the Westbay System completion was monitored at a depth different from the open borehole water level for a minimum period of thirty minutes to confirm hydraulic integrity of the completion. The data from the hydraulic integrity test is shown on the last page of the Westbay Completion Log in the Appendix and in Table 3 below.

Table 3: Hydraulic Integrity Test

Well Name	Oct 2 – 3, 2015	Fluid Levels	
	Time	Inside Tubing	Outside Tubing
DH-01	5:40 pm	67.48 m	TOC
	5:48 pm	67.49 m	TOC
	6:01 pm	67.46 m	TOC
	6:15 pm	67.49 m	TOC
	7:30 pm	67.60 m	TOC
	8:30 pm	67.70 m	TOC
	9:30 pm	67.80 m	TOC
	10:30 pm	67.95 m	TOC
	11:30 pm	68.05 m	TOC
	12:30 am	68.20 m	TOC
	1:30 am	67.46 m	TOC
	2:30 am	67.45 m	TOC
	3:30 am	67.45 m	TOC
	4:30 am	67.45 m	TOC
	5:30 am	67.45 m	TOC
	6:30 am	67.45 m	TOC

3.5 Positioning of Westbay System Completion

After the Westbay System components were lowered into the well, the Westbay System was positioned as illustrated on the Westbay Completion Log. The Westbay System was supported in this position while packer inflation was carried out. The positioning of the Westbay System components is based on the "nominal" lengths of Westbay System components. The positioning calculations do not include allowances for borehole temperature or deviation effects.

The attached figure 1 titled "MOSDAX Transducer Position" provides information to correlate the position of MOSDAX transducer sensor to the reference position at the top of the measurement port. The attached Figure 2 titled "Dimensions of Packer Seals and Monitoring Zones" outlines the calculations used to determine the packer depths and zone length. The Summary Completion Log, which shows the final "as-built" locations of the components in the well, are included in the Appendix.

3.6 Pre-inflation Profile

A pre-inflation pressure profile was carried out at the well prior to inflating the packers to confirm the proper position and operation of measurement ports and magnetic collars. The ports operated properly and were positioned correctly in the well. A plot of the Pre-inflation Piezometric levels in all zones is shown on Figure 3 in the Appendix.

3.7 Inflation of Westbay System Packers

The Westbay System packers were inflated sequentially beginning at the bottom of the well using clean water provided by Geotech Drilling. The Westbay Model No. 6055 vented inflation tool was used for packer inflation. All the packers appear to have inflated normally. The data for inflation of each packer are provided on the Westbay Packer Inflation Records included in the Appendix.

3.8 Separation of Westbay Casing

After the Westbay System was lowered to depth, the measured weight of Westbay System was about 500 lbs. The expected weight of the Westbay System was about 750 lbs. It was suspected that the Westbay System might have been partially supported by friction in the borehole. The Westbay System was raised and lowered several times, but the measured weight remained the same. After consulting with the client, it was decided to leave the Westbay System at current depth and continue installation. The bottom two packers were inflated, and the Westbay System was clamped off overnight with a suspended weight of 500 lbs. The following day it was discovered that Westbay casing had separated at a depth of about 100m. Additional sections of Westbay casing were added to the top, and the downhole end was re-engaged about 6.1m deeper than previous. The well was sounded and full access to all zones was proven. After consulting with the client it was decided to continue inflation the Westbay packers as they were positioned. Packer inflation was then continued.

4. Fluid Pressure Measurements

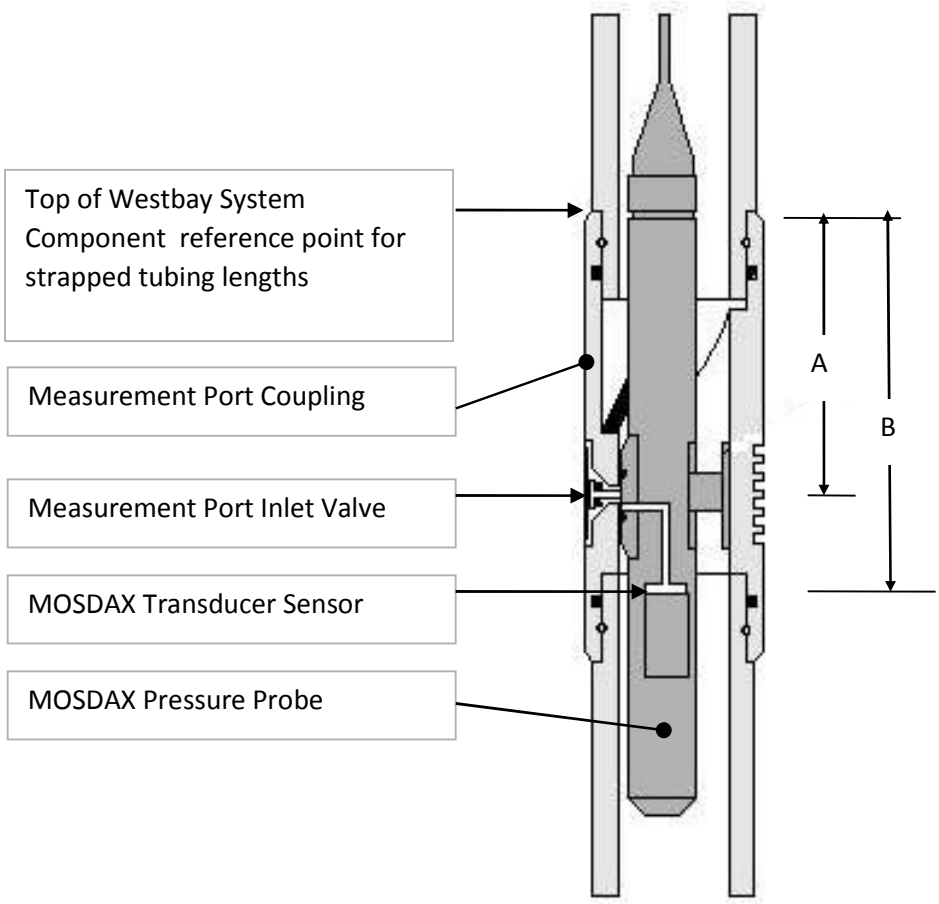
After packer inflation was completed, fluid pressures were measured at each measurement port. At that time, the in-situ formation pressures may not have recovered from the pre-installation activities and potential groundwater pressure increases in monitoring zones that may result from packer inflation. This latter effect may be more likely to occur in monitoring zones located in low-permeability geological formations. Longer term monitoring may be required to establish representative fluid pressures.

A plot of the Post-Inflation Piezometric levels in all zones in the well is shown on Figure 4 in the Appendix. The data were examined to confirm proper operation of the measurement ports and as a check on the presence of annulus seals between monitoring zones. The calculation sheets for all pressure profiles of the Westbay System are also enclosed in the Appendix.

Figure 1:

MOSDAX Transducer Position

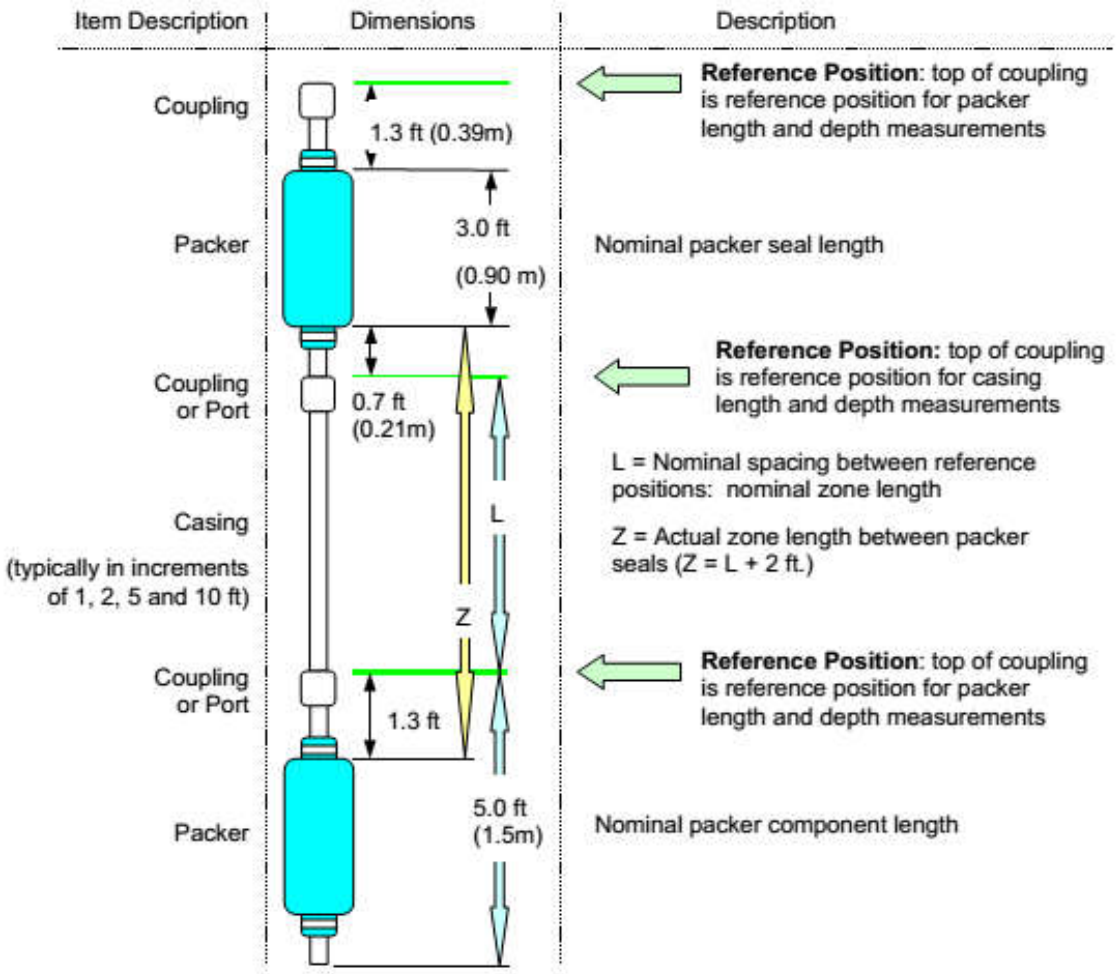
In an Westbay System Measurement Port Coupling



System	Measurement Port	A	B
Plastic MP38	0205	0.37 ft. (114.3 mm)	0.54 ft. (165.1 mm)

Figure 2:

Dimensions of Packer Seals and Monitoring Zones Westbay MP38 System 0238 Packers



Discussion Points:

- The top of a coupling (Regular Coupling, Measurement Port or Pumping Port) is the reference point for describing nominal depths and nominal lengths. Actual positions of packer seals and zone lengths are determined with respect to the appropriate reference positions.
- Packer Position Example: A packer with a nominal depth of 50 ft (15.2m), will have a nominal packer seal position of 51.3 to 54.3 ft. (15.59 to 16.49m)
- Zone Length Example: A zone whose upper packer is at 50 ft (15.2m) and bottom packer is at 70 ft (21.3m) will have a nominal zone length of 15 ft (4.6m) and an actual zone length (between packer seals) of 15.0+1.3+0.7 = 17.0ft. (4.6 + 0.39 + 0.2 = 5.19m)
- Information on the position of Measurement Port Valve and MOSDAX Transducer sensor, used for detailed calculation of piezometric level measurements, are described separately.

APPENDIX: MONITORING WELL: DH-01

As-Built Packer and Port Summary (Table 4)	- 1 page
As-Built Tubing Summary (Table 5)	- 8 pages
QA/QC Summary of Westbay System MP38 Installation	- 1 page
Summary Completion Log	- 7 pages
Pre-Inflation Piezometric Pressure/ Levels	
Field Data and Calculation Sheet (Oct 3rd)	- 2 pages
Figure 3, Pre-Inflation Profile	- 1 page
Post- Inflation Piezometric Pressure/Levels	
Field Data and Calculation Sheet (Oct 8th)	- 2 pages
Figure 4, Post-Inflation Profile	- 1 page
Westbay Completion Log (field copy)	- 22 pages
Westbay System Packer Inflation Records	- 28 pages

TABLE 4
DH-01 As-Built Packer and Port Summary

Zone No.	Measurement Port Depth (m)	Pumping Port Depth (m)	Magnetic Collar Depth (m)	Top of Zone (m)	Bottom of Zone (m)
1	972.0	973.5	972.6	971.8	1004.0
2	950.7		951.3	950.5	970.9
3	943.0	944.5	943.6	942.8	949.6
4	938.3	939.9	938.9	938.1	941.9
5	928.5	930.0	929.1	928.3	937.2
6	914.7	916.2	915.3	914.5	927.4
7	881.2		881.8	865.8	913.6
8	856.7	858.3	857.3	856.5	864.8
9	785.1		785.7	784.9	855.6
10	778.3	779.9	778.9	778.1	784.0
11	772.2		772.8	772.0	777.2
12	746.3		746.9	746.1	771.1
13	741.8		742.4	741.6	745.2
14	732.5	734.1	733.1	732.3	740.6
15	717.2	718.7	717.8	712.4	731.4
16	694.3	695.8	694.9	694.1	711.5
17	686.7		687.3	651.4	693.2
18	644.0		644.6	643.8	650.5
19	628.8		629.4	584.4	642.9
20	525.1		525.7	512.7	583.4
21	509.9		510.5	509.7	511.8
22	413.9		414.5		
23	320.9		321.5		
24	228.0		228.6		
25	132.0		132.6		
26	39.0		39.6		
27	37.5				

Note 1: All depth measurements in meters below ground surface.
Note 2: All depth measurements use 'Nominal' casing lengths.
Note 3: Not corrected for borehole deviation or borehole temperature effects.
Note 4: All Westbay Port depth measurements to upper edge of coupling item.
Note 5: Depths for top and bottom of zone based on packer seal position.

Item No.	Component Part Number	Component S/N	Coupling P/N	Coupling Description	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
352	0203							-2.2
351	020102		0202					-2.1
350	020105		0202					-1.5
349	020105		0202					0.0
348	020101		0202					1.5
347	020102		0202					1.8
346	020110		0202					2.4
345	020105		0202					5.5
344	020110		0202					7.0
343	020110		0202					10.0
342	020110		0202					13.1
341	020110		0202					16.1
340	020110		0202					19.2
339	020110		0202					22.2
338	020110		0202					25.3
337	020110		0202					28.3
336	020110		0202					31.4
335	020110		0202					34.4
334	0238	19300	0205	Measurement Port	5469			**37.5**
333	020110		0205	Measurement Port	8610	0216	39.6	**39.0**
332	020110		0202					42.0
331	020110		0202					45.1
330	020110		0202					48.1
329	020110		0202					51.2
328	020110		0202					54.2
327	020110		0202					57.3
326	020110		0202					60.3
325	020110		0202					63.4
324	020110		0202					66.4
323	020110		0202					69.5
322	020110		0202					72.5
321	020110		0202					75.6
320	020110		0202					78.6
319	020110		0202					81.7
318	020110		0202					84.7
317	020110		0202					87.8
316	020110		0202					90.8
315	020110		0202					93.9
314	020110		0202					96.9
313	020110		0202					100.0
312	020110		0202					103.0
311	020110		0202					106.1
310	020110		0202					109.1
309	020110		0202					112.1
308	020110		0202					115.2
307	020110		0202					118.2
306	020110		0202					121.3
305	020110		0202					124.3
304	020110		0202					127.4
303	0238	19285	0202					130.4

Item No.	Component Part Number	Component S/N	Coupling P/N	Coupling Description	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
302	020110		0205	Measurement Port	8614	0216	132.6	**132.0**
301	020110		0202					135.0
300	020110		0202					138.1
299	020110		0202					141.1
298	020110		0202					144.2
297	020110		0202					147.2
296	020110		0202					150.2
295	020110		0202					153.3
294	020110		0202					156.3
293	020110		0202					159.4
292	020110		0202					162.4
291	020110		0202					165.5
290	020110		0202					168.5
289	020110		0202					171.6
288	020110		0202					174.6
287	020110		0202					177.7
286	020110		0202					180.7
285	020110		0202					183.8
284	020110		0202					186.8
283	020110		0202					189.9
282	020110		0202					192.9
281	020110		0202					196.0
280	020110		0202					199.0
279	020110		0202					202.1
278	020110		0202					205.1
277	020110		0202					208.2
276	020110		0202					211.2
275	020110		0202					214.3
274	020110		0202					217.3
273	020110		0202					220.3
272	020110		0202					223.4
271	0238	19308	0202					226.4
270	020110		0205	Measurement Port	8608	0216	228.6	**228.0**
269	020110		0202					231.0
268	020110		0202					234.1
267	020110		0202					237.1
266	020110		0202					240.2
265	020110		0202					243.2
264	020110		0202					246.3
263	020110		0202					249.3
262	020110		0202					252.4
261	020110		0202					255.4
260	020110		0202					258.4
259	020110		0202					261.5
258	020110		0202					264.5
257	020110		0202					267.6
256	020110		0202					270.6
255	020110		0202					273.7
254	020110		0202					276.7
253	020110		0202					279.8

Item No.	Component Part Number	Component S/N	Coupling P/N	Coupling Description	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
252	020110		0202					282.8
251	020110		0202					285.9
250	020110		0202					288.9
249	020110		0202					292.0
248	020110		0202					295.0
247	020110		0202					298.1
246	020110		0202					301.1
245	020110		0202					304.2
244	020110		0202					307.2
243	020110		0202					310.3
242	020110		0202					313.3
241	020110		0202					316.4
240	0238	19307	0202					319.4
239	020110		0205	Measurement Port	8618	0216	321.5	**320.9**
238	020110		0202					324.0
237	020110		0202					327.0
236	020110		0202					330.1
235	020110		0202					333.1
234	020110		0202					336.2
233	020110		0202					339.2
232	020110		0202					342.3
231	020110		0202					345.3
230	020110		0202					348.4
229	020110		0202					351.4
228	020110		0202					354.5
227	020110		0202					357.5
226	020110		0202					360.5
225	020110		0202					363.6
224	020110		0202					366.6
223	020110		0202					369.7
222	020110		0202					372.7
221	020110		0202					375.8
220	020110		0202					378.8
219	020110		0202					381.9
218	020110		0202					384.9
217	020110		0202					388.0
216	020110		0202					391.0
215	020110		0202					394.1
214	020110		0202					397.1
213	020110		0202					400.2
212	020110		0202					403.2
211	020110		0202					406.3
210	020110		0202					409.3
209	0238	19284	0202					412.4
208	020110		0205	Measurement Port	8594	0216	414.5	**413.9**
207	020110		0202					416.9
206	020110		0202					420.0
205	020110		0202					423.0
204	020110		0202					426.1
203	020110		0202					429.1

Item No.	Component Part Number	Component S/N	Coupling P/N	Coupling Description	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
202	020110		0202					432.2
201	020110		0202					435.2
200	020110		0202					438.3
199	020110		0202					441.3
198	020110		0202					444.4
197	020110		0202					447.4
196	020110		0202					450.5
195	020110		0202					453.5
194	020110		0202					456.6
193	020110		0202					459.6
192	020110		0202					462.7
191	020110		0202					465.7
190	020110		0202					468.7
189	020110		0202					471.8
188	020110		0202					474.8
187	020110		0202					477.9
186	020110		0202					480.9
185	020110		0202					484.0
184	020110		0202					487.0
183	020110		0202					490.1
182	020110		0202					493.1
181	020110		0202					496.2
180	020110		0202					499.2
179	020110		0202					502.3
178	020110		0202					505.3
177	0238	19286	0202					508.4
176	020105		0205	Measurement Port	8607	0216	510.5	**509.9**
175	0238	19306	0202					511.4
174	020110		0202					512.9
173	020110		0202					516.0
172	020110		0202					519.0
171	020110		0202					522.1
170	020110		0205	Measurement Port	8617	0216	525.7	**525.1**
169	020110		0202					528.2
168	020110		0202					531.2
167	020110		0202					534.3
166	020110		0202					537.3
165	020110		0202					540.4
164	020110		0202					543.4
163	020110		0202					546.5
162	020110		0202					549.5
161	020110		0202					552.6
160	020110		0202					555.6
159	020110		0202					558.7
158	020110		0202					561.7
157	020110		0202					564.8
156	020110		0202					567.8
155	020110		0202					570.9
154	020110		0202					573.9
153	020110		0202					576.9

Item No.	Component Part Number	Component S/N	Coupling P/N	Coupling Description	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
152	020110		0202					580.0
151	0238	19388	0202					583.0
150	020110		0202			0216	585.2	584.6
149	020105		0202					587.6
148	020110		0202					589.1
147	020110		0202					592.2
146	020110		0202					595.2
145	020110		0202					598.3
144	020110		0202					601.3
143	020110		0202					604.4
142	020110		0202					607.4
141	020110		0202					610.5
140	020110		0202					613.5
139	020110		0202					616.6
138	020110		0202					619.6
137	020110		0202					622.7
136	020110		0202					625.7
135	020110		0205	Measurement Port	8616	0216	629.4	**628.8**
134	020110		0202					631.8
133	020110		0202					634.9
132	020110		0202					637.9
131	020105		0202					641.0
130	0238	19287	0202					642.5
129	020110		0205	Measurement Port	8594	0216	644.6	**644.0**
128	020110		0202					647.0
127	0238	19289	0202					650.1
126	020110		0202			0216	652.2	651.6
125	020105		0202					654.7
124	020110		0202					656.2
123	020110		0202					659.2
122	020110		0202					662.3
121	020110		0202					665.3
120	020110		0202					668.4
119	020110		0202					671.4
118	020110		0202					674.5
117	020110		0202					677.5
116	020110		0202					680.6
115	020110		0202					683.6
114	020110		0205	Measurement Port	8596	0216	687.3	**686.7**
113	020110		0202					689.7
112	0238	19290	0202					692.8
111	020105		0205	Measurement Port	8603	0216	694.9	**694.3**
110	020110		0206	Pumping Port	333			**695.8**
109	020110		0202					698.9
108	020110		0202					702.0
107	020110		0202					705.0
106	020110		0202					708.1
105	0238	19301	0202					711.1
104	020105		0202					712.7
103	020110		0202					714.2

Item No.	Component Part Number	Component S/N	Coupling P/N	Coupling Description	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
102	020105		0205	Measurement Port	8606	0216	717.8	**717.2**
101	020110		0206	Pumping Port	332			**718.7**
100	020110		0202					721.9
99	020110		0202					724.9
98	020110		0202					728.0
97	0238	19304	0202					731.0
96	020105		0205	Measurement Port	8615	0216	733.1	**732.5**
95	020110		0206	Pumping Port	331			**734.1**
94	020110		0202					737.2
93	0238	19302	0202					740.2
92	020110		0205	Measurement Port	8599	0216	742.4	**741.8**
91	0238	19303	0202					744.8
90	020110		0205	Measurement Port	8598	0216	746.9	**746.3**
89	020110		0202					749.4
88	020110		0202					752.4
87	020110		0202					755.5
86	020110		0202					758.5
85	020110		0202					761.6
84	020110		0202					764.6
83	020110		0202					767.7
82	0238	19305	0202					770.7
81	020105		0205	Measurement Port	8600	0216	772.8	**772.2**
80	020110		0202					773.8
79	0238	19296	0202					776.8
78	020105		0205	Measurement Port	8609	0216	778.9	**778.3**
77	020110		0206	Pumping Port	330			**779.9**
76	020102		0202					783.0
75	0238	19292	0202					783.6
74	020110		0205	Measurement Port	6971	0216	785.7	**785.1**
73	020110		0202					788.2
72	020110		0202					791.2
71	020110		0202					794.3
70	020110		0202					797.3
69	020110		0202					800.4
68	020110		0202					803.4
67	020110		0202					806.5
66	020110		0202					809.5
65	020110		0202					812.5
64	020110		0202					815.6
63	020110		0202					818.6
62	020110		0202					821.7
61	020110		0202					824.7
60	020110		0202					827.8
59	020110		0202					830.8
58	020110		0202					833.9
57	020110		0202					836.9
56	020110		0202					840.0
55	020110		0202					843.0
54	020110		0202					846.1
53	020110		0202					849.1

Item No.	Component Part Number	Component S/N	Coupling P/N	Coupling Description	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
52	020110		0202					852.2
51	0238	17704	0202					855.2
50	020105		0205	Measurement Port	8612	0216	857.3	**856.7**
49	020110		0206	Pumping Port	339			**858.3**
48	020110		0202					861.4
47	0238	19293	0202					864.4
46	020110		0202					866.0
45	020110		0202					869.0
44	020110		0202					872.1
43	020110		0202					875.1
42	020110		0202					878.2
41	020105		0205	Measurement Port	8604	0216	881.8	**881.2**
40	020110		0202					882.7
39	020110		0202					885.8
38	020110		0202					888.8
37	020110		0202					891.9
36	020110		0202					894.9
35	020110		0202					898.0
34	020110		0202					901.0
33	020110		0202					904.1
32	020110		0202					907.1
31	020110		0202					910.2
30	0238	19295	0202					913.2
29	020105		0205	Measurement Port	8613	0216	915.3	**914.7**
28	020110		0206	Pumping Port	338			**916.2**
27	020105		0202					919.4
26	020110		0202					920.9
25	020110		0202					923.9
24	0238	19291	0202					927.0
23	020105		0205	Measurement Port	8611	0216	929.1	**928.5**
22	020110		0206	Pumping Port	337			**930.0**
21	020102		0202					933.2
20	020110		0202					933.8
19	0238	19297	0202					936.8
18	020105		0205	Measurement Port	8605	0216	938.9	**938.3**
17	020105		0206	Pumping Port	336			**939.9**
16	0238	19298	0202					941.5
15	020105		0205	Measurement Port	8602	0216	943.6	**943.0**
14	020105		0206	Pumping Port	335			**944.5**
13	020110		0202					946.1
12	0238	19299	0202					949.2
11	020110		0205	Measurement Port	7934	0216	951.3	**950.7**
10	020110		0202					953.7
9	020105		0202					956.8
8	020110		0202					958.3
7	020110		0202					961.4
6	020110		0202					964.4
5	020110		0202					967.5
4	0238	19294	0202					970.5
3	020105		0205	Measurement Port	8601	0216	972.6	**972.0**

Item No.	Component Part Number	Component S/N	Coupling P/N	Coupling Description	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
2	020110		0206	Pumping Port	334			**973.5**
1	020110		0202					976.7
0	0203							979.7

Depths are with respect to ground surface.

* Component positions are referenced to the top of the subject Westbay System coupling.

* Packer positions are referenced to the top Westbay System coupling on the packer.

Monitoring zone dimensions are determined as described on the attached “Dimensions of Packer Seals and Monitoring Zones”.

The position of a MOSDAX Transducer in a Measurement Port is illustrated in the attached “MOSDAX Transducer Position”.

This information may be used in calculating piezometric levels.

QA/QC Summary of Westbay System MP38 Installation

Client: HD Mining
Well: DH-01

Project: WB 946

			Check ✓	Initials	Date
1	**Client Data and Approvals**				
	1.1	Client design request and Borehole/Well information	✓	MZ	9/29/15
	1.2	Client approved final design (file name: DH-01V2.WWO)	✓	MZ	9/29/15
	1.3	Client decision on filter sleeves for Measurement Ports	✓	MZ	9/29/15
	1.4	Client approval to install, including well and borehole conditions	✓	MZ	9/29/15
Comments					
	Hold Point – Design and well information are complete				
2	**Layout of Completion Components**				
	2.1	Installation Log and Confirmation Log printed from approved design (file name: DH-01V2.WWO)	✓	MZ	9/29/15
	2.2	Components taken from inventory	✓	MZ	9/29/15
	2.3	Layout completed according to log, plus copy S/N and packer data)	✓	MZ	9/30/15
	2.3	Independent confirmation of layout (use Confirmation Log)	✓	MZ	9/30/15
	2.4	Independent check on laid out length vs design length	—	—	—
Comments					
	Hold Point – Layout is good to install				
3	**Lowering of Completion String**				
	3.1	Independent staff for layout rack and installation check list	✓	MZ	9/29/15
	3.2	Components individually verified with approved log (with call-back repeat)	✓	MZ	9/30/15
	3.3	Pressure test tool and apparatus verified	✓	MZ	10/2/15
	3.4	Components pass pressure test	✓	MZ	10/2/15
	3.5	Tensile loads managed within system limits	n/a	n/a	n/a
	3.6	Depth to water in Westbay tube checked and adjusted Kept artesian	✓	MZ	10/2/15
	3.7	Hydraulic integrity test is passed	✓	MZ	10/3/15
	3.8	Pre-Inflation profile is completed, analyzed and accepted	✓	MZ	10/3/15
	3.9	Top of Westbay tubing is positioned according to the approved log	✓	MZ	10/3/15
Comments					
	Hold Point – Completion is good to inflate packers				
4	**Packer Inflation**				
	4.1	Inflation tool and apparatus verified	✓	MZ	10/5/15
	4.2	Inflation data recorded on forms at time of inflation	✓	MZ	10/8/15
	4.3	Inflation V and P consistent with BH diameter and packer model	✓	MZ	10/8/15
	4.4	De-stressing procedure followed (if required)	n/a	n/a	n/a
	4.5	All packers inflated normally	✓	MZ	10/8/15
	4.6	Post inflation profile completed, analyzed and accepted	✓	MZ	10/8/15
Comments					
	Hold Point – Packer inflation is complete				
5	**Documentation**				
	5.1	Wellhead completion sketch completed	✓	MZ	10/9/15
	5.2	Draft completion Log and pressure profile data given to client	✓	MZ	10/8/15
	5.3	Completion Report data appendix is complete	✓	MZ	10/21/15
	Installation and Documents Complete				

Signature: [signature] **Date:** Oct 21/15

Summary Completion Log

Company: HD Mining
Well: DH-01
Site: Murray River, BC
Project: Murray, River

Job No: WB946
Author: ML

Well Information

Reference Datum: Ground Surface
Elevation of Datum: 0.00 m.
MP Casing Top: 0.00 m.
MP Casing Length: 979.76 m.

Borehole Depth: 1004.00 m.
Borehole Inclination: Vertical
Borehole Diameter: 76.00 mm

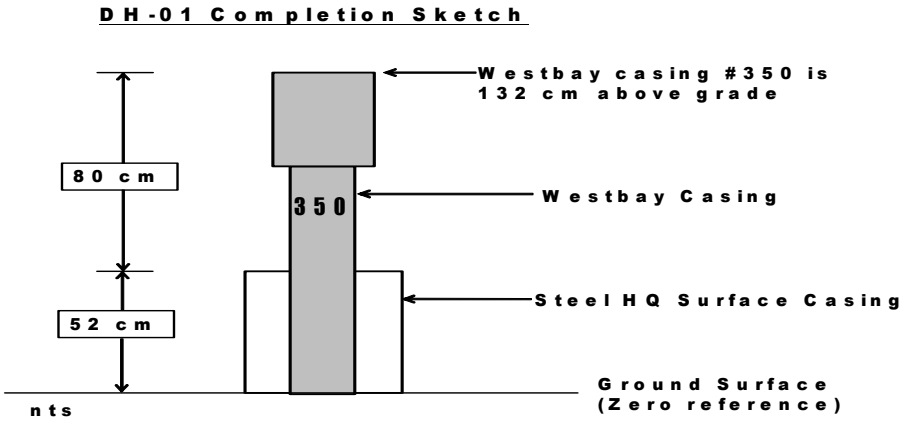
Well Description:
MP38
Other References:

File Information

File Name: DH-01V3.WWD
Report Date: Wed Oct 21 22:41:24 2015

File Date: Oct 14 22:36:58 2015

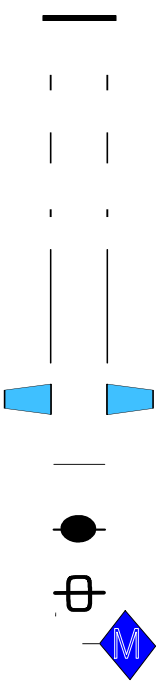
Sketch of Wellhead Completion



Legend

(Qty) MP Components

(Library - WD Library 04/29/15)



(2) 0203 - MP38 End Cap

(4) 020102 - MP38 Casing 3 (2F/0.6M)

(24) 020105 - MP38 Casing 2 (5F/1.5M)

(1) 020101 - MP38 Casing 4 (1F/0.3M)

(296) 020110 - MP38 Casing 1 (10F/3M)

(26) 0238 - MP38 Packer - 74mm (5F/1.5M)

(314) 0202 - MP38 Regular Coupling

(27) 0205 - MP38 Measurement Port

(10) 0206 - MP38 Hydraulic Pumping Port

(28) 0216 - Magnetic Location Collar

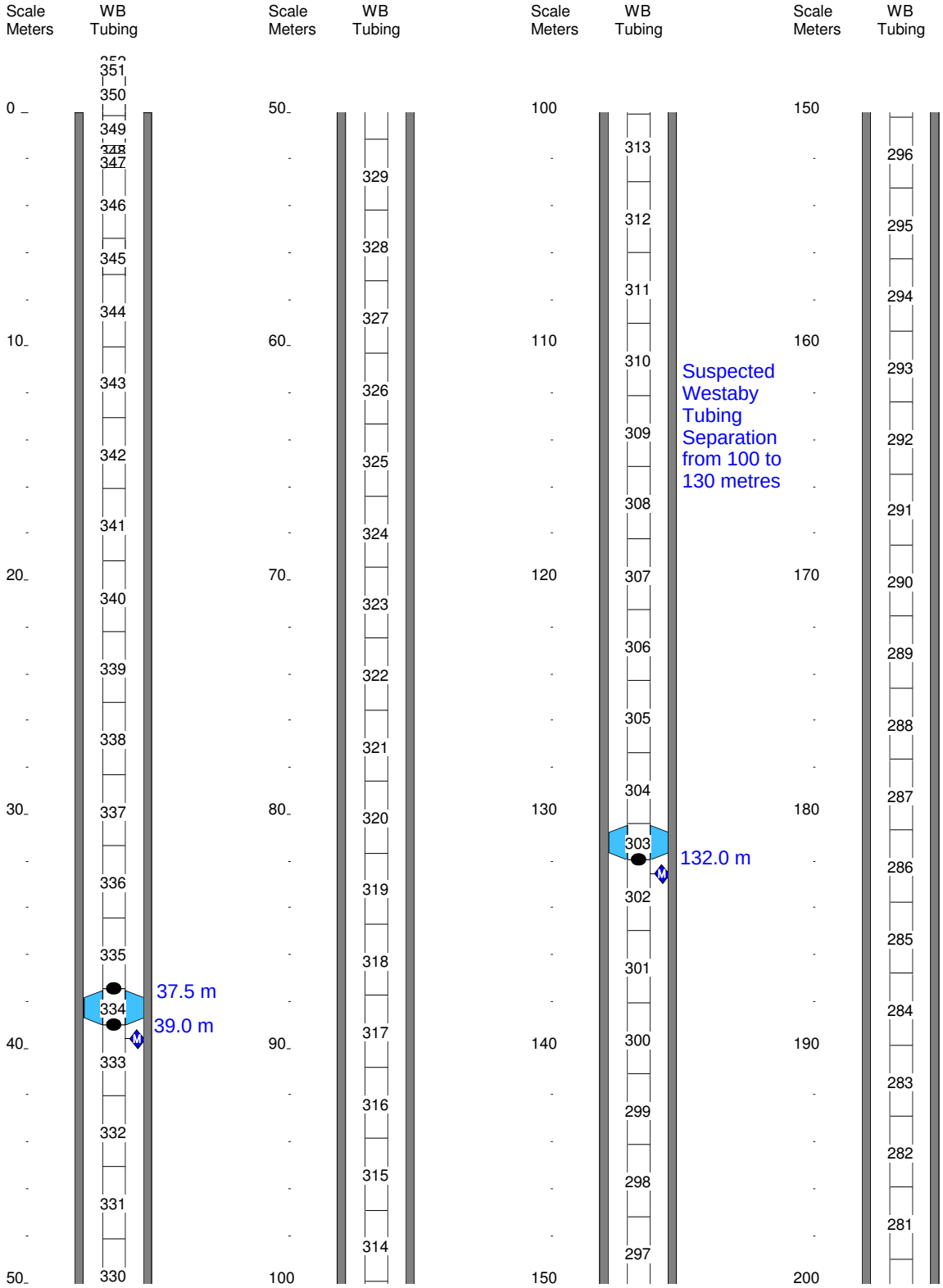
Geology

Backfill/Casing

Mild Steel

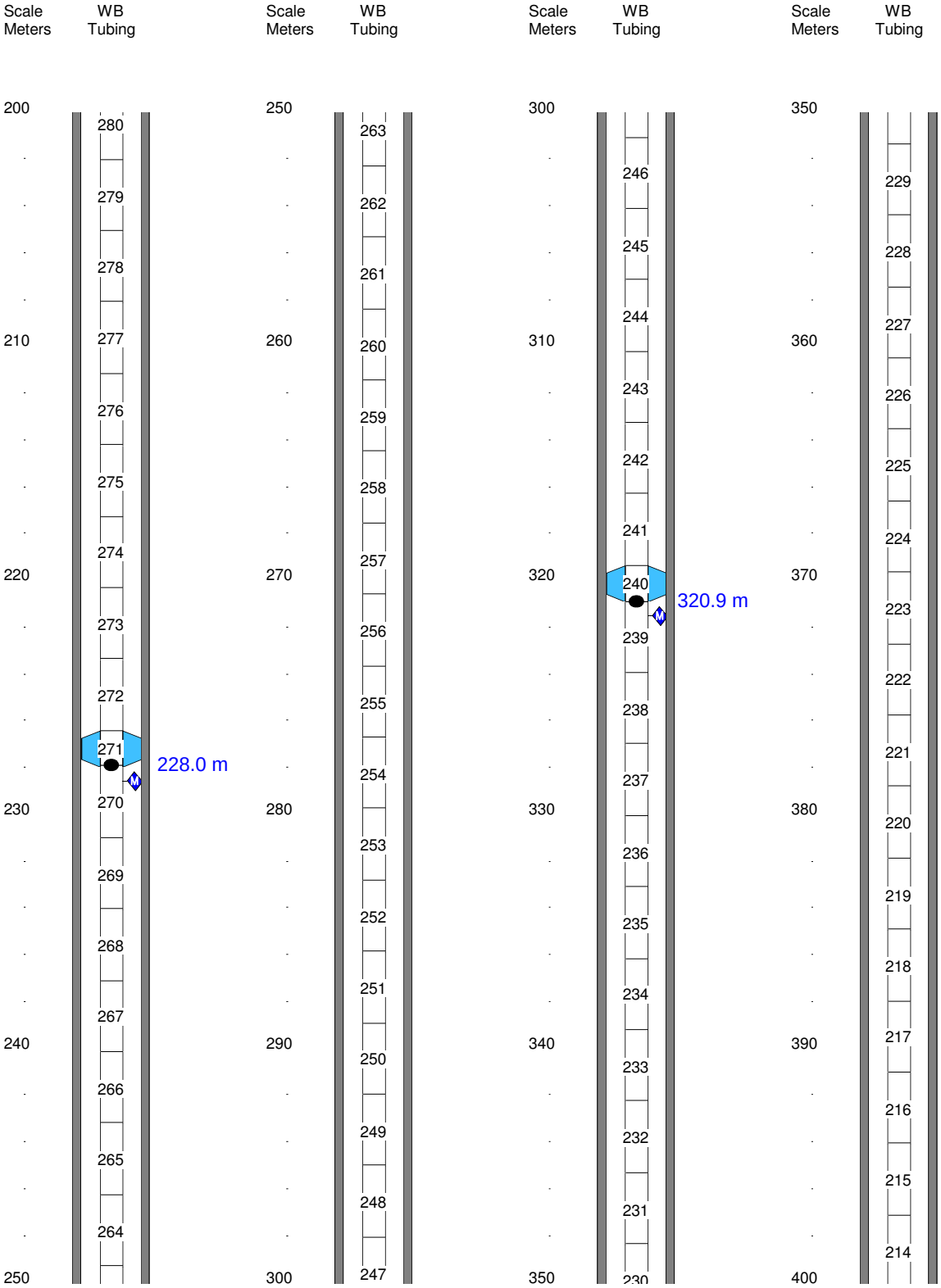
Summary Completion Log
HD Mining

Job No: WB946
Well: DH-01



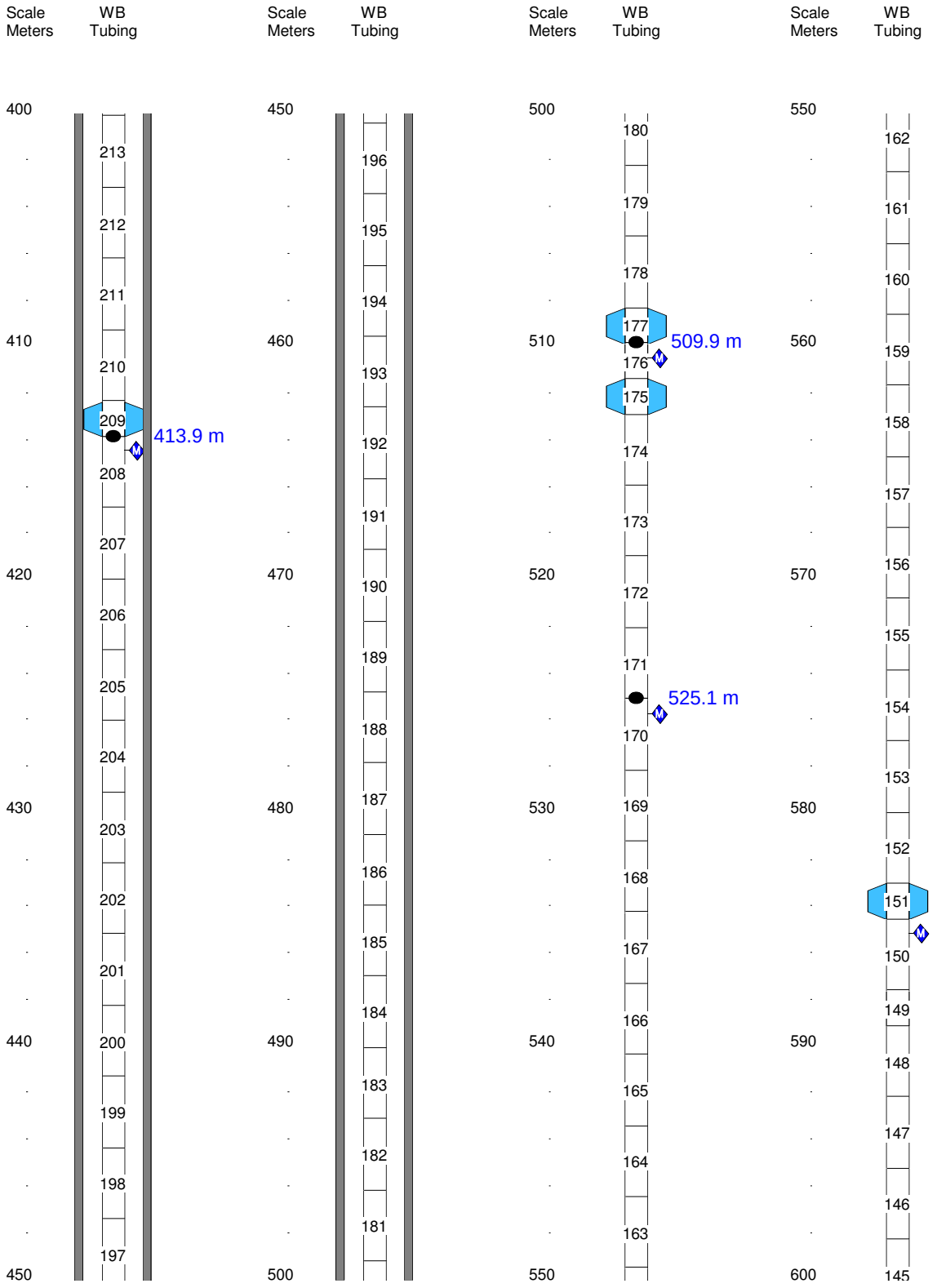
Summary Completion Log
HD Mining

Job No: WB946
Well: DH-01



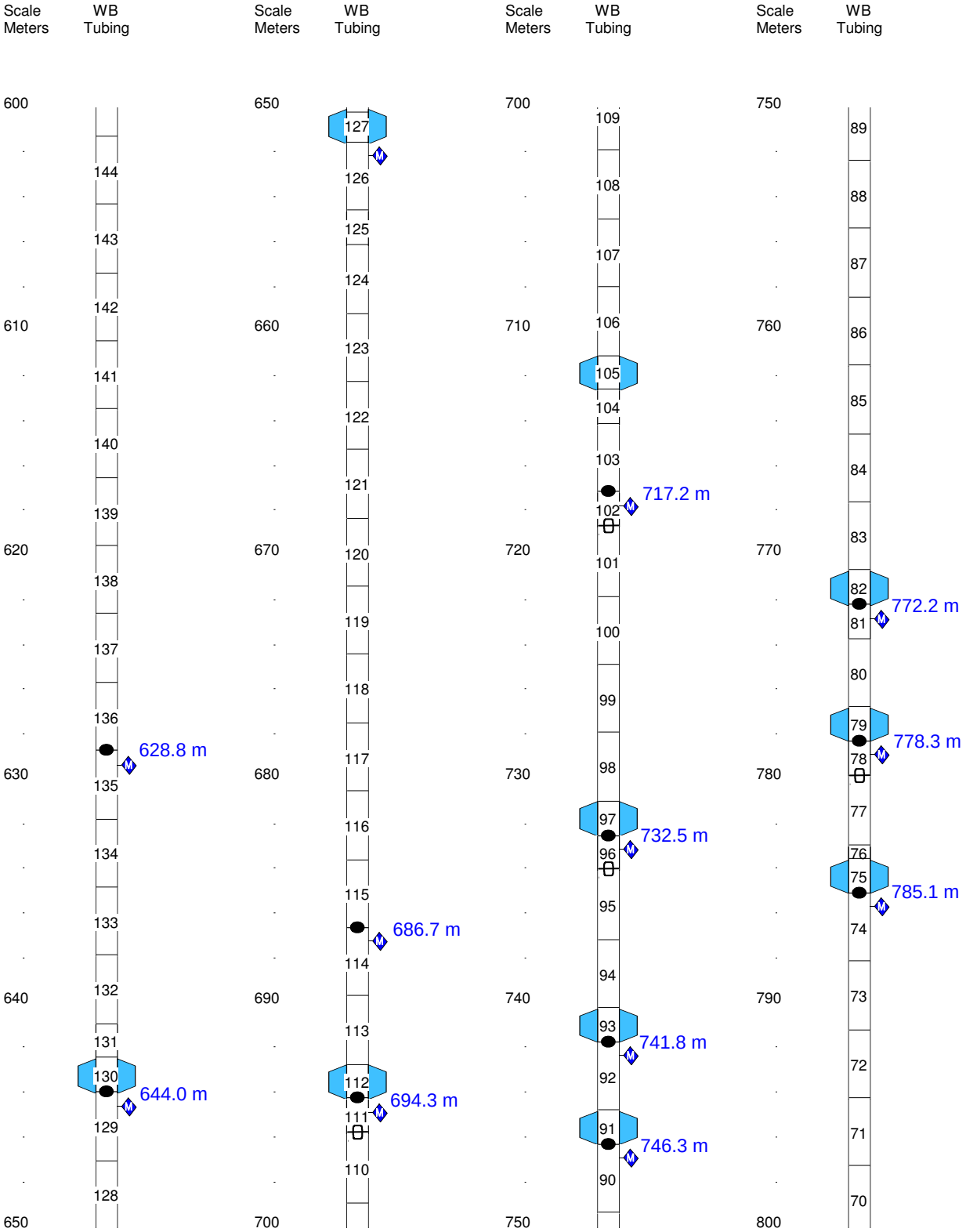
Summary Completion Log
HD Mining

Job No: WB946
Well: DH-01



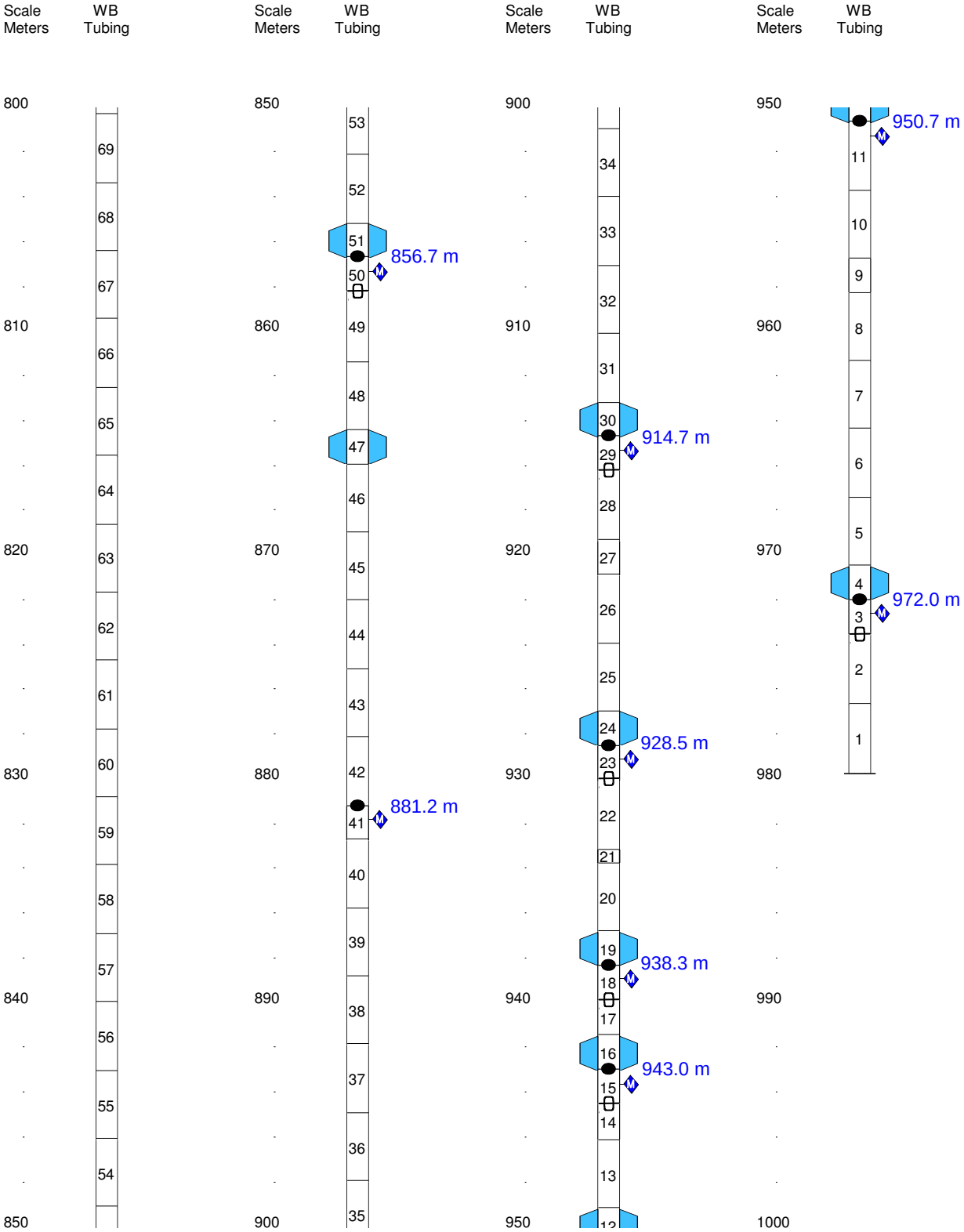
Summary Completion Log
HD Mining

Job No: WB946
Well: DH-01



Summary Completion Log
HD Mining

Job No: WB946
Well: DH-01



Westbay Instruments

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Well No.: DH-01
Datum: GS
Elev. G.S.: 0
Height of Westbay above G.S.: 2.14 m
Elev. top of Westbay Casing: 0
Reference Elevation: 0
Borehole angle: Vertical

Probe Type: Sampler
Serial No.: EMS 2653
Probe Range: 2000 psi
Westbay Casing Type: MP38
Sampler Valve Position: closed

Date: Oct 3/15
Client: HD Mining
Job No.: Murray River
Location: WB 946
Weather: Cold-Clear
Operator: M. Lessard

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

Start: Pressure 12.76 psi
Temp 7.39°C
Time 7:57 am
Finish:

P_{atm} 12.76 psi

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	Pressure Head Outside Port (m) H = (P2-Patm)/w	Piez. Level Outside Port (m) Dz = Dp - H	Comments: collar (m) depth by center
1	965.9	963.9	—	1304.50	1389.95	9:05	26.00	1303.85	968.5	-2.6	~~964.5~~ 964.5
2	944.6	942.7	—	1273.30	1359.51	9:15	25.93	1273.30	947.1	-2.5	943
3	936.9	934.9	—	1262.29	1348.33	9:20	25.78	1262.30	939.2	-2.3	935
4	932.3	930.3	—	1255.67	1341.51	9:23	25.66	1255.66	934.4	-2.1	931
5	922.4	920.4	—	1241.61	1327.20	9:26	25.42	1241.62	924.4	-2.0	921
6	908.6	906.6	—	1221.90	1307.46	9:29	25.18	1221.89	910.5	-1.9	908
7	875.1	873.3	—	1173.94	1259.13	9:34	24.56	1173.95	876.5	-1.4	874
8	850.6	848.8	—	1138.87	1223.43	9:38	23.90	1138.84	851.4	-0.8	850
9	779.0	777.4	—	1036.09	1119.87	9:43	22.30	1036.10	778.6	+0.4	778
10	772.2	770.6	—	1026.41	1109.61	9:46	21.79	1026.93	771.3	+0.9	772
11	766.1	764.6	—	1017.67	1100.24	9:49	21.34	1017.61	764.8	+1.3	765
12	740.2	738.8	—	980.53	1062.19	9:54	20.90	980.57	738.0	2.2	740
13	735.7	734.1	—	974.01	1055.14	9:57	20.58	974.02	737.0	2.7	735
14	726.5	725.0	—	960.89	1041.34	10:00	20.32	960.79	727.3	3.2	726
15	711.1	709.7	—	938.84	1024.9	10:03	19.65	—	—	—	—

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

0 1303.85

Westbay Instruments

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Well No.: DH-01
Datum: GS
Elev. G.S.: ø
Height of Westbay above G.S.: 2.14 m
Elev. top of Westbay Casing: ø
Reference Elevation: ø
Borehole angle: Vertical

Probe Type: Sampler
Serial No.: EMS 2653
Probe Range: 2000 psi
Westbay Casing Type: MP38
Sampler Valve Position: Closed

Date: Oct 3/15
Client: HD Mining
Job No.: WB 946
Location: Murray River
Weather: Cold - clear
Operator: M Lessard

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

Start: Pressure 12.75 psi Finish:
Temp 5.51 °C
Time 11:10 am

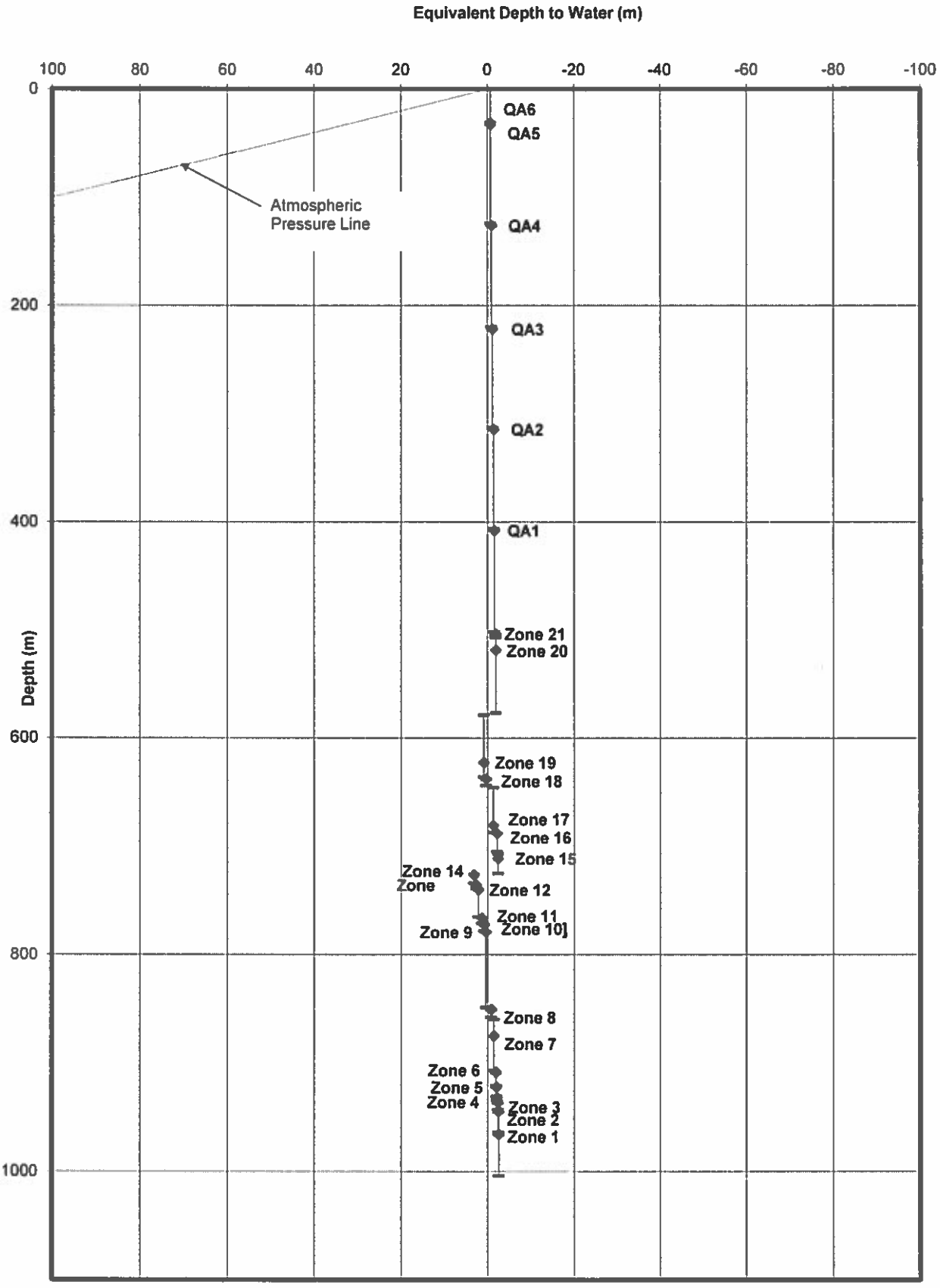
P_{atm} 12.76 psi

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	Pressure Head Outside Port (m) H = (P2-Patm)/w	Piez. Level Outside Port (m) Dz = Dp - H	Collar depth by counter (cm) Comments
15	711.1	709.7	—	—	1027.35	10:06	18.59	938.99	713.5	-2.4	710
16	688.2	686.8	—	906.20	994.45	10:10	17.74	906.20	690.4	-2.2	688
17	680.6	679.2	—	895.26	982.42	10:13	17.37	895.23	681.9	-1.3	680
18	637.9	636.6	—	834.30	919.36	10:17	16.82	834.02	637.6	0.3	637
19	622.7	621.3	—	812.14	896.99	10:22	15.90	812.12	621.8	0.9	622
20	519.0	518.0	—	663.68	753.49	10:30	13.87	663.71	520.9	-1.9	519
21	503.8	502.8	—	641.78	731.81	10:39	12.98	641.79	505.2	-1.9	503
22	407.8	406.9	—	504.14	594.90	10:40	10.97	504.16	409.4	-1.6	408
23	314.8	314.2	—	370.90	462.40	10:46	8.85	370.91	316.2	-1.4	315
24	221.9	221.3	—	237.60	329.85	10:51	7.21	237.56	223.0	-1.1	222
25	125.9	125.3	—	99.93	193.02	10:57	5.95	99.93	126.8	-0.9	126
26	32.9	32.3	—	12.94	60.52	11:04	5.52	12.81	33.6	-0.7	33
27	31.4	31.2	—	12.94	58.36	11:05	5.52	12.84	32.1	-0.7	-

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: DH-01

Profile Date: October 3, 2015
Comments:Pre-Inflation Profile



Client: HD Mining
Site: Murray River
Datum: Ground Surface

Figure 3

Plot By: ML Date: Oct 14, 2015
Checked By: Date:
Westbay Project: WB946

Westbay Piezometric Pressures/Levels

Post-Inflation Pressure Profile

Transcribed from field book

Field Data and Calculation Sheet

Well No.: DH-01
Datum: Ground Surface
Elev. G.S.: n/a
Height of Westbay above G.S.: 1.41 m
Elev. top of Westbay Casing: n/a
Reference Elevation: n/a
Borehole angle: Vertical

Probe Type: Sampler
Serial No.: EMS2652
Probe Range: 2000 psi
Westbay Casing Type: MP38
Sampler Valve Position: Closed

Date: October 8, 2015
Client: HD Mining
Job No.: WB946
Location: Murray River
Weather: Cool - Clear
Operator: Mark Lessard

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

Start: Pressure 12.83 psi
Temp 13.54 Deg C
Time 12:56 PM
Finish:

P_{atm} 12.83 **psi**

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings					Pressure Head Outside Port (m)	Piez. Level Outside Port (m)	Comments					
				Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	H = (P2-Patm)/w	Dz = Dp - H		ZONES				
1	972.0	970.1	n/a	888.8	962.8	1:28	24.4	888.8	668.0	304.0		Zone 1				
2	950.7	948.8	n/a	858.3	932.4	1:31	25.6	858.3	646.7	304.0		Zone 2				
3	943.0	941.1	n/a	847.3	921.4	1:35	25.8	847.3	639.0	304.0		Zone 3				
4	938.3	936.5	n/a	840.6	903.1	1:39	25.8	840.6	626.1	312.2		Zone 4				
5	928.5	926.7	n/a	826.7	885.1	1:42	25.7	826.7	613.4	315.1		Zone 5				
6	914.7	912.9	n/a	806.9	865.4	1:45	25.6	806.9	599.5	315.2		Zone 6				
7	881.2	879.5	n/a	758.9	905.2	1:49	25	759.0	627.5	253.7		Zone 7				
8	856.7	855.1	n/a	724.0	869.0	1:54	24.3	724.0	602.1	254.6		Zone 8				
9	785.1	783.7	n/a	621.6	778.4	2:00	22.9	621.6	538.4	246.7		Zone 9				
10	778.3	777.0	n/a	611.9	812.9	2:03	22.2	611.9	562.7	215.6		Zone 10				
11	772.2	770.9	n/a	603.1	810.9	2:06	21.7	603.2	561.2	211.0		Zone 11				
12	746.3	745.0	n/a	566.2	749.2	2:15	21.1	566.2	517.8	228.5		Zone 12				
13	741.8	740.5	n/a	559.5	698.7	2:18	20.8	559.6	482.3	259.5		Zone 13				
14	732.5	731.3	n/a	546.5	636.7	2:22	20.6	546.4	438.8	293.7		Zone 14				
15	717.2	716.0	n/a	524.6	487.4	2:24	20.3	524.6	333.7	383.5		Zone 15				

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Westbay Piezometric Pressures/Levels

Post-Inflation Pressure Profile

Transcribed from field book

Field Data and Calculation Sheet

Well No.: DH-01
Datum: Ground Surface
Elev. G.S.: n/a
Height of Westbay above G.S.: 1.41 m
Elev. top of Westbay Casing: n/a
Reference Elevation: n/a
Borehole angle: Vertical

Probe Type: Sampler
Serial No.: EMS2652
Probe Range: 2000 psi
Westbay Casing Type: MP38
Sampler Valve Position: Closed

Date: October 8, 2015
Client: HD Mining
Job No.: WB946
Location: Murray River
Weather: Cool - Clear
Operator: Mark Lessard

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

Start: Pressure 12.83 psi
Temp 13.54 Deg C
Time 12:56 PM
Finish:

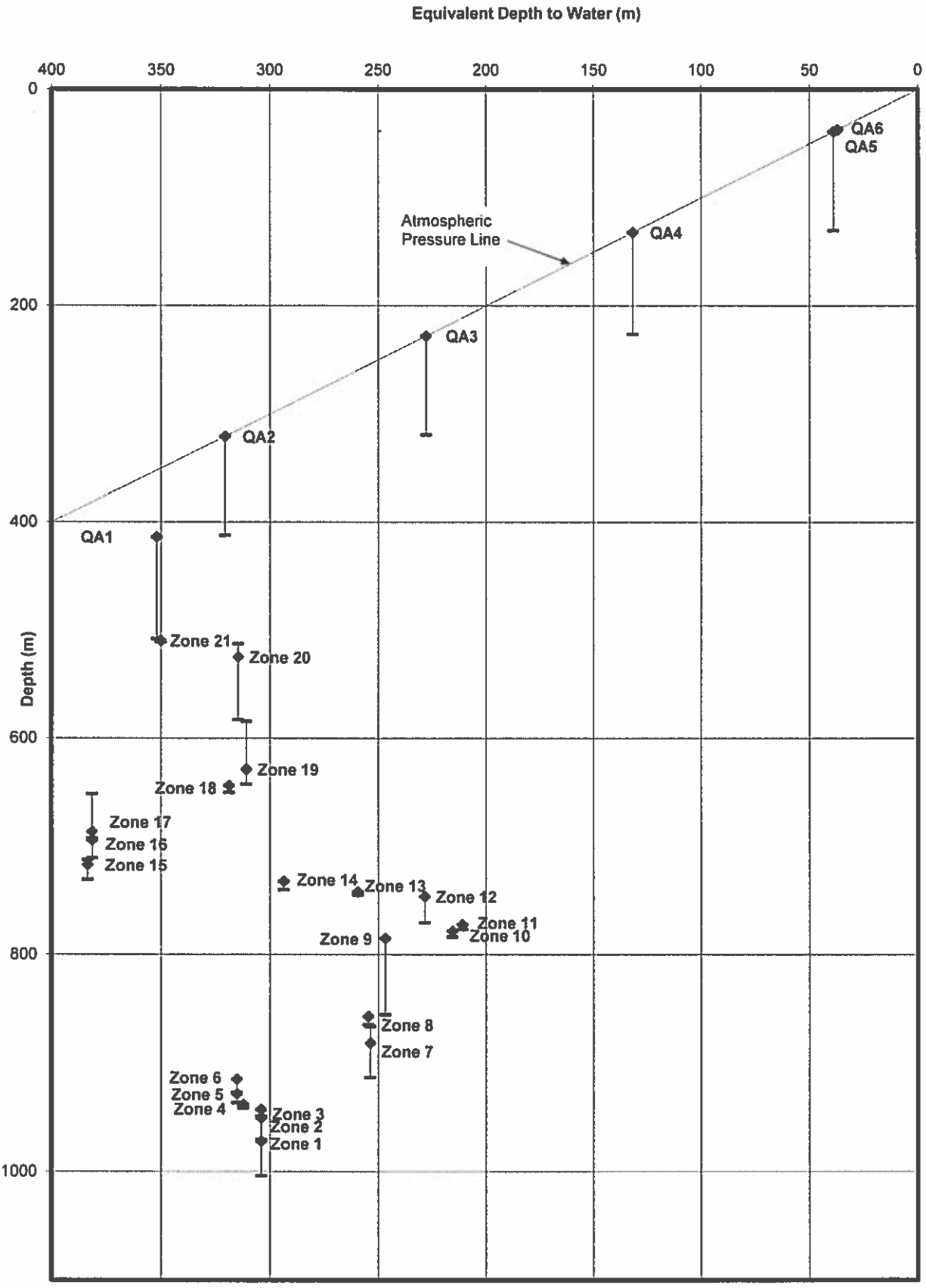
P_{atm} 12.83 **psi**

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings					Pressure Head Outside Port (m)	Piez. Level Outside Port (m)	Comments					
				Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	H = (P2-Patm)/w	Dz = Dp - H		ZONES				
16	694.3	693.2	n/a	491.8	457.9	2:28	19.8	491.8	313.0	381.3		Zone 16				
17	686.7	685.6	n/a	480.8	446.8	2:31	19.2	480.9	305.2	381.5		Zone 17				
18	644.0	643.1	n/a	419.9	475.4	2:35	18.6	420.0	325.3	318.7		Zone 18				
19	628.8	627.9	n/a	398.2	465.0	2:40	17.9	398.2	318.0	310.8		Zone 19				
20	525.1	524.7	n/a	250.1	312.2	2:46	16.5	250.1	210.5	314.6		Zome 20				
21	509.9	509.5	n/a	228.3	240.0	2:48	15.7	228.3	159.8	350.1		Zone 21				
QA1	413.9	413.9	n/a	91.3	100.9	2:55	13.8	91.3	61.9	352.0		QA1				
QA2	320.9	321.3	n/a	13.4	13.2	2:59	12.1	13.3	0.2	320.7		QA2				
QA3	228.0	228.8	n/a	13.2	13.0	3:04	11.0	13.2	0.1	227.9		QA3				
QA4	132.0	133.1	n/a	13.0	13.0	3:08	10.1	13.0	0.1	131.9		QA4				
QA5	39.0	40.5	n/a	12.9	12.9	3:12	9.4	12.9	0.0	39.0		QA5				
QA6	37.5	38.9	n/a	12.9	13.5	3:14	8.9	12.9	0.5	37.0		QA6				

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: DH-01

Profile Date: October 8, 2015
Comments: Post-Inflation Profile



Client: HD Mining
Site: Murray River
Datum: Ground Surface

Figure 4

Plot By: ML Date: Oct 13, 2015
Checked By: DL Date: Jan 6/2016
Westbay Project: WB946

Westbay Completion Log

Company: HD Mining
Well: DH-01
Site: Murray River, BC
Project: Murray, River

Job No: WB946
Author: AB/ML

ML

Well Information

Reference Datum: Ground Surface
Elevation of Datum: 0.00 m.
MP Casing Top: 0.00 m.
MP Casing Length: 973.68 m.

sluff at 977m / Bottom at 976m P.R.

Borehole Depth: ~~995.66~~ m. 1004 m ML
Borehole Inclination: Vertical
Borehole Diameter: 76.00 mm

Well Description:
MP38
Other References:

File Information

File Name: DH-01V2.WWD
Report Date: Tue Sep 29 10:45:43 2015

File Date: Sep 29 08:15:05 2015

Comments

Zero reference is ground surface – P.R.
Filter socks to be used – P.R.

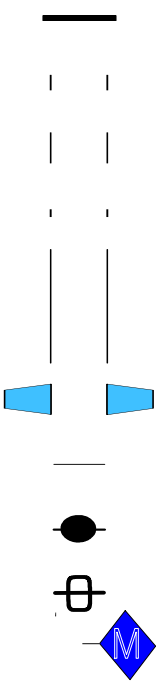
Log Information

Borehole condition confirmed. (method) Drill Rods Date:
MP well design & preparation. By: Mark Lucas Date: Sept 29/15
MP well design checked. By: P.R. Date: Sep. 30/15
MP well and borehole approved to install. By: Gord Bagnall Date: Sep. 30/15

Legend

(Qty) MP Components

(Library - WD Library 04/29/15)



(2) 0203 - MP38 End Cap

(4) 020102 - MP38 Casing 3 (2F/0.6M)

(24) 020105 - MP38 Casing 2 (5F/1.5M)

(1) 020101 - MP38 Casing 4 (1F/0.3M)

(296) 020110 - MP38 Casing 1 (10F/3M)

(26) 0238 - MP38 Packer - 74mm (5F/1.5M)

(314) 0202 - MP38 Regular Coupling

(27) 0205 - MP38 Measurement Port

(10) 0206 - MP38 Hydraulic Pumping Port

(28) 0216 - Magnetic Location Collar

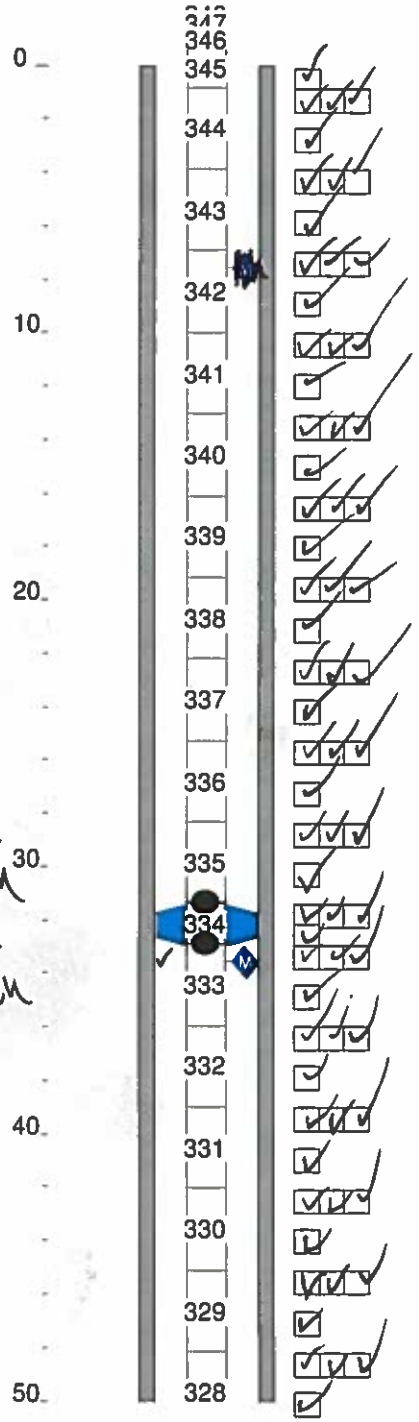
Geology

Backfill/Casing

Mild Steel

Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01



Finish lowering at 4:20pm on Oct 2/15.

Filter Sock

Filter Sock

5469
19300 - 150 psi
8610

(c) Westbay Instruments Inc. 2000

Tue Sep 29 10:46:37 2015

3:28pm

Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01

Scale Meters	WB Tubing	QA Tested OK	WB Tubing Description	Serial Numbers
50	327	✓	020110 - MP38 Casing 1 (10F/3M)	
	326	✓	020110 - MP38 Casing 1 (10F/3M)	
	325	✓	020110 - MP38 Casing 1 (10F/3M)	
60	324	✓	020110 - MP38 Casing 1 (10F/3M)	
	323	✓	020110 - MP38 Casing 1 (10F/3M)	
	322	✓	020110 - MP38 Casing 1 (10F/3M)	
70	321	✓	020110 - MP38 Casing 1 (10F/3M)	
	320	✓	020110 - MP38 Casing 1 (10F/3M)	
	319	✓	020110 - MP38 Casing 1 (10F/3M)	
80	318	✓	020110 - MP38 Casing 1 (10F/3M)	
	317	✓	020110 - MP38 Casing 1 (10F/3M)	
	316	✓	020110 - MP38 Casing 1 (10F/3M)	
90	315	✓	020110 - MP38 Casing 1 (10F/3M)	
	314	✓	020110 - MP38 Casing 1 (10F/3M)	
	313	✓	020110 - MP38 Casing 1 (10F/3M)	
100	312	✓	020110 - MP38 Casing 1 (10F/3M)	

3:15 pm

Fill Westbay Casing with water.

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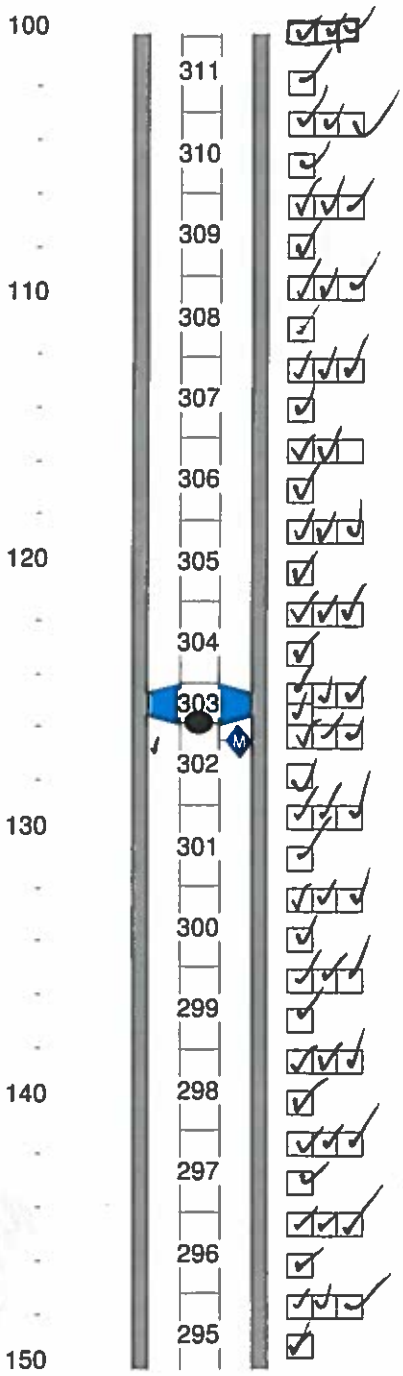
Tue Sep 29 10:46:37 2015

Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01



Top of coupling on component #309 leaked. Inspected - CNC shaving on o-ring. Reseated - 04

19285 - 140 psi
8614

Fill westbay with water after component #297
650 lbs
1:50 pm continue lowering
Lunch / fit pump / water
12:30 pm

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Tue Sep 29 10:46:37 2015

Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01

Scale Meters	WB Tubing	QA Tested OK	WB Tubing Description	Serial Numbers
150				
	294		020110 - MP38 Casing 1 (10F/3M)	12:25pm
	293		020110 - MP38 Casing 1 (10F/3M)	
	292		020110 - MP38 Casing 1 (10F/3M)	
160	291		020110 - MP38 Casing 1 (10F/3M)	
	290		020110 - MP38 Casing 1 (10F/3M)	
	289		020110 - MP38 Casing 1 (10F/3M)	
170	288		020110 - MP38 Casing 1 (10F/3M)	
	287		020110 - MP38 Casing 1 (10F/3M)	12:04pm
	286		020110 - MP38 Casing 1 (10F/3M)	
180	285		020110 - MP38 Casing 1 (10F/3M)	
	284		020110 - MP38 Casing 1 (10F/3M)	
	283		020110 - MP38 Casing 1 (10F/3M)	
	282		020110 - MP38 Casing 1 (10F/3M)	
190	281		020110 - MP38 Casing 1 (10F/3M)	
	280		020110 - MP38 Casing 1 (10F/3M)	
	279		020110 - MP38 Casing 1 (10F/3M)	
200				

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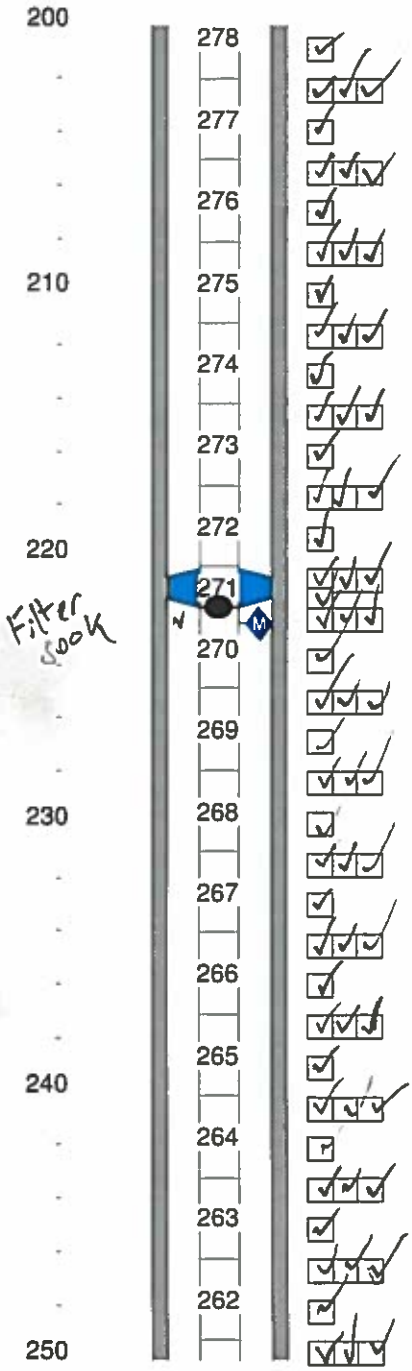
Tue Sep 29 10:46:37 2015

Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01

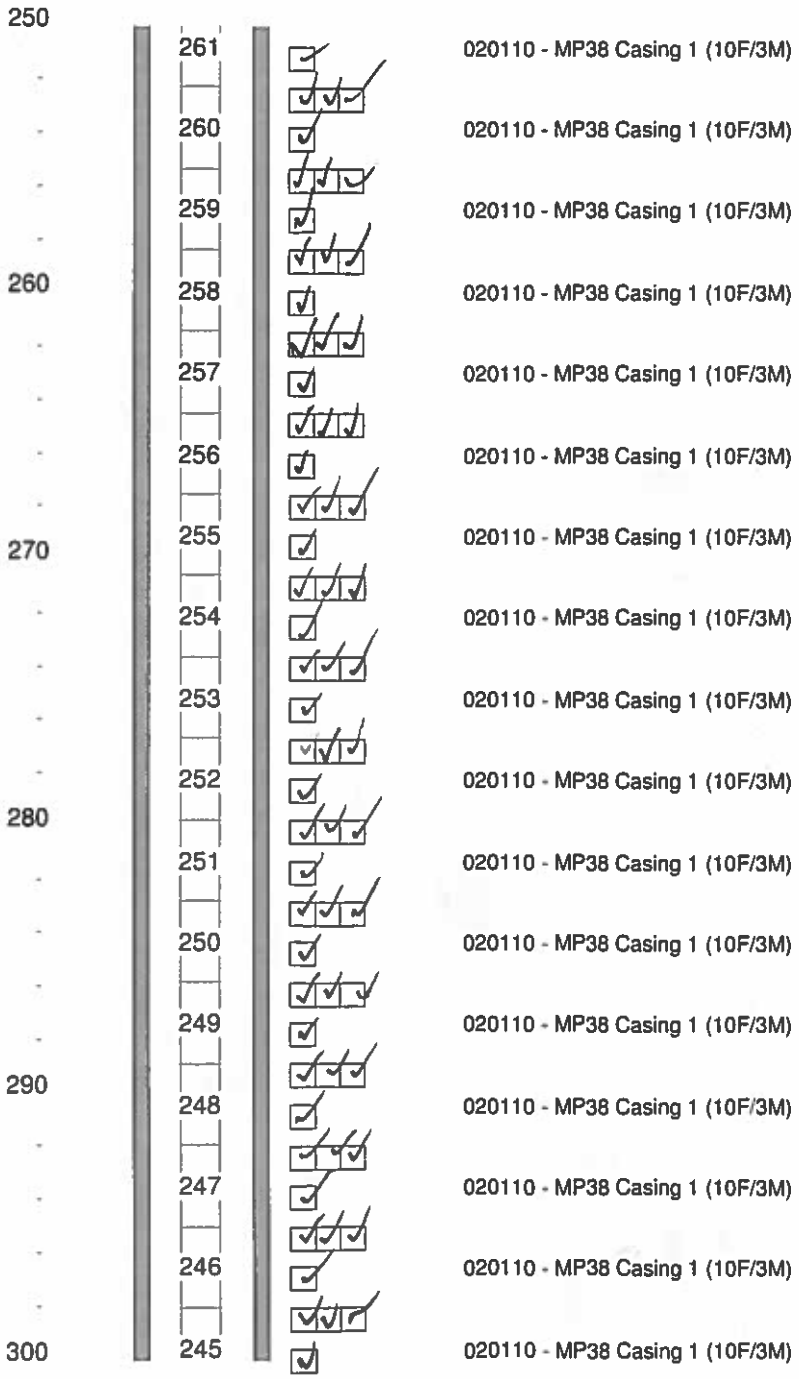


19308 - 145 psi
8608

Fill Westbay casing with water
11:02am
300 lbs before filling
600 lbs after filling

Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01



10:37 am

10:00 am continue lowering
Driller to shut off pump of water tank
9:37 am

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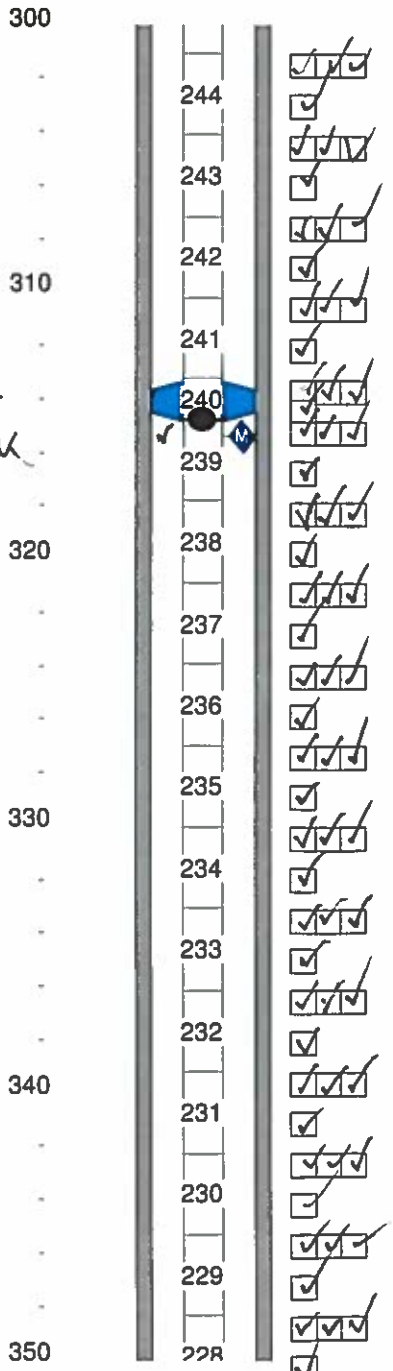
Tue Sep 29 10:46:54 2015

Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01



Filter Sock

19307 - 155 p.s.i
8618

8:49 am

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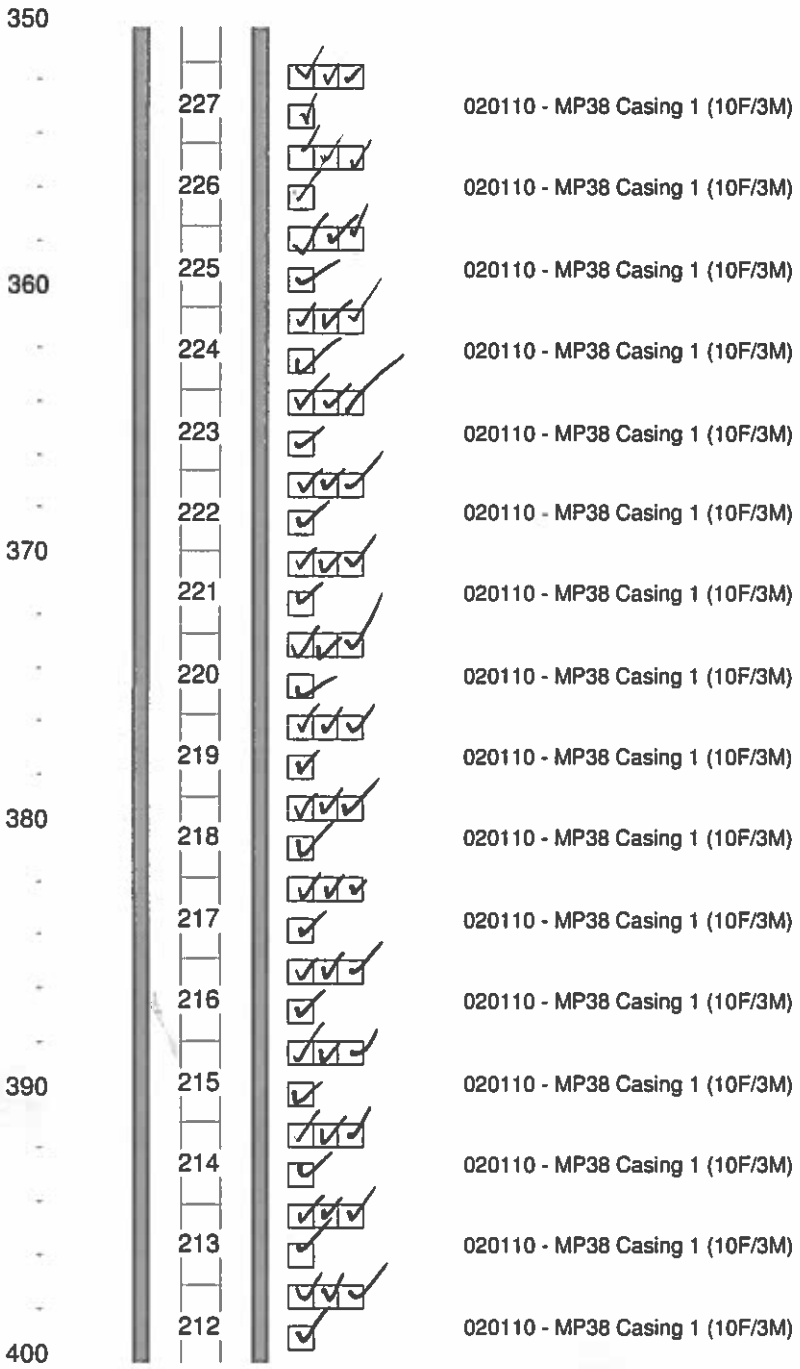
Tue Sep 29 10:46:54 2015

Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01



Start lowering for the shift at 9:30 am Oct 2 15 comp# 226

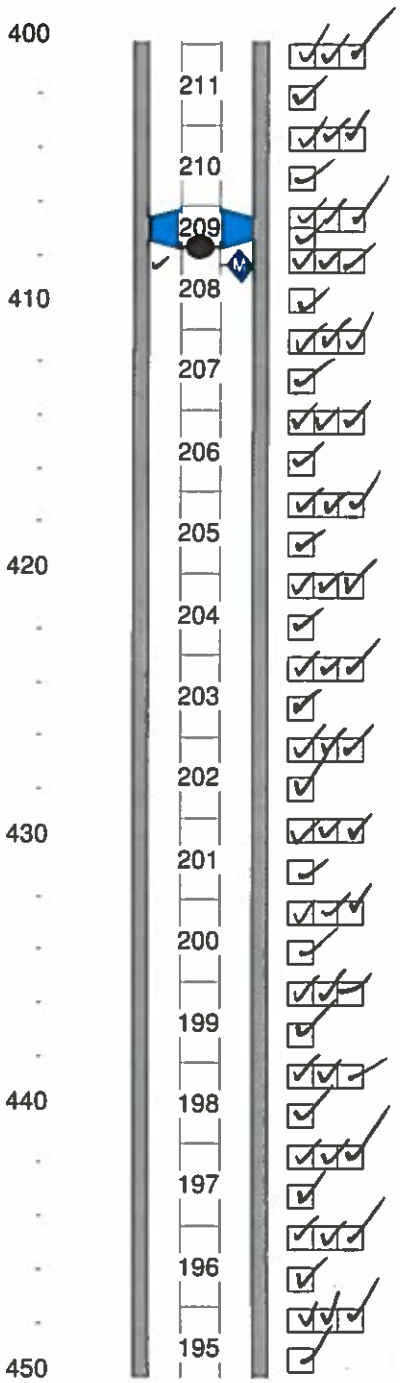
Fill Westbay casing with water - 525 lbs.

375 lbs.

6:15 pm Finish lowering for the shift. Oct 1 15 comp# 225 in borehole

Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01



Serial Numbers

Filter Sock

19284-145 ps:
8594
5:28pm

5:08 continue lowering

Westbay water top up.

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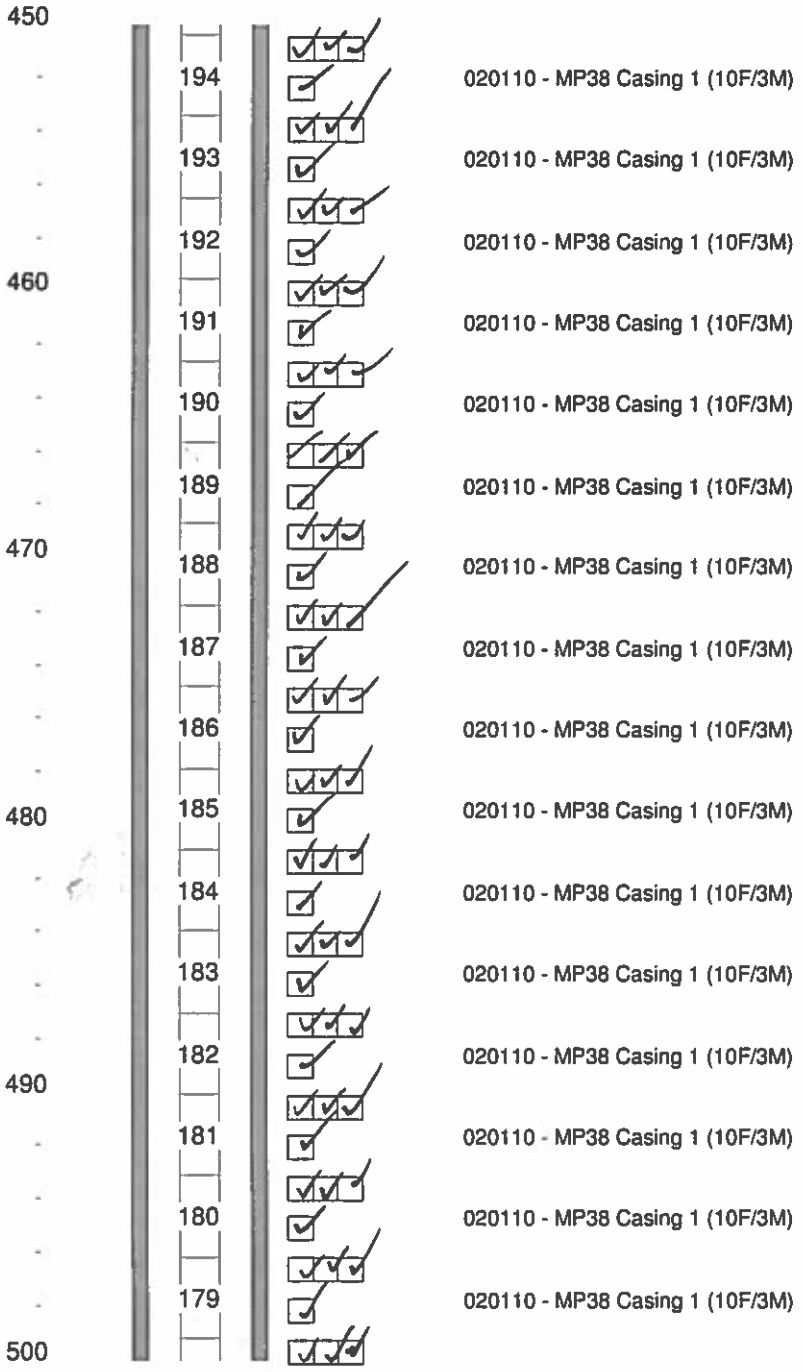
Tue Sep 29 10:46:54 2015

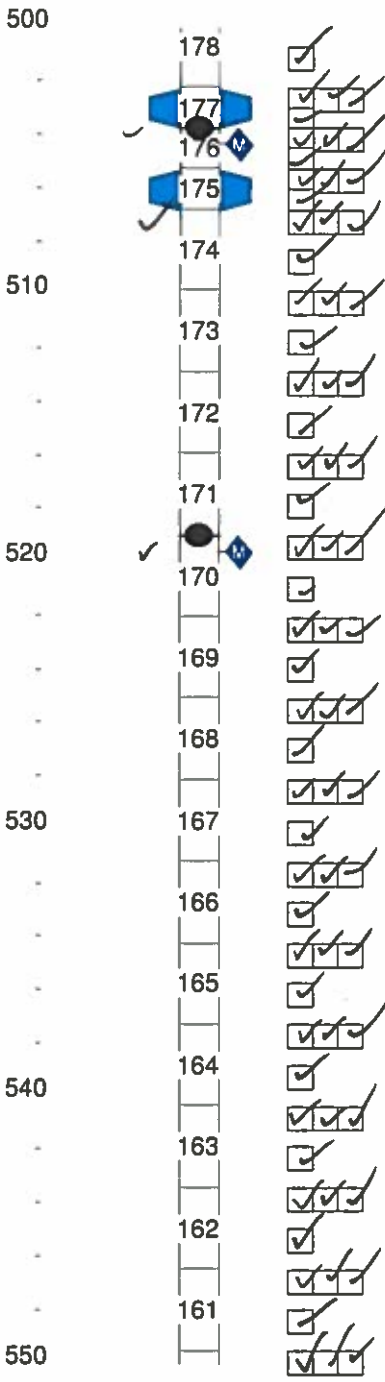
Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01



Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01



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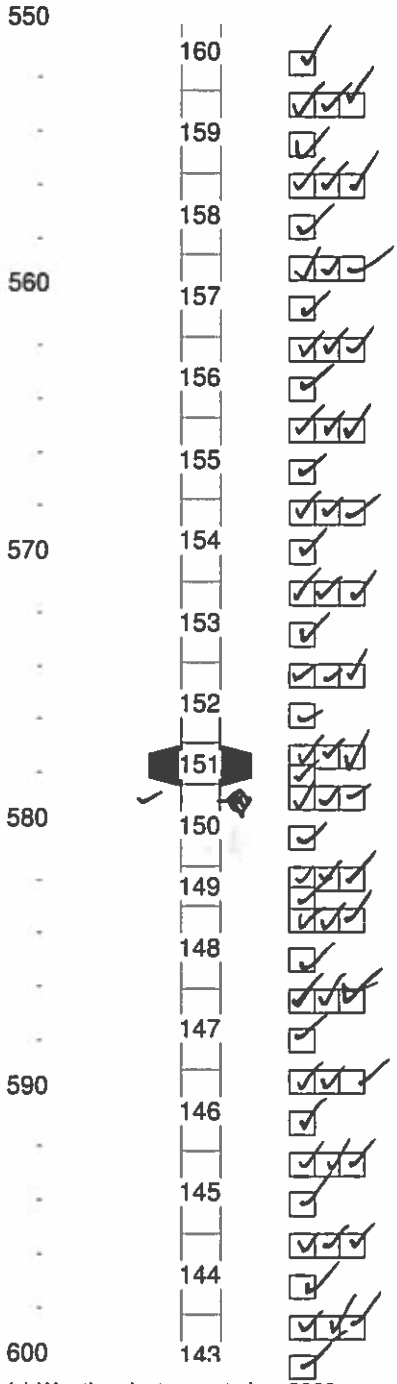
Tue Sep 29 10:47:12 2015

Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01



2:52pm cont.
Fill Westbay Casing with water. 2:41pm

~~WB water?~~

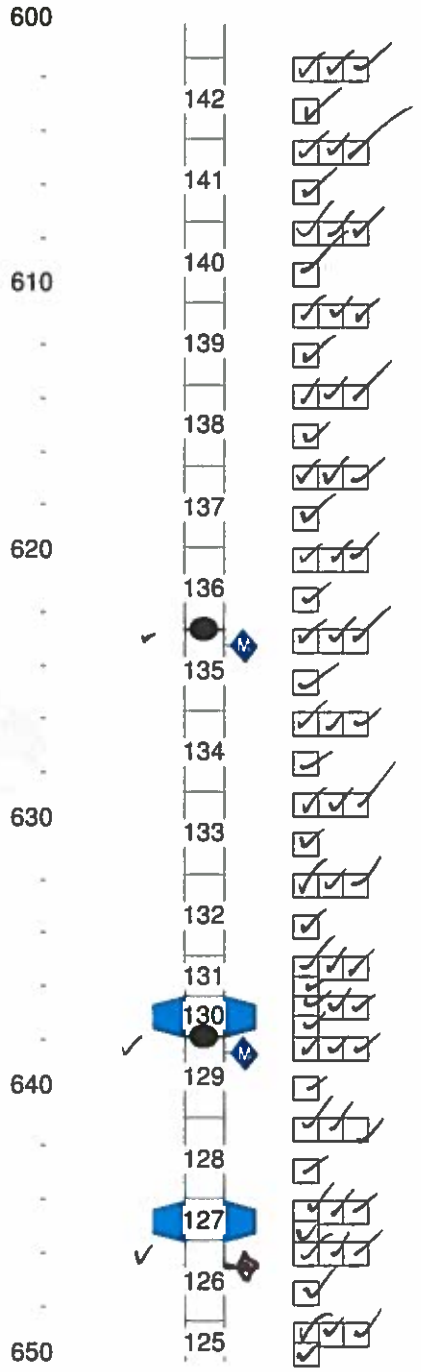
2:17pm Cont lowering
1:37pm stop + fill water tank

collar added for inflation purposes.
19388 - 145 psi

1:23 pm

Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01



Filter Sock

Filter Sock

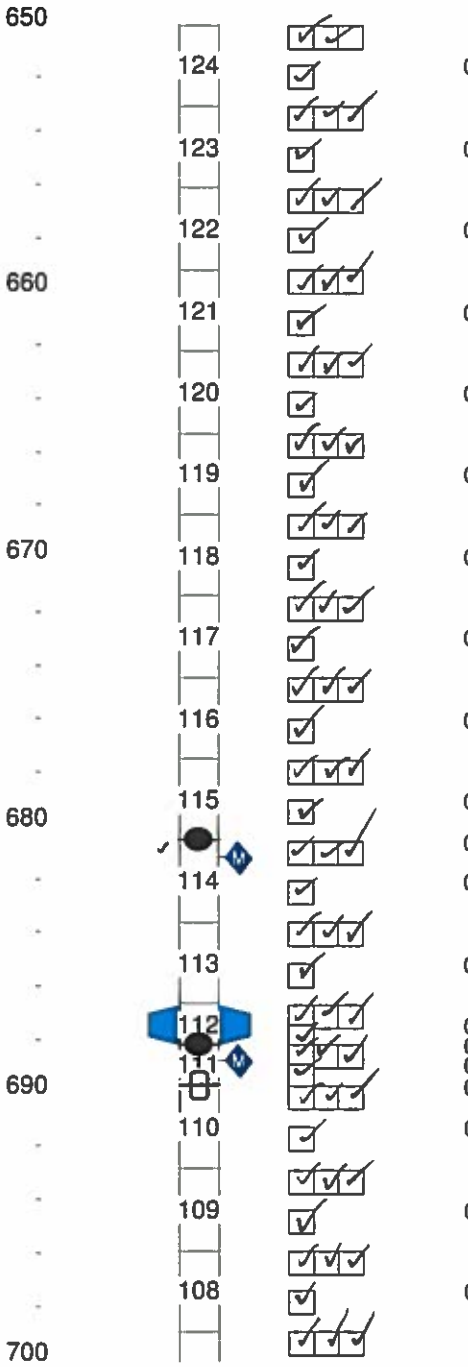
Joint test top pressure 280 psi.
8596 - low re-seal (dropping) replace with 8616. 1:06 pm

19287 - 145 psi
8594

12:33 pm
19289 - 150 psi
collar added for inflation purposes.

Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01



Filter Sock

Filter Sock

12:15

~~Fill Westbay with water~~

8596

19290 - 140 psi

8603

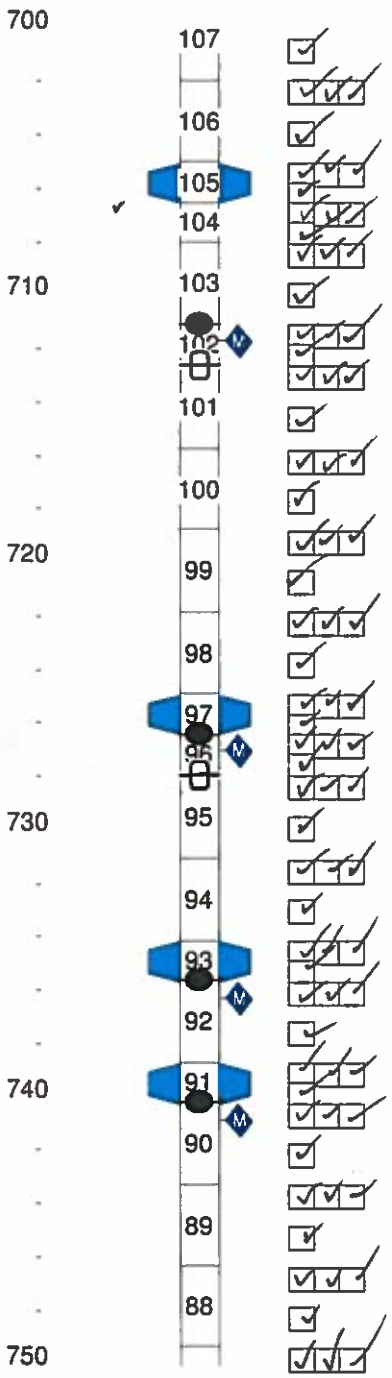
333

Westbay casing starting to float. fill with water

11:37

Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01



Serial Numbers

19301 - 145 psi
11:05 am

8606
332

19304 - 145 psi
8615
331

19302 - 140 psi
8599

19303 - 145 psi
8598

Filter Sock

Filter Socks

Filter Sock

Filter Sock

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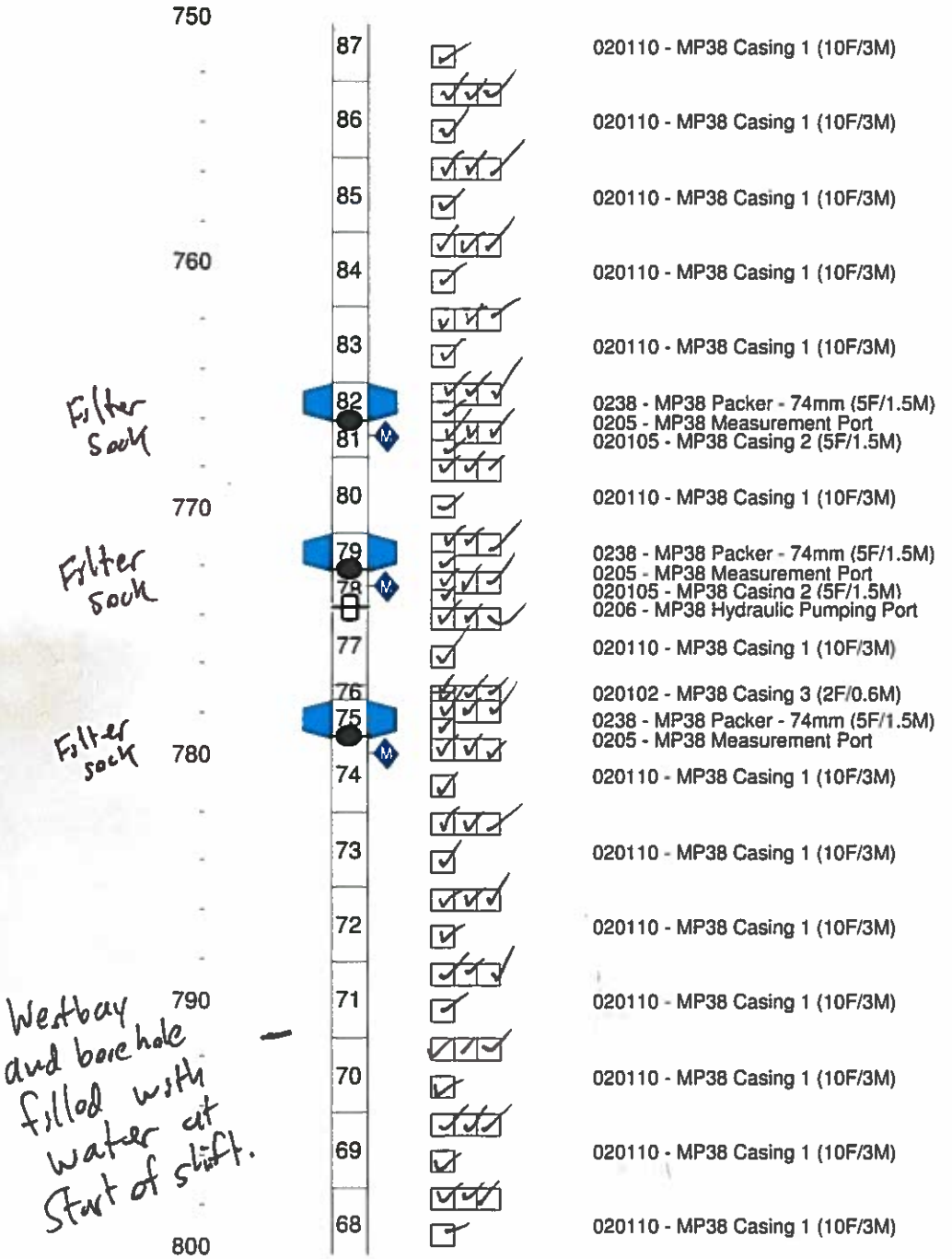
Tue Sep 29 10:47:13 2015

Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01

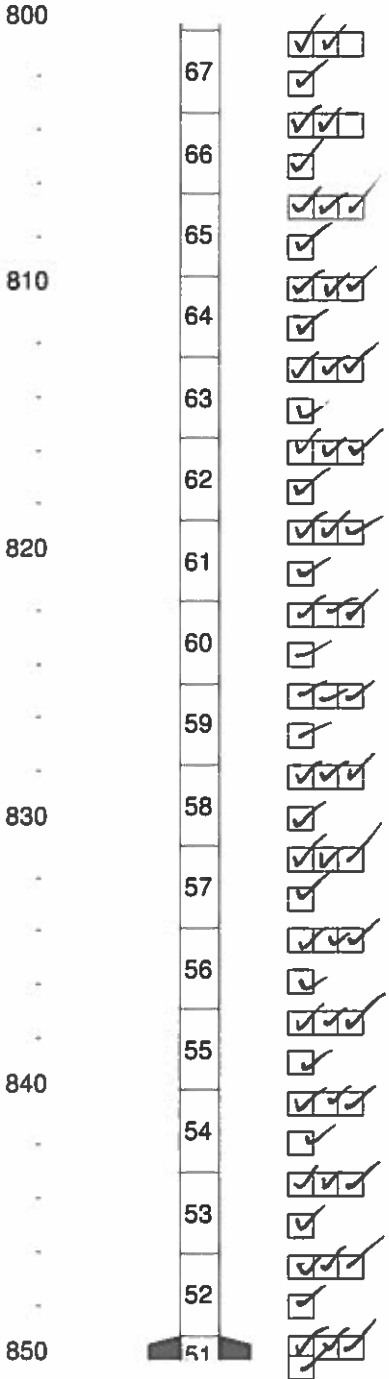


(c) Westbay Instruments Inc. 2000

Tue Sep 29 10:47:27 2015

Westbay Completion Log
HD Mining

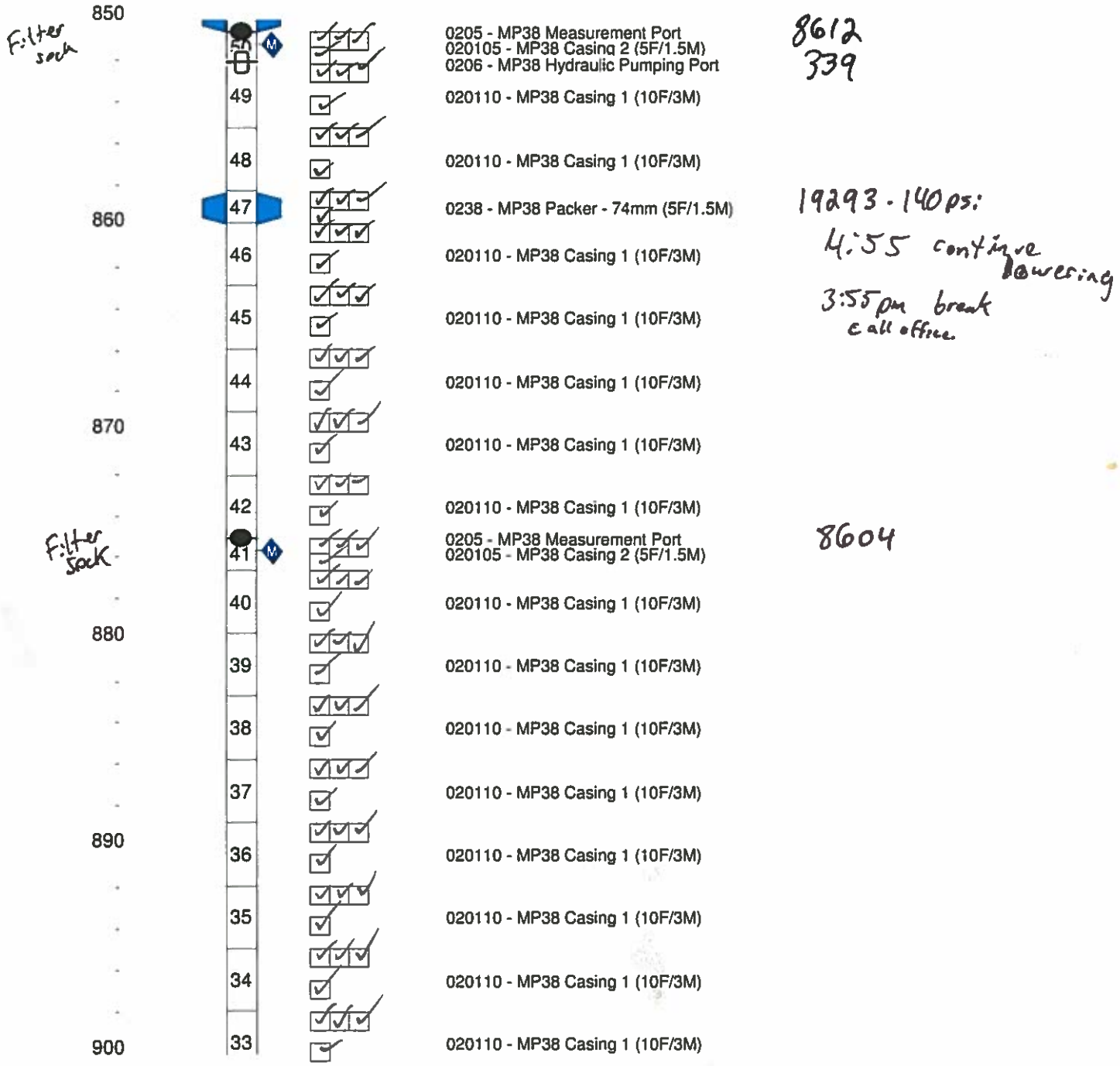
Job No: WB946
Well: DH-01



17704-145ps:

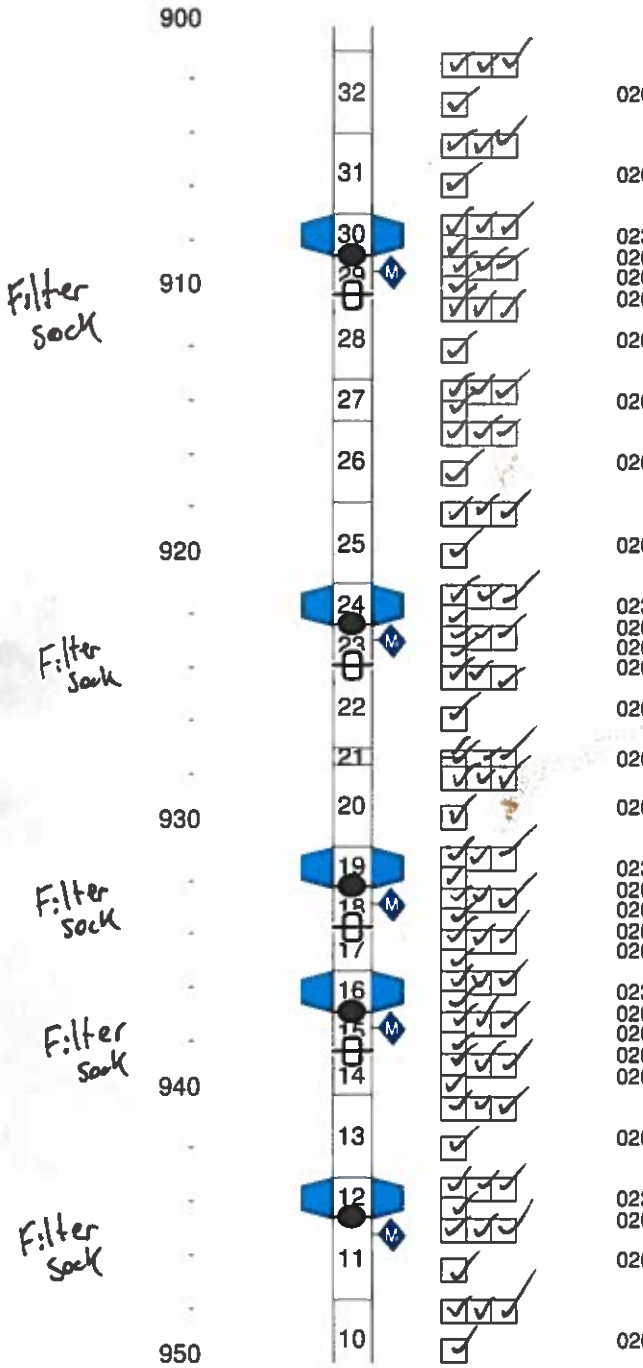
Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01



Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01



Filter sock

Filter sock

Filter sock

Filter sock

Filter sock

19295 - 140 psi
8613
338

2:46

19291 - 140 psi
8611
337

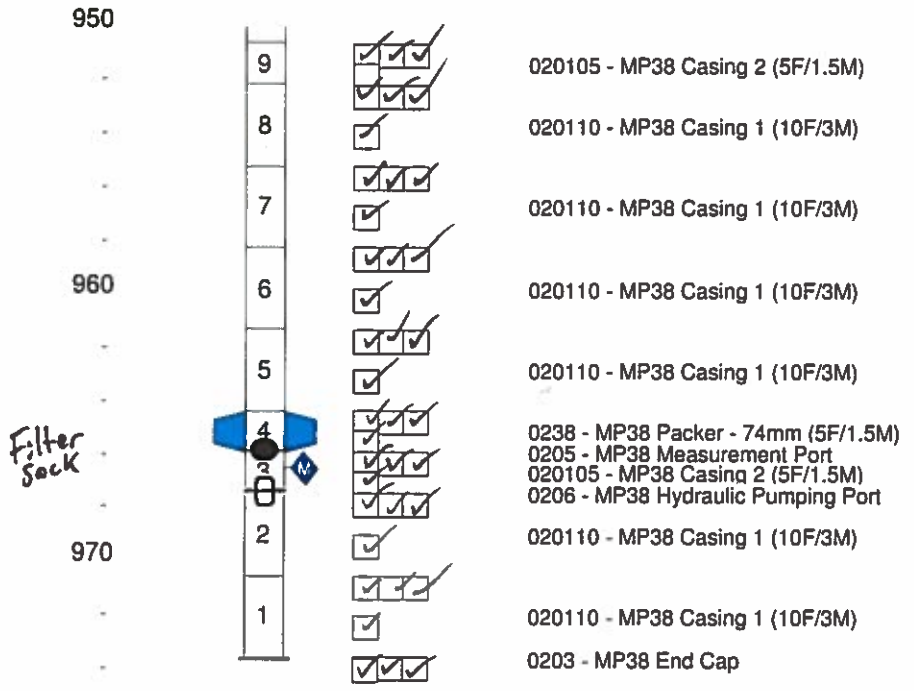
19297 - 140 psi
8605
336

19298 - 150 psi
8602
335
1:56 pm

19299 - 145 psi
7934

Westbay Completion Log
HD Mining

Job No: WB946
Well: DH-01



Westbay not getting lighter
Fill annulus back up with water.
Cair in water during 1st fill?)

19294 - 150 psi
8601
334

Joint test tool 300 psi
Start lowering at 12:45 pm Sept 30/15.

Hydraulic Integrity Test

Oct 2/15

67.48 m	at	5:40 pm
67.50 m	at	5:48 pm
67.46 m	at	6:01 pm
67.49 m	at	6:15 pm
67.60 m	at	7:30 pm
67.70 m	at	8:30 pm
67.80 m	at	9:30 pm
67.95 m	at	10:30 pm
68.05 m	at	11:30 pm
68.20 m	at	12:30 am Oct 3/15

Oct 3/15

67.46 m	at	1:30 am
67.45 m	at	2:30 am
67.45 m	at	3:30 am
67.45 m	at	4:30 am
67.45 m	at	5:30 am
67.45 m	at	6:30 am

Westbay Casing is water tight.
Mark Leonard

Pre-Inflation Profile
- Measurements recorded / calculations completed.
- Confirm MPort position and function.
Mark Leonard

Sheet 1 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 3/15

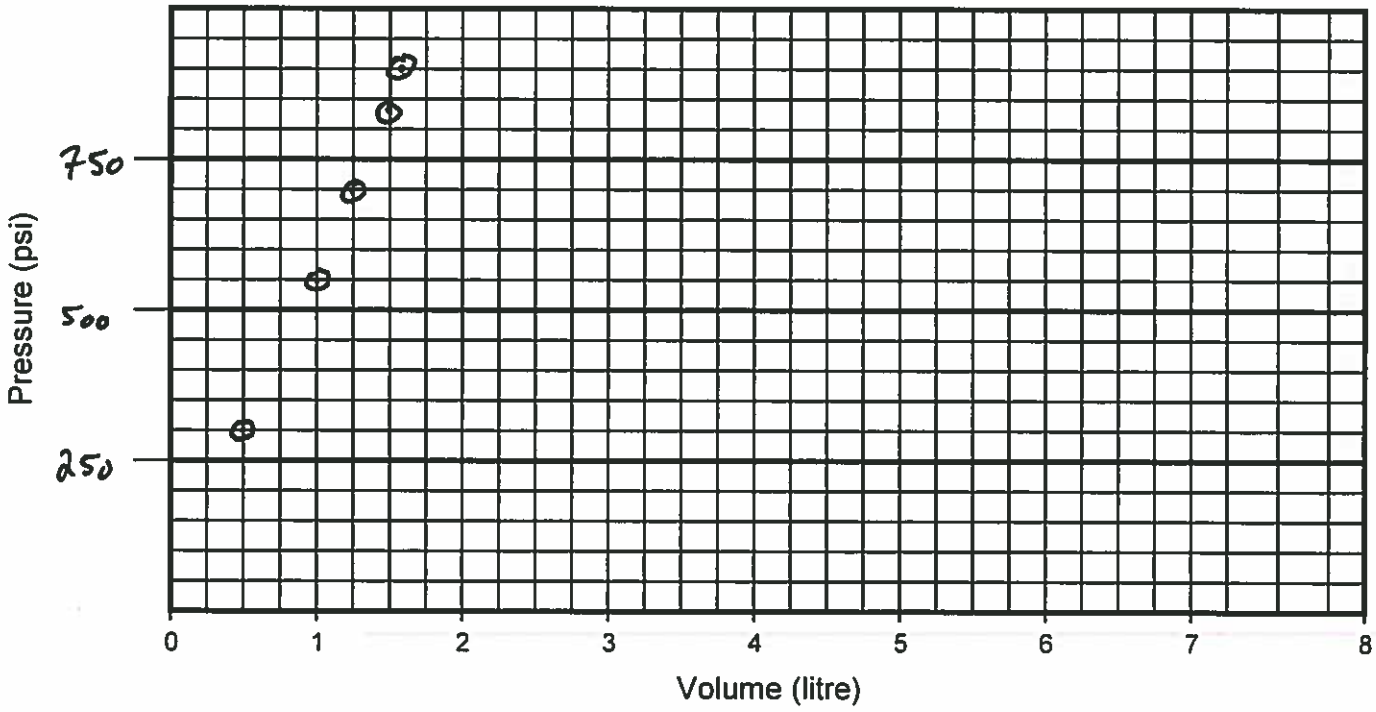
Packer No. Blank Wall Test | Depth (m): 974 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: n/a psi | Final Line Pressure, P_L: 900 psi | Tool Pressure, P_T: 500 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = n/a psi

Volume, litres	0.5	1.0	1.25	1.5	1.6	/	0.5			
Pressure, psi	300	550	700	830	900	/	ϕ			
Volume, litres										
Pressure, psi										



Comments: Blank Wall Test | Time - 2:40 pm

Sheet 2 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M.Lessard | Date Inflated: Oct 3/15

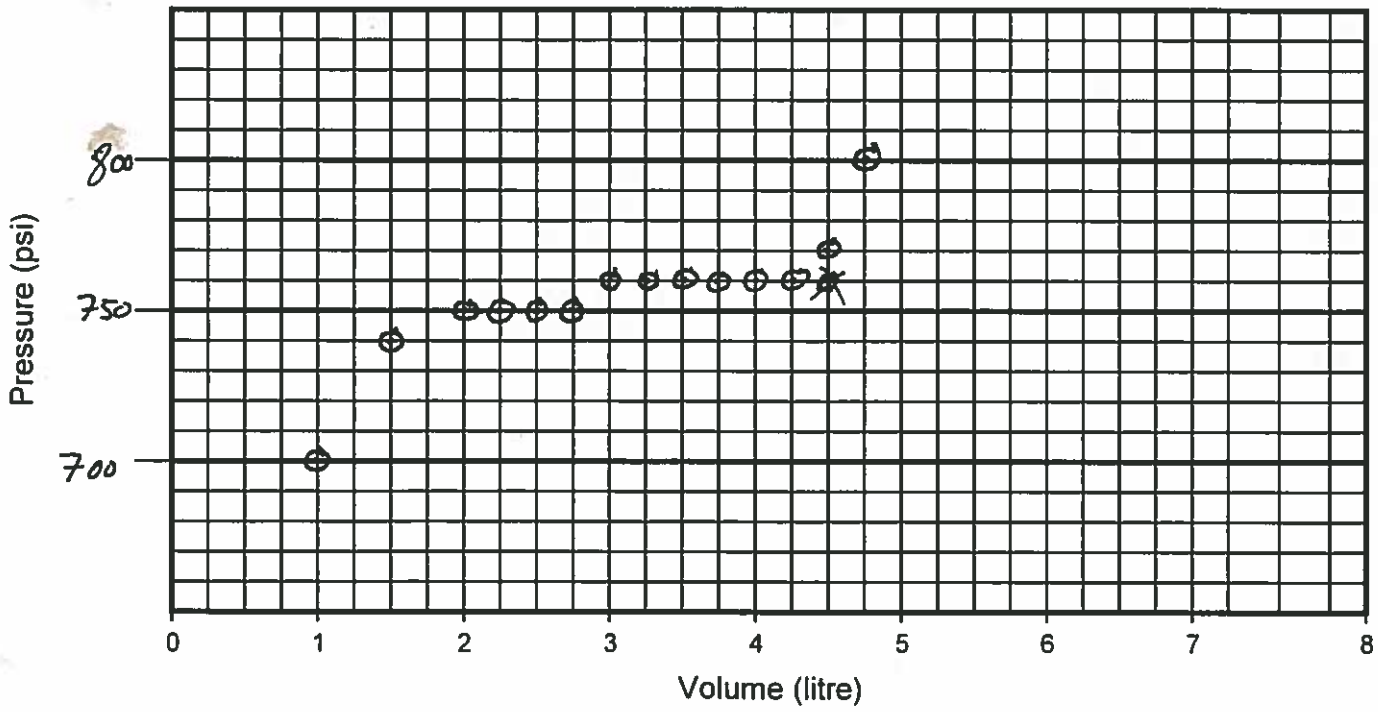
Packer No.: 1, comp 4 SN# 19294 | Depth (m): 970.5 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 150 psi | Final Line Pressure, P_L: 800 psi | Tool Pressure, P_T: 500 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 150 psi

Volume, litres	1.0	1.5	2.0	2.25	2.5	2.75	3.0	3.25	3.5	3.75
Pressure, psi	700	740	750	750	750	750	760	760	760	760
Volume, litres	4.0	4.25	4.5	4.75		3.8				
Pressure, psi	760	760	770	800		ø				



Comments: Packer #1 | Time - 3:28 pm

Target 800 psi

Sheet 3 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 3/15

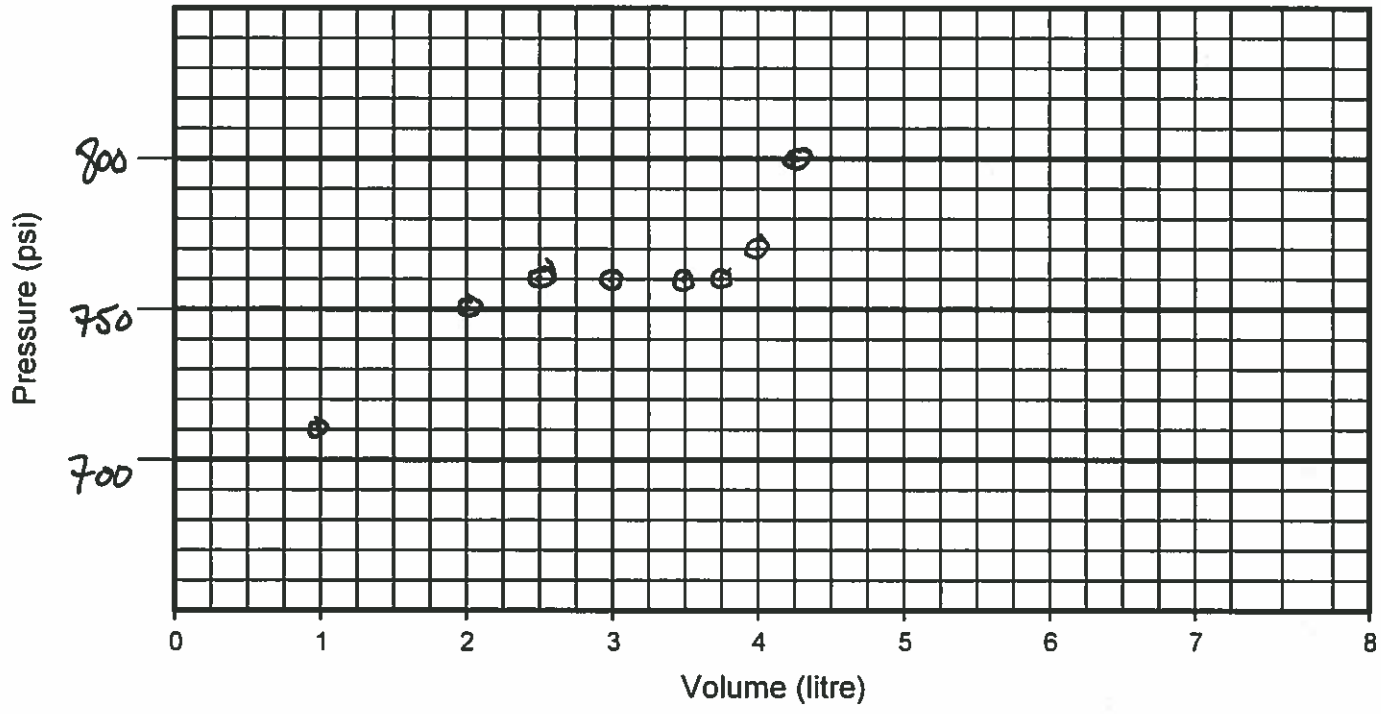
Packer No. 2, comp 12 SN# 19299 | Depth (m): 949.2 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 145 psi | Final Line Pressure, P_L: 800 psi | Tool Pressure, P_T: 500 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 155 psi

Volume, litres	1.0	2.0	2.5	3.0	3.5	3.75	4.0	4.25	/	3.3
Pressure, psi	710	750	760	760	760	760	770	800	/	ϕ
Volume, litres										
Pressure, psi										



Comments: Packer #2 | Time - 3:56 pm

Sheet 4 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 6/15

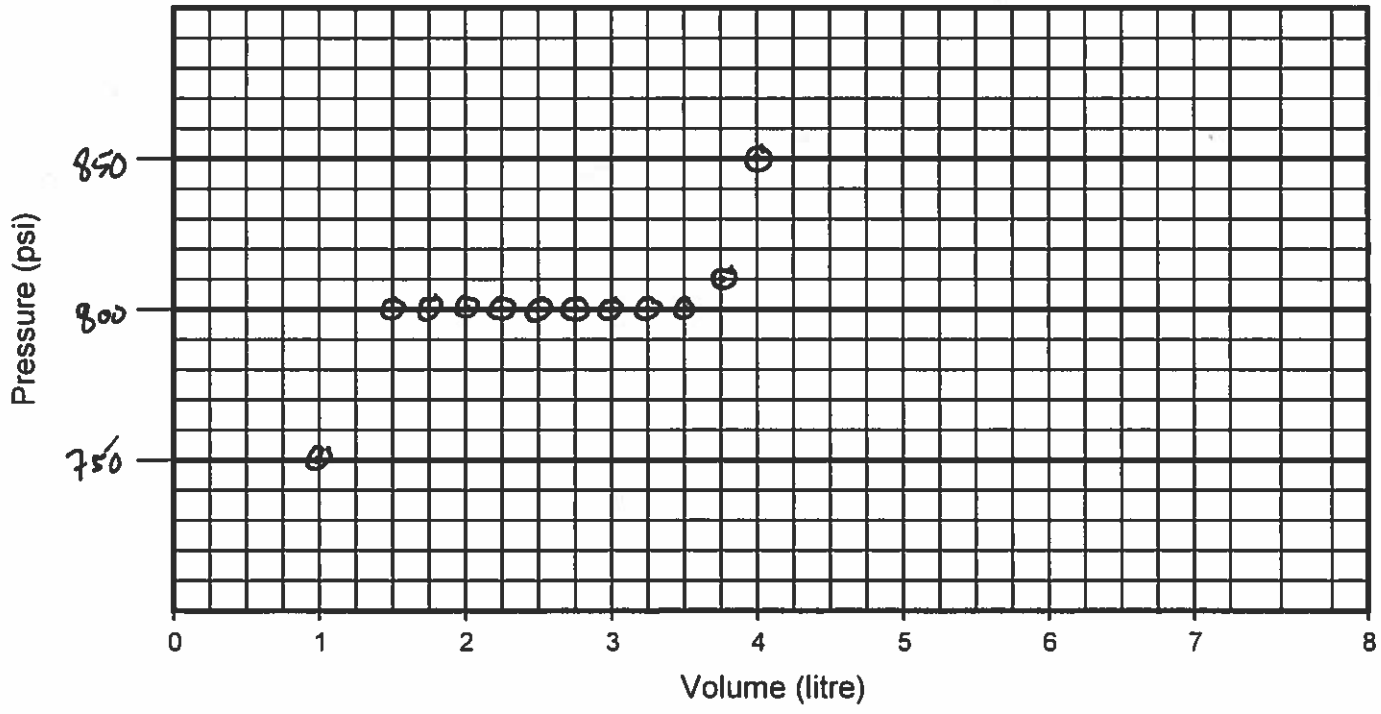
Packer No. 3, comp 16 SN# 19298 | Depth (m): 941.5 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 150 psi | Final Line Pressure, P_L: 850 psi | Tool Pressure, P_T: 900 psi

Borehole Water Level: 292 (m) = 415 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 215 psi

				4:30	4:00	4:00				
Volume, litres	1.0	1.5 ~~2.0~~	1.75	2.0	2.25	2.5	2.75	3.0	3.25	3.5
Pressure, psi	750	800	800	800	800	800	800	800	800	800
Volume, litres	3.75	4.0	/	3.0						
Pressure, psi	810	850	/	Ø						



Comments: Packer #3 | Time - 2:57 pm

Target ~ 800 psi

1L - 800 psi @ 2½ min

2L - 770 psi @ 5 min

Sheet 5 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Leonard | Date Inflated: Oct 6/15

Packer No. 4" comp 19 SN# 19297 | Depth (m): 936.8 | Inflation Tool No.: TIW852

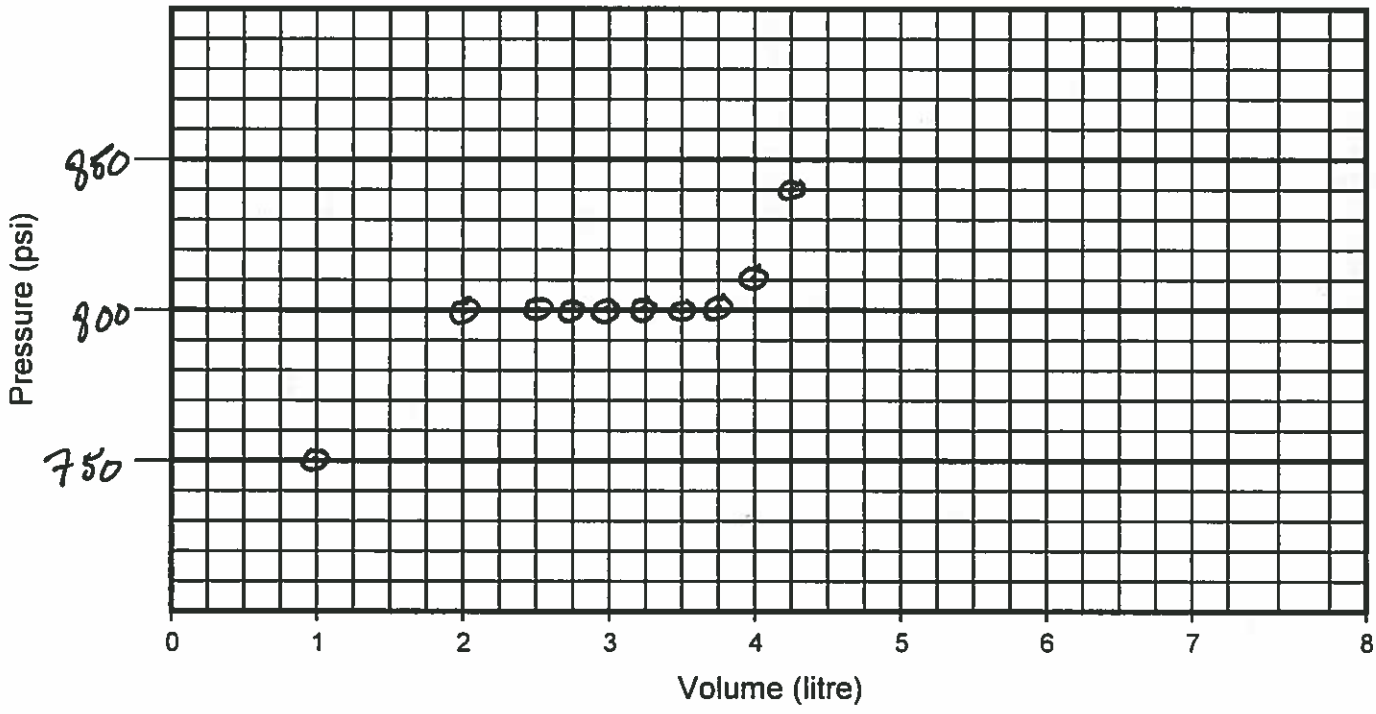
Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 840 psi | Tool Pressure, P_T: 900 psi

Borehole Water Level: 292 (m) = 415 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 205 psi

2:30

Volume, litres	1.0	2.0	2.5	2.75	3.0	3.25	3.5	3.75	4.0	4.25
Pressure, psi	750	800	800	800	800	800	800	800	810	840
Volume, litres	/	3.25								
Pressure, psi	/	Ø								



Comments: Packer #4 | Time - 3:44 pm

2L · 800 3m

770 3½ min

Sheet 6 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: MLarsard | Date Inflated: Oct 6/15

Packer No. 5, comp 24 SN# 19291 | Depth (m): 927.0 | Inflation Tool No.: TIW852

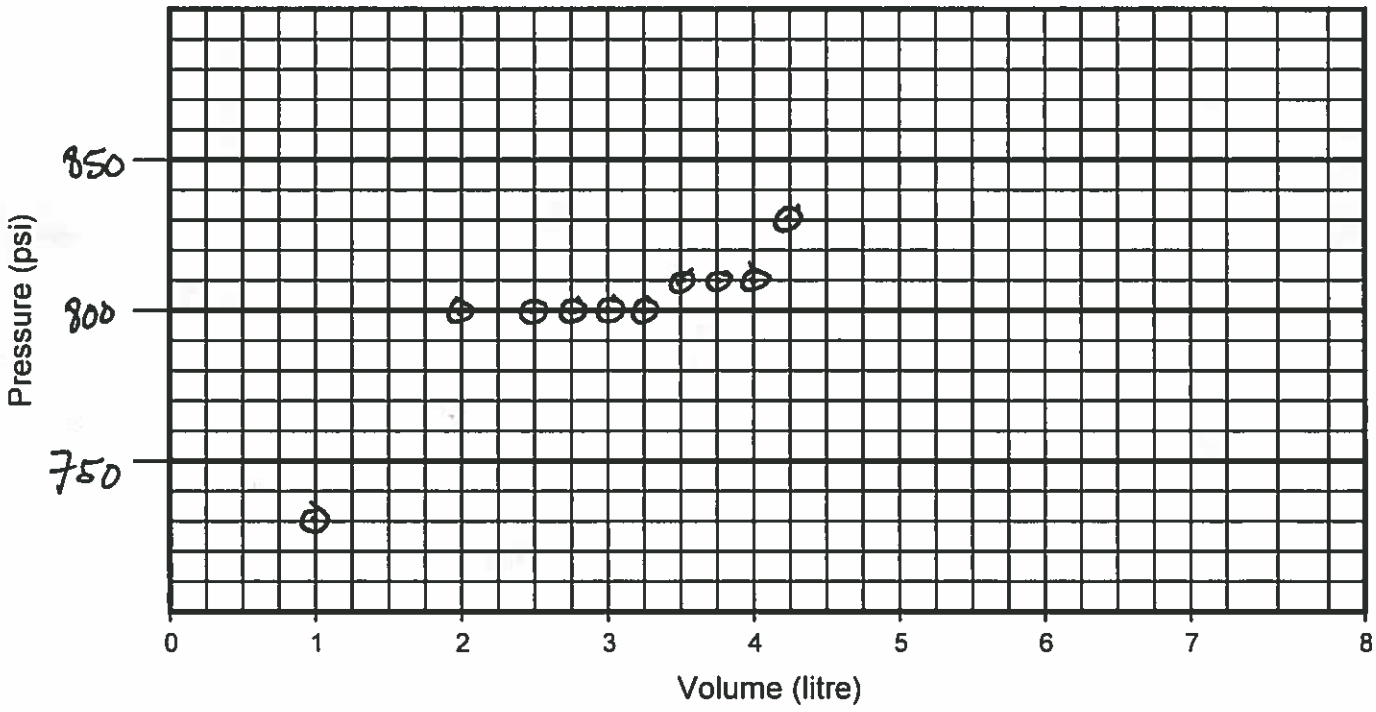
Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 830 psi | Tool Pressure, P_T: 900 psi

Borehole Water Level: 292 (m) = 415 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 205 psi

2:30

Volume, litres	1.0	2.0	2.5	2.75	3.0	3.25	3.5	3.75	4.0	4.25
Pressure, psi	730	800	800	800	800	800	810	810	810	830
Volume, litres		3.4								
Pressure, psi		0								



Comments: Packer #5 | Time - 4:30 pm

2-L 8mm @ 800 psi

2 1/8 mm @ 800 psi

Steady

Sheet 7 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 5/15

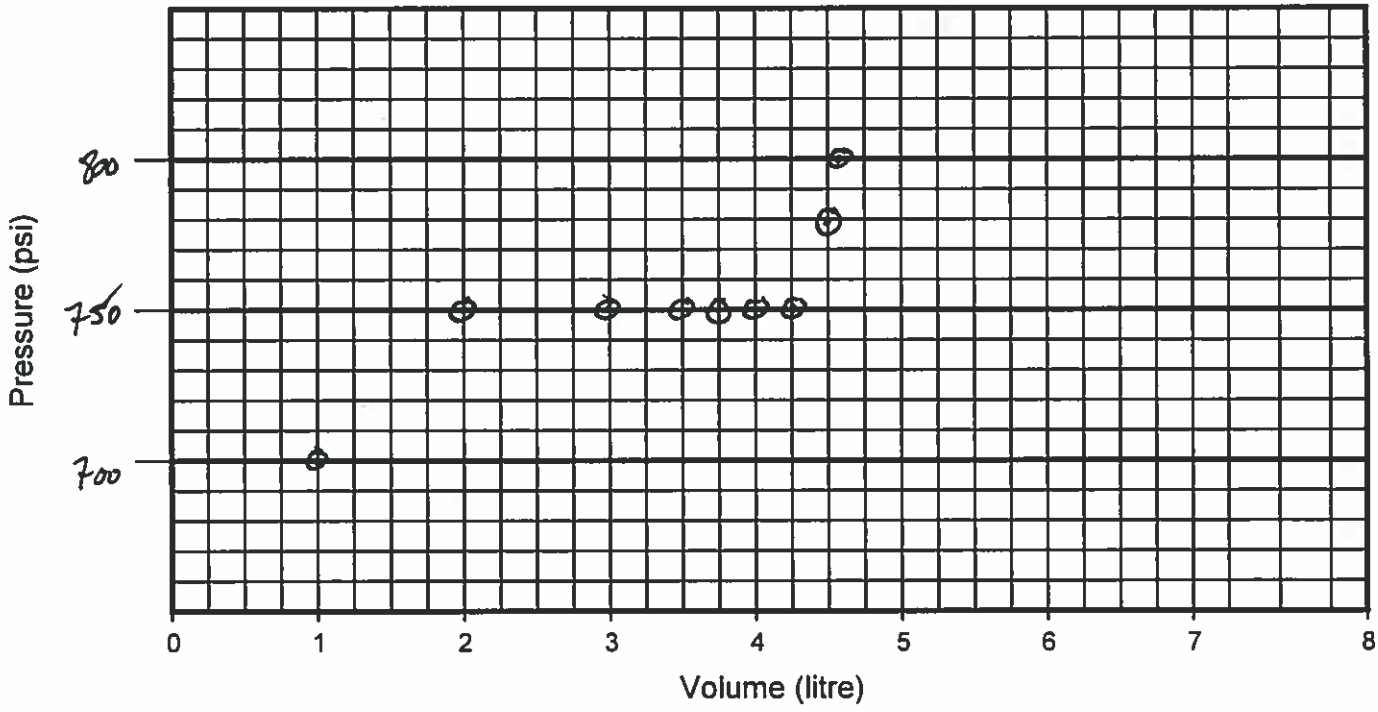
Packer No. 6, comp 30 Sn#19295 | Depth (m): 913.2 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 800 psi | Tool Pressure, P_T: 500 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 160 psi

Volume, litres	1.0	2.0	3.0	3.5	3.75	4.0	4.25	4.5	4.6	/
Pressure, psi	700	750	750	750	750	750	750	780	800	/
Volume, litres	3.6									
Pressure, psi	0									



Comments: Packer #6 Time - 11:47 am

Sheet 8 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 5/15

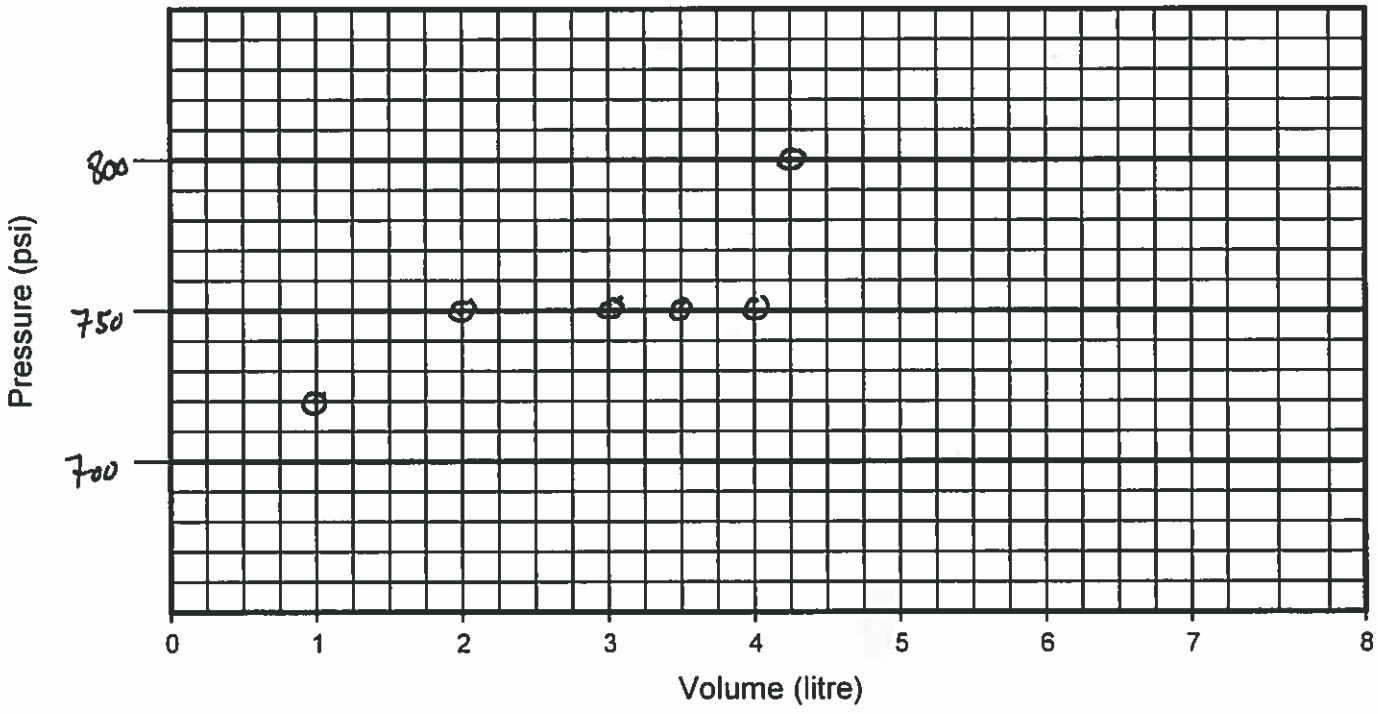
Packer No. 7, comp 47 SN# 19293 | Depth (m): 864.4 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 800 psi | Tool Pressure, P_T: 500 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 160 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.25	/	3.2		
Pressure, psi	720	750	750	750	750	800	/	ø		
Volume, litres										
Pressure, psi										



Comments: Packer #7 Time - 12:32pm

Sheet 9 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Leggard | Date Inflated: Oct 5/15

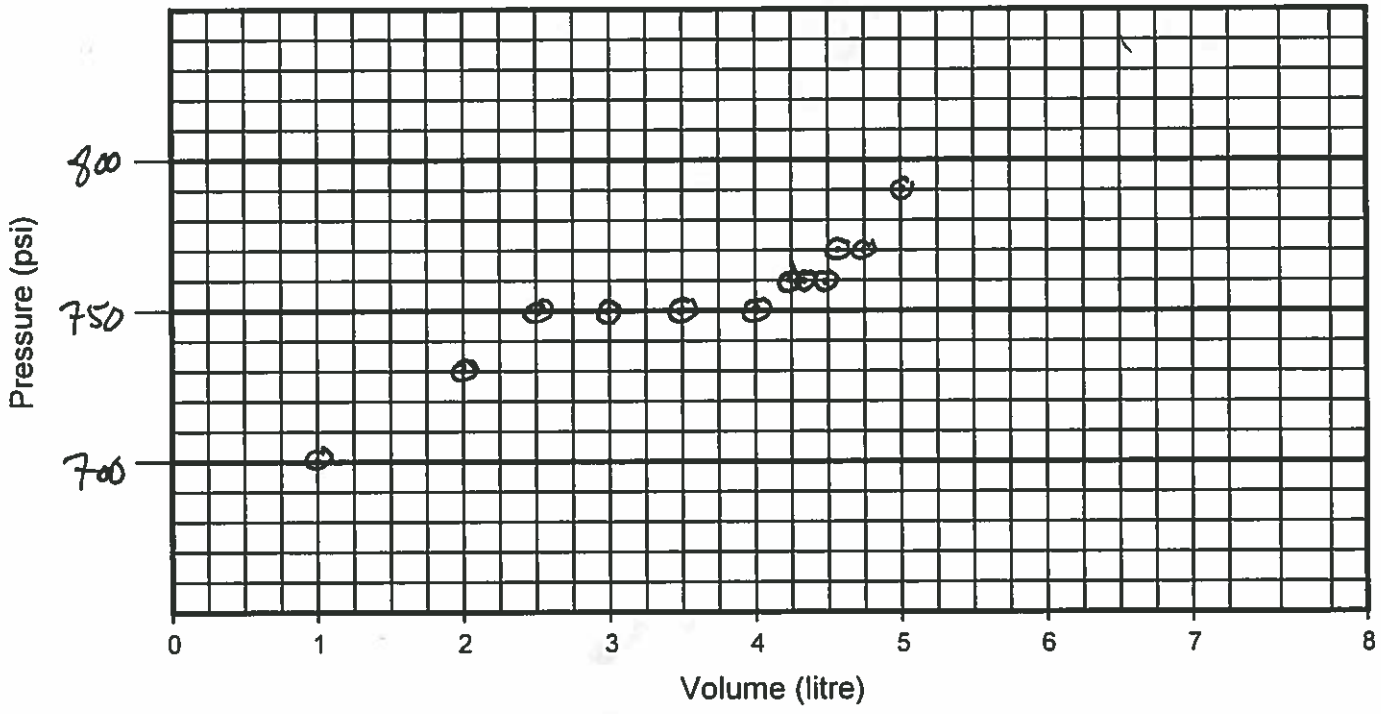
Packer No. 8, comp 51 SN#17704 | Depth (m): 955.2 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 145 psi | Final Line Pressure, P_L: 790 psi | Tool Pressure, P_T: 500 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 145 psi

Volume, litres	1.0	2.0	2.5	3.0	3.5	4.0	4.25	4.35	4.5	4.6 ~~4.6~~
Pressure, psi	700	730	750	750	750	750	760	760	760	770
Volume, litres	4.75	5.0	/	4.1						
Pressure, psi	770	790	/	Ø						



Comments: Parker # 8 | Time - 1:11 pm

Sheet 10 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 5/15

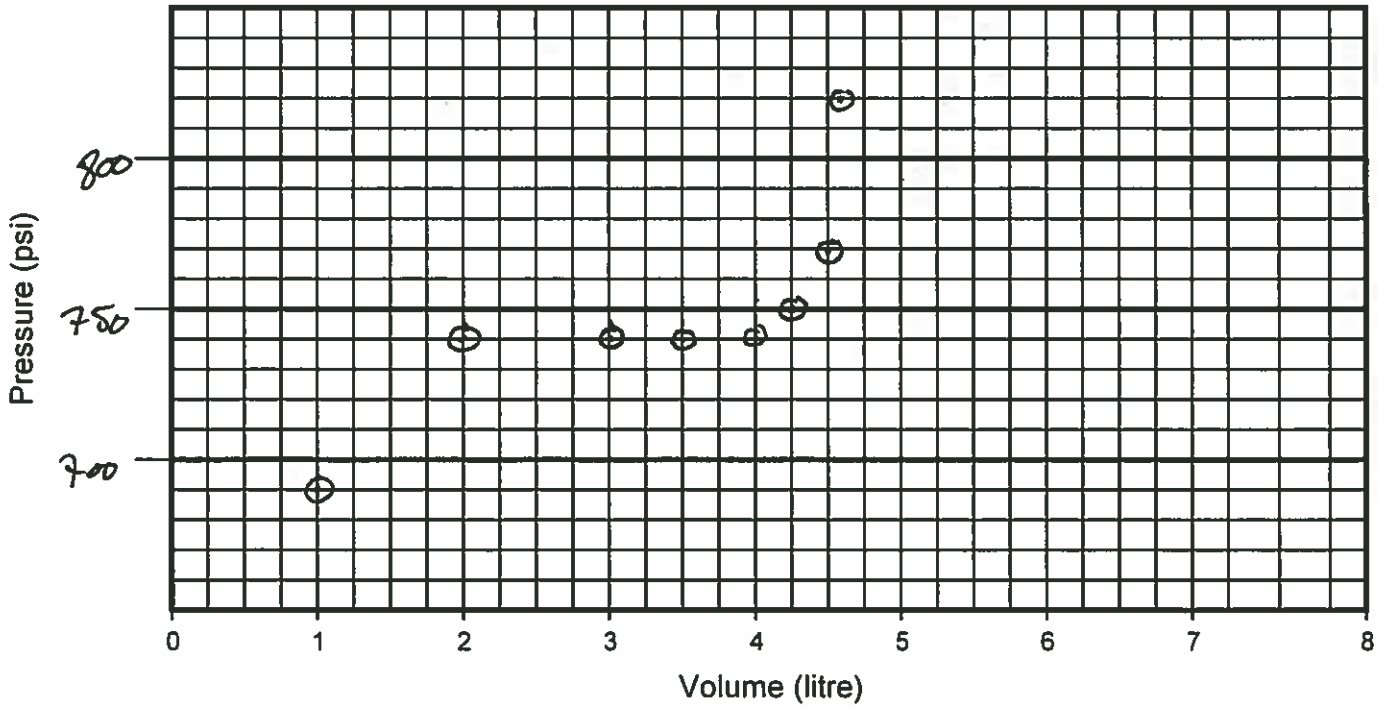
Packer No. 9, comp 75 SN# 19292 | Depth (m): 783.6 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 150 psi | Final Line Pressure, P_L: 820 psi | Tool Pressure, P_T: 500 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 170 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.25	4.5	4.6	/	4.0
Pressure, psi	690	740	740	740	740	750	770	820	/	Ø
Volume, litres										
Pressure, psi										



Comments: Packer #9 | Time - 1:53 pm

Sheet 11 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 5/15

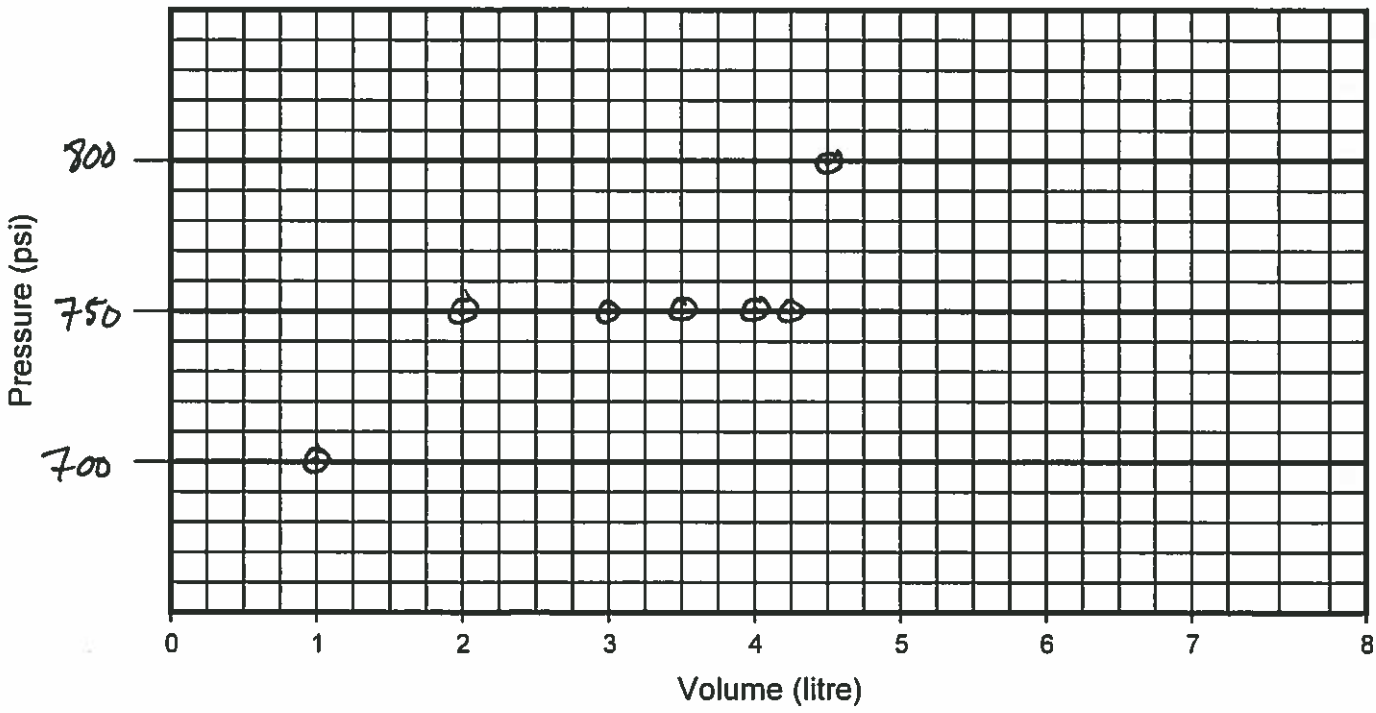
Packer No. 10, comp 79 SN# 19296 | Depth (m): 776.8 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 145 psi | Final Line Pressure, P_L: 800 psi | Tool Pressure, P_T: 500 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 155 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.25	4.5	/	3.8	
Pressure, psi	700	750	750	750	750	750	800	/	∅	
Volume, litres										
Pressure, psi										



Comments: Packer #10 | Time - 2:19 pm

Sheet 12 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 5/15

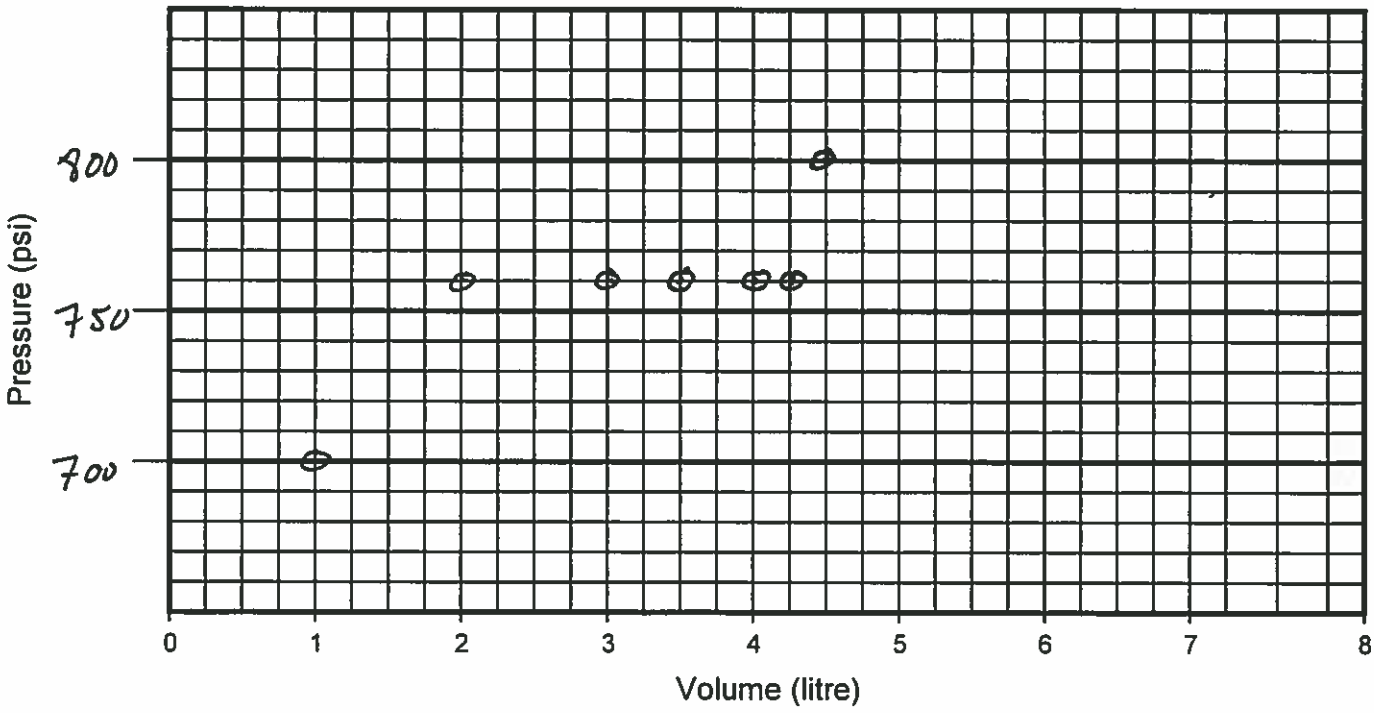
Packer No. 11 comp 82 SN# 19305 | Depth (m): 770.7 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 150 psi | Final Line Pressure, P_L: 800 psi | Tool Pressure, P_T: 500 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 150 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.25	4.5	/	3.8	
Pressure, psi	700	760	760	760	760	760	800	/	Ø	
Volume, litres										
Pressure, psi										



Comments: Packer #11 | Time - 2:42 pm

Sheet 13 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lassard | Date Inflated: Oct 5/15

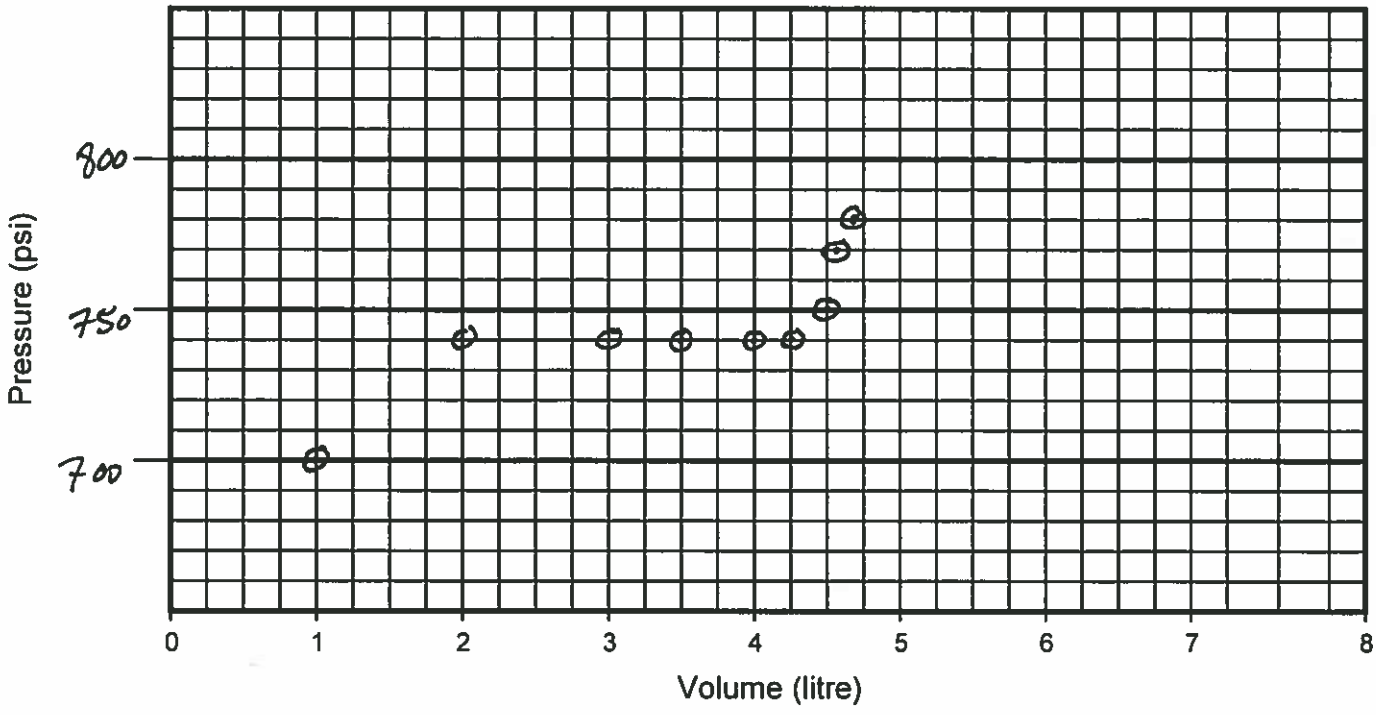
Packer No. 12 comp 91 SN# 19363 | Depth (m): 744.8 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 145 psi | Final Line Pressure, P_L: 780 psi | Tool Pressure, P_T: 500 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 135 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.25	4.5	4.6	4.7	/
Pressure, psi	700	740	740	740	740	740	750	~~770~~ 770	780	/
Volume, litres	4.0									
Pressure, psi	Ø									



Comments: Packer #12 | Time - 3:13 pm

Sheet 14 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 5/15

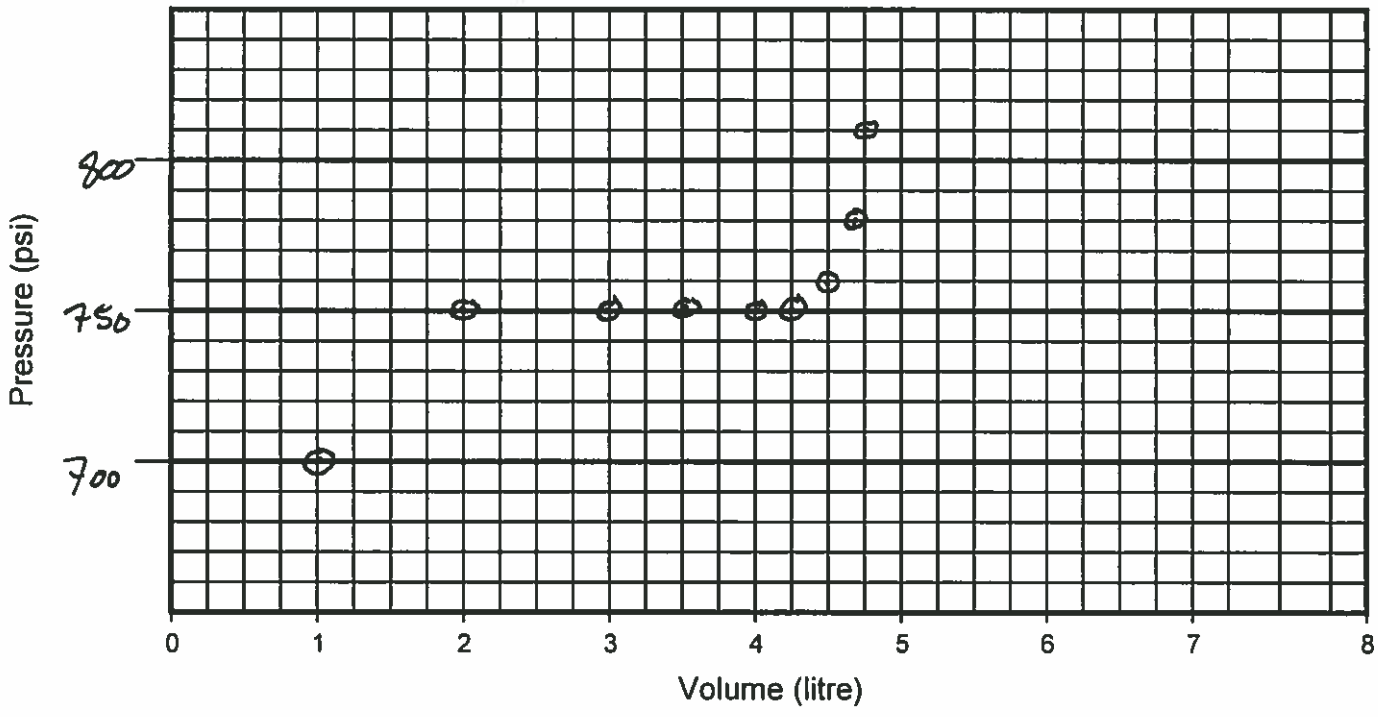
Packer No. 13, comp 93 SN# 1930a | Depth (m): 740.2 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 810 psi | Tool Pressure, P_T: 500 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 170 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.25	4.5	4.65	4.75	/
Pressure, psi	700	750	750	750	750	750	760	780	810	/
Volume, litres										
Pressure, psi	ø									



Comments: Packer # 13 | Time - 3:37 am

Sheet 15 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 5/15

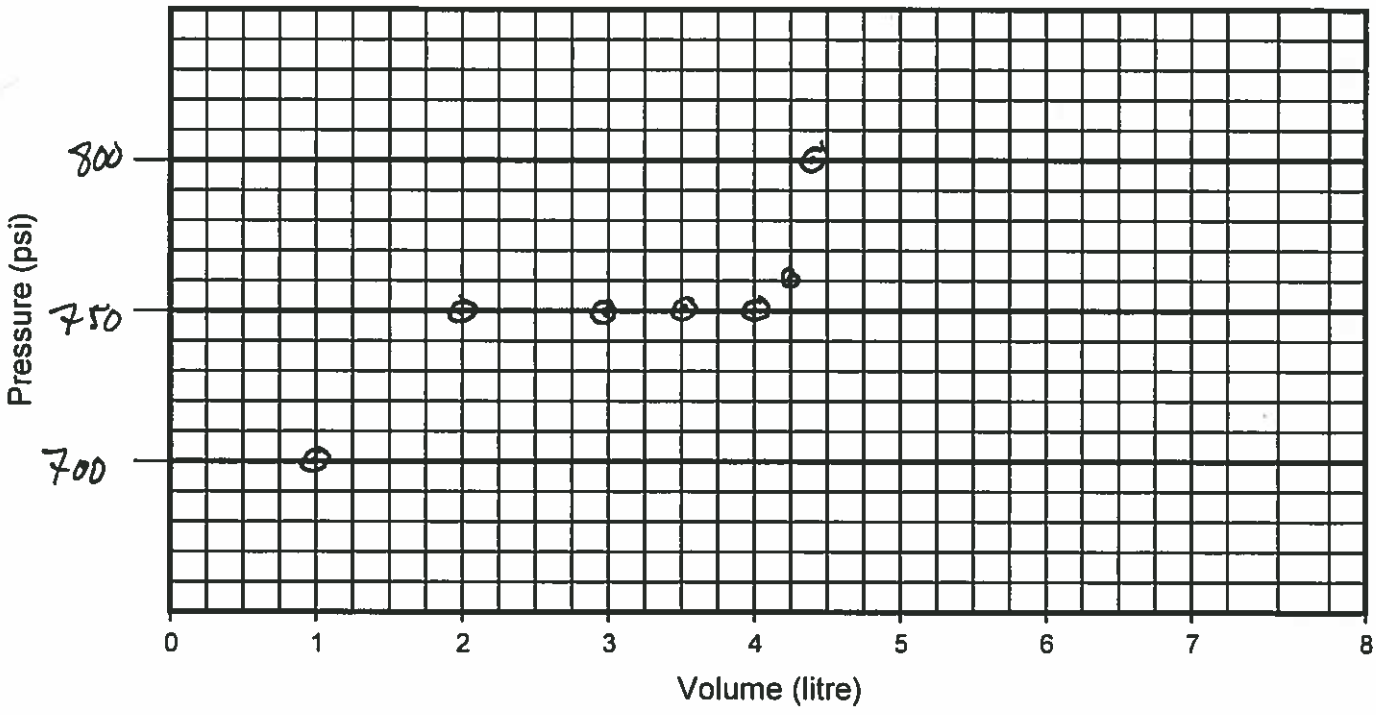
Packer No. 14, comp 97 SN# 19304 | Depth (m): 731.0 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 145 psi | Final Line Pressure, P_L: 800 psi | Tool Pressure, P_T: 500 psi

Borehole Water Level: 0 (m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 155 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.25	4.4	/	3.7	
Pressure, psi	700	750	750	750	750	760	800	/	0	
Volume, litres										
Pressure, psi										



Comments: Packer #14 | Time - 3:58 pm

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Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 7/15

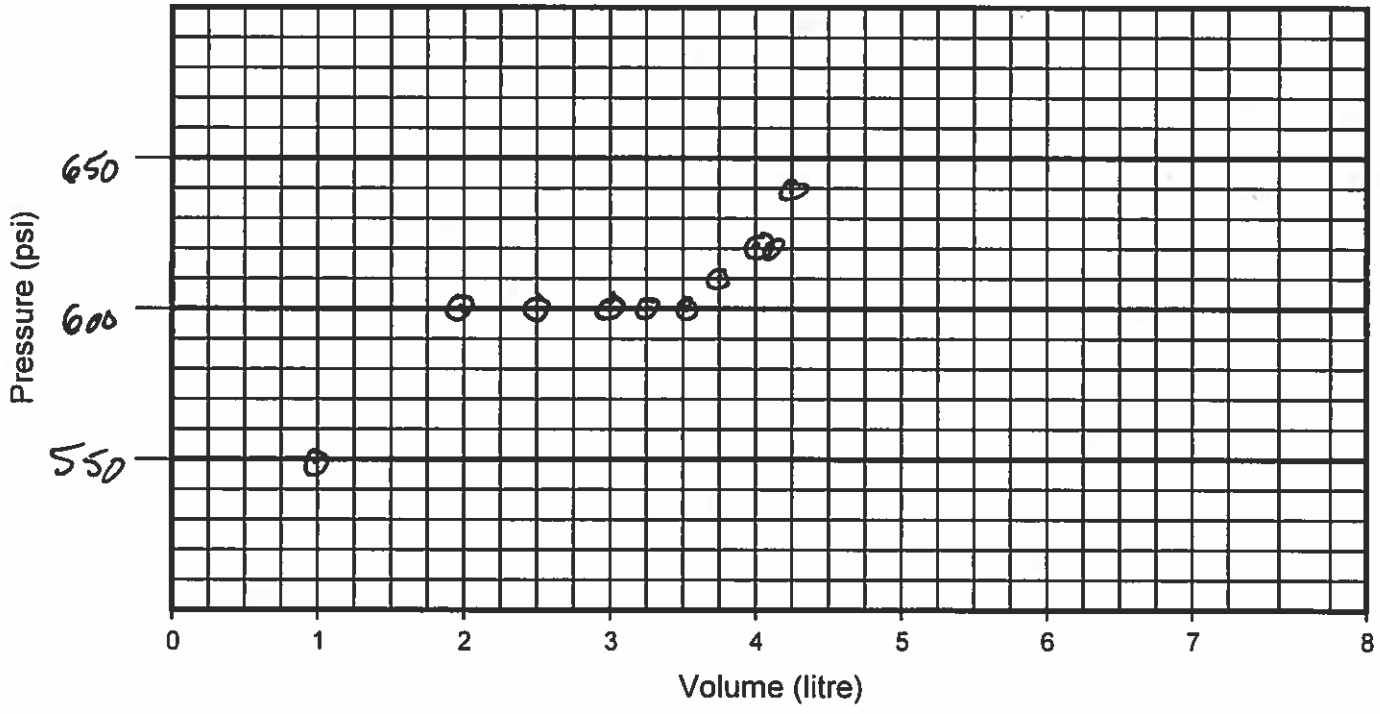
Packer No. 15, comp 105 SN# 19301 | Depth (m): 711.1 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 145 psi | Final Line Pressure, P_L: 640 psi | Tool Pressure, P_T: 900 psi

Borehole Water Level: 367 (m) = ~~520~~ 520 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 115 psi

Volume, litres	1.0	2.0	2.5	3.0	3.25	3.5	3.75	4.0	4.1	4.25
Pressure, psi	550	600	600	600	600	600	610	620	620	640
Volume, litres	/	3.6								
Pressure, psi	/	0								



Comments: Packer #15 | Time - 8:49 am

Target 650 psi? | 2-L | 650 psi @ 1 min

No squeeze relief | 610 psi @ 1½ min

600 psi @ 2 min

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 7/15

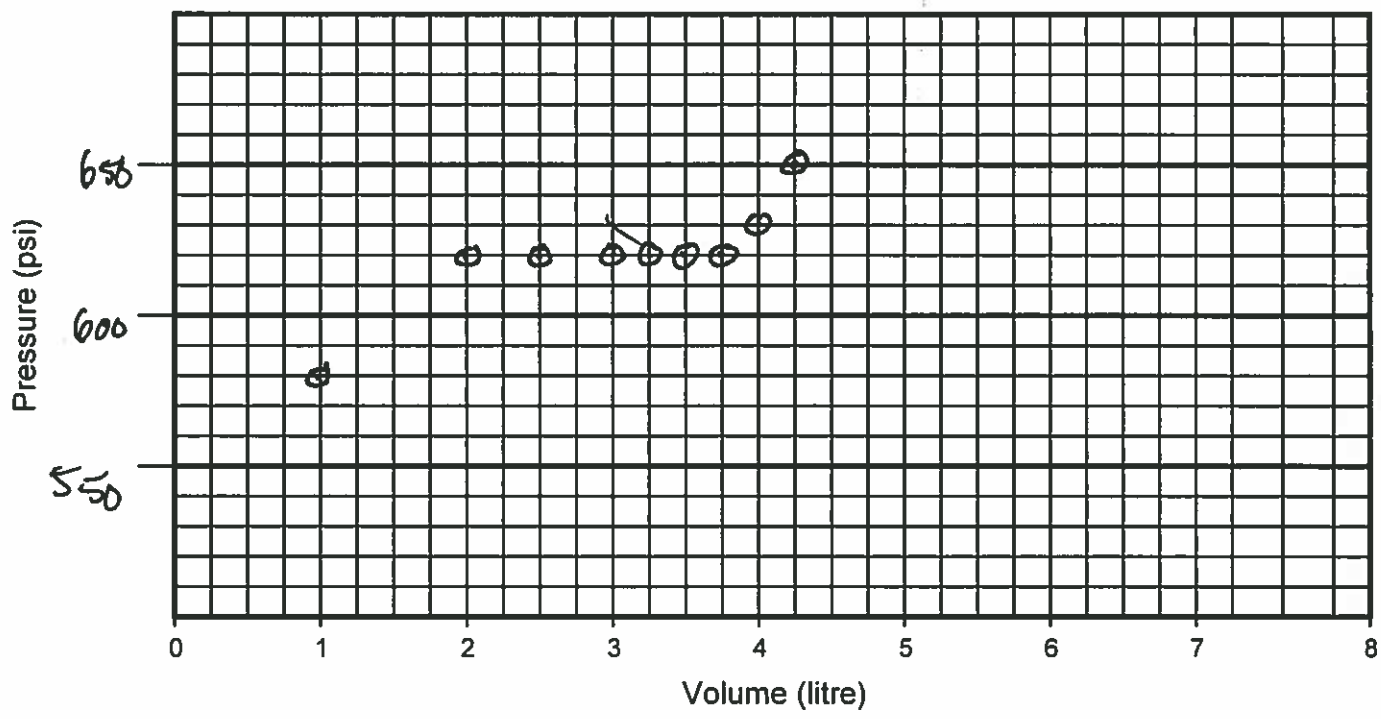
Packer No. 16, comp 112 SN# 19290 | Depth (m): 692.8 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 650 psi | Tool Pressure, P_T: 900 psi

Borehole Water Level: 367 (m) = 520 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 130 psi

Volume, litres	1.0	2.0	2.5	3.0	3.25	3.5	3.75	4.0	4.25	/
Pressure, psi	580	620	620	620	620	620	620	630	650	/
Volume, litres	3.6									
Pressure, psi	0									



Comments: Packer #16

Time - 9:32 am

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 7/15

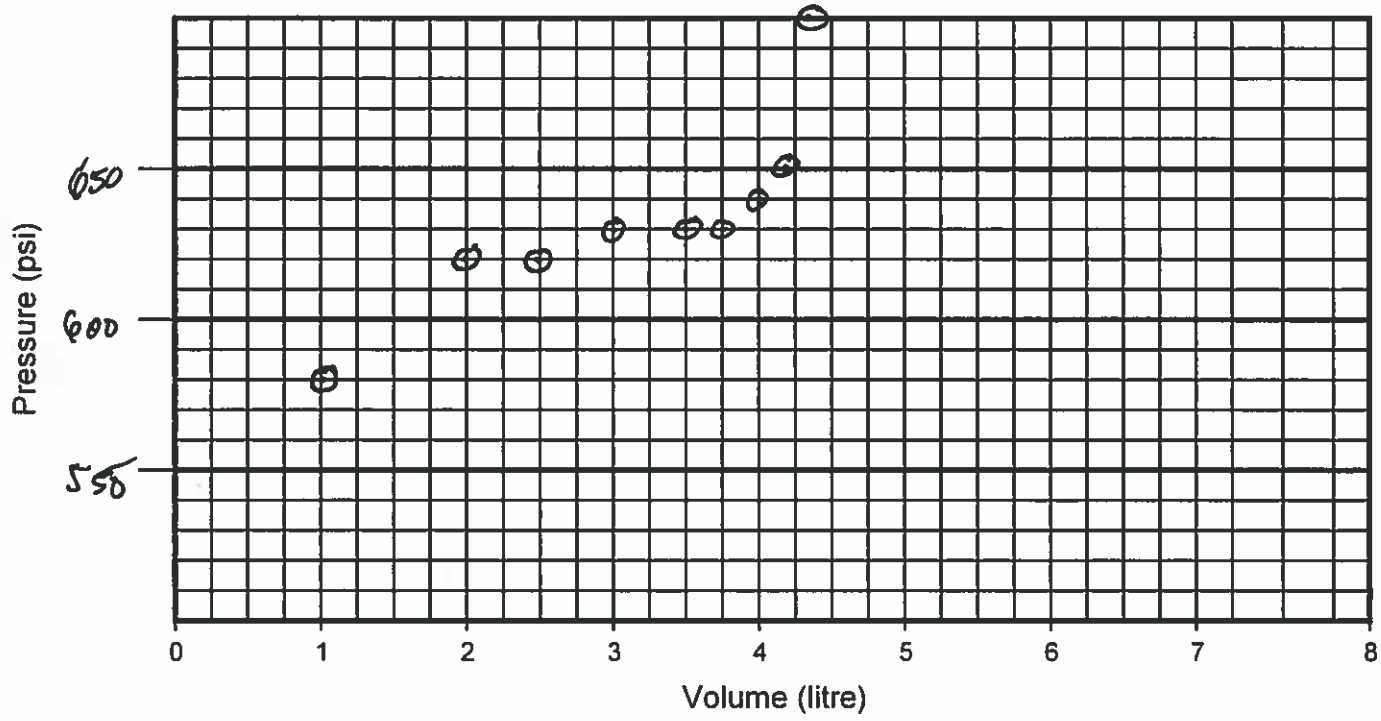
Packer No. 17, comp 127 SN# 19289 | Depth (m): 650.1 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 150 psi | Final Line Pressure, P_L: 700 psi | Tool Pressure, P_T: 900 psi

Borehole Water Level: 367 (m) = 520 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 170 psi

Volume, litres	1.0	2.0	2.5	3.0	3.5	3.75	4.0	4.2	4.35	✓
Pressure, psi	580	620	620	630	630	630	640	650	700	✓
Volume, litres	3.9									
Pressure, psi	ø									



Comments: Packer #17 Time - 10:28 am

Battery running low at 2.5-L.

Start up Marooka.

Sheet 19 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M Lessard | Date Inflated: Oct 7/15

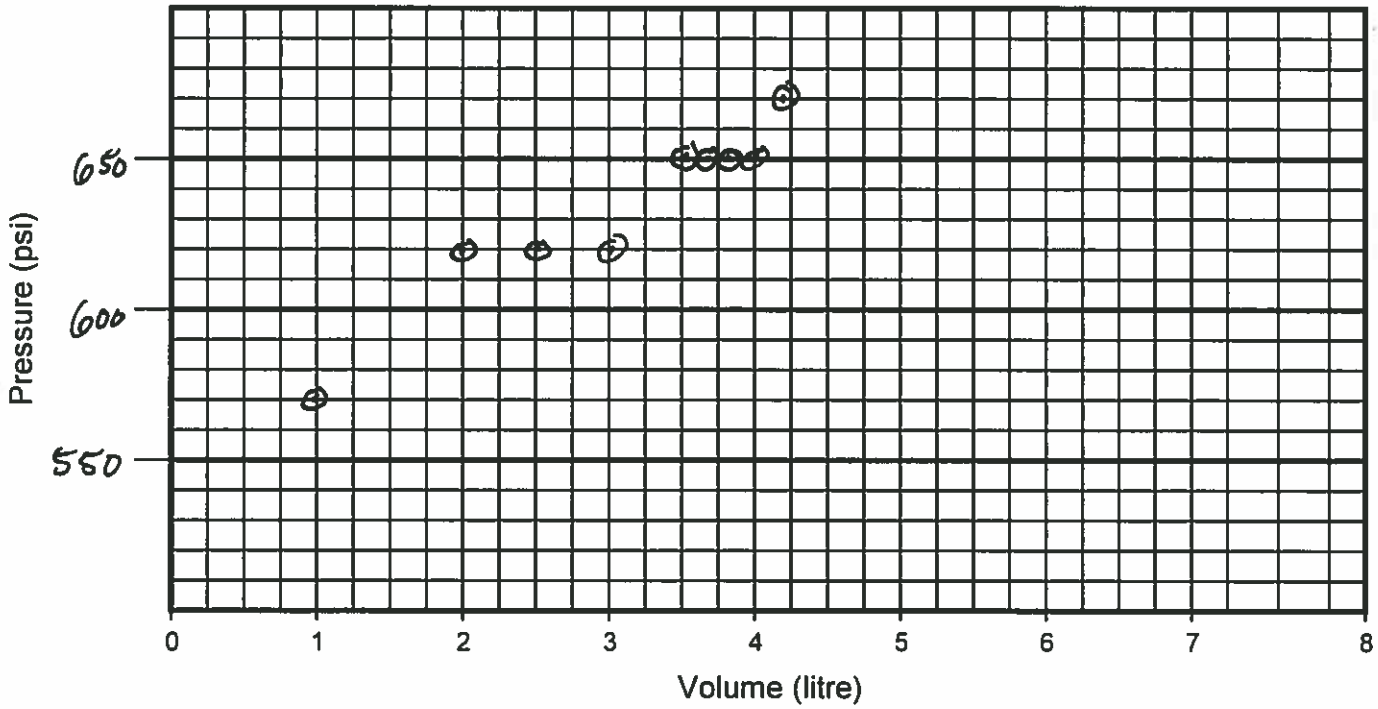
Packer No. 18, comp 130 SN# 19287 | Depth (m): 642.5 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 145 psi | Final Line Pressure, P_L: 670 psi | Tool Pressure, P_T: 900 psi

Borehole Water Level: 367 (m) = 520 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 145 psi

Volume, litres	1.0	2.0	2.5	3.0	3.5	3.65	~~3.8~~	4.0	4.2	/
Pressure, psi	570	620	620	620	650	650	650	650	670	/
Volume, litres	3.5									
Pressure, psi	Ø									



Comments: Packer #19 | Time - 11:06 am

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Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 7/15

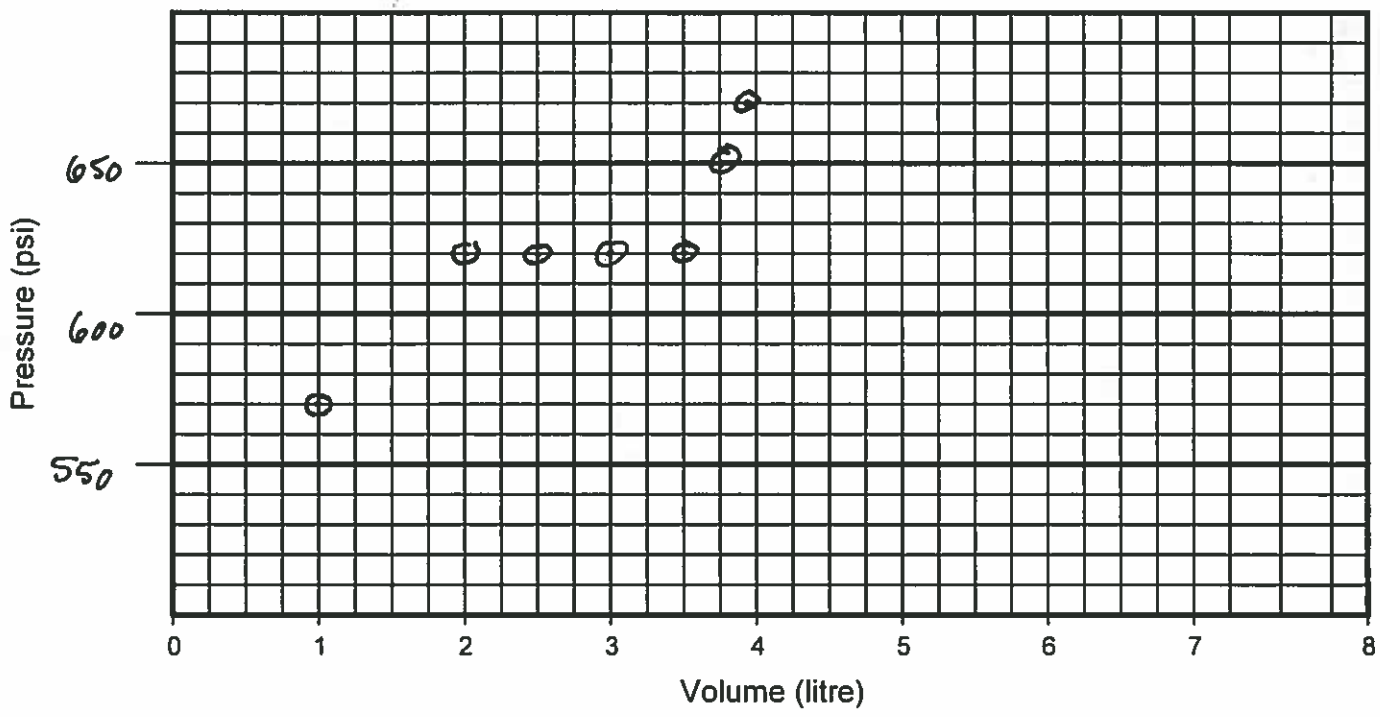
Packer No. 19, comp 151 SN# 19388 | Depth (m): 5830 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 145 psi | Final Line Pressure, P_L: 670 psi | Tool Pressure, P_T: 900 psi

Borehole Water Level: 367 (m) = 520 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 145 psi

Volume, litres	1.0	2.0	2.5	3.0	3.5	3.75	3.9	✓	3.4	
Pressure, psi	570	620	620	620	620	650	670	✓	∅	
Volume, litres										
Pressure, psi										



Comments: Packer #19 | Time - 11:49 am

Sheet 21 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 7/15

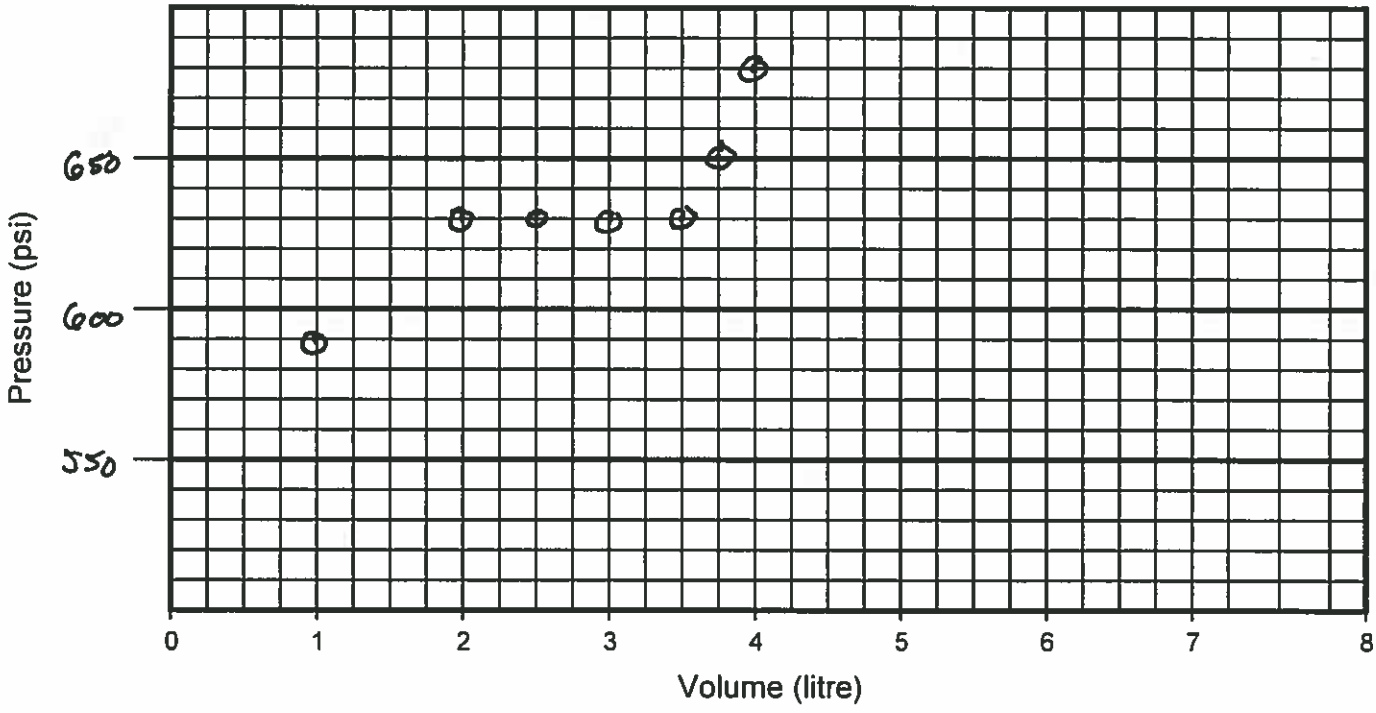
Packer No. 20, comp 175 SN# 19306 | Depth (m): 511.4 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 150 psi | Final Line Pressure, P_L: 680 psi | Tool Pressure, P_T: 900 psi

Borehole Water Level: 367 (m) = 520 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 150 psi

Volume, litres	1.0	2.0	2.5	3.0	3.5	3.75	4.0	/	3.4	
Pressure, psi	590	630	630	630	630	650	680	/	Ø	
Volume, litres										
Pressure, psi										



Comments: Packer #20 | Time - 12:31 pm

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 7/15

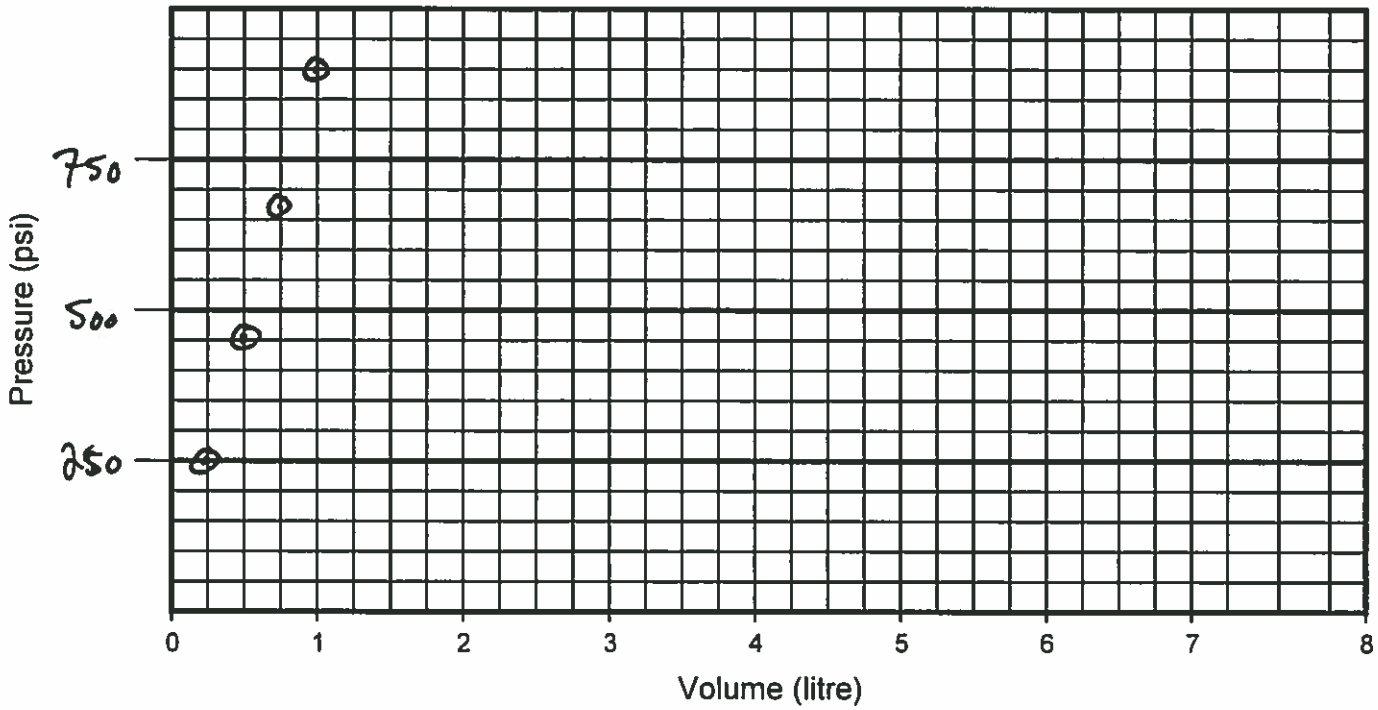
Packer No. Blank Wall Test | Depth (m): 416 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: n/a psi | Final Line Pressure, P_L: 900 psi | Tool Pressure, P_T: 900 psi

Borehole Water Level: 367 (m) = 520 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = n/a psi

Volume, litres	0.25	0.5	0.75	1.0	/	0.25				
Pressure, psi	250	450	670	900	/	ø				
Volume, litres										
Pressure, psi										



Comments: Blank Wall Test in HQ casing Time - 1:30 pm

Sheet 23 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 7/15

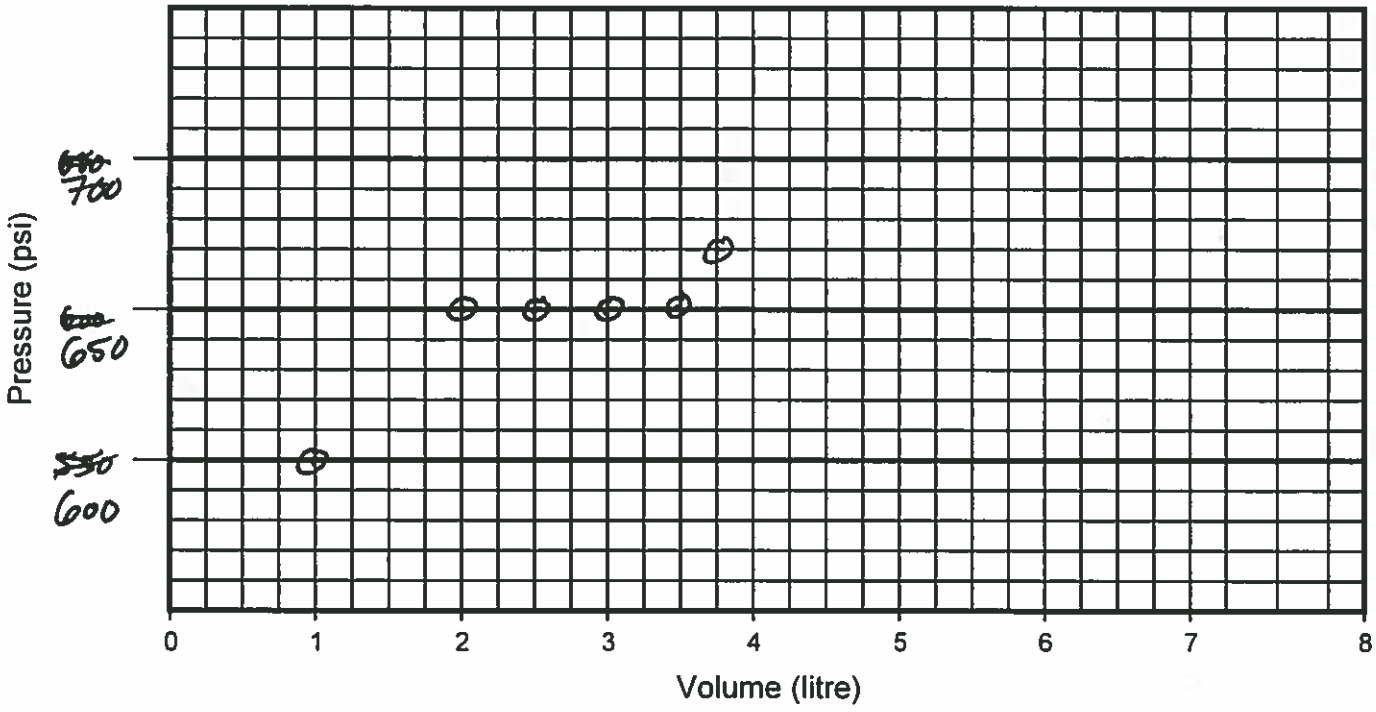
Packer No. 21, comp 177 SN# 19286 | Depth (m): 508.4 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 145 psi | Final Line Pressure, P_L: 670 psi | Tool Pressure, P_T: 900 psi

Borehole Water Level: 367 (m) = 520 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 145 psi

Volume, litres	1.0	2.0	2.5	3.0	3.5	3.75	/	3.1		
Pressure, psi	600	650	650	650	650	670	/	ø		
Volume, litres										
Pressure, psi										



Comments: Packer #21 | Time - 1:01 pm

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Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 7/15

Packer No. 22, comp 209 SN#19284 | Depth (m): 412.3 | Inflation Tool No.: TIW852

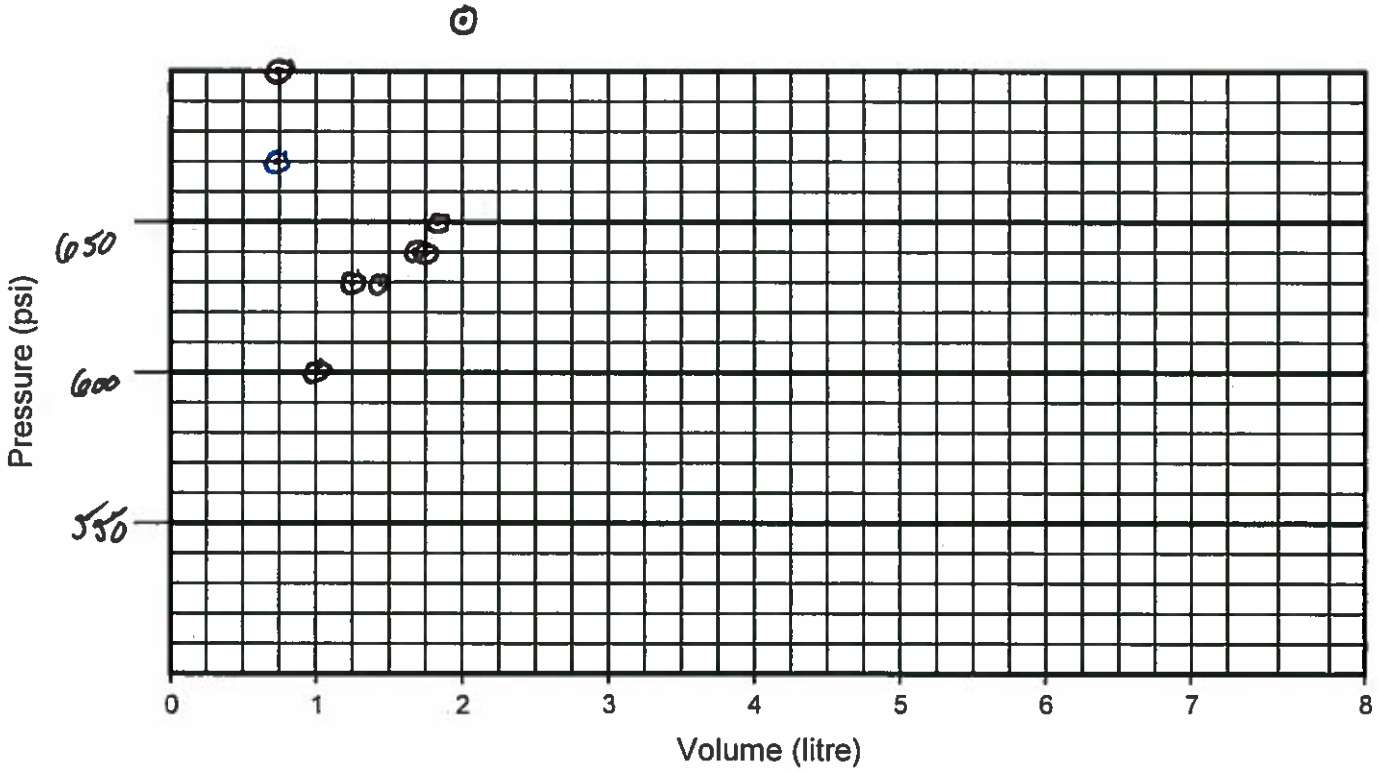
Packer Valve Pressure, P_V: 145 psi | Final Line Pressure, P_L: 720 psi | Tool Pressure, P_T: 900 psi

Borehole Water Level: 367 (m) = 520 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 195 psi

2:45

Volume, litres	0.25	0.5	0.75	1.0	1.25	1.45	1.65	1.75	1.85	2.0
Pressure, psi	270	480	700	600	630	630	640	640	650	720
Volume, litres		1.4								
Pressure, psi		0								



Comments: Packer #22 Time - 2:03 pm

Target ~ 670 psi

BLANK WALL TEST IN HQ CASING Packer valve opens between 0.75 L and 1 L.

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 7/15

Packer No. 23, comp 240 SN# 19307 | Depth (m): 319.4 | Inflation Tool No.: TIW852

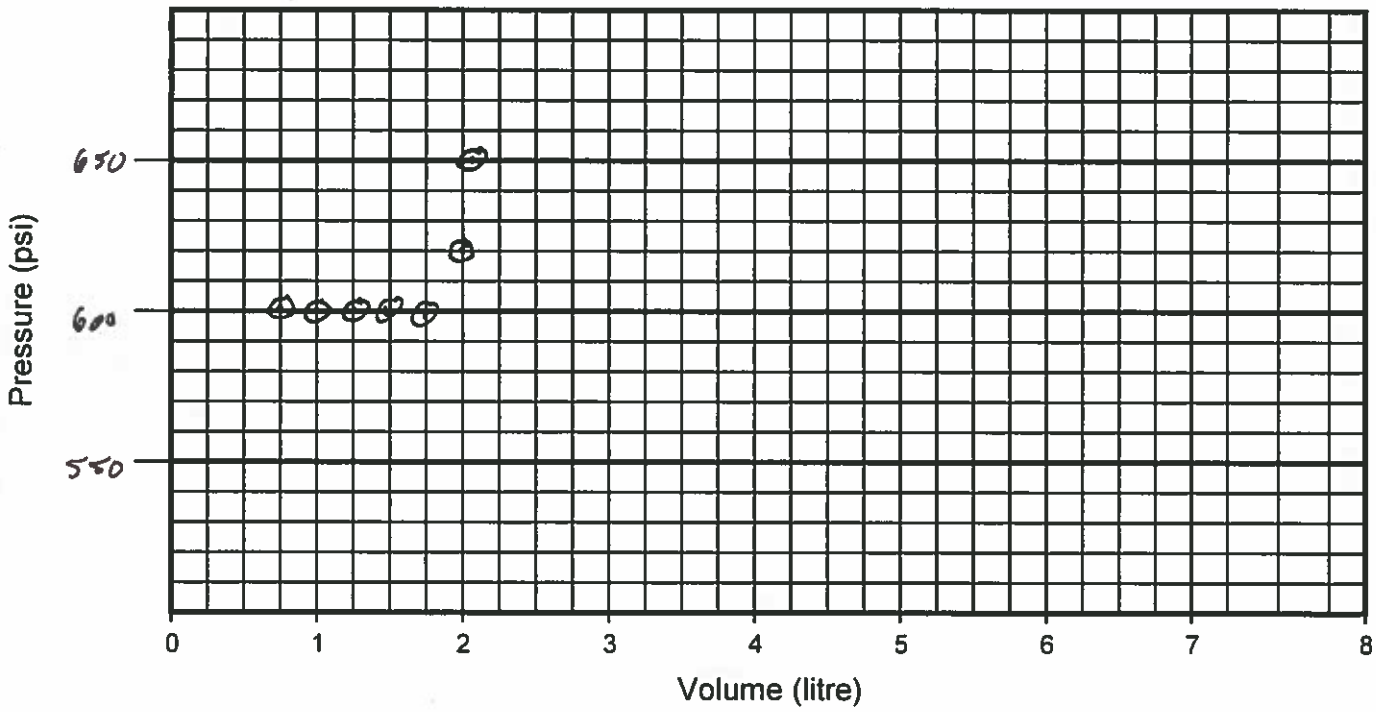
Packer Valve Pressure, P_V: 155 psi | Final Line Pressure, P_L: 650 psi | Tool Pressure, P_T: 800 psi

Borehole Water Level: 367 (m) = 520 psi (P_W)

Packer depth: 319.4 (m) = 450 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 145 psi

Volume, litres	0.25	0.5	0.75	1.0	1.25	1.5	1.75	2.0	2.1	✓
Pressure, psi	300	400	600	600	600	600	600	620	650	✓
Volume, litres	1.7									
Pressure, psi	0									



Comments: Packer #23 Time - 4:52 pm

Target 650 est 2¼ - L

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 7/15

Packer No. 24, comp 271 SN# 19308 | Depth (m): 226.4 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 145 psi | Final Line Pressure, P_L: 790 psi | Tool Pressure, P_T: 800 psi

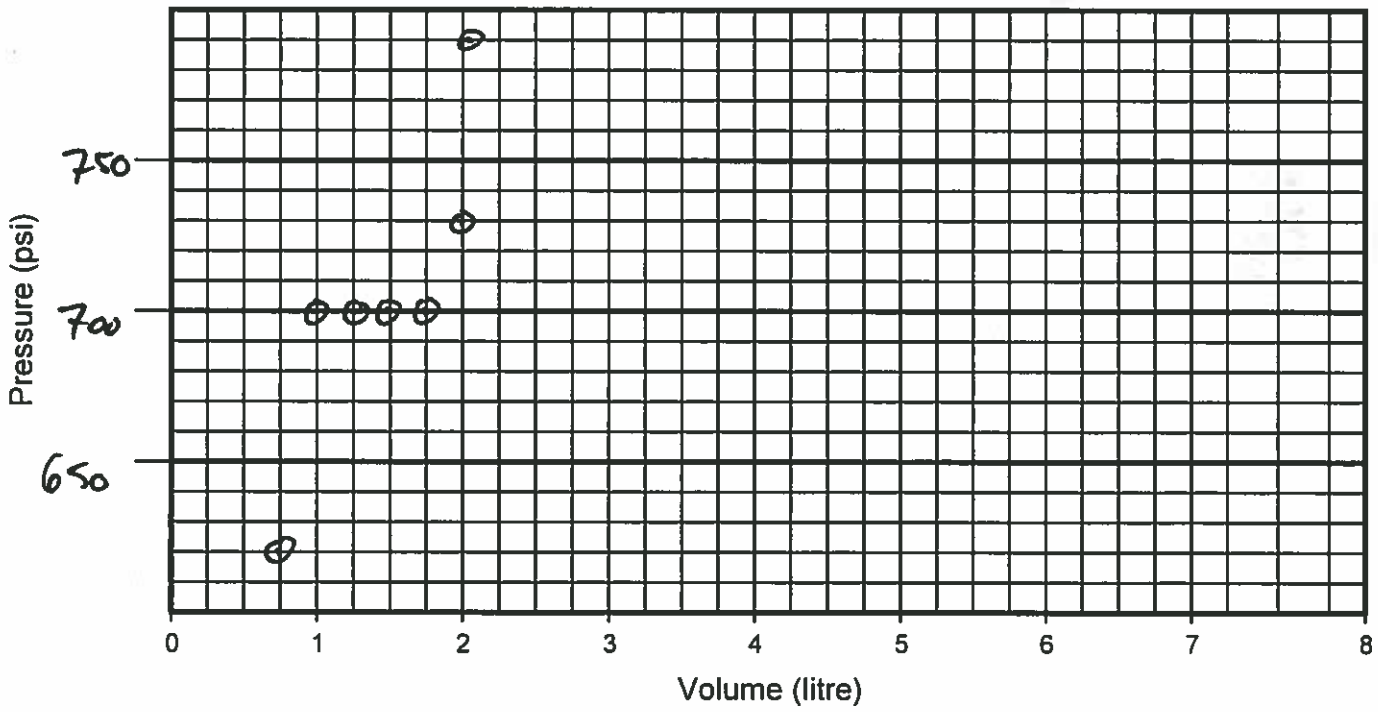
Borehole Water Level: 367 (m) = 520 psi (P_W)

Packed depth 226.4 m = 325 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 170 psi

PVO ↓

Volume, litres	0.25	0.5	0.75	1.0	1.25	1.5	1.75	2.0	2.1	✓
Pressure, psi	300	420	620	700	700	700	700	730	790	✓
Volume, litres	1.6									
Pressure, psi	∅									



Comments: Packer #24 | Time - 5:33 pm

Target ~ 750 psi

PVO - packer valve opened

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 8/15

Packer No. 25, comp 303 sn# 19285 | Depth (m): 130.4 | Inflation Tool No.: TIW852

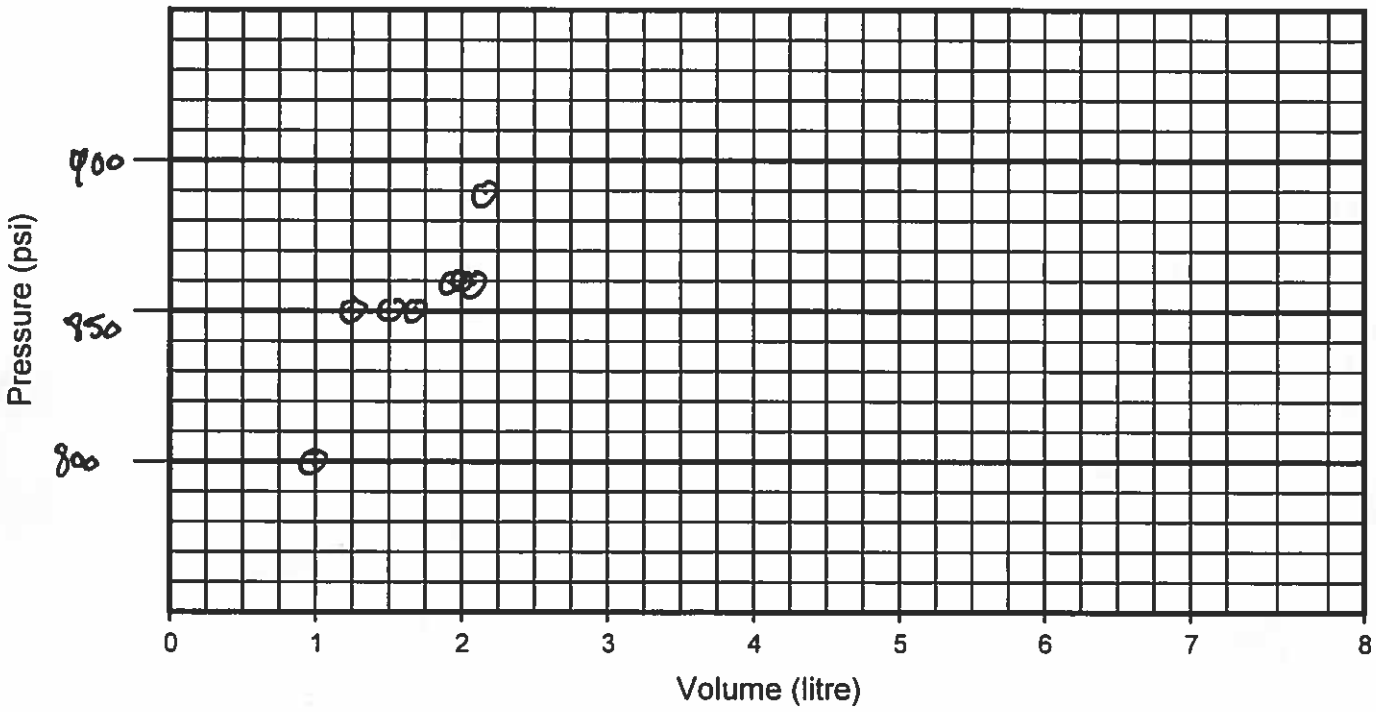
Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 890 psi | Tool Pressure, P_T: 800 psi

Borehole Water Level: 367 (m) = 520 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 135 psi

Packer depth 130.4 m = 185 psi (Pw)

Volume, litres	0.5	0.75	1.0	1.25	1.5	1.7	1.9	2.0	2.1	2.2
Pressure, psi	500	650	800	~~800~~ 850	~~800~~ 850	850	860	860	860	890
Volume, litres	/	1.5								
Pressure, psi	/	ϕ								



Comments: Packer # 25 1.25 L @ 900 psi @ 1 min Time - 8:00 am
850 psi @ 2 min

Target 900 psi

Sheet 28 of 28

Westbay Packer Inflation Record

Project: HD Mining | Project No.: WB946 | Well No.: DH-01

Location: Murray River | Completed by: M. Lessard | Date Inflated: Oct 7/15

Packer No. 26, comp 334 SN# 19300 | Depth (m): 37.5 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 150 psi | Final Line Pressure, P_L: 980 psi | Tool Pressure, P_T: 800 psi

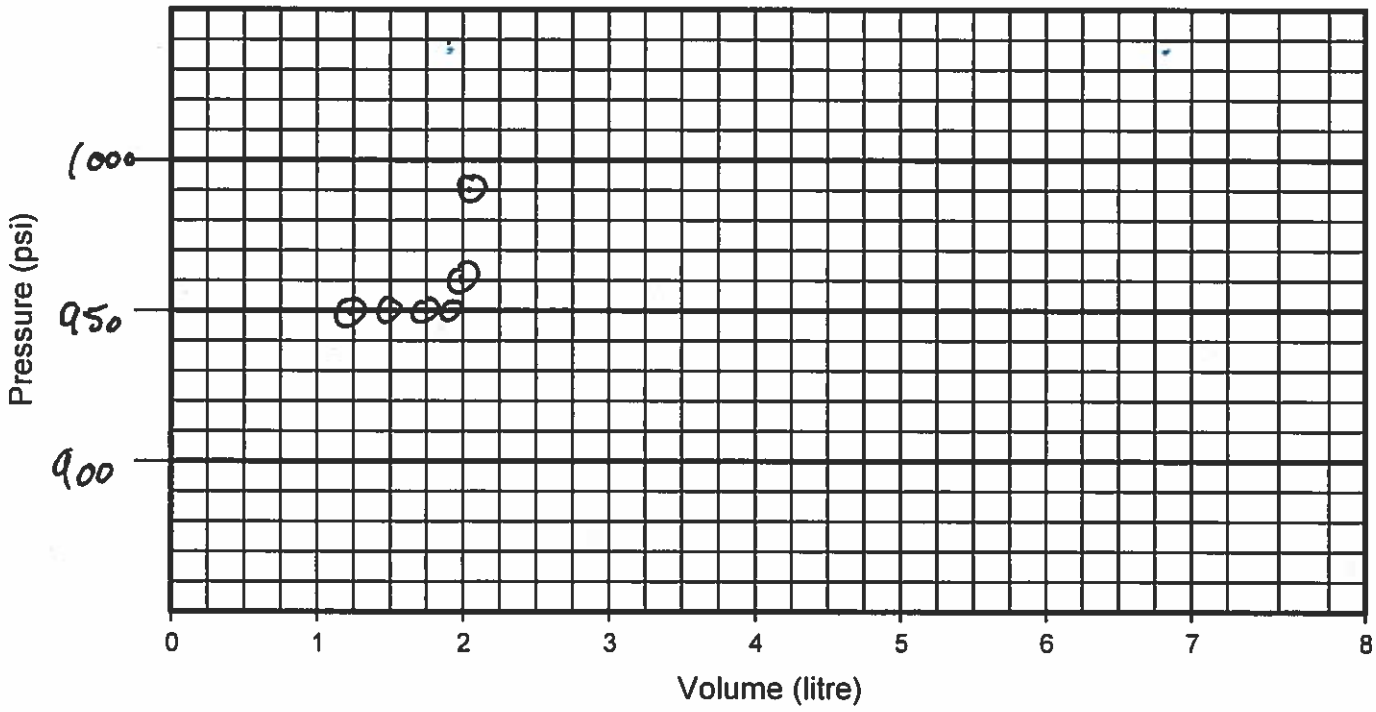
Borehole Water Level: 367 (m) = 520 psi (P_W)

Packer depth 37.5 (m) = 50 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 80 psi

2 ½

Volume, litres	0.5	0.75	1.0	1.25	1.5	1.75	1.9	2.0	2.1	✓
Pressure, psi	500	660	800	950	950	950	950	960	980	✓
Volume, litres	1.25									
Pressure, psi	Ø									



Comments: Packer #26 Time - 8:35am

Target ~ 1050 psi

Westbay
Instruments

APPENDIX 5

Drilling Logs, DH-02

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Drillhole DH-02 Final Report In Murray River Project

墨玉河项目 DH-02 井完井报告

HD Mining International Inc.
HD 国际矿业股份有限公司

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WELL DATA 基本参数

Well Name 井名: DH-02

Surface Location 位置: E: 623692.090 N: 6100314.785

Operator 承钻: Geotech Drilling Services Ltd

Licence No.许可证号:

Ground Elevation 地面标高: 1039.63

R.S. Elevation 实测标高： 1039.63

Designed Depth 设计井深: 950
Total Depth 实际井深: 865.5

Start Date 开钻日期: 2015-10-15

Completed date 完井日期: 2015-11-20(drilling), 2015-12-12(Westbay installation)

Objective Formation 目的层: 15m below K seam

Westbay 系统安装: 安装深度 718.8m(150m HQ Rods left in the bottom of hole)

COMPANY & CONTRACTOR 甲方与乙方

Company 甲方: HD Mining International Ltd.

Company 乙方: Drilling Contractor 钻井公司: Geotech Drilling Services Ltd

Drilling Fluid Contractor 钻井液公司:

CBM Detector Contractor 瓦斯检测公司: Petro-Logic Services

Wireline Logging Contractor 测井公司: Century Wireline Services

Aquifer Formation Testing 水层测试公司：Environmental Resources Management (ERM)

Westbay System Westbay 系统多层监测安装： Westbay Instruments

HOLE SIZE 井眼尺寸

Hole Section 井段	Size 尺寸	Depth 深度(m)
0-36	PWT	36
36-300	PQ	300
300-865.5	HQ	565.5

CASING 套管数据

Type 类 型	Make 制 造	Size (OD) 尺 寸	Grade 钢 级	Depth(m) 下 深	Weight(kg/m) 重 量
PWT	Di-Corp	139.7mm		0-36	
0-300	Di-Corp	122.6mm		0-300	

DRILL BIT RECORD 钻头尺寸

No. 序号	Size (mm)	Type 类型	Make 制造	Jets 喷嘴(mm)	In 下人 (m)	Out提出 (m)	Progress 纯钻(m)	Hours 小时

DRILLING FLUID DATA 钻井液参数

Date 日 期	Depth 深 度	Type 类 型	Density 密 度	Viscosity 粘 度	Water Loss 失 水	PH 酸碱度
		Kion				
		Penetrol				
		Synvis				
		Linseed Soap				

		Turbo-Cut				

WATER SHOWS RECORD 水显示记录

No.序号	Depth 深 度（m）	Layer 层 位	Aquifer Yield 水 量（m^3）	Remark 备 注
				See ERM report

AQUIFER FORMATION TEST 水层测试 记录

Date 日期	Interval 井段	Type 类型	Choke 水嘴(mm)	Pressure 压力	Yield 水量	Salinity 矿化度
					See ERM report	

ABNORMAL GAS RECORD 异常气体气显示记录

GAS TYPE 气体类型	Depth 深 度（m）	Layer 层 位	Gas Yield 气量（m^3）	Remark 备 注
Methane 瓦斯	683	Gates	N/A	做 packer 试验时气体溢出，水位 80 米，加满水后恢复循环，气体消失

WIRELINE LOGGING DATA 测井数据

Run # 测次	Log Type 测井项目	BHT 温度	Logged Interval 井 段	Date Run Ends 日 期
	Thru-rods Neutron, Thru-Density			2015--11-21
	Openhole Neutron,Density			2015-11-22
	Gamma,SP,Dipmeter,Caliper,temperature			2015-11-22
	Televiewer			2015-11-23

GEOCHEMICAL SAMPLES COLLECTION RECORD 地化样品采样记录

No. 序号	Box No. 箱号	Interval 井段(m)	Thickness 厚度 （m）	Collection Time 采集时间	Remark 备注
1	Box 288	707.91- 708.86		2016-01-10	D Seam Gob
2	Box 288	709.42- 710.00		2016-01-10	D Seam Gob
3	Box 288	706.91 707.91		2016-01-10	D Seam Gob
4	Box 287	705.91 706.91		2016-01-10	D coal
5	Box 287	704.90 705.91		2016-01-10	D coal
6	Box 307	762.42 764.00		2016-01-11	F1 coal
7	Box307,308	764.00 765.50		2016-01-11	F1 coal
8	Box 308	765.50 767.00		2016-01-11	F1 coal
9	Box 308	766.00 767.00		2016-01-11	F1 Gob
10	Box 308	765.00 766.00		2016-01-11	F1 Gob
11	Box 307	764.00 765.00		2016-01-11	F1 Gob
12	Box 307	763.00 764.00		2016-01-11	F1 Gob
13	Box 307	762.00 763.00		2016-01-11	F1 Gob
14	Box 307	761.00 762.00		2016-01-11	F1 Gob
15	Box 307	760.00 761.00		2016-01-11	F1 Gob
16	Box323,324	810.44 811.54		2016-01-11	G/I
17	Box 323	809.44 810.44		2016-01-11	G/I Gob
18	Box323	808.79 809.44		2016-01-11	G/I Gob
19	Box333	836.27 837.67		2016-01-11	J coal
20	Box333	837.67 839.07		2016-01-11	J coal
21	Box 333	839.07 840.47		2016-01-11	J coal
22	Box333,334	840.47 841.87		2016-01-11	J coal
23	Box 333	841.87 843.10		2016-01-11	J coal
24	Box 332	835.27 836.27		2016-01-11	J Gob
25	Box 332	834.27 835.27		2016-01-11	J Gob
26	Box 332	833.27 834.27		2016-01-11	J Gob
27	Box 331	832.27 833.27		2016-01-11	J Gob

28	Box 331	831.27 832.27		2016-01-11	J Gob
29	Box 331	830.27 831.27		2016-01-11	J Gob
30	Box 330	829.27 830.27		2016-01-11	J Gob
31	Box 330	828.27 829.27		2016-01-11	J Gob
32	Box 330	827.27 828.27		2016-01-11	J Gob
33	Box 329	826.27 827.27		2016-01-11	J Gob

Note：The list from ERM Ezra

GT SAMPLE COLLECTION RECORD GT 样品采集记录

No. 序号	Box 箱号	Interval 井段(m)	Remark 备注
1	Box 286	701.20-701.40	D Roof
2	Box 287	703.54-703.81	D Roof
3	Box 287	704.70-704.90	D Immediate Roof
4	Box 288	707.00-707.17	D Immediate Floor
5	Box 288	708.20-708.36	D Floor
6	Box 288	708.64-708.81	D Floor
7	Box 294	723.29-723.40	E Immediate Roof
8	Box 294	723.72-723.86	E Immediate Floor
9	Box 307	759.30-759.45	F1 immediate Roof
10	Box 307	761.00-761.25	F1 immediate Floor
11	Box 313	779.65-779.79	F2 Roof
12	Box 313	780.18-780.38	F2 roof
13	Box 314	783.56-783.75	F2 Floor
14	Box 314	783.80-784.00	F2 Floor
15	Box 322	806.70-806.90	G/I Roof
16	Box 323	807.23-807.40	G/I Roof
17	Box 323	808.10-808.18	G/I
18	Box 323	808.18-808.30	G/I
19	Box 331	831.00-831.15	J Roof
20	Box 333	837.34-837.44	J Floor
21	Box 333	840.10-840.20	J floor
22	Box 333	840.70-840.90	J floor

Note: The list from Peter Cain

CBM SAMPLES COLLECTION RECORD 煤层气样品采集记录

No. 序号	Box 箱号	Interval 井段	Remark 备注
1	Box 287	705.05-705.34	D Seam
2	Box 287	705.52-705.84	D Seam
3	Box 288	706.54-706.87	D Seam
4	Box 294	723.40-723.72	Carb Shale
5	Box 307	759.64-759.98	F1 Seam
6	Box 313	780.38-780.70	F2 Seam
7	Box 314	783.27-783.58	Carb Shale
8	Box 323	807.68-808.00	G/I Seam
9	Box 332	833.57-833.87	J Seam
10	Box 332	834.04-834.34	J Seam
11	Box 332	834.39-834.70	J Seam
12	Box 332	834.82-835.14	J Seam
13	Box 332	835.63-835.92	J Seam
14	Box 333	836.46-836.77	J Seam
15	Box 333	837.04-837.34	J Seam

FINAL FORMATION TOPS 层位顶界

NAME 名称	PROGNOSIS 设计		ACTUAL 实际			
	TVD 深度	SS 海拔深度	MD 中深	TVD 深度	SS 海拔深度	+/- TO PROG 误差
Q				0		
Hasler				6		
Boulder Creek				389.71		
Hulcross				520.55		
Gates				626.66		

CORE DESCRIPTION 岩芯描述

Box or Tube 箱号或样槽	Interval 井 段(m)	Lithology Description 岩性描述

CEMENTING RECORD 封井记录

Date 日期	Cement type 水泥型号	Consumption 用量（Kg）	Plug Depth 段塞深度（m）	Hours 小时(Hr)	Remark 备注
	N/A	N/A			安装 Westbay,没封井

HD Mining International Ltd.

Drilling Company: Geotech Drilling Services
Rig Type: A 5
Total Depth: 865.50
Start Date: 2015-10-15
Finished Date: 2015-11-20
Core Size: HQ

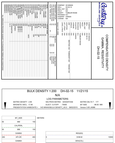
Hole No.: DH-02
Collar Elevation: 1039.63
Northing: 6100314.785
Easting: 623692.09
Logger George, Kevin
Note: Hydrogeology logged sampled by ERM staff seperately, this log for charactering resource

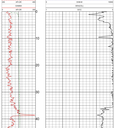
Strata	Coal Seam	Interval (m)		Thickness(m)		Dip	Rock Name	Lithology Description
		From	To	Thick	TRUE			
Q		0	6.00	6.00			Overburden	clay, cobbles, sand, mudstone
		6.00	12.00	6.00			Mudstone	grey mudstone with light grey siltstone, weathered, broken pieces
		12.00	20.17	8.17			Mudstone	dark grey mudstone with light grey siltstone
		20.17	23.13	2.96			Sandstone	light grey FS, massive
		23.13	31.43	8.30			Sandstone	Grey sandstone with dark grey mudstone, sand decrease
		31.43	53.00	21.57			Mudstone	dark Grey mudstone laminated with grey Silt and FS. 28.78-29.19m and 33.46-33.78m core broken
		53.00	83.72	30.72		<5	Mudstone	dark grey mudstone with grey FS
		83.72	101.85	18.13		0	Mudstone	dark grey mudstone laminated with grey FS, 70 degree breaks
		101.85	109.78	7.93			Sandstone	grey FS, laminated with silt locally, broken
		109.78	127.27	17.49		<5	Siltstone	dark grey Siltstone, 22*8cm py bleb at 112.95m
		127.27	137.00	9.73			Sandstone	grey FS laminated with silt
		137.00	139.15	2.15			Mudstone	dark grey with grey silt
		139.15	157.42	18.27		0	Mudstone	dark grey MS laminated with grey FS, micro horizontal bedding
		157.42	161.00	3.58			Mudstone	dark grey mudstone, near vertical breaks visible
		161.00	171.65	10.65			Mudstone	dark grey mudstone, vertical breaks
		171.65	175.91	4.26		0	Mudstone	dark grey MS with grey FS, silt
		175.91	187.70	11.79		<5	Mudstone	dark grey MS with grey FS, silt. Slickensides present, some core broken very samll pieces
		187.70	220.30	32.60			Mudstone	dark grey MS with grey FS, silt. Micro-horizontal
Hasler		220.30	232.79	12.49		<5	Mudstone	dark grey MS. Silt increase. Joints present at 230.32-230.42m
		232.79	243.08	10.29		<5	Mudstone	dark grey MS with grey FS, Micro horizontal bedding. Slickensides, carbonate veins, Py(0.5-1mm) blebs present. And mechanical breaks
		243.08	250.70	7.62			Mudstone	dark grey
		250.70	256.15	5.45		<5	Mudstone	dark grey mudstone interveded with grey fine sandstone
		256.15	257.00	0.85			Mudstone	dark grey, broken
		257.00	261.57	4.57		<5	Mudstone	dark grey laminated with grey fine sandstone
		261.57	262.45	0.88			Sandstone	grey FS with dark grey mudstone
		262.45	272.00	9.55			Mudstone	dark grey laminated with grey fine sandstone
		272.00	277.60	5.60			Mudstone	dark grey MS
		277.60	278.00	0.40		<5	Mudstone	core broken
		278.00	281.00	3.00			Mudstone	dark grey MS
		281.00	283.70	2.70			Sandstone	grey FS with dark grey mudstone
		283.70	286.87	3.17			Mudstone	dark grey laminated with grey fine sandstone
		286.87	300.00	13.13			Mudstone	dark grey laminated with grey fine sandstone, sand increase at 296.36-297, congl at 296.36-296.51
		300.00	320.07	20.07			Mudstone	dark grey mudstone with grey fine SS, SS up to 40%. Mechanical breakd
		320.07	324.44	4.37			Mudstone	fine sand increase, Slickensides present.
		324.44	339.95	15.51			Mudstone	2cm sheared at 327.1m, and mechanical breaks
		339.95	386.05	46.10			Mudstone	dark grey MS laminated with grey FS, micro horizontal. Breaks present. Sand increase locally
		386.05	389.71	3.66			Mudstone	sand increase signicantly, micro cross bedding
Boulder		389.71	390.13	0.42			Conglomerate	grey conglomerate, grain size 2mm. With minor coal stringers
		390.13	393.84	3.71		20	Sandstone	grey coarse sandstone with minor coal stringers
		393.84	394.24	0.40			Sandstone	grey coarse sandstone with conglomerate included
		394.24	397.76	3.52			Sandstone	grey coarse sandstone
		397.76	409.60	11.84			Mudstone	greenish grey bauxitic mudstone
		409.60	410.57	0.97			Sandstone	grey FS

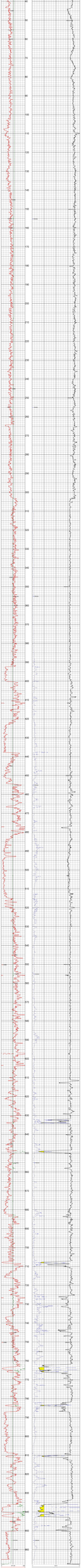
Strata	Coal Seam	Interval (m)		Thickness(m)		Dip	Rock Name	Lithology Description
		From	To	Thick	TRUE			
Boulder		410.57	413.00	2.43			Mudstone	bauxitic Mudstone
		413.00	419.20	6.20			Siltstone	grey bauxitic siltstone
		419.20	427.47	8.27			Sandstone	grey coarse sandstone
		427.47	428.45	0.98			Conglomerate	grey conglomerate
		428.45	430.22	1.77			Sandstone	grey coarse SS with conglomerate
		430.22	431.50	1.28			Sandstone	grey coarse sanstone with conglomerate grain size up to 20mm
		431.50	434.88	3.38			Sandstone	coarse sandstone
		434.88	435.34	0.46			Sandstone	grey coarse sanstone with conglomerate grain size up to 10mm
		435.34	436.83	1.49			Siltstone	brownish grey bauxitic siltstone
		436.83	446.43	9.60			Sandstone	grey medium coarse sandstone with minor coal stringers
		446.43	447.40	0.97			Sandstone	grey fine sandstone, well sorted
		447.40	452.00	4.60			Sandstone	grey medium coarse sandstone with minor coal stringers, core broken at 449.78-450
		452.00	463.50	11.50			Mudstone	grey MS
		463.50	464.35	0.85			Sandstone	grey coarse sandstone
		464.35	468.30	3.95			Mudstone	sand increase, slickensides present
		468.30	482.05	13.75			Mudstone	dark grey mudstone
		482.05	485.84	3.79		20	Sandstone	dark grey coarse sandstone
		485.84	490.10	4.26			Conglomerate	grey
		490.10	490.60	0.50			Mudstone	dark grey
		490.60	495.90	5.30			Conglomerate	grey conglomerate
		495.90	497.90	2.00			Sandstone	dark grey coarse sandstone with conglomerate
		497.90	502.14	4.24			Sandstone	grey medium sandstone with conglomerate
		502.14	509.31	7.17			Sandstone	grey fine -medium sandstone
		509.31	520.55	11.24		15	Sandstone	ggrey FS, mudy conglomerate locally
Hulcross		520.55	535.00	14.45			Mudstone	dark grey MS with grey FS, sand up to 35%
		535.00	582.87	47.87			Mudstone	dark grey MS with FS, micro horizontal bedding
		582.87	588.43	5.56		30	Mudstone	dark grey MS with 25 carbonate veins along bedding faces. 30-60 degree slickensides
		588.43	609.05	20.62		10	Mudstone	dark grey MS laminated with grey FS, sand increase at 594.67-595
		609.05	609.21	0.16			Conglomerate	dark grey, Py visible
		609.21	617.72	8.51			Mudstone	dark grey
		617.72	618.97	1.25			Sandstone	grey FS
		618.97	622.35	3.38			Mudstone	dark grey, broken
		622.35	623.50	1.15		40	Mudstone	dark grey MS laminated with grey FS
		623.50	626.66	3.16		30	Mudstone	dark grey, broken
Gates	A	626.66	626.70	0.04			coal	smashed
		626.70	629.74	3.04			Mudstone	brownish grey, 30-70 degree slickenside, broken
	B	629.74	629.95	0.21			coal	
		629.95	630.57	0.62			Mudstone	brownish
		630.57	630.82	0.25			coal	black,
		630.82	631.15	0.33			Mudstone	brownish
		631.15	631.70	0.55		25	coal	black, dull, broken
		631.70	632.55	0.85			Sandstone	fine sandstone with carbonaceous
		632.55	633.56	1.01			Mudstone	grey MS, sandy, slickenside, broken
		633.56	635.60	2.04			Mudstone	dark grey, FS lnterbeded locally. Break along slickensides
		635.60	640.40	4.80			Mudstone	dark grey
		640.40	646.07	5.67		35	Sandstone	grey FS with dark grey mudstone
		646.07	646.27	0.20			Mudstone	black, carbonaceous
	C	646.27	647.00	0.73			coal	recover 4cm pieces, dull, bony coal.
		647.00	647.82	0.82			Mudstone	black carb MS
		647.82	656.42	8.60		35	Sandstone	grey sandstone, massive, slickensides
		656.42	670.53	14.11			Sandstone	grey medium-coarse sandstone, slickensides, core breaks at 60 degree

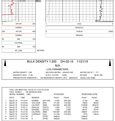
Strata	Coal Seam	Interval (m)		Thickness(m)		Dip	Rock Name	Lithology Description
		From	To	Thick	TRUE			
		670.53	675.91	5.38			Sandstone	grey coarse sandstone, massive, slickensides
		675.91	676.76	0.85		40	Sandstone	Grey coarse sanstone
		676.76	679.85	3.09			Conglomerate	grey congl with minor coal stringers, grain size up to 15mm, slickensides,
		679.85	680.60	0.75			Mudstone	brownish grey
		680.60	680.90	0.30			Sandstone	grey FS
		680.90	685.05	4.15			Mudstone	dark grey, broken and weathered at 680.9-681.30
		685.05	685.40	0.35		15	Sandstone	grey FS
		685.40	689.97	4.57			Mudstone	dark grey mudstone laminated with grey fine sandstone
		689.97	690.47	0.50			Sandstone	grey FS
		690.47	691.70	1.23			Mudstone	dark grey mudstone laminated with grey sandstone
		691.70	692.85	1.15			Sandstone	grey FS
		692.85	695.47	2.62			Mudstone	black, with grey fine sandstone
		695.47	704.85	9.38			Sandstone	grey FS with black MS
		704.85	704.93	0.08			Conglomerate	
	D	704.93	706.00	1.07			coal	black, shiny, cleaves. Recovery 85%
		706.00	706.55	0.55			Mudstone	black carbonaceous
		706.55	707.00	0.45			coal	black, dull
		707.00	707.77	0.77			Sandstone	black, fine sandstoen with carbonaceous
		707.77	710.05	2.28			Mudstone	dark grey
		710.05	713.52	3.47			Sandstone	grey medium-coarse sandstone
		713.52	718.84	5.32			Mudstone	brownish grey
		718.84	722.79	3.95		20	Sandstone	grey fine sandstone with little mudstone
		722.79	725.55	2.76			Mudstone	dark carbonaceous, broken at 723.4-723.72, 724.63-725.07
		725.55	729.15	3.60		15	Mudstone	brownish grey
		729.15	734.00	4.85			Sandstone	grey fine sandstone with mudstone
Gates		734.00	738.73	4.73			Sandstone	grey coarse sandstone, mudstone laminated at lower
		738.73	742.85	4.12			Mudstone	black MS
		742.85	744.12	1.27			Sandstone	grey fine sandstone
		744.12	758.81	14.69			Mudstone	black mudstone with minor coal stringers. Slickensides
		758.81	759.45	0.64		40	Mudstone	dark grey mudstone
	F1	759.45	761.00	1.55			coal	759.45-759.64 smashed, 759.64-761 core lost. Recovery 31%
		761.00	763.45	2.45			?	Core lost
		763.45	771.45	8.00			Mudstone	dark grey MS, 763.45-763.65m, 765.85-766.55, 767.73-768.33 broken. Carbonateveins, slickensides
		771.45	773.10	1.65			Sandstone	grey fine sandstone
		773.10	779.00	5.90		20	Mudstone	grey medium grain sandstone with coarse sandstone, pyrite present
		779.00	779.30	0.30			Mudstone	black, pieces with coal, up to 5 cm dimesion
		779.30	780.38	1.08			Mudstone	black carbonaceous MS
	F2	780.38	781.57	1.19			Coal	black,shiny. Recover 30%, 781.57-781.7 broken, 780.7-781.57 core lost
		781.57	782.00	0.43			Mudstone	black carb MS
		782.00	784.34	2.34			Mudstone	black MS with coal stringers
		784.34	806.27	21.93		30	Sandstone	grey medium-coarse sandstone
		806.27	807.68	1.41			Mudstone	black carbonaceous mudstone
	G/I	807.68	808.50	0.82			coal	black, bright, gassy. 50% recovery
		808.50	811.36	2.86			Mudstone	black carbonaceous mudstone
		811.36	813.34	1.98		15	Sandstone	grey fine sandstone, dark grey mudstoen laminated
		813.34	815.33	1.99			Mudstone	dark grey MS with grey FS
		815.33	820.37	5.04		30	Sandstone	greyfine-medium sandstone
		820.37	822.68	2.31			Mudstone	dark grey mudstone with grey fine sandstone
		822.68	826.50	3.82		30	Sandstone	grey fine -medium sandstone, slickensides
		826.50	833.35	6.85			Mudstone	black mudstone, silt laminated
	J	833.35	837.34	3.99			coal	black, shiny, cleaves. Gassy Recovery 92%

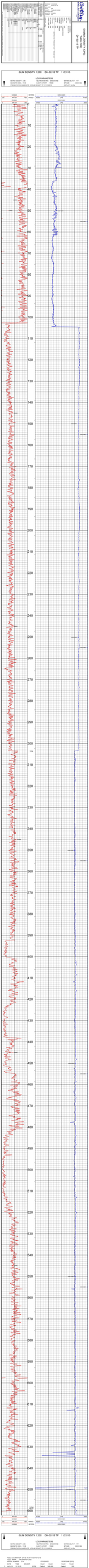
Strata	Coal Seam	Interval (m)		Thickness(m)		Dip	Rock Name	Lithology Description
		From	To	Thick	TRUE			
Gates		837.34	837.84	0.50			Mudstone	black mudstone with coal stringers.
	J	837.84	840.08	2.24			coal	smashed, 20% recovery
		840.08	840.35	0.27			Mudstone	black carb MS
		840.35	842.94	2.59		30	Sandstone	grey sandstone with dark grey mudstone
		842.94	847.46	4.52			Mudstone	black mudstone with coal stringers.
		847.46	851.95	4.49			Sandstone	grey coarse sandstone
		851.95	863.00	11.05			Sandstone	grey medium-coarse sandstone, with MS laminated slickensides along bedding
		863.00	865.50	2.50			Sandstone	grey sandstone


Schlumberger
Platform Express
Three Detector Lithology Density
Compensated Neutron
Array Induction Imager Tool
Gamma Ray
Caliper
Bit Size
Mud Type
Density Viscosity
Mud Resistivity
Mud Density
Mud Filtrate Resistivity
Mud Cake Resistivity
Mud Filtrate Density
Mud Cake Density
Source
Rm @ BHT
Rmf @ BHT
Rmc @ BHT
Rm @ Meas. Temp
Rmf @ Meas. Temp
Rmc @ Meas. Temp
Source Rmf Rmc
Rm @ BHT
Rmf @ BHT
Rmc @ BHT
Rm @ Meas. Temp
Rmf @ Meas. Temp
Rmc @ Meas. Temp
Source Rmf Rmc
Max Recorded Temp
Equipment Number
Location
Recorded By
Witnessed By
Run Number
Depth Driller
Schlumberger Depth
Bottom Logged Interval
Top Logged Interval
Casing Driller Size @ Depth
Casing Schlumberger
Bit Size
Type Fluid in Hole
Density
Viscosity
PH
Fluid Loss
Source of Sample
Rm @ Meas Temp
Rmf @ Meas Temp
Rmc @ Meas Temp
Source of Rmf and Rmc
Rm @ BHT
Time Since Circulation
Time on Bottom
Max Rec Temp
Equipment Number
Location
Recorded By
Witnessed By


BULK DENSITY / GR 300-35 TO 115 FT
API
LOG MEASUREMENTS
SPECIFIC GRAVITY
GAMMA RAY (API)
CALIPER (IN)
BULK DENSITY (G/CC)
DELTA RHO (G/CC)
PHOTOELECTRIC FACTOR (BARNS/ELECTRON)
NEUTRON POROSITY (DEC)
RESISTIVITY (OHMM)
DEEP RESISTIVITY (OHMM)
MEDIUM RESISTIVITY (OHMM)
SHALLOW RESISTIVITY (OHMM)
MICRO RESISTIVITY (OHMM)
DEPTH (FT)


BULK DENSITY / GR 300-35 TO 115 FT
API
LOG MEASUREMENTS
SPECIFIC GRAVITY
GAMMA RAY (API)
CALIPER (IN)
BULK DENSITY (G/CC)
DELTA RHO (G/CC)
PHOTOELECTRIC FACTOR (BARNS/ELECTRON)
NEUTRON POROSITY (DEC)
RESISTIVITY (OHMM)
DEEP RESISTIVITY (OHMM)
MEDIUM RESISTIVITY (OHMM)
SHALLOW RESISTIVITY (OHMM)
MICRO RESISTIVITY (OHMM)
DEPTH (FT)

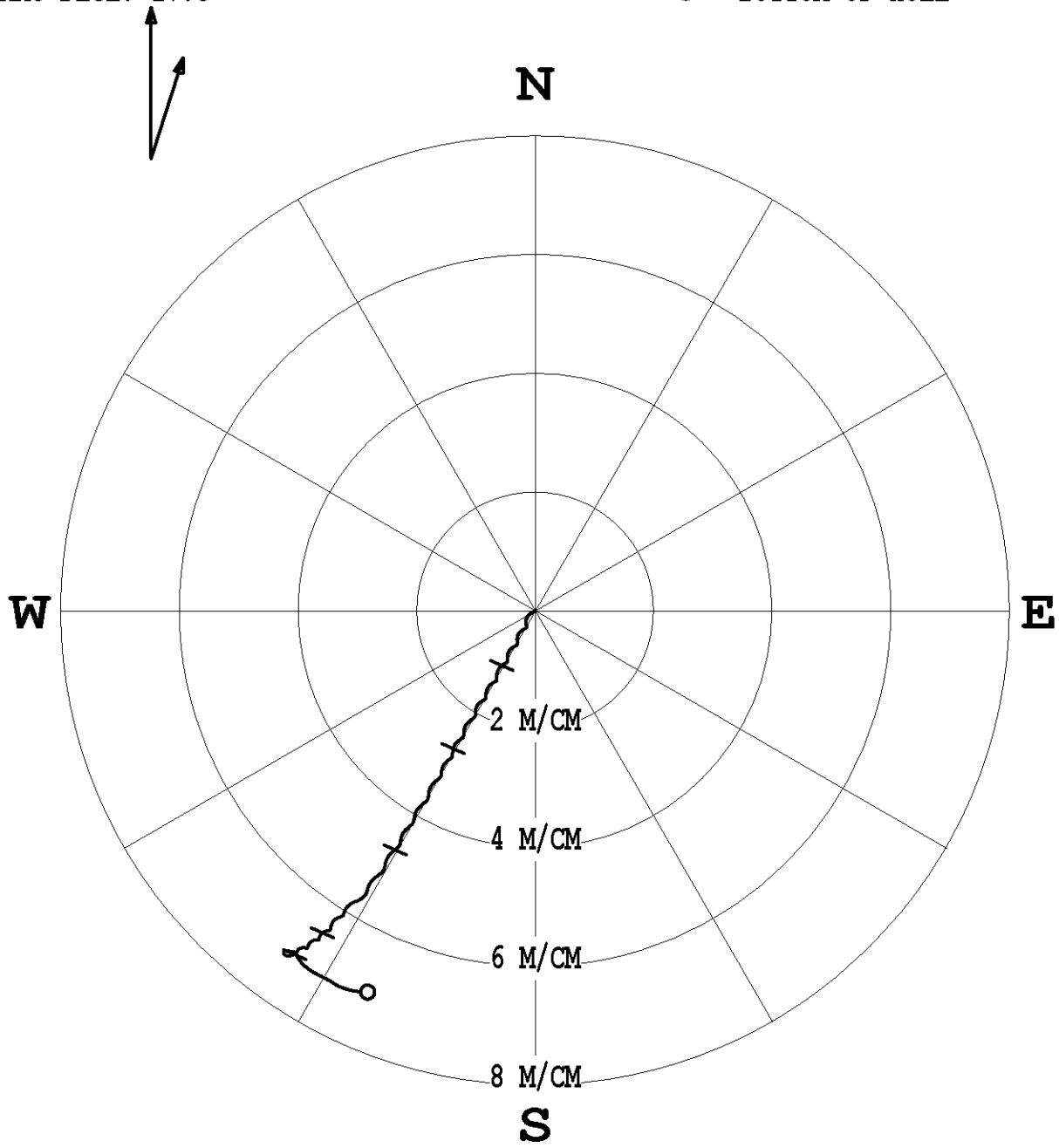

Data Type: Schlumberger Platform Express
Data Source: Schlumberger Platform Express
Run Number: 1
Depth Driller: 300 ft
Schlumberger Depth: 300 ft
Bottom Logged Interval: 300 ft
Top Logged Interval: 35 ft
Casing Driller Size @ Depth: 13.375 in @ 115 ft
Casing Schlumberger: 13.375 in @ 115 ft
Bit Size: 12.25 in
Type Fluid in Hole: Water Based Mud
Density: 8.6 lbm/gal
Viscosity: 26 s/qt
PH: 9.5
Fluid Loss: 6 cm3/30min
Source of Sample: Flowline
Rm @ Meas Temp: 0.2 @ 70 degF
Rmf @ Meas Temp: 0.15 @ 70 degF
Rmc @ Meas Temp: 0.25 @ 70 degF
Source of Rmf and Rmc: Measured
Rm @ BHT: 0.12 @ 150 degF
Time Since Circulation: 12 hr
Time on Bottom: 12 hr
Max Rec Temp: 150 degF
Equipment Number: 3
Location: Cook Inlet
Recorded By: J. Smith
Witnessed By: M. Johnson

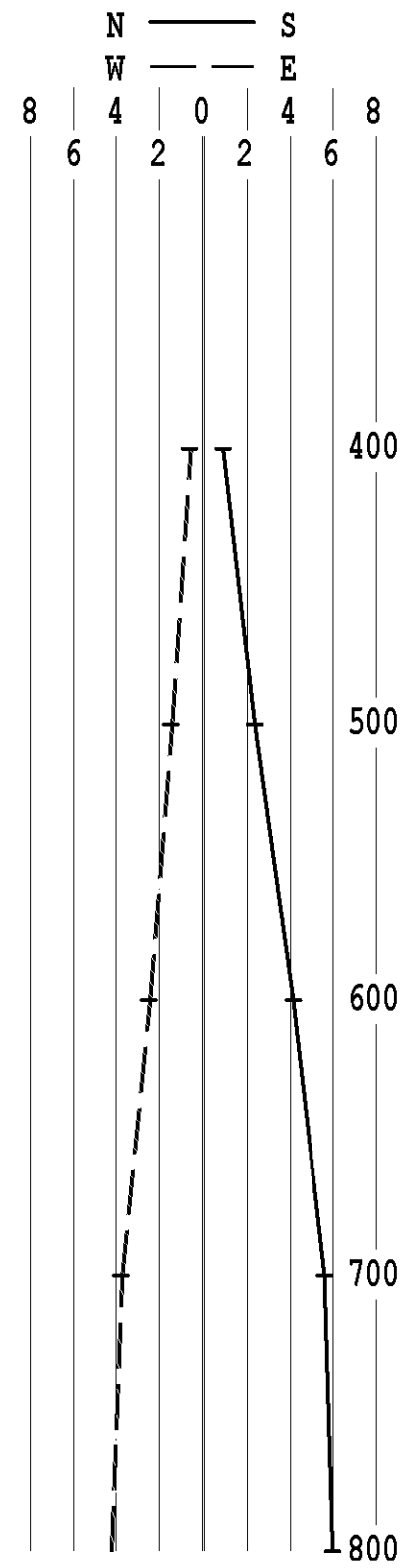

Schlumberger
Platform Express
AIT-H PEX
Dual Burst Thermal Neutron
SLIM DENSITY 1.200 DH-SD-15 TP 11/21/13
LOG PARAMETERS
MATRIX DENSITY 2.65
MUD FILTRATE DENSITY 1.00
MATRIX DELTA T 47.5 US/F
MUD FILTRATE DELTA T 189 US/F
CASING
CASING
CASING

PLAN VIEW
COMPU-LOG DEVIATION

CLIENT: HD MINING
LOCATION: N/A
HOLE ID: DH-02-15
DATE OF LOG: 11/22/15
PROBE: 9411A 2372
MAG DECL: 17.8

SCALE: 1 M/CM
TRUE DEPTH: 865.81 M
AZIMUTH: 203.7
DISTANCE: 7.0 M
+ = 100 M INCR
o = BOTTOM OF HOLE





* * * * * * * COMPU-LOG - VERTICAL DEVIATION * * * * * * *

CLIENT : HD MINING HOLE ID. : DH-02-15
FIELD OFFICE : CENTURY DATE OF LOG : 11/22/15
DATA FROM : N/A PROBE : 9411A , 2372
MAG. DECL. : 17.800 DEPTH UNITS : METERS
LOG: DH-02-15_11-22-15_03-31_9411A_005_310.000_865.900_DEVI.log

CABLE DEPTH	TRUE DEPTH	NORTH DEV.	EAST DEV.	DISTANCE	AZIMUTH	SANG	SANGB
310.00	310.00	-0.00	-0.00	0.0	186.5	0.2	186.5
320.00	320.00	-0.04	-0.07	0.1	241.6	0.8	238.8
330.00	330.00	-0.19	-0.16	0.2	220.5	1.0	180.4
340.00	340.00	-0.29	-0.15	0.3	208.0	0.3	224.0
350.00	350.00	-0.35	-0.26	0.4	216.0	1.1	225.5
360.00	359.99	-0.52	-0.31	0.6	210.7	0.7	169.1
370.00	369.99	-0.59	-0.33	0.7	209.4	0.6	244.5
380.00	379.99	-0.70	-0.46	0.8	213.1	1.2	204.0
390.00	389.99	-0.85	-0.47	1.0	209.0	0.4	198.0
400.00	399.99	-0.92	-0.57	1.1	211.7	1.1	232.3
410.00	409.99	-1.10	-0.65	1.3	210.6	1.0	180.1
420.00	419.99	-1.19	-0.68	1.4	209.7	0.7	238.0
430.00	429.99	-1.32	-0.81	1.5	211.7	1.2	204.2
440.00	439.98	-1.47	-0.84	1.7	209.6	0.5	201.7
450.00	449.98	-1.56	-0.95	1.8	211.4	1.3	224.7
460.00	459.98	-1.75	-1.01	2.0	210.0	0.8	181.6
470.00	469.98	-1.84	-1.09	2.1	210.6	1.0	233.5
480.00	479.98	-2.03	-1.21	2.4	210.7	1.2	184.7
490.00	489.98	-2.15	-1.25	2.5	210.1	0.8	231.6
500.00	499.97	-2.32	-1.39	2.7	210.8	1.4	192.6
510.00	509.97	-2.48	-1.42	2.9	209.8	0.7	224.3
520.00	519.97	-2.62	-1.56	3.1	210.8	1.5	204.4
530.00	529.97	-2.80	-1.60	3.2	209.7	0.7	215.5
540.00	539.97	-2.94	-1.74	3.4	210.7	1.5	218.4
550.00	549.96	-3.15	-1.81	3.6	209.8	0.8	191.6
560.00	559.96	-3.27	-1.92	3.8	210.4	1.4	229.9
570.00	569.96	-3.50	-2.04	4.1	210.3	1.2	187.0
580.00	579.96	-3.65	-2.14	4.2	210.4	1.3	232.3
590.00	589.95	-3.87	-2.27	4.5	210.4	1.3	187.9
600.00	599.95	-4.02	-2.37	4.7	210.4	1.3	230.7
610.00	609.95	-4.25	-2.53	4.9	210.7	1.5	192.1
620.00	619.95	-4.42	-2.61	5.1	210.5	1.2	228.2
630.00	629.94	-4.62	-2.80	5.4	211.3	1.7	204.0
640.00	639.94	-4.81	-2.88	5.6	211.0	0.9	219.8
650.00	649.94	-4.90	-3.04	5.8	211.8	1.2	247.7
660.00	659.94	-5.05	-3.21	6.0	212.5	1.2	203.5
670.00	669.93	-5.15	-3.28	6.1	212.5	0.8	250.9
680.00	679.93	-5.27	-3.43	6.3	213.1	1.1	199.0
690.00	689.93	-5.38	-3.46	6.4	212.8	0.4	227.5
700.00	699.93	-5.42	-3.59	6.5	213.5	1.1	237.2
710.00	709.93	-5.54	-3.65	6.6	213.4	0.4	210.0
720.00	719.93	-5.56	-3.76	6.7	214.1	1.0	243.4
730.00	729.93	-5.67	-3.84	6.8	214.1	0.5	201.8
740.00	739.93	-5.67	-3.92	6.9	214.7	0.9	263.9
750.00	749.93	-5.75	-4.02	7.0	215.0	0.3	205.1
760.00	759.93	-5.74	-4.08	7.0	215.4	0.8	285.5
770.00	769.93	-5.72	-4.20	7.1	216.3	0.6	272.9
780.00	779.92	-5.77	-4.24	7.2	216.3	0.5	163.4
790.00	789.92	-5.81	-4.15	7.1	215.5	0.7	88.1
800.00	799.92	-5.79	-4.06	7.1	215.0	0.3	82.4
810.00	809.92	-5.82	-4.01	7.1	214.6	0.5	156.9
820.00	819.92	-5.94	-3.93	7.1	213.5	1.0	136.6
830.00	829.92	-6.08	-3.76	7.1	211.7	1.4	119.6
840.00	839.92	-6.20	-3.53	7.1	209.6	2.3	124.2
850.00	849.91	-6.33	-3.30	7.1	207.5	1.5	120.8
860.00	859.91	-6.41	-3.01	7.1	205.1	1.7	99.9
865.90	865.80	-6.43	-2.82	7.0	203.7	1.8	95.0

FORMATION DIP 1:200 DH-02-15 11/22/15

LOG PARAMETERS

MATRIX DENSITY: 2.65		MATRIX DELTA-T: 55.5	
MAGNETIC DECL.: 10.66E	GRID CORR.: NONE	MUD SALINITY: 1000	MUD PH: 9.0
FORMATION EVALUATION ANGLE(DIP): 0		MD MINIMUM (INCL.,AZI.): 0	MD MAXIMUM (INCL.,AZI.): 0

MATRIX SALINITY: 177
MF @ 68F: 1.0
MUD @ 68F: 1.0

MT_ADS	DEPTHS
90 SPA 150	
CALIPER2	
150 SPA 90	
CALIPER1	
90 SPA 150	
GAMMA	
API_ADS	

CURVE
LR
CURVE
LR
CURVE
LR
CURVE
DIP

TADPOLE
DEG

AZIMUTH
DEG
RADIAL

DEPTHS
DEPTH

MT_ADS	DEPTHS
90 SPA 150	
CALIPER2	
150 SPA 90	
CALIPER1	
90 SPA 150	
GAMMA	
API_ADS	

CURVE
LR
CURVE
LR
CURVE
LR
CURVE
DIP

TADPOLE
DEG

AZIMUTH
DEG
RADIAL

DEPTHS
DEPTH

FORMATION DIP 1:200 DH-02-15 11/22/15

LOG PARAMETERS

MATRIX DENSITY: 2.65		MATRIX DELTA-T: 55.5	
MAGNETIC DECL.: 10.66E	GRID CORR.: NONE	MUD SALINITY: 1000	MUD PH: 9.0
FORMATION EVALUATION ANGLE(DIP): 0		MD MINIMUM (INCL.,AZI.): 0	MD MAXIMUM (INCL.,AZI.): 0

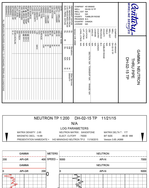
MATRIX SALINITY: 177
MF @ 68F: 1.0
MUD @ 68F: 1.0

TOOL ALIGNMENT: ROLL & THEFACE (R, H)

ROLL OFFSET: 0.00		PITCH OFFSET: 0.00	
AZIMUTH TYPE: TRUE		INCLINATION TYPE: TRUE	
SURVEY	AZIMUTH	STANDARD	MODIFIED (DYN)
		Found Fixed	Found Fixed
1 04/07/15	0.00	0.000 0.000	0.000 0.000
2 04/07/15	0.00	0.000 0.000	0.000 0.000
3 04/07/15	0.00	0.000 0.000	0.000 0.000
4 04/07/15	0.00	0.000 0.000	0.000 0.000
5 04/07/15	0.00	0.000 0.000	0.000 0.000
6 04/07/15	0.00	0.000 0.000	0.000 0.000
7 04/07/15	0.00	0.000 0.000	0.000 0.000
8 04/07/15	0.00	0.000 0.000	0.000 0.000

FORMATION DIP CALCULATION CONSTANTS

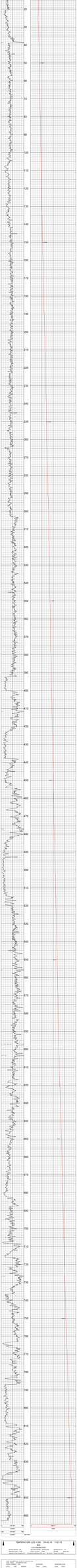
CORRELATION INTERVAL TOP: CORRELATION INTERVAL END: SURVEY HIGHLIGHTED: ALL


Schlumberger
DIFFERENTIAL TEMPERATURE
GAMMA RAY
NEUTRON
CASING COLLAR LOCATOR
CABLE HEAD TENSION
CASING COLLAR LOCATOR
GAMMA RAY
CASING COLLAR LOCATOR
CABLE HEAD TENSION
DIFFERENTIAL TEMPERATURE
NEUTRON

TEMPERATURE LOG 1.000 DH:66.66 - 110116

Well
LOG PARAMETERS

API/UWI:00-0000-0-00 SPUD DATE:01-01-00
SURFACE LOCATION:Sec. 00 T00S R00E FNL FEL
INTERMEDIATE LOCATION: FNL FEL



TEMPERATURE LOG 1.000 DH:66.66 - 110116

Well
LOG PARAMETERS

API/UWI:00-0000-0-00 SPUD DATE:01-01-00
SURFACE LOCATION:Sec. 00 T00S R00E FNL FEL
INTERMEDIATE LOCATION: FNL FEL

Completion Report

Well Name: DH-02

January 20, 2016

Completion Report

Well Name: DH-02

Project Number: WB946

Prepared for:

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APPENDICES

APPENDIX: Monitoring Well: DH-02

1. Introduction

This report and the attached Appendix document the technical services carried out by Westbay Instruments (Westbay) under HD Mining P.O. HDPO-150135 dated July 7, 2015. A Westbay System completion was installed in borehole DH-02 at the Murray River site near Tumbler Ridge, BC, Canada.

Westbay technical services representatives Mr. David Larssen and Mr. Tony Kim were on site for installation of the Westbay System from November 26 to December 13, 2015. ERM representatives Mr. Yaming Chen and Mr. Tyler Gale were on-site to supervise the installation.

This report documents the installation tasks and related QA checks.

2. Pre-Installation Activities

PQ-size wireline drill rods (4.1 inches ID) were cemented in place to a depth of 300 meters. A nominal 4 inch borehole was drilled to Total Depth using a diamond rotary method. Water with polymer additives was used as a lubricant during drilling.

Hydrogeologic logging of recovered core and geophysical survey (caliper, acoustic televiewer, gamma, density, dip meter, neutron, borehole deviation) logging were performed in the borehole.

Upon the completion of drilling to the targeted depth of about 870 meters, packer testing was conducted by ERM. After the testing, about 150 meters of HQ rods remained in the borehole due to technical difficulties during retrieving. A decision was made among HD Mining, ERM, and Geotech Drilling to place a Van Ruth Cementing and Wedging (CW) plug in the borehole above HQ rods.

After setting the Van Ruth CW plug at 714.5 meters depth, the borehole was flushed with clear water (no polymer additives) until it circulated to surface. HQ rods with a casing shoe were placed to 714m as a temporary guide tube for deployment of the Westbay completion.

(Note: all depths are with respect to ground surface. Monitoring well reference elevations were not available at the time of writing).

3. Installation

Westbay Instruments technical services representatives Mr. Larssen and Mr. Kim were on site to install the Westbay System in DH-02. Mr. Chen and Mr. Gale of ERM were on site to supervise the Westbay installation. A summary of the Westbay Installation is indicated below in Table 1.

Table 1: Summary of Westbay System Installation

Well Name.	Field Installation Dates	Total Depth (m)	MP38 Tubing Length (m)	No. Monitoring Zones
DH-02	Dec 5-13 2015	715.8	715.8	16

The Westbay System in DH - 02 was installed according to the procedure described below.

3.1 Preparation of Westbay System Design

Packer depths for the borehole were provided to Westbay by Mr. Gale of ERM. A proposed well design was created based on these depths. The well design was used to prepare a Westbay Completion Log, which specifies the location of the Westbay System components in the well. This log was reviewed and approved in the field by Mr. Gale and Mr. Chen prior to installation of the Westbay System. The Westbay Completion Log as approved was used as an installation guide in the field. A field copy of the log is in the Appendix.

A measurement port coupling was included in each primary monitoring zone to provide the capability to measure fluid pressures and collect fluid samples. Measurement port couplings were also included in QA zones to provide QA testing capabilities and to permit operation of squeeze relief venting capabilities of the Westbay Model No. 6055 vented inflation tool. A Model 0206 hydraulic pumping port coupling was also included in 9 selected monitoring zones to provide purging and hydraulic conductivity testing capabilities. Mr. Gale requested that optional synthetic (PET) filters were to be installed over the measurement port couplings.

A summary of the installed Westbay System components is shown on Table 2 below and in the Summary Completion Log Legend in the Appendix.

Table 2: Summary of Installed Westbay System Components

Well Name	Packers (0238)	Measurement Ports (0205)	Pumping Ports (0206)
DH-02	19	20	9

3.2 Layout of Westbay System Tubing Components

Prior to the installation, the Westbay System components were set out at the borehole according to the sequence indicated on the Westbay Completion Log. Each casing length was numbered and measured beginning with the lowermost as an aid to confirming the proper sequence of components. The appropriate Westbay System couplings were attached to each casing section. Magnetic location collars were attached 0.6 m below the top of the measurement port couplings in the monitoring intervals. Locations of key components are listed in Tables 5 and 6 in the Appendix.

Each component was visually inspected. Serial numbers for each packer, pumping port and measurement port coupling were recorded on the Westbay Completion Log. The component layout was confirmed with the log before the components were lowered into the borehole.

3.3 Lowering of Westbay System Components

The Westbay System components were lowered into the borehole by the drill hoist rig. Each joint was tested with a minimum internal hydraulic pressure of 150-psi for one minute to confirm hydraulic seals. A record of each successful joint test and the placement of each component are noted by check marks on the Westbay Completion Log. Clean water supplied by Geotech Drilling was added to the Westbay System when necessary to counter buoyancy effects while components were lowered into the borehole. Potable water supplied from Tumbler Ridge, mixed with CHEM FROST antifreeze at 3:1 ratio, was used for testing of joint seals during lowering.

3.4 Hydraulic Integrity Testing

After the Westbay System string was lowered into the borehole, the water level inside the Westbay System completion was monitored at a depth different from the open borehole water level for a minimum period of thirty minutes to confirm hydraulic integrity of the completion. A mosdax sampler probe was positioned at the bottom of the Westbay tubing for the test. Outside tubing pressure is calculated from pre-inflation profile data. The data from the hydraulic integrity test are shown in Table 3 below.

Table 3: Hydraulic Integrity Test

Well Name	December 8, 2015	Fluid Levels	
	Time	Inside Tubing	Outside Tubing
DH-02	11:15	505.46 psia	821.31psia
	11:20	505.36 psia	
	11:25	505.39 psia	
	11:30	505.38 psia	
	11:35	505.37 psia	
	11:40	505.41 psia	
	11:45	505.35 psia	
	11:50	505.41 psia	
	11:55	505.41 psia	
	12:00	505.40 psia	
	12:05	505.41 psia	
	12:10	505.41 psia	
	12:15	505.41 psia	

3.5 Positioning of Westbay System Completion

After the Westbay System components were lowered into the well, the top of the Van Ruth CW plug was encountered at a depth of 715.8m below ground level, based on the cumulative lengths of the Westbay tubing sections. The Westbay System was positioned as illustrated on the Westbay Completion Log. The Westbay System was supported in this position while packer inflation was carried out. The positioning of the Westbay System components is based on the "nominal" lengths of Westbay System components corrected for de-stressing as described in section 3.8. The positioning calculations do not include allowances for borehole temperature or deviation effects.

The attached figure titled "MOSDAX Transducer Position" provides information to correlate the position of MOSDAX transducer sensor to the reference position at the top of the measurement port. The attached figure titled "Dimensions of Packer Seals and Monitoring Zones" outlines the calculations used to determine the packer depths and zone length. The Summary Completion Log, which shows the final "as-built" locations of the components in the well, are included in the Appendix.

3.6 Pre-inflation Profile

A pre-inflation pressure profile was carried out at the well prior to inflating the packers to confirm the proper position and operation of measurement ports and magnetic collars. The ports operated properly and were positioned correctly in the well. A plot of the Pre-inflation Piezometric levels in all zones is shown on Figure 3 in the Appendix.

3.7 Inflation of Westbay System Packers

The Westbay System packers were inflated sequentially beginning at the bottom of the well using 1 to 3 CHEM FROST/water mixture. Tap water from Tumbler Ridge was used. The Westbay Model No. 6055 vented inflation tool was used for packer inflation. All the packers appear to have inflated normally. The data for inflation of each packer are provided on the Westbay Packer Inflation Records included in the Appendix.

3.8 De-Stressing of Westbay Tubing

Westbay's procedure for de-stressing the Westbay casing was used to reduce the long-term load on the upper components. A summary of the de-stressing activities is shown on Table 4. The final positions of the Westbay casing components (ports and packers) are shown on the Summary Casing Log and in Table 5 and 6 in the Appendix.

Table 4 – Summary of De-stressing Activities

Monitoring Well	Initial Hanging Weight (lbs.)	Final Clamp-off Weight (lbs.)	Total Movement at surface (m)	Beginning Stick-up (m) *	End Stick-up (m) *
DH-02	450	0	0.61	1.03	0.42

*Measurements taken above datum from the temporary stick-up before wellhead completion built.

4. Fluid Pressure Measurements

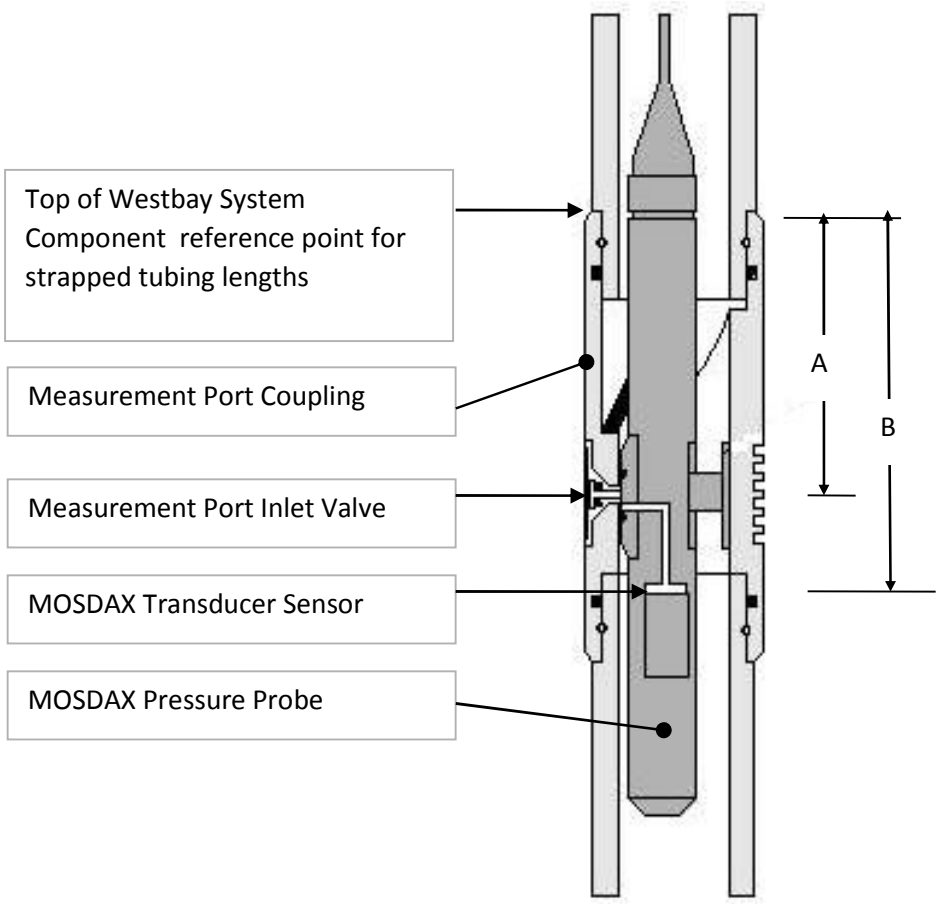
After packer inflation was completed, fluid pressures were measured at each measurement port. At that time, the in-situ formation pressures may not have recovered from the pre-installation activities and potential groundwater pressure increases in monitoring zones that may result from packer inflation. This latter effect may be more likely to occur in monitoring zones located in low-permeability geological formations. Longer term monitoring may be required to establish representative fluid pressures.

A plot of the Post-Inflation Piezometric levels in all zones in the well is shown on Figure 5 in the Appendix. The data were examined to confirm proper operation of the measurement ports and as a check on the presence of annulus seals between monitoring zones. The calculation sheets for all pressure profiles of the Westbay System are also enclosed in the Appendix.

Figure 1:

MOSDAX Transducer Position

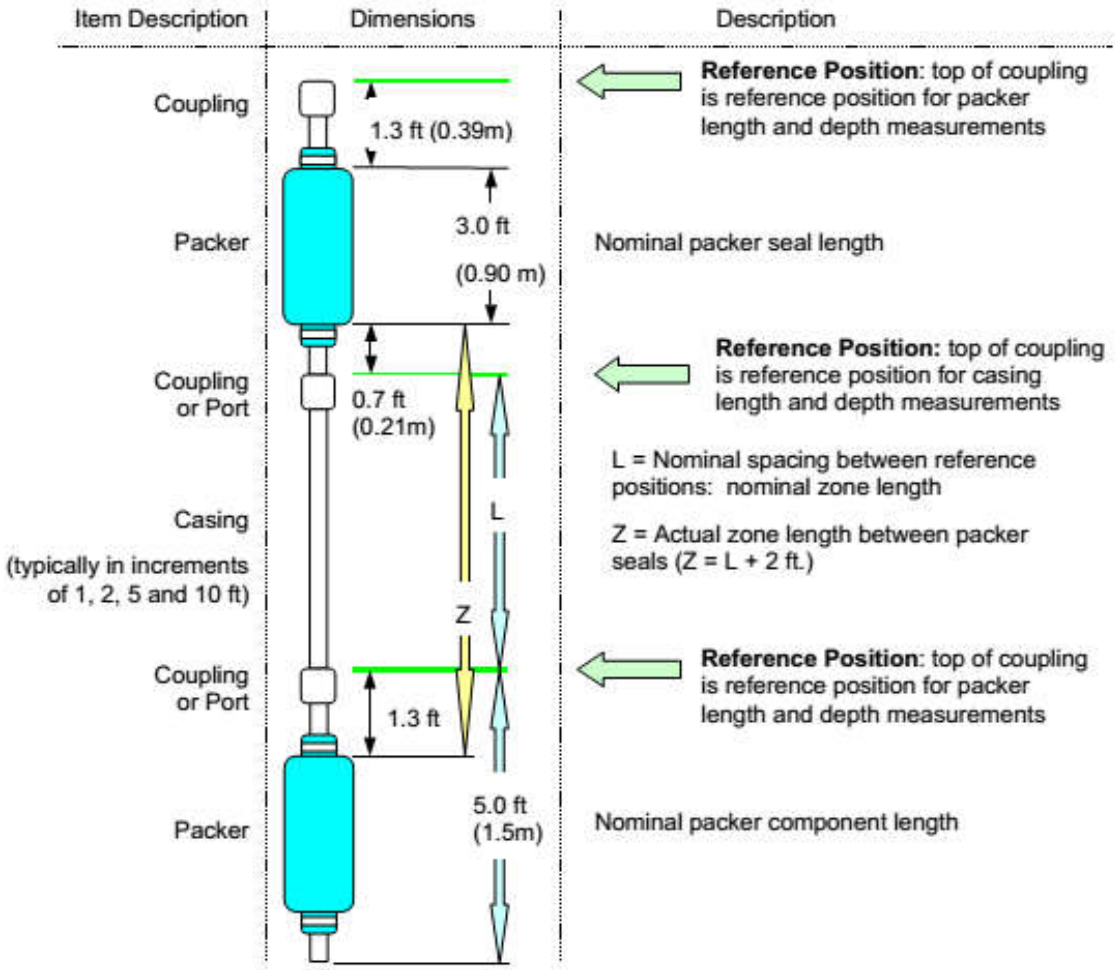
In an Westbay System Measurement Port Coupling



System	Measurement Port	A	B
Plastic MP38	0205	0.37 ft. (114.3 mm)	0.54 ft. (165.1 mm)

Figure 2:

Dimensions of Packer Seals and Monitoring Zones Westbay MP38 System 0238 Packers



Discussion Points:

- The top of a coupling (Regular Coupling, Measurement Port or Pumping Port) is the reference point for describing nominal depths and nominal lengths. Actual positions of packer seals and zone lengths are determined with respect to the appropriate reference positions.
- Packer Position Example: A packer with a nominal depth of 50 ft (15.2m), will have a nominal packer seal position of 51.3 to 54.3 ft. (15.59 to 16.49m)
- Zone Length Example: A zone whose upper packer is at 50 ft (15.2m) and bottom packer is at 70 ft (21.3m) will have a nominal zone length of 15 ft (4.6m) and an actual zone length (between packer seals) of 15.0+1.3+0.7 = 17.0ft. (4.6 + 0.39 + 0.2 = 5.19m)
- Information on the position of Measurement Port Valve and MOSDAX Transducer sensor, used for detailed calculation of piezometric level measurements, are described separately.

APPENDIX: MONITORING WELL: DH-02

As-Built Packer and Port Summary (Table 5)	- 1 page
As-Built Tubing Summary (Table 6)	- 6 pages
QA/QC Summary of Westbay System MP38 Installation	- 1 page
Summary Completion Log	- 5 pages
Pre-Inflation Piezometric Pressure/ Levels	
Field Data and Calculation Sheet (Dec 8th)	- 4 page
Figure 3, Pre-Inflation Profile	- 1 page
Post- Inflation Piezometric Pressure/Levels	
Field Data and Calculation Sheet (Dec 12th)	- 4 page
Figure 4, Post-Inflation Profile	- 1 page
Westbay Completion Log (field copy)	- 25 pages
Westbay System Packer Inflation Records	- 20 pages

TABLE 5
DH-02 As-Built Packer and Port Summary

Zone No.	Measurement Port Depth (m)	Pumping Port Depth (m)	Magnetic Collar Depth (m)	Top of Zone (m)	Bottom of Zone (m)
1	712.7		713.3	712.5	715.8
2	702.9	705.9	703.5	702.7	711.6
3	663.0		663.6	662.7	701.8
4	654.7		655.3	654.5	661.8
5	640.9	644.0	641.5	640.7	653.6
6	632.6	635.7	633.2	632.4	639.8
7	616.7	619.7	617.3	616.5	631.5
8	609.3	610.8	609.9	609.1	615.6
9	595.5	598.6	596.1	595.3	608.2
10	534.0		534.6	533.7	594.4
11	524.1	527.2	524.7	523.9	532.8
12	511.9	514.9	512.5	511.6	523.0
13	460.0		460.6	459.8	510.7
14	453.3	456.3	453.9	453.1	458.9
15	392.4		393.0	392.2	452.2
16	351.2		351.8	351.0	391.3
17	246.2		246.8	246.0	350.1
18	147.3		147.9	147.1	245.1
19	45.3		45.9	45.1	146.2
20	43.8				

Note 1: All depth measurements in meters below ground surface.
Note 2: All depth measurements use 'Nominal' casing lengths.
Note 3: Not corrected for borehole deviation or borehole temperature effects.
Note 4: All Westbay Port depth measurements to upper edge of coupling item.
Note 5: Depths for top and bottom of zone based on packer seal position.
Note 6: All depths are corrected for effects of the Westbay casing de-stressing procedure.

Item No.	Component Part Number	Component S/N	Coupling P/N	Component Discription	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
265	020102		0202					-2.4
264	020102		0202					-1.8
263	020102		0202					-1.2
262	020102		0202					-0.6
261	020102		0202					0.0
260	020102		0202					0.6
259	020110		0202					1.2
258	020110		0202					4.3
257	020110		0202					7.3
256	020110		0202			0216	11.0	10.4
255	020110		0202					13.4
254	020110		0202					16.4
253	020110		0202					19.5
252	020110		0202					22.5
251	020110		0202					25.6
250	020110		0202					28.6
249	020110		0202					31.6
248	020110		0202					34.7
247	020110		0202					37.7
246	020110		0202					40.8
245	0238	19315	0205	Measurement Port	8663			**43.8**
244	020110		0205	Measurement Port	8659	0216	45.9	**45.3**
243	020110		0202					48.4
242	020110		0202					51.4
241	020110		0202					54.5
240	020110		0202					57.5
239	020110		0202					60.5
238	020110		0202					63.6
237	020110		0202					66.6
236	020110		0202					69.7
235	020110		0202					72.7
234	020110		0202					75.8
233	020110		0202					78.8
232	020110		0202					81.9
231	020110		0202					84.9
230	020110		0202					87.9
229	020110		0202					91.0
228	020110		0202					94.0
227	020110		0202					97.1
226	020110		0202					100.1
225	020110		0202					103.2
224	020110		0202					106.2
223	020110		0202					109.2
222	020110		0202					112.3
221	020110		0202					115.3
220	020110		0202					118.4
219	020110		0202					121.4
218	020110		0202					124.5
217	020110		0202					127.5
216	020110		0202					130.5

Item No.	Component Part Number	Component S/N	Coupling P/N	Component Discription	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
215	020110		0202					133.6
214	020110		0202					136.6
213	020110		0202					139.7
212	020110		0202					142.7
211	0238	19314	0202					145.8
210	020110		0205	Measurement Port	8657	0216	147.9	**147.3**
209	020110		0202					150.3
208	020110		0202					153.4
207	020110		0202					156.4
206	020110		0202					159.5
205	020110		0202					162.5
204	020110		0202					165.6
203	020110		0202					168.6
202	020110		0202					171.6
201	020110		0202					174.7
200	020110		0202					177.7
199	020110		0202					180.8
198	020110		0202					183.8
197	020110		0202					186.9
196	020110		0202					189.9
195	020110		0202					192.9
194	020110		0202					196.0
193	020110		0202					199.0
192	020110		0202					202.1
191	020110		0202					205.1
190	020110		0202					208.2
189	020110		0202					211.2
188	020110		0202					214.3
187	020110		0202					217.3
186	020110		0202					220.3
185	020110		0202					223.4
184	020110		0202					226.4
183	020110		0202					229.5
182	020110		0202					232.5
181	020110		0202					235.6
180	020110		0202					238.6
179	020110		0202					241.7
178	0238	19311	0202					244.7
177	020110		0205	Measurement Port	8656	0216	246.8	**246.2**
176	020110		0202					249.3
175	020110		0202					252.3
174	020110		0202					255.3
173	020110		0202					258.4
172	020110		0202					261.4
171	020110		0202					264.5
170	020110		0202					267.5
169	020110		0202					270.6
168	020110		0202					273.6
167	020110		0202					276.7
166	020110		0202					279.7

Item No.	Component Part Number	Component S/N	Coupling P/N	Component Discription	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
165	020110		0202					282.7
164	020110		0202					285.8
163	020110		0202					288.8
162	020110		0202					291.9
161	020110		0202					294.9
160	020110		0202					298.0
159	020110		0202					301.0
158	020110		0202					304.1
157	020110		0202					307.1
156	020110		0202					310.1
155	020110		0202					313.2
154	020110		0202					316.2
153	020110		0202					319.3
152	020110		0202					322.3
151	020110		0202					325.4
150	020110		0202					328.4
149	020110		0202					331.5
148	020110		0202					334.5
147	020110		0202					337.6
146	020110		0202					340.6
145	020110		0202					343.6
144	020110		0202					346.7
143	0238	19312	0202					349.7
142	020110		0205	Measurement Port	8661	0216	351.9	**351.2**
141	020110		0202					354.3
140	020110		0202					357.3
139	020110		0202					360.4
138	020110		0202					363.4
137	020110		0202					366.5
136	020110		0202					369.5
135	020110		0202					372.6
134	020110		0202					375.6
133	020110		0202					378.6
132	020110		0202					381.7
131	020110		0202					384.7
130	020110		0202					387.8
129	0238	19313	0202					390.8
128	020110		0205	Measurement Port	8660	0216	393.0	**392.4**
127	020105		0202					395.4
126	020110		0202					396.9
125	020110		0202					400.0
124	020110		0202					403.0
123	020110		0202					406.1
122	020110		0202					409.1
121	020110		0202					412.1
120	020110		0202					415.2
119	020110		0202					418.2
118	020110		0202					421.3
117	020110		0202					424.3
116	020110		0202					427.4

Item No.	Component Part Number	Component S/N	Coupling P/N	Component Discription	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
115	020110		0202					430.4
114	020110		0202					433.5
113	020110		0202					436.5
112	020110		0202					439.6
111	020110		0202					442.6
110	020110		0202					445.6
109	020110		0202					448.7
108	0238	19316	0202					451.7
107	020110		0205	Measurement Port	8664	0216	453.9	**453.3**
106	020105		0206	Pumping Port	340			456.3
105	020102		0202					457.9
104	0238	19317	0202					458.5
103	020110		0205	Measurement Port	8651	0216	460.6	**460.0**
102	020105		0202					463.1
101	020110		0202					464.6
100	020110		0202					467.7
99	020110		0202					470.7
98	020110		0202					473.8
97	020110		0202					476.8
96	020110		0202					479.9
95	020110		0202					482.9
94	020110		0202					485.9
93	020110		0202					489.0
92	020110		0202					492.0
91	020110		0202					495.1
90	020110		0202					498.1
89	020110		0202					501.2
88	020110		0202					504.2
87	020110		0202					507.3
86	0238	19318	0202					510.3
85	020110		0205	Measurement Port	8650	0216	512.5	**511.9**
84	020110		0206	Pumping Port	341			514.9
83	020105		0202					518.0
82	020110		0202					519.5
81	0238	19319	0202					522.6
80	020110		0205	Measurement Port	8648	0216	524.7	**524.1**
79	020110		0206	Pumping Port	342			527.2
78	020102		0202					530.3
77	020105		0202					530.9
76	0238	19320	0202					532.4
75	020110		0205	Measurement Port	8649	0216	534.6	**534.0**
74	020105		0202					537.0
73	020102		0202					538.5
72	020110		0202					539.1
71	020110		0202					542.2
70	020110		0202					545.2
69	020110		0202					548.3
68	020110		0202					551.3
67	020110		0202					554.4
66	020110		0202					557.4

Item No.	Component Part Number	Component S/N	Coupling P/N	Component Discription	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
65	020110		0202					560.5
64	020110		0202					563.5
63	020110		0202					566.6
62	020110		0202					569.6
61	020110		0202					572.7
60	020110		0202					575.7
59	020110		0202					578.8
58	020110		0202					581.8
57	020110		0202					584.8
56	020110		0202					587.9
55	020110		0202					590.9
54	0238	19333	0202					594.0
53	020110		0205	Measurement Port	8653	0216	596.1	**595.5**
52	020110		0206	Pumping Port	347			598.6
51	020110		0202					601.7
50	020110		0202					604.7
49	0238	19332	0202					607.8
48	020105		0205	Measurement Port	8662	0216	609.9	**609.3**
47	020105		0206	Pumping Port	344			610.8
46	020102		0202					612.4
45	020102		0202					613.0
44	020105		0202					613.7
43	0238	19331	0202					615.2
42	020110		0205	Measurement Port	8652	0216	617.3	**616.7**
41	020110		0206	Pumping Port	345			619.7
40	020105		0202					622.9
39	020102		0202					624.4
38	020110		0202					625.0
37	020110		0202					628.1
36	0238	19310	0202					631.1
35	020110		0205	Measurement Port	8641	0216	633.2	**632.6**
34	020105		0206	Pumping Port	343			635.7
33	020102		0202					637.3
32	020105		0202					637.9
31	0238	19309	0202					639.4
30	020110		0205	Measurement Port	8654	0216	641.5	**640.9**
29	020110		0206	Pumping Port	346			644.0
28	020110		0202					647.1
27	020110		0202					650.2
26	0238	19329	0202					653.2
25	020110		0205	Measurement Port	8658	0216	655.3	**654.7**
24	020102		0202					657.8
23	020110		0202					658.4
22	0238	19326	0202					661.4
21	020110		0205	Measurement Port	8655	0216	663.6	**663.0**
20	020105		0202					666.0
19	020101		0202					667.5
18	020110		0202					667.8
17	020110		0202					670.9
16	020110		0202					673.9

Item No.	Component Part Number	Component S/N	Coupling P/N	Component Discription	Coupling S/N	Accessory P/N	Accessory Depth (m)	Depth (m) *
15	020110		0202					677.0
14	020110		0202					680.0
13	020110		0202					683.1
12	020110		0202					686.1
11	020110		0202					689.2
10	020110		0202					692.2
9	020110		0202					695.3
8	020110		0202					698.3
7	0238	19327	0202					701.4
6	020110		0205	Measurement Port	8640	0216	703.5	**702.9**
5	020105		0206	Pumping Port	348			705.9
4	020102		0202					707.5
3	020110		0202					708.1
2	0238	19328	0202					711.2
1	020110		0205	Measurement Port	8643	0216	713.3	**712.7**
								715.8

Depths are with respect to ground level.

* Component positions are referenced to the top of the subject Westbay System coupling.

* Packer positions are referenced to the top Westbay System coupling on the packer.

Monitoring zone dimensions are determined as described on the attached “Dimensions of Packer Seals and Monitoring Zones”.

The position of a MOSDAX Transducer in a Measurement Port is illustrated in the attached “MOSDAX Transducer Position”.

This information may be used in calculating piezometric levels.

Westbay Field QA Summary Form

Client: HD MINING Project: WB 946

Well:

			Check ✔	Initials	Date
1	**Client Data and Approvals**				
	1.1	Client design request and Borehole/Well information	✓	TK	Dec 4/15
	1.2	Client approved final design (file name: DH-02. WWD.)	✓	TK	Dec 5/15
	1.3	Client decision on filter sleeves for Measurement Ports	✓	TK	Dec 5/15
	1.4	Client approval to install, including well and borehole conditions	✓	TK	Dec 5/15
Comments					
		Hold Point – Design and well information are complete			
2	**Layout of Completion Components**				
	2.1	Installation Log and Confirmation Log printed from approved design (file name: DH-02, WWD)	✓	TK	Dec 4/15
	2.2	Components taken from inventory	✓	TK/DL	Dec 4/15
	2.3	Layout completed according to log, plus copy S/N and packer data)	✓	"	"
	2.3	Independent confirmation of layout (use Confirmation Log)	✓	TK/YC/TG	Dec 6/15
	2.4	Independent check on laid out length vs design length	✓	DL/YC	Dec 6/15
Comments					
		Hold Point – Layout is good to install			
3	**Lowering of Completion String**				
	3.1	Independent staff for layout rack and installation check list	✓	TK/TG/YC	Dec 6/15
	3.2	Components individually verified with approved log (with call-back repeat)	✓	"	"
	3.3	Pressure test tool and apparatus verified	✓	TK/DL	"
	3.4	Components pass pressure test	✓	TK	Dec 7/15
	3.5	Tensile loads managed within system limits	✓	TK/DL	Dec 7/15
	3.6	Depth to water in Westbay tube checked and adjusted	✓	"	"
	3.7	Hydraulic integrity test is passed	✓	TK	Dec 8/15
	3.8	Pre-Inflation profile is completed, analyzed and accepted	✓	TK	Dec 8/15
	3.9	Top of Westbay tubing is positioned according to the approved log	✓	TK/DL	"
Comments					
		Hold Point – Completion is good to inflate packers			
4	**Packer Inflation**				
	4.1	Inflation tool and apparatus verified	✓	TK/DL	Dec 9-11/15
	4.2	Inflation data recorded on forms at time of inflation	✓	TK	"
	4.3	Inflation V and P consistent with BH diameter and packer model	✓	TK	"
	4.4	De-stressing procedure followed (if required)	✓	TK/DL	Dec 11/15
	4.5	All packers inflated normally	✓	TK	Dec 9-11/15
	4.6	Post inflation profile completed, analyzed and accepted	✓	TK	"
Comments					
		Hold Point – Packer inflation is complete			
5	**Documentation**				
	5.1	Wellhead completion sketch completed	✓	TK	Dec 12/15
	5.2	Draft completion Log and pressure profile data given to client	✓	TK	Dec 12/15
	5.3	Completion Report data appendix is complete	✓	TK	Jan 7/16
		Installation and Documents Complete			

Signature: Date: Jan 7, 2015

Summary Completion Log

Company: HD MINING
Well: DH-02
Site: Murray River, BC
Project: Murray River

Job No: WB946
Author: TK

Well Information

Reference Datum: Ground Level
Elevation of Datum: 0.00 m.
MP Casing Top: 0.00 m.
MP Casing Length: 715.80 m.

Borehole Depth: 715.80 m.
Borehole Inclination:
Borehole Diameter: 0.00 mm

Well Description:

Other References:

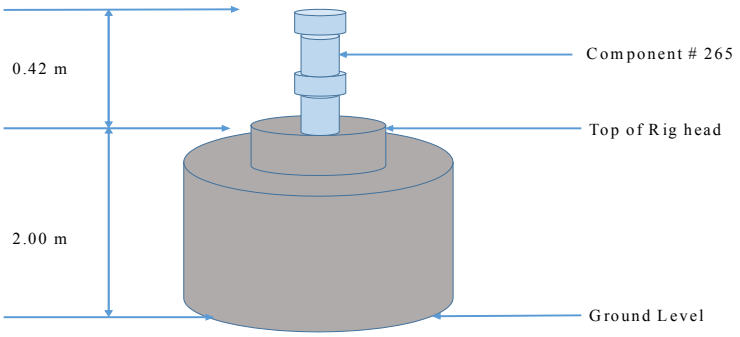
File Information

File Name: DH-02F.WWD
Report Date: Thu Jan 07 09:29:51 2016

File Date: Jan 05 11:51:27 2016

Sketch of Wellhead Completion

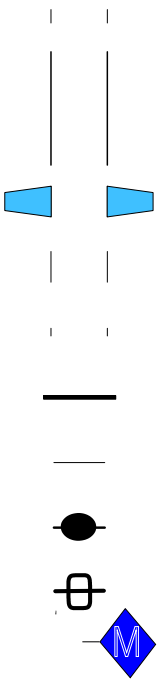
DH-02 Completion Sketch



Legend

(Qty) MP Components

(Library - WD Library 04/29/15)



(15) 020102 - MP38 Casing 3 (2F/0.6M)

(216) 020110 - MP38 Casing 1 (10F/3M)

(19) 0238 - MP38 Packer - 74mm (5F/1.5M)

(14) 020105 - MP38 Casing 2 (5F/1.5M)

(1) 020101 - MP38 Casing 4 (1F/0.3M)

(1) 0203 - MP38 End Cap

(236) 0202 - MP38 Regular Coupling

(20) 0205 - MP38 Measurement Port

(9) 0206 - MP38 Hydraulic Pumping Port

(20) 0216 - Magnetic Location Collar

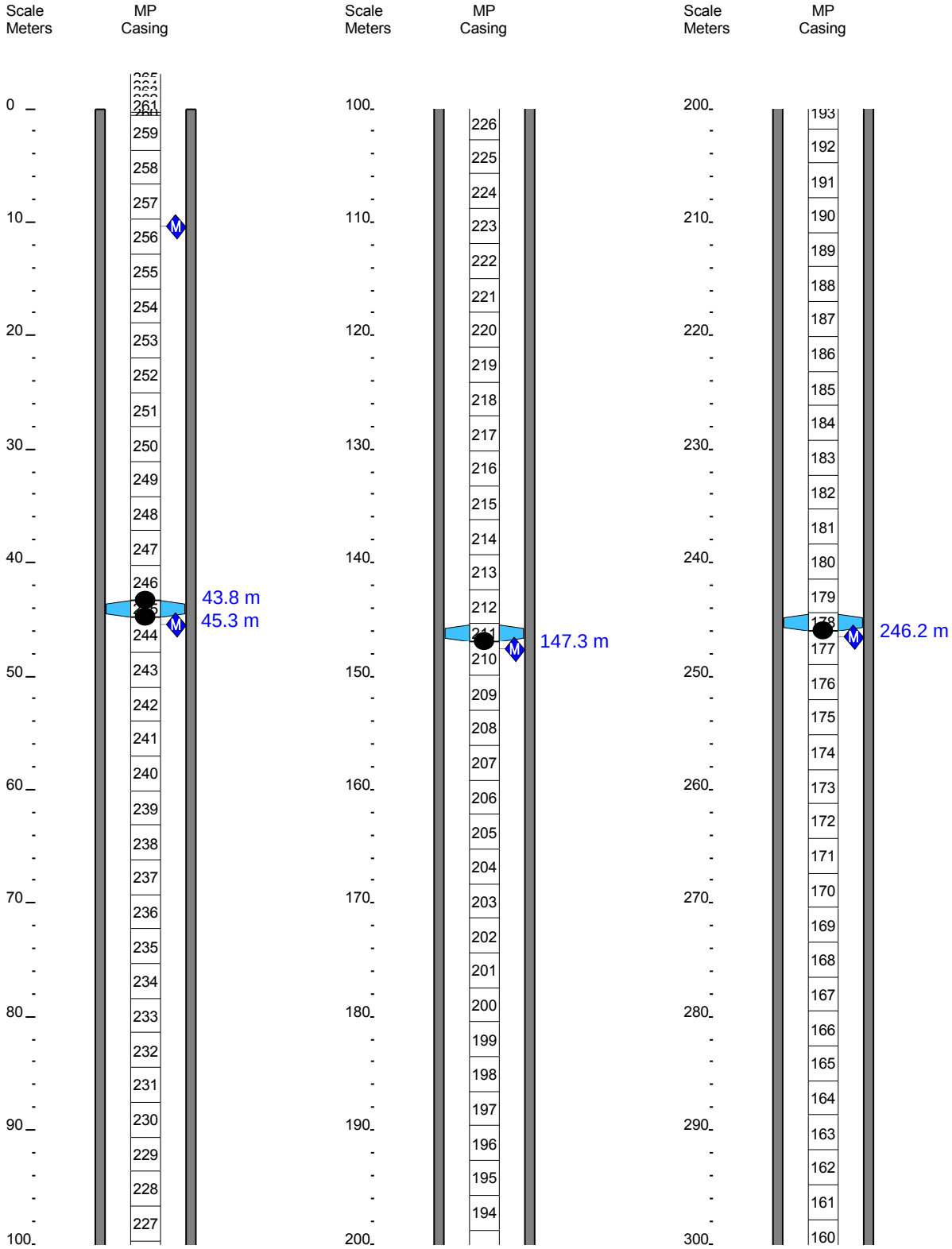
Geology

Backfill/Casing

Mild Steel

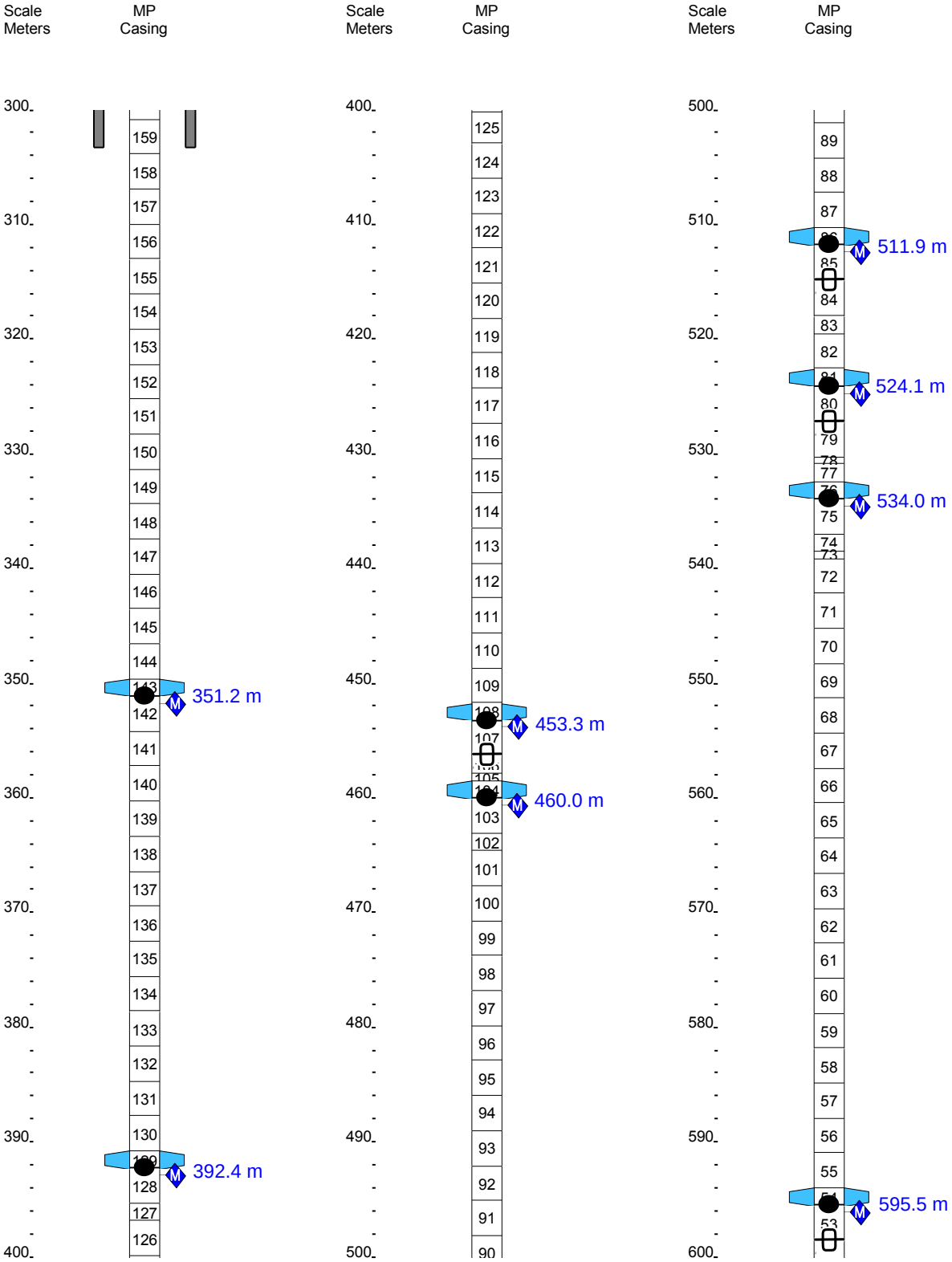
Summary Completion Log
HD MINING

Job No: WB946
Well: DH-02



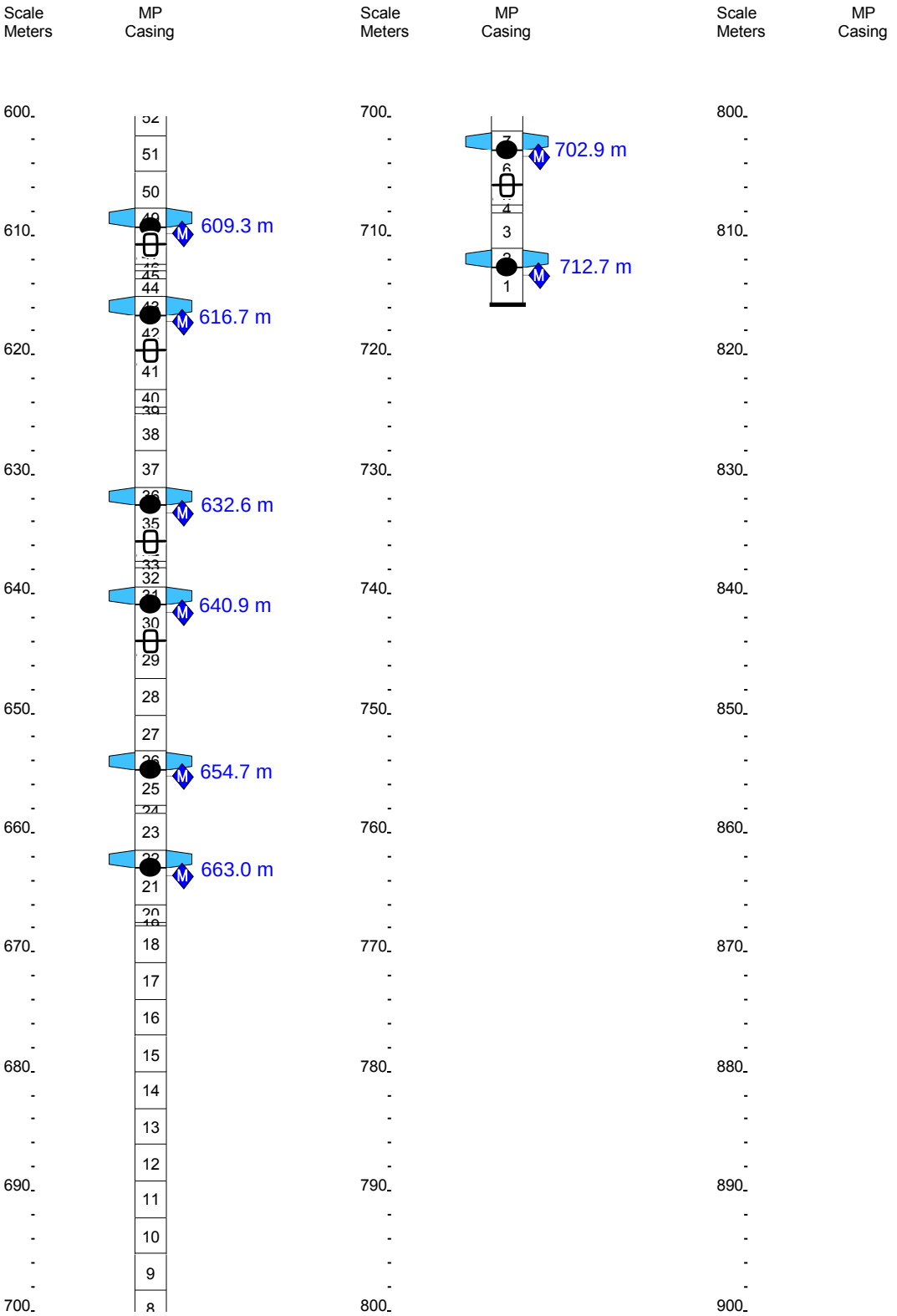
Summary Completion Log
HD MINING

Job No: WB946
Well: DH-02



Summary Completion Log
HD MINING

Job No: WB946
Well: DH-02



Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Pre - Inflation. 1/2

Well No.: DH - 02
Datum: Ground
Elev. G.S.:
Height of Westbay above G.S.:
Elev. top of Westbay Casing:
Reference Elevation:
Borehole angle: vertical

Probe Type: Sampler
Serial No.: Ems 2652
Probe Range: 2000 psi
Westbay Casing Type: MP 38
Sampler Valve Position: closed

Date: Dec 8, 2015.
Client: HD MINING
Job No.: WB 946
Location: TUMBLER RIDGE
Weather: SNOW
Operator: TH.

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

	Start	Finish
Pressure	12.90	12.27
Temp	13.98	8.99
Time	10:30 a.m.	3:50 p.m.

P_{atm} 12.90 psi

Port No.	Port Position From Log (ft) m	Port Position From Cable (ft)	True Port Depth "Dp" (ft)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	Pressure Head Outside Port (ft) H = (P2-Patm)/w	Piez. Level Outside Port (ft) Dz = Dp - H	Comments
1	711.02	700.3	703	503.29	819.18	12:27	21.30	502.29	567.0	136	
2	701.1	690.9	693	489.14	805.09	12:33	21.09	489.14	557.1	135.9	
3	661.3	651.1	653.3	431.98	748.22	12:38	20.67	431.96	517.1	136.2	
4	653.0	642.8	645	420.12	736.45	12:43	20.24	420.14	508.8	136.2	
5	639.3	629.1	631.3	400.42	716.81	12:48	19.90	400.41	495.0	136.3	
6	630.9	620.8	622.9	388.51	705.01	12:53	19.48	[illegible]	[illegible]	136.2	P1 = ~~405.08~~ 388.52
7	615.0	604.9	607	365.74	682.32	12:56	19.05	365.76	470.8	136.2	
8	607.6	597.6	599.6	353.24	671.99	13:00	18.73	355.14	463.35	136.2	
9	593.8	583.8	585.0	335.35	652.19	13:04	18.52	335.37	449.57	136.2	
10	532.3	522.4	524.3	247.25	664.47	13:14	16.79	247.25	387.88	136.4	
11	522.4	512.6	514.4	233.21	650.46	13:16	16.57	233.09	378.03	136.4	
12	510.2	500.4	502.2	215.99	632.98	13:20	16.36	215.56	365.73	136.4	
13	458.4	448.7	450.4	141.43	459.20	13:26	15.49	141.41	313.85	136.5	
14	451.6	442.0	443.6	131.72	449.51	13:28	15.05	131.73	307.03	136.5	
15	390.6	381.2	382.6	44.49	362.79	13:34	14.29	44.46	245.99	136.6	

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = almospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

* Piez. level's calculations were done using "True Port Depth" value.

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Pre- Inflation. 2/2

Well No.: DH - 02
Datum: Ground
Elev. G.S.:
Height of Westbay above G.S.:
Elev. top of Westbay Casing:
Reference Elevation:
Borehole angle: vertical

Probe Type: Sampler
Serial No.: 2015 2652
Probe Range: 2000 PSI
Westbay Casing Type: MP 38
Sampler Valve Position: closed

Date: Dec 8, 2015
Client: HD MINING
Job No.: WB 946
Location: Trumbler Ridge
Weather: SNOW
Operator: TL

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

Start: Pressure 12.90 Finish: 12.97
Temp 13.98 8.99
Time 10:30 am 3:50 pm

P_{atm} 12.90 psi

Port No.	Port Position From Log (ft)	Port Position From Cable (ft)	True Port Depth "Dp" (ft)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	Pressure Head Outside Port (ft) H = (P2-Patm)/w	Piez. Level Outside Port (ft) Dz = Dp - H	Comments
16	349.5	340.1	341.5	13.36	304.11	13:39	13.34	13.36	205.07	136.4	
17	244.32	235.3	236.3	13.22	154.52	13:47	12.66	13.25	99.59	136.7	
18	145.74	136.5	137.74	13.13	13.74	13:52	11.77	13.12			
19	43.16	34.7	35.16	12.91	12.93	14:07	9.66	12.95			
20	41.64	32.1	33.64	12.96	13.01	14:10	8.88	12.96			

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

* Piez. levels calculations were done using "True Port Depth" values.

Westbay Piezometric Pressures/Levels

Pre-Inflation Pressure Profile

Transcribed from field book

Field Data and Calculation Sheet

Well No.: DH-02
Datum: Ground Surface
Elev. G.S.: n/a
Height of Westbay above G.S.:
Elev. top of Westbay Casing: n/a
Reference Elevation: n/a
Borehole angle: Vertical

Probe Type: Sampler
Serial No.: EMS2652
Probe Range: 2000 psi
Westbay Casing Type: MP38
Sampler Valve Position: Closed

Date: December 8, 2015
Client: HD Mining
Job No.: WB946
Location: Murray River
Weather: snow
Operator: Tony KIM

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

		Start:	Finish:
	Pressure	12.90 psi	12.77 psi
	Temp	13.98 °C	8.99.10 °C
P_{atm} 12.9 psi	Time	10:30 AM	3:50 PM

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings					Pressure Head Outside Port (m)	Piez. Level Outside Port (m)	Comments					
				Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	H = (P2-Patm)/w	Dz = Dp - H		ZONES				
1	703.0			503.3	819.2	12:27	21.3	503.3	566.9	136.1		Zone 1				
2	693.0			489.1	805.1	12:33	21.09	489.1	557.0	136.0		Zone 2				
3	653.3			432.0	748.2	12:38	20.67	432.0	517.0	136.3		Zone 3				
4	645.0			420.1	736.5	12:43	20.24	420.1	508.7	136.3		Zone 4				
5	631.3			400.4	716.8	12:48	19.7	400.4	494.9	136.4		Zone 5				
6	622.9			388.5	705.0	12:53	19.48	388.5	486.6	136.3		Zone 6				
7	607.0			365.7	682.3	12:56	19.05	365.8	470.7	136.3		Zone 7				
8	599.6			355.2	671.8	13:00	18.73	355.1	463.3	136.3		Zone 8				
9	585.8			335.4	652.2	13:04	18.52	335.4	449.5	136.3		Zone 9				
10	524.3			247.3	564.5	13:14	16.79	247.3	387.8	136.5		Zone 10				
11	514.4			233.2	550.5	13:16	16.57	233.1	377.9	136.5		Zone 11				
12	502.2			215.5	533.0	13:20	16.36	215.6	365.6	136.6		Zone 12				
13	450.4			141.4	459.2	13:26	15.49	141.4	313.8	136.6		Zone 13				
14	443.6			131.7	449.5	13:28	15.05	131.7	306.9	136.7		Zone 14				
15	382.6			44.5	362.8	13:34	14.29	44.5	246.0	136.6		Zone 15				

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Westbay Piezometric Pressures/Levels

Pre-Inflation Pressure Profile

Transcribed from field book

Field Data and Calculation Sheet

Well No.: DH-01
Datum: Ground Surface
Elev. G.S.: n/a
Height of Westbay above G.S.:
Elev. top of Westbay Casing: n/a
Reference Elevation: n/a
Borehole angle: Vertical

Probe Type: Sampler
Serial No.: EMS2652
Probe Range: 2000 psi
Westbay Casing Type: MP38
Sampler Valve Position: Closed

Date: December 8, 2015
Client: HD Mining
Job No.: WB946
Location: Murray River
Weather: snow
Operator: Tony KIM

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

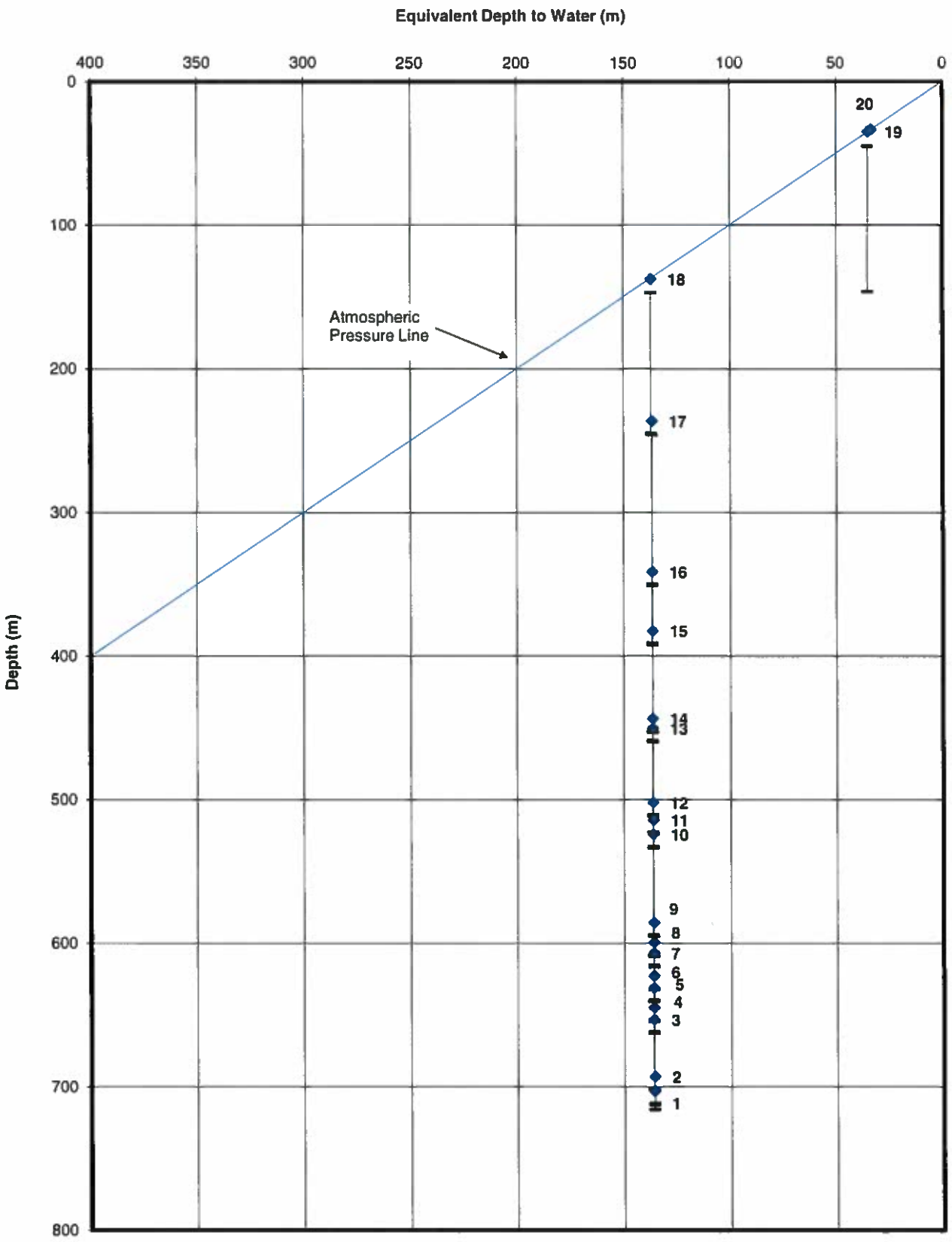
		Start	Finish
	Pressure	12.90 psi	12.77 psi
	Temp	13.98 °C	8.99 °C
P_{atm} 12.9 psi	Time	10:30 AM	3:50 PM

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings					Pressure Head Outside Port (m)	Piez. Level Outside Port (m)	Comments					
				Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	H = (P2-Patm)/w	Dz = Dp - H		ZONES				
16	341.5			13.36	304.11	13:39	13.54	13.36	204.7	136.8		Zone 16				
17	236.3			13.22	154.52	13:47	12.66	13.25	99.5	136.8		Zone 17				
18	137.7			13.13	13.74	13:52	11.77	13.12	0.5	137.2		Zone 18				
19	35.2			12.91	12.93	14:07	9.66	12.95	-0.1	35.2		Zone 19				
20	33.6			12.96	13.01	14:10	8.88	12.96	0.0	33.7		Zone 20				

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well: DH-02

Profile Date: Dec 8, 2015
Comments: Pre-Inflation Profile



Client: HD Mining
Site: Murray River
Datum: Ground Surface

Figure 3

Plot By: TK Date: Jan 8/16
Checked By: DL Date: Jan 8/16
Westbay Project: WB946

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Post - Inflation 1/2

Well No.: DH-02
Datum: Ground
Elev. G.S.:
Height of Westbay above G.S.:
Elev. top of Westbay Casing:
Reference Elevation:
Borehole angle: vertical.

Probe Type: Sampler
Serial No.: ZMS 2652
Probe Range: 2000 psi
Westbay Casing Type: MP38
Sampler Valve Position: closed.

Date: Dec 12/15
Client: HD MINING
Job No.: WB 946
Location: Tulsequah Bridge.
Weather: cold
Operator: TK

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

	Start:	Finish:
Pressure	13.03	12.90
Temp	12.10	7.10
Time	12=55	3=40

P_{atm} 13.03 psi

Port No.	Port Position From Log (ft)	Port Position From Cable (ft)	True Port Depth "Dp" (ft)	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	Pressure Head Outside Port (ft) H = (P2-Patm)/w	Piez. Level Outside Port (ft) Dz = Dp - H	Comments
1	~~712.77~~	709.27	712.7	804.33	852.95	1=23	20.75	804.33	590.66	~~122.1~~	118.61
2	699.44		702.9	790.21	831.24	1=29	21.30	790.26	575.39	124.0	
3	689.32		663.0	732.90	773.41	1=34	21.20	732.92	534.72	124.8	
4	651.29		654.9	721.19	756.37	1=37	20.77	721.19	522.74	128.5	
5	637.5		640.9	701.45	735.34	1=41	20.45	701.42	507.95	129.5	
6	629.19		632.6	689.47	734.03	1=46	19.91	689.44	507.03	122.2	
7	613.27		616.7	666.68	705.75	1=52.	19.48	666.71	487.14	126.1	
8	605.88		609.3	656.16	697.67	1=55	19.27	656.11	481.46	124.4	
9	592.08		595.5	636.43	680.96	1=57	19.05	636.39	469.71	122.4	
10	530.52		534.0	548.02	612.12	2=03	18.20	548.09	421.30	109.2	
11	520.69		524.1	533.86	559.42	2=06	17.44	533.84	384.24	136.45	
12	508.42		511.9	516.26	534.71	2=53	15.90	516.28	366.86	141.56	Shoe - Bent broke
13	456.61		460.0	442.19	435.86	2=59	15.60	442.16	297.35	159.26	
14	449.83		453.3	432.36	425.02	3=02	15.39	432.33	289.72	160.10	160.10
15	388.87		392.3	345.11	368.41	3=07	14.84	345.11	249.91	138.95	

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

* Piez level's calculations were done with using "Port Position from Log" values.

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Port Inflation 1/2.

Well No.: DH-02
Datum: Ground
Elev. G.S.:
Height of Westbay above G.S.:
Elev. top of Westbay Casing:
Reference Elevation:
Borehole angle: vertical

Probe Type: Sampler
Serial No.: BMS 2652
Probe Range: 2000 psi
Westbay Casing Type: MP38
Sampler Valve Position: closed

Date: Dec 12 /15
Client: MD MINING
Job No.: WB946
Location: Tumbler Ridge
Weather: cold
Operator: TLe.

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

		Finish:
Start: Pressure	13.03	12.90
Temp	~~13.0~~ 12.10	11.10
Time	12:55	3:40

P_{atm} 13.03 psi

Port No.	Port Position From Log (ft) m	Port Position From Cable (ft)	True Port Depth "Dp" (ft) m	Fluid Pressure Readings: Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	Pressure Head Outside Port (ft) m H = (P2-Patm)/w	Piez. Level Outside Port (ft) m Dz = Dp - H	Comments
16	347.572		351.2	286.07	398.57	3:13	13.63	286.03	271.12	76.59	
17	242.577		246.0	135.53	156.76	3:21	11.77	135.57	101.07	141.49	
18	143.52		146.9	13.10	13.23	3:28	9.22	13.04			
19	41.4		44.8	12.91	12.91	3:33	8.21	12.91			
20	39.89		43.3	12.98	12.94	3:35	7.78	12.98			

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

* Piez. level's calculations were done with wrong "Port Position from Log" values.

Westbay Piezometric Pressures/Levels

Post-Inflation Pressure Profile

Transcribed from field book

Field Data and Calculation Sheet

Well No.: DH-02
Datum: Ground Surface
Elev. G.S.: n/a
Height of Westbay above G.S.:
Elev. top of Westbay Casing: n/a
Reference Elevation: n/a
Borehole angle: Vertical

Probe Type: Sampler
Serial No.: EMS2652
Probe Range: 2000 psi
Westbay Casing Type: MP38
Sampler Valve Position: Closed

Date: December 12, 2015
Client: HD Mining
Job No.: WB946
Location: Murray River
Weather: overcast
Operator: Tony KIM

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

		Start:	Finish:
	Pressure	13.03 psi	12.90 psi
	Temp	12.10 °C	7.10 °C
P_{atm} 13.03 psi	Time	12:55 AM	3:40 PM

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings					Pressure Head Outside Port (m)	Piez. Level Outside Port (m)	Comments					
				Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	H = (P2-Patm)/w	Dz = Dp - H		ZONES				
1	712.7			804.3	853.0	13:23	20.75	804.3	590.7	122.0		Zone 1				
2	702.9			790.2	831.2	13:29	21.3	790.3	575.4	127.5		Zone 2				
3	663.0			732.9	773.4	13:34	21.2	732.9	534.7	128.3		Zone 3				
4	654.7			721.2	756.4	13:37	20.77	721.2	522.7	132.0		Zone 4				
5	640.9			701.5	735.3	13:41	20.45	701.4	508.0	132.9		Zone 5				
6	632.6			689.5	734.0	13:46	19.91	689.4	507.0	125.6		Zone 6				
7	616.7			666.7	705.8	13:52	19.48	666.7	487.1	129.6		Zone 7				
8	609.3			656.2	697.7	13:55	19.27	656.1	481.5	127.8		Zone 8				
9	595.5			636.4	681.0	13:57	19.05	636.4	469.7	125.8		Zone 9				
10	534.0			548.0	612.1	14:02	18.2	548.1	421.3	112.7		Zone 10				
11	524.1			533.9	559.4	14:06	17.44	533.8	384.2	139.9		Zone 11				
12	511.9			516.3	534.7	14:53	15.7	516.3	366.9	145.0		Zone 12				
13	460.0			442.2	435.9	14:59	15.6	442.2	297.3	162.7		Zone 13				
14	453.3			432.4	425.0	15:02	15.39	432.3	289.7	163.6		Zone 14				
15	392.4			345.1	368.4	15:07	14.84	345.1	249.9	142.5		Zone 15				

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Westbay Piezometric Pressures/Levels

Post-Inflation Pressure Profile

Transcribed from field book

Field Data and Calculation Sheet

Well No.: DH-01
Datum: Ground Surface
Elev. G.S.: n/a
Height of Westbay above G.S.:
Elev. top of Westbay Casing: n/a
Reference Elevation: n/a
Borehole angle: Vertical

Probe Type: Sampler
Serial No.: EMS2652
Probe Range: 2000 psi
Westbay Casing Type: MP38
Sampler Valve Position: Closed

Date: December 12, 2015
Client: HD Mining
Job No.: WB946
Location: Murray River
Weather: overcast
Operator: Tony KIM

Note: "Port position" in angled boreholes refer to position along drillhole. True depth (Dp) needs to be calculated using borehole angle and deviation data to calculate zone piezometric level (Dz).

Ambient Reading (P_{atm}) (pressure, temperature, time)

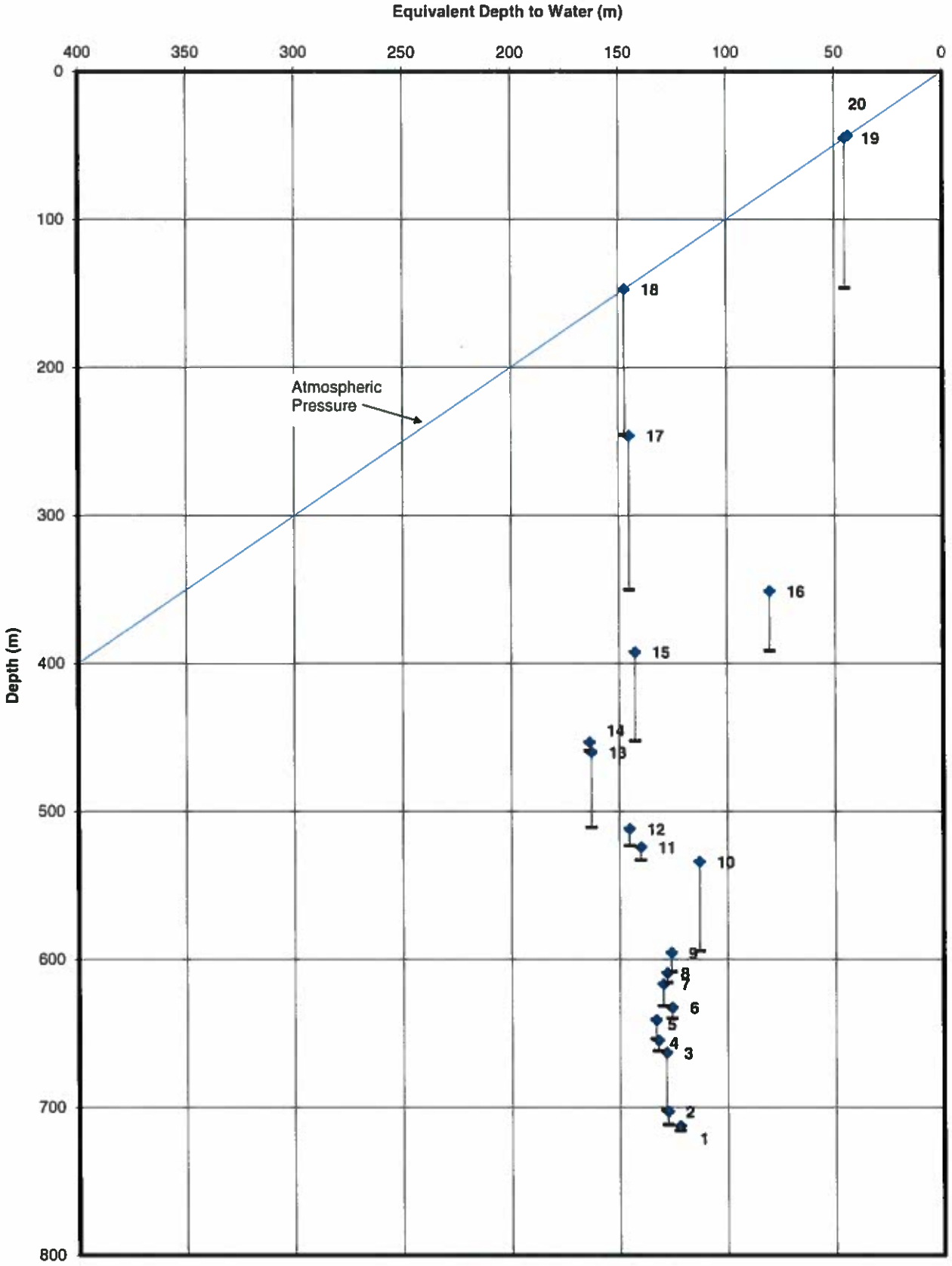
		Start	Finish
	Pressure	13.03 psi	12.90 psi
	Temp	12.10 °C	7.10 °C
P_{atm} 13.03 psi	Time	12:55 AM	3:40 PM

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings					Pressure Head Outside Port (m)	Piez. Level Outside Port (m)	Comments					
				Inside Casing (P1)	Outside Casing (P2)	Time H:M:S	Probe Temp. (°C)	Inside Casing (P1)	H = (P2-Patm)/w	Dz = Dp - H		ZONES				
16	351.2			286.07	398.57	15:13	13.63	286.03	271.1	80.1		Zone 16				
17	246.2			135.53	156.76	15:21	11.77	135.57	101.1	145.1		Zone 17				
18	147.3			13.10	13.10	15:28	9.22	13.04	0.0	147.3		Zone 18				
19	45.3			12.91	12.91	15:33	8.21	12.91	-0.1	45.4		Zone 19				
20	43.8			12.98	12.94	15:35	7.78	12.98	-0.1	43.9		Zone 20				

Notes: w = 0.4335 psi/ft (1.422psi/m) of H_2O Dz = piezometric level in zone Patm = atmospheric pressure H = pressure head of water in zone Dp = true depth of measurement port

Piezometric Profile
Monitoring Well:DH-02

Profile Date: Dec 12, 2015
Comments: Post-Inflation Profile



Client: HD Mining
Site: Murray River
Datum: Ground Surface

Figure 4

Plot By: TK Date: Jan 6/16
Checked By: DH Date: Jan 8/16
Westbay Project: WB946

Westbay Installation Log

Company: HD MINING
Well: HD-02
Site:
Project:

Job No: WB946
Author: TK

Well Information

Reference Datum: G.L
Elevation of Datum: 0.00 m.
MP Casing Top: 0.00 m.
MP Casing Length: 714.12 m.

Borehole Depth: 715.00 m. ~~714m~~ 715.8 m
Borehole Inclination: VERTICAL
Borehole Diameter: 0.00 mm
102

Well Description:

Other References:

File Information

File Name: DH-02.WWD
Report Date: Fri Dec 04 21:20:07 2015

File Date: Dec 04 20:37:26 2015

Comments

- Plug is at 714m.
- Reference datum is grand.
- Filter socks on MP

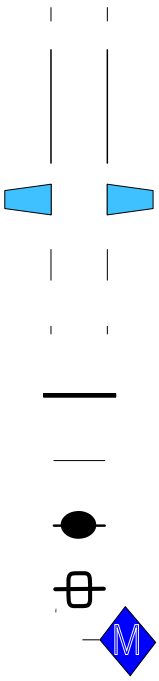
Log Information

Borehole condition confirmed. (method) Rods Date: Dec 5/15
MP well design & preparation. By: TK Date: Dec 5/15
MP well design checked. By: TK / TG Date: Dec 5/15
MP well and borehole approved to install. By: YAMING CHEN Date: Dec 5, 2015

Legend

(Qty) MP Components

(Library - WD Library 04/29/15)



(15) 020102 - MP38 Casing 3 (2F/0.6M)

(216) 020110 - MP38 Casing 1 (10F/3M)

(19) 0238 - MP38 Packer - 74mm (5F/1.5M)

(14) 020105 - MP38 Casing 2 (5F/1.5M)

(1) 020101 - MP38 Casing 4 (1F/0.3M)

(1) 0203 - MP38 End Cap

(236) 0202 - MP38 Regular Coupling

(20) 0205 - MP38 Measurement Port

(9) 0206 - MP38 Hydraulic Pumping Port

(20) 0216 - Magnetic Location Collar

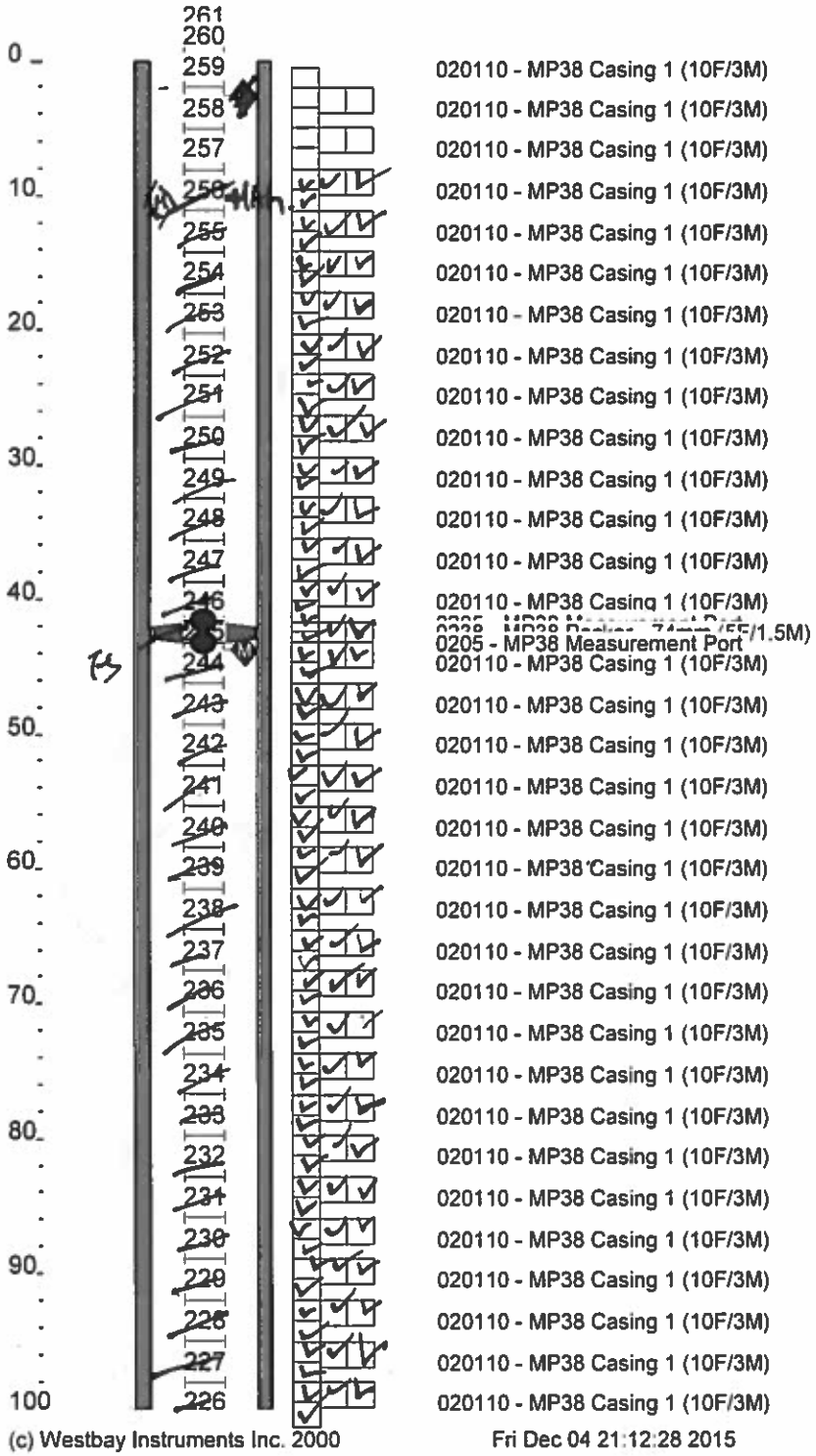
Geology

Backfill/Casing

Mild Steel

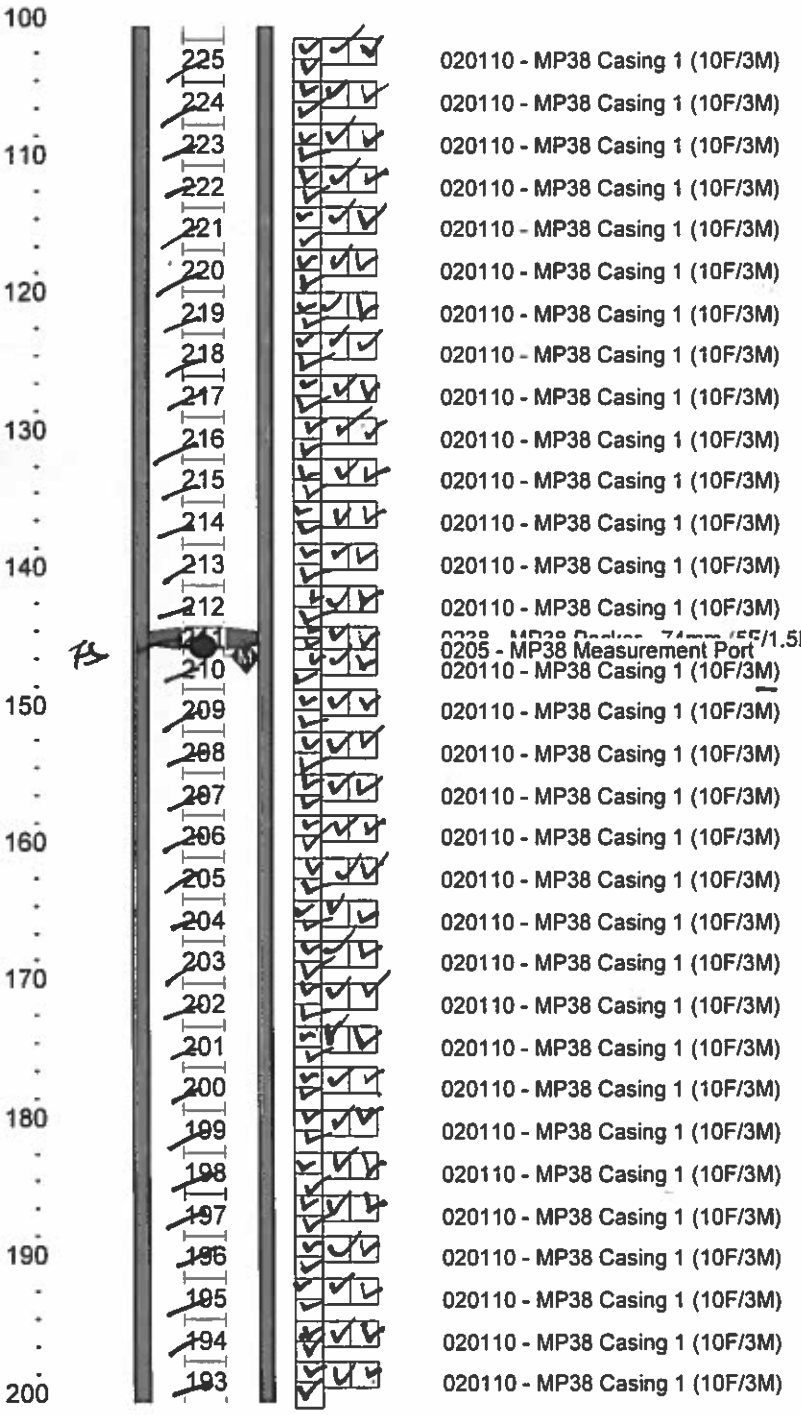
Casing Installation Log
HD MINING

Job No: WB946
Well: HD-02



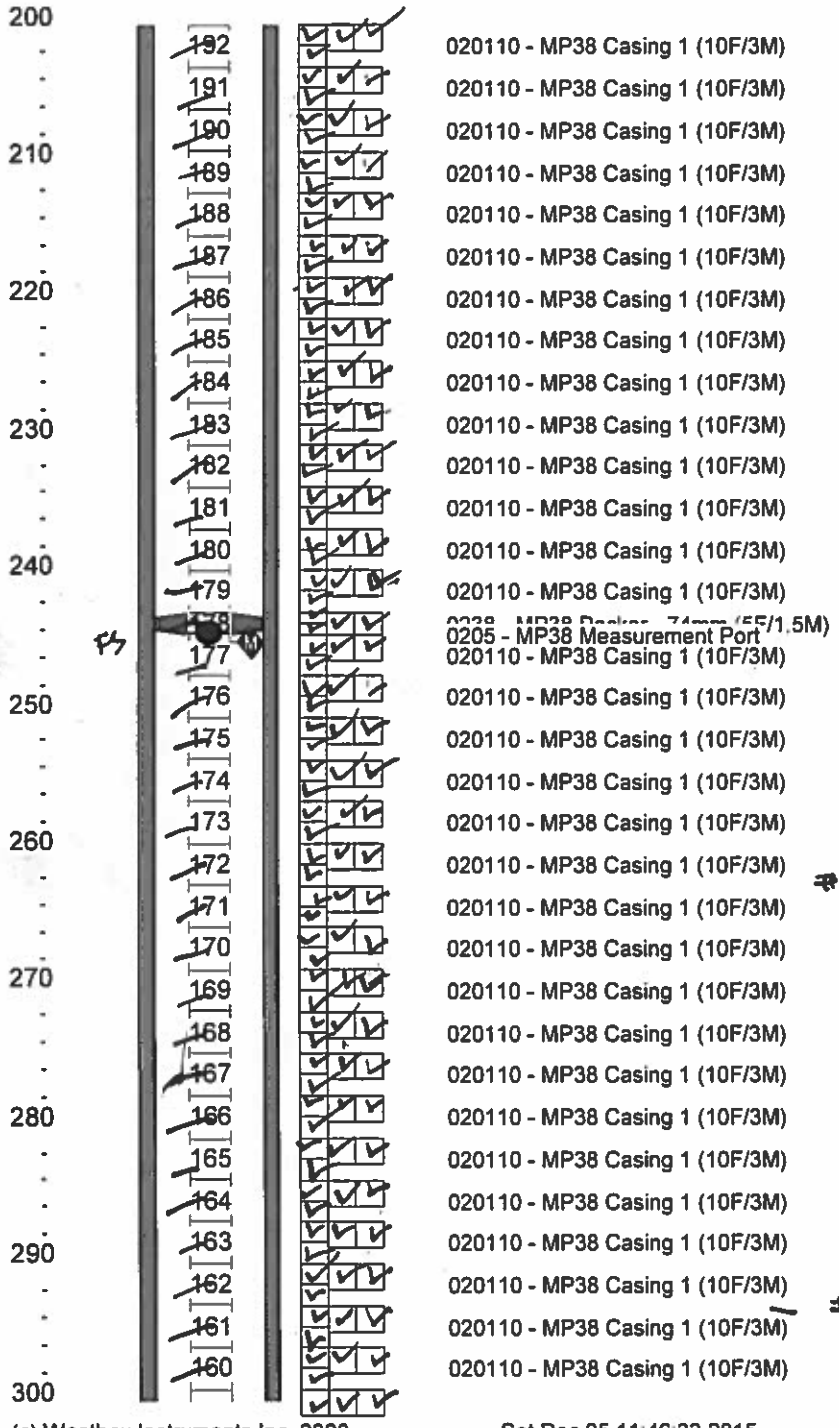
Casing Installation Log
HD MINING

Job No: WB946
Well: HD-02



Westbay Installation Log
HD MINING

Job No: WB946
Well: HD-02



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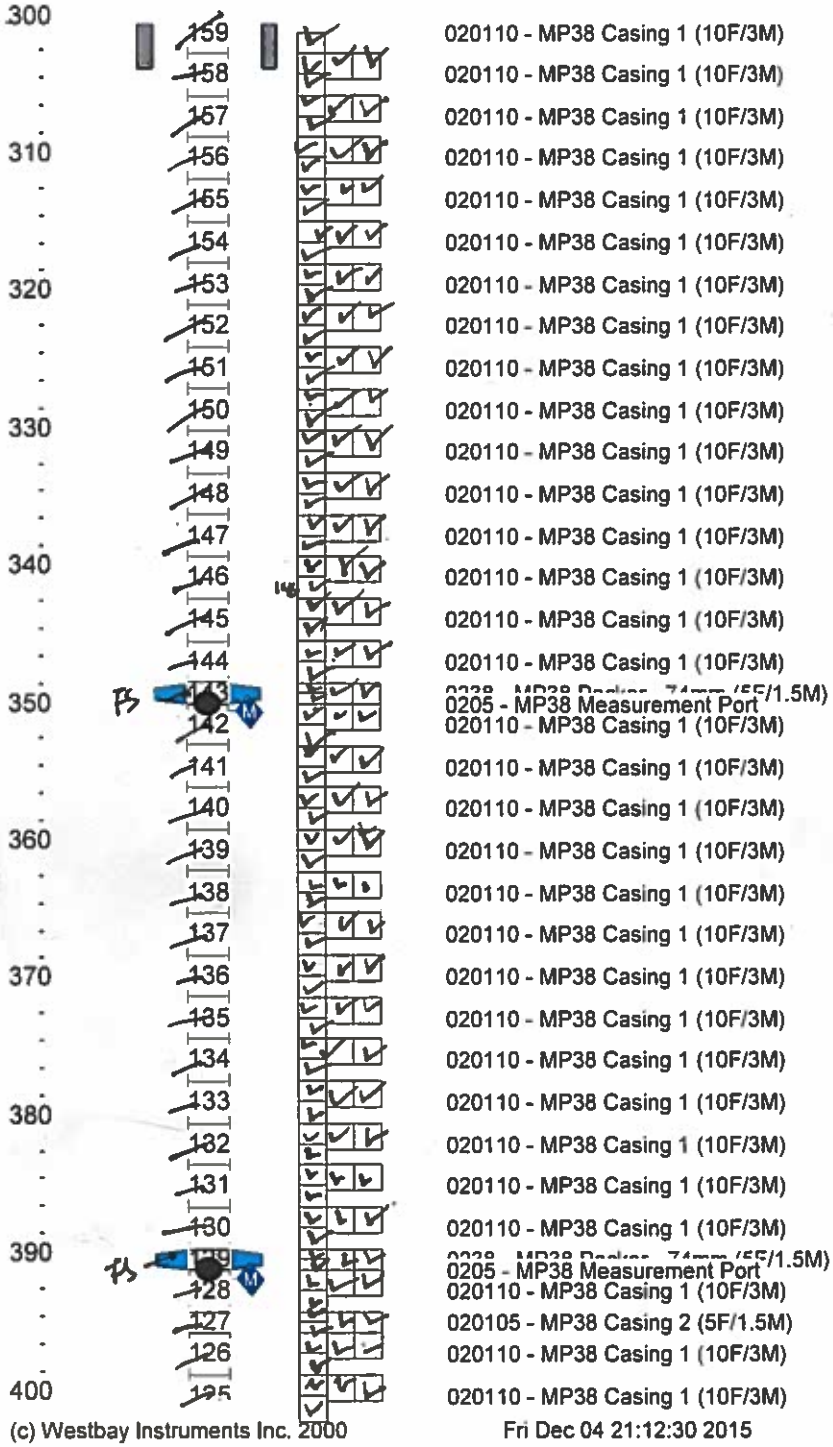
Sat Dec 05 11:46:33 2015

Casing Installation Log
HD MINING

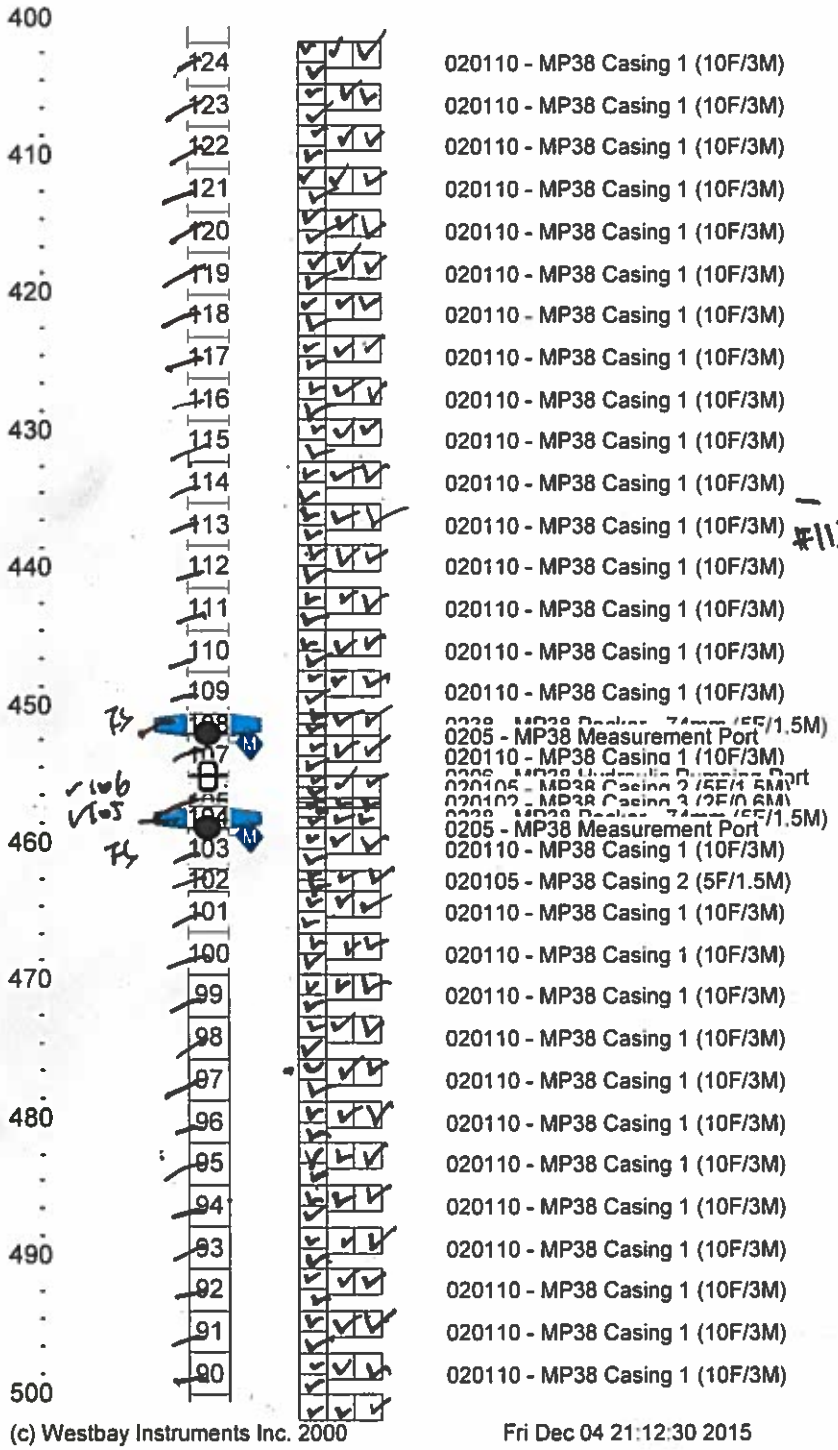
Job No: WB946
Well: HD-02



#141 start on Dec 7
9:30
#141 in the hole
stopped for wt check.
stop lowering at 5:45pm
wt at WB 160lbs

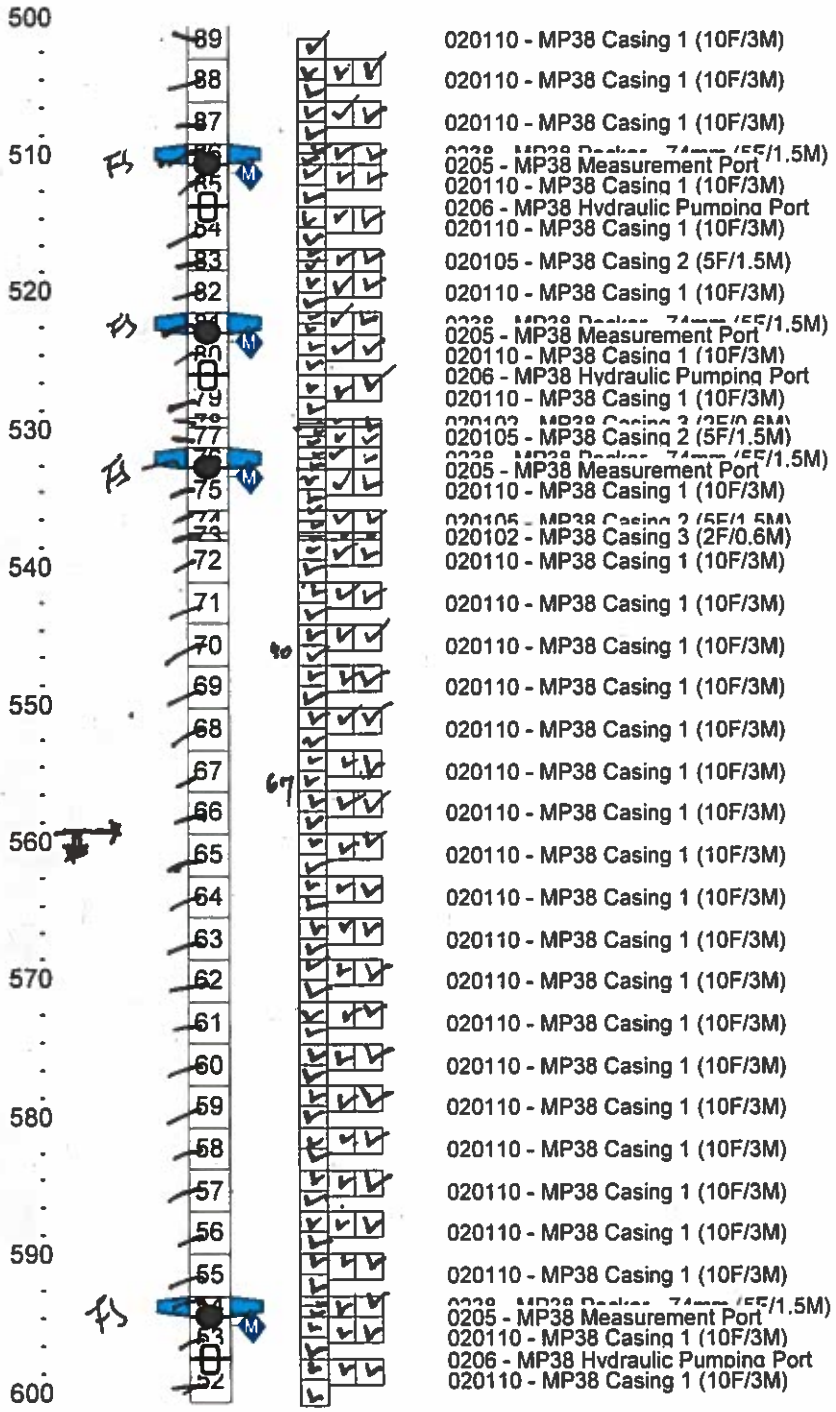
Casing Installation Log
HD MINING

Job No: WB946
Well: HD-02



Casing Installation Log
HD MINING

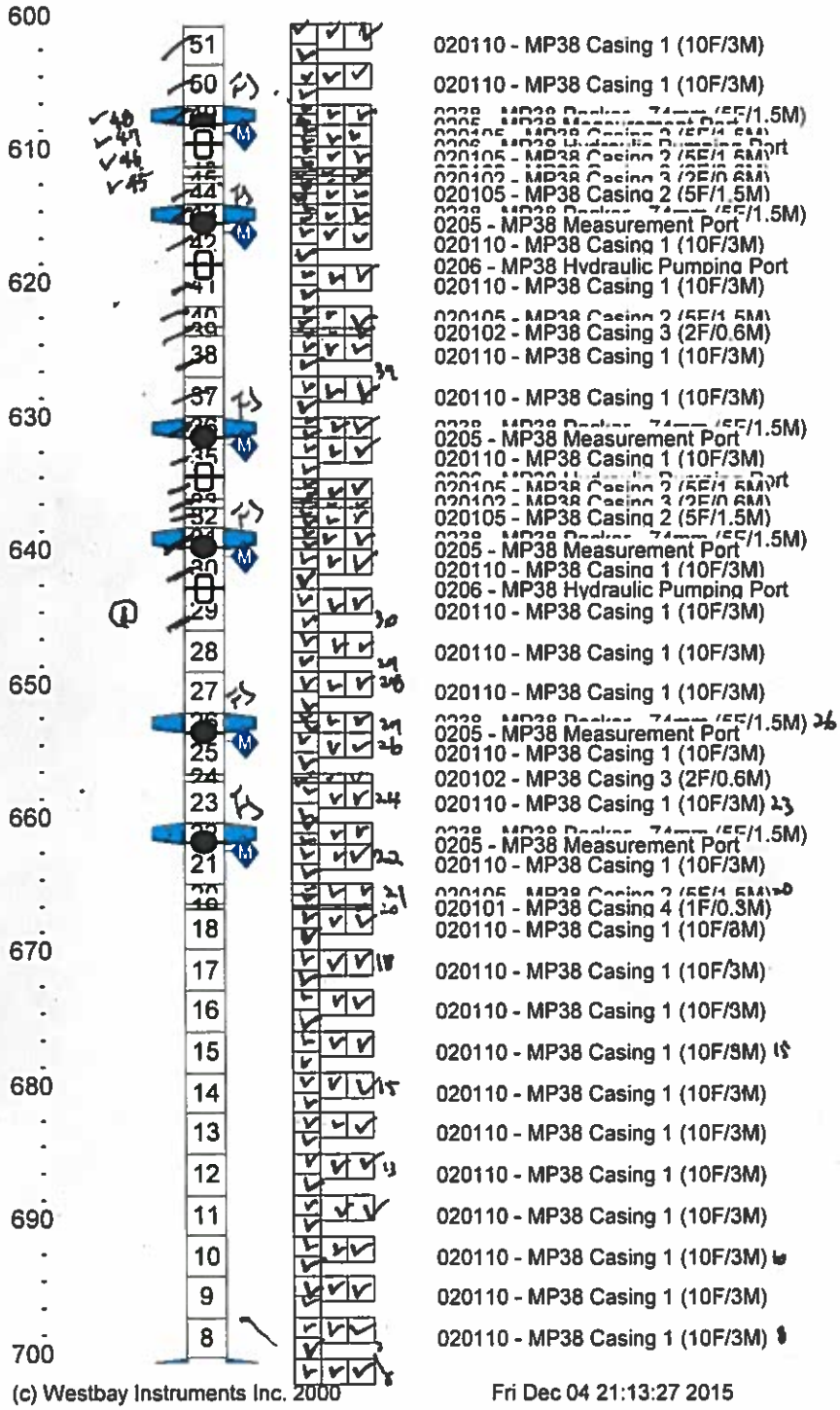
Job No: WB946
Well: HD-02



stopped ~~[illegible]~~ after # 65
for QA check on 3rd layer
WB weight, 280 lbs

Casing Installation Log
HD MINING

Job No: WB946
Well: HD-02

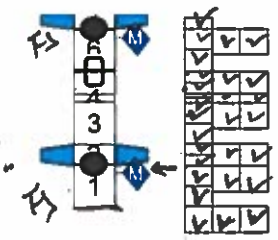


#29 start lowering Dec 6/15 9:00 am
#28 stopped
6:00 pm

#20 5:20 pm stopped for QA check. on 2nd layer

Casing Installation Log
HD MINING

Job No: WB946
Well: HD-02

Scale Meters	Westbay Casing	QA Tested OK	MP Casing Description	Serial Numbers
700				
			0205 - MP38 Measurement Port 020110 - MP38 Casing 1 (10F/3M) 020102 - MP38 Casing 3 (2F/0.6M) 020110 - MP38 Casing 1 (10F/3M) 0205 - MP38 Measurement Port 020110 - MP38 Casing 1 (10F/3M) 0203 - MP38 End Cap	
710				
720				
730				
740				
750				
760				
770				
780				
790				
800				

4:00 start lowering
Dec 5 / 2015

Joint test tool at 220

Hydraulic Integrity Test

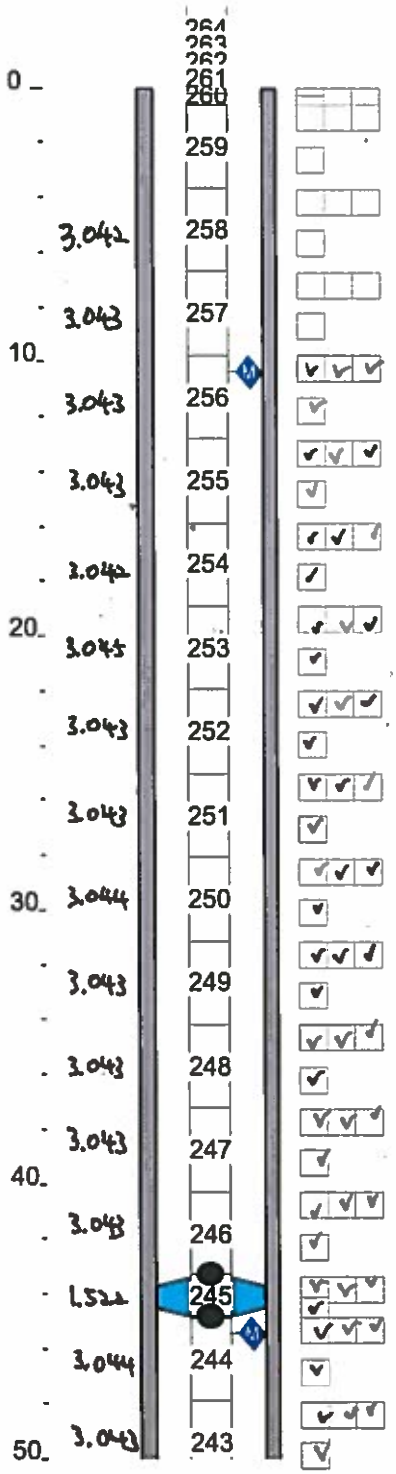
time	psi
11:15am	505.46
11:20	505.36
11:25	505.39
11:30	505.38
11:35	505.37
11:40	505.41
11:45	505.38
11:50	505.41
11:55	505.40
12:00	505.41
12:05	
12:10	505.41
12:15	505.41

WB water tight.

TK Dec 8/15

Westbay Completion Log
HD MINING

Job No: WB946
Well: DH-02



8663
19315
8659

165 / 140

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Tue Jan 05 14:22:26 2016

Westbay Completion Log
HD MINING

Job No: WB946
Well: DH-02

Scale Meters	Westbay Casing	QA Tested OK	MP Casing Description	Serial Numbers
50	242	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043				
	241	✓	020110 - MP38 Casing 1 (10F/3M)	
3.045				
	240	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043				
60	239	✓	020110 - MP38 Casing 1 (10F/3M)	
3.044				
	238	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043				
	237	✓	020110 - MP38 Casing 1 (10F/3M)	
3.044				
70	236	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043				
	235	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043				
	234	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043				
80	233	✓	020110 - MP38 Casing 1 (10F/3M)	
3.044				
	232	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043				
	231	✓	020110 - MP38 Casing 1 (10F/3M)	
3.044				
90	230	✓	020110 - MP38 Casing 1 (10F/3M)	
3.044				
	229	✓	020110 - MP38 Casing 1 (10F/3M)	
3.044				
	228	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043				
	227	✓	020110 - MP38 Casing 1 (10F/3M)	
3.044				
100				

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Westbay Completion Log
HD MINING

Job No: WB946
Well: DH-02

Scale Meters	Westbay Casing	QA Tested OK	MP Casing Description	Serial Numbers
100				
3.043	226	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043	225	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043	224	✓	020110 - MP38 Casing 1 (10F/3M)	
110 3.044	223	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043	222	✓	020110 - MP38 Casing 1 (10F/3M)	
3.044	221	✓	020110 - MP38 Casing 1 (10F/3M)	
120 3.044	220	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043	219	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043	218	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043	217	✓	020110 - MP38 Casing 1 (10F/3M)	
130 3.043	216	✓	020110 - MP38 Casing 1 (10F/3M)	
3.044	215	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043	214	✓	020110 - MP38 Casing 1 (10F/3M)	
140 3.043	213	✓	020110 - MP38 Casing 1 (10F/3M)	
3.044	212	✓	020110 - MP38 Casing 1 (10F/3M)	
1.522	211	✓	0238 - MP38 Packer - 74mm (5F/1.5M)	19314
		✓	0205 - MP38 Measurement Port	8657
3.044	210	✓	020110 - MP38 Casing 1 (10F/3M)	
150				

163/140

Westbay Completion Log
HD MINING

Job No: WB946
Well: DH-02

Scale Meters	Westbay Casing	QA Tested OK	MP Casing Description	Serial Numbers
150				
3.044	209		020110 - MP38 Casing 1 (10F/3M)	
3.043	208		020110 - MP38 Casing 1 (10F/3M)	
3.043	207		020110 - MP38 Casing 1 (10F/3M)	
160				
3.044	206		020110 - MP38 Casing 1 (10F/3M)	
3.044	205		020110 - MP38 Casing 1 (10F/3M)	
3.044	204		020110 - MP38 Casing 1 (10F/3M)	
170 3.043	203		020110 - MP38 Casing 1 (10F/3M)	
3.043	202		020110 - MP38 Casing 1 (10F/3M)	
3.043	201		020110 - MP38 Casing 1 (10F/3M)	
3.043	200		020110 - MP38 Casing 1 (10F/3M)	
180				
3.043	199		020110 - MP38 Casing 1 (10F/3M)	
3.043	198		020110 - MP38 Casing 1 (10F/3M)	
3.043	197		020110 - MP38 Casing 1 (10F/3M)	
190				
3.043	196		020110 - MP38 Casing 1 (10F/3M)	
3.043	195		020110 - MP38 Casing 1 (10F/3M)	
3.043	194		020110 - MP38 Casing 1 (10F/3M)	
200				

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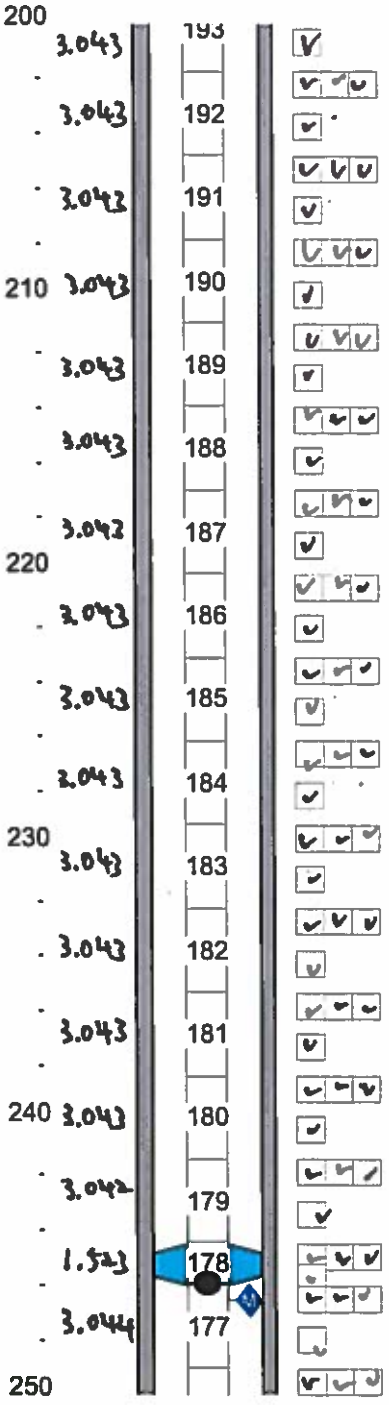
Westbay Completion Log
HD MINING

Job No: WB946
Well: DH-02



Westbay Completion Log
HD MINING

Job No: WB946
Well: DH-02

Scale Meters	Westbay Casing	QA Tested OK	MP Casing Description	Serial Numbers
250	176	✓	020110 - MP38 Casing 1 (10F/3M)	
3.043		✓ ✓ ✓		
3.042	175	✓	020110 - MP38 Casing 1 (10F/3M)	
		✓ ✓ ✓		
3.043	174	✓	020110 - MP38 Casing 1 (10F/3M)	
		✓ ✓ ✓		
260 3.043	173	✓	020110 - MP38 Casing 1 (10F/3M)	
		✓ ✓ ✓		
3.043	172	✓	020110 - MP38 Casing 1 (10F/3M)	
		✓ ✓ ✓		
3.042	171	✓	020110 - MP38 Casing 1 (10F/3M)	
		✓ ✓ ✓		
3.043	170	✓	020110 - MP38 Casing 1 (10F/3M)	
270		✓ ✓ ✓		
3.043	169	✓	020110 - MP38 Casing 1 (10F/3M)	
		✓ ✓ ✓		
3.043	168	✓	020110 - MP38 Casing 1 (10F/3M)	
		✓ ✓ ✓		
3.042	167	✓	020110 - MP38 Casing 1 (10F/3M)	
280		✓ ✓ ✓		
3.043	166	✓	020110 - MP38 Casing 1 (10F/3M)	
		✓ ✓ ✓		
3.043	165	✓	020110 - MP38 Casing 1 (10F/3M)	
		✓ ✓ ✓		
3.043	164	✓	020110 - MP38 Casing 1 (10F/3M)	
		✓ ✓ ✓		
290 3.043	163	✓	020110 - MP38 Casing 1 (10F/3M)	
		✓ ✓ ✓		
3.043	162	✓	020110 - MP38 Casing 1 (10F/3M)	
		✓ ✓ ✓		
3.042	161	✓	020110 - MP38 Casing 1 (10F/3M)	
		✓ ✓ ✓		
300 3.042	160	✓	020110 - MP38 Casing 1 (10F/3M)	

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Tue Jan 05 14:22:53 2016

Westbay Completion Log
HD MINING

Job No: WB946
Well: DH-02

Scale Meters	Westbay Casing	QA Tested OK	MP Casing Description	Serial Numbers
300				
3.043	159		020110 - MP38 Casing 1 (10F/3M)	
3.043	158		020110 - MP38 Casing 1 (10F/3M)	
3.043	157		020110 - MP38 Casing 1 (10F/3M)	
310				
3.043	156		020110 - MP38 Casing 1 (10F/3M)	
3.043	155		020110 - MP38 Casing 1 (10F/3M)	
3.043	154		020110 - MP38 Casing 1 (10F/3M)	
320				
3.043	153		020110 - MP38 Casing 1 (10F/3M)	
3.044	152		020110 - MP38 Casing 1 (10F/3M)	
3.043	151		020110 - MP38 Casing 1 (10F/3M)	
330	3.043	150	020110 - MP38 Casing 1 (10F/3M)	
3.043	149		020110 - MP38 Casing 1 (10F/3M)	
3.043	148		020110 - MP38 Casing 1 (10F/3M)	
3.043	147		020110 - MP38 Casing 1 (10F/3M)	
340				
3.043	146		020110 - MP38 Casing 1 (10F/3M)	
3.043	145		020110 - MP38 Casing 1 (10F/3M)	
3.043	144		020110 - MP38 Casing 1 (10F/3M)	
350				

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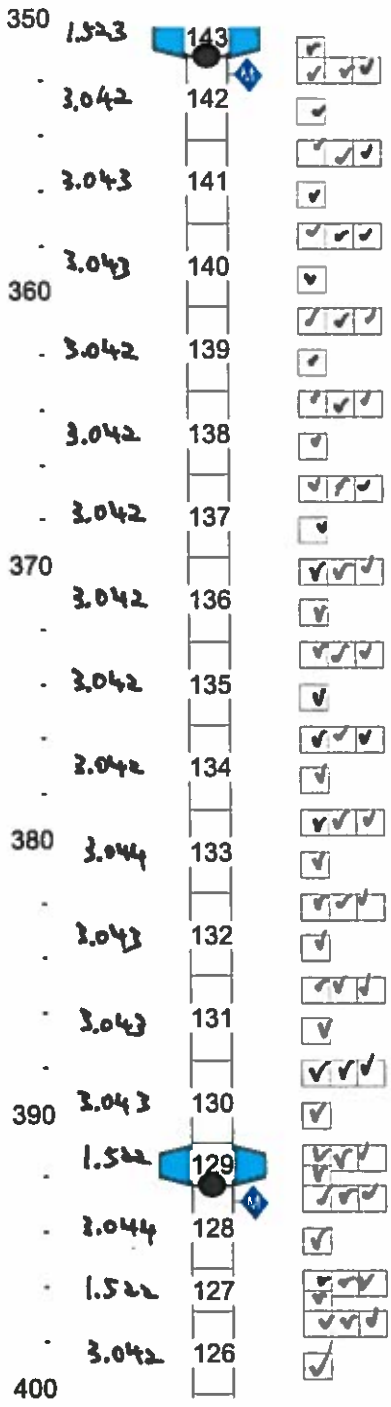
Westbay Completion Log
HD MINING

Job No: WB946
Well: DH-02



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Westbay Completion Log
HD MINING

Job No: WB946
Well: DH-02

Scale Meters	Westbay Casing	QA Tested OK	MP Casing Description	Serial Numbers
400				
	3.043 125	☑	020110 - MP38 Casing 1 (10F/3M)	
	3.042 124	☑	020110 - MP38 Casing 1 (10F/3M)	
	3.043 123	☑	020110 - MP38 Casing 1 (10F/3M)	
410	3.043 122	☑	020110 - MP38 Casing 1 (10F/3M)	
	3.043 121	☑	020110 - MP38 Casing 1 (10F/3M)	
	3.043 120	☑	020110 - MP38 Casing 1 (10F/3M)	
420	3.043 119	☑	020110 - MP38 Casing 1 (10F/3M)	
	3.043 118	☑	020110 - MP38 Casing 1 (10F/3M)	
	3.043 117	☑	020110 - MP38 Casing 1 (10F/3M)	
430	3.043 116	☑	020110 - MP38 Casing 1 (10F/3M)	
	3.043 115	☑	020110 - MP38 Casing 1 (10F/3M)	
	3.043 114	☑	020110 - MP38 Casing 1 (10F/3M)	
	3.043 113	☑	020110 - MP38 Casing 1 (10F/3M)	
440	3.043 112	☑	020110 - MP38 Casing 1 (10F/3M)	
	3.043 111	☑	020110 - MP38 Casing 1 (10F/3M)	
	3.043 110	☑	020110 - MP38 Casing 1 (10F/3M)	
450				

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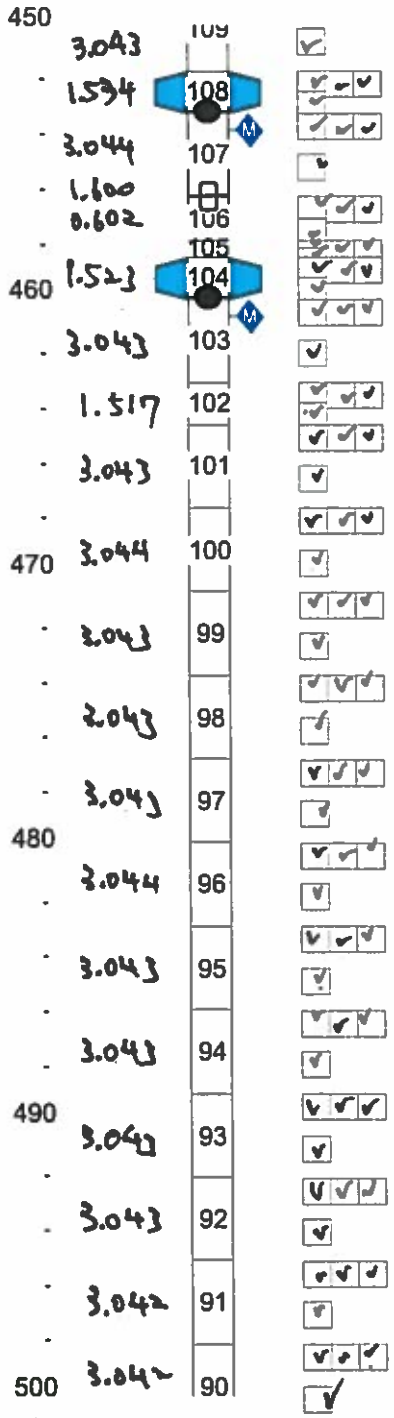
Westbay Completion Log
HD MINING

Job No: WB946
Well: DH-02



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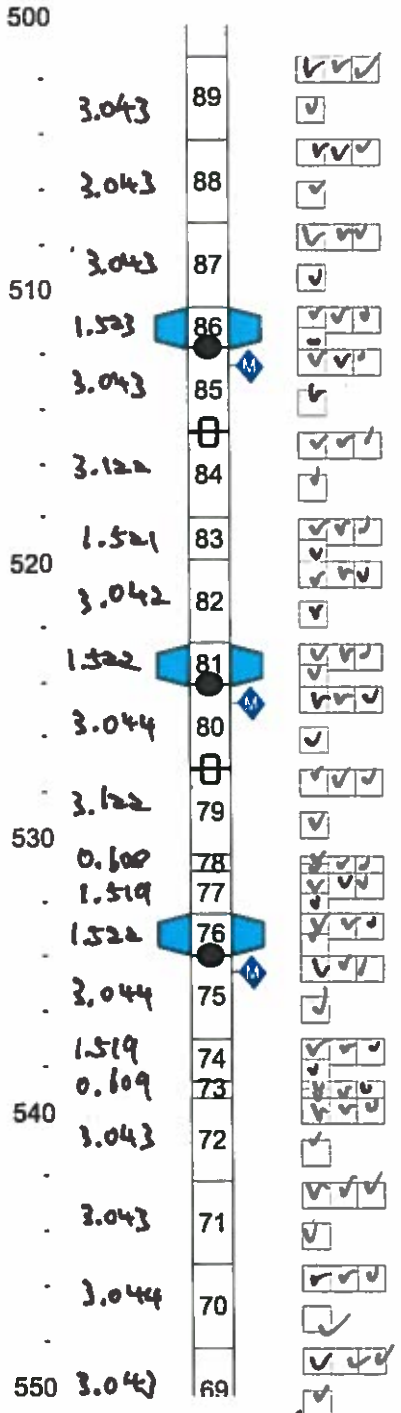
Westbay Completion Log
HD MINING

Job No: WB946
Well: DH-02



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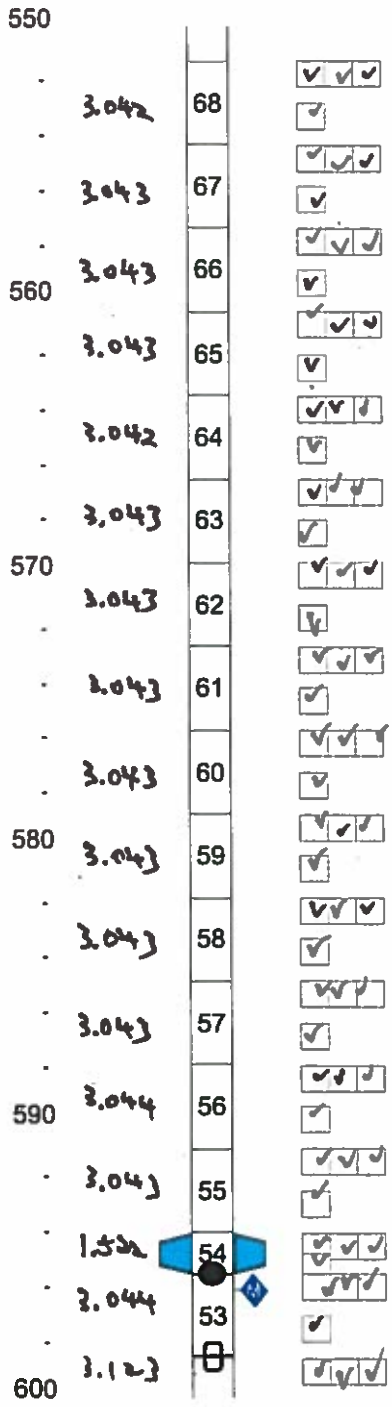
Westbay Completion Log
HD MINING

Job No: WB946
Well: DH-02



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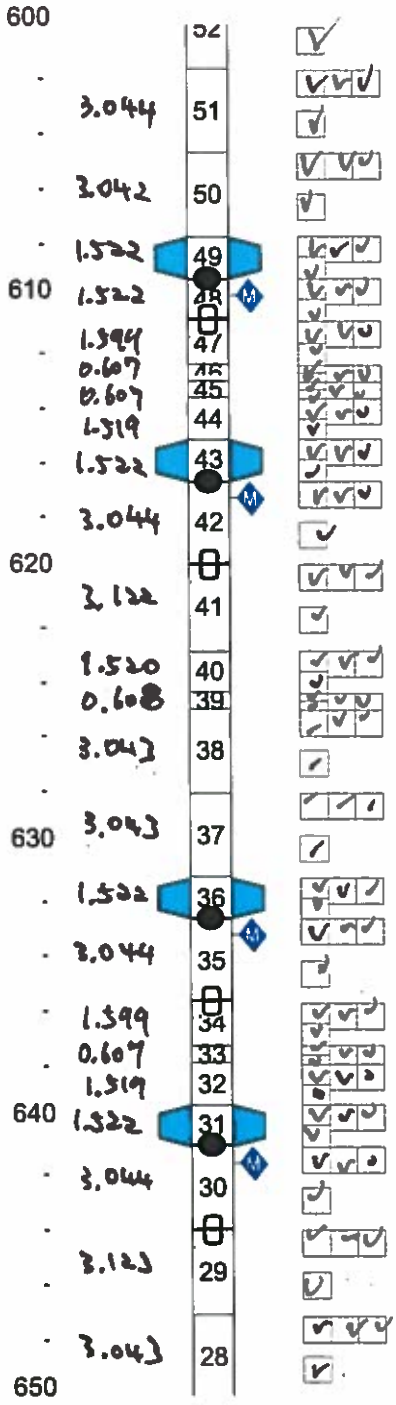
Tue Jan 05 14:23:16 2016

Westbay Completion Log
HD MINING

Job No: WB946
Well: DH-02



Scale Meters	Westbay Casing	QA Tested OK	MP Casing Description	Serial Numbers	
	52	✓	020110 - MP38 Casing 1 (10F/3M)		
	51	✓✓✓	020110 - MP38 Casing 1 (10F/3M)		
	50	✓✓✓	020110 - MP38 Casing 1 (10F/3M)		
	49	✓✓✓	0238 - MP38 Packer - 74mm (5F/1.5M)	19332	170 / 130
		✓	0205 - MP38 Measurement Port		
	48	✓✓✓	020105 - MP38 Casing 2 (5F/1.5M)	8662	
		✓	0206 - MP38 Hydraulic Pumping Port		
	47	✓✓✓	020105 - MP38 Casing 2 (5F/1.5M)	344	
	46	✓✓✓	020102 - MP38 Casing 3 (2F/0.6M)		
	45	✓✓✓	020102 - MP38 Casing 3 (2F/0.6M)		
	44	✓✓✓	020105 - MP38 Casing 2 (5F/1.5M)		
	43	✓✓✓	0238 - MP38 Packer - 74mm (5F/1.5M)	19331	170 / 130
		✓✓✓	0205 - MP38 Measurement Port	8652	
	42	✓	020110 - MP38 Casing 1 (10F/3M)		
		✓✓✓	0206 - MP38 Hydraulic Pumping Port	345	
	41	✓	020110 - MP38 Casing 1 (10F/3M)		
	40	✓✓✓	020105 - MP38 Casing 2 (5F/1.5M)		
	39	✓✓✓	020102 - MP38 Casing 3 (2F/0.6M)		
	38	✓	020110 - MP38 Casing 1 (10F/3M)		
		✓✓✓			
	37	✓	020110 - MP38 Casing 1 (10F/3M)		
	36	✓✓✓	0238 - MP38 Packer - 74mm (5F/1.5M)	19310	160 / 140
		✓✓✓	0205 - MP38 Measurement Port	8641	
	35	✓	020110 - MP38 Casing 1 (10F/3M)		
		✓✓✓	0206 - MP38 Hydraulic Pumping Port	343	
	34	✓✓✓	020105 - MP38 Casing 2 (5F/1.5M)		
	33	✓✓✓	020102 - MP38 Casing 3 (2F/0.6M)		
	32	✓✓✓	020105 - MP38 Casing 2 (5F/1.5M)		
	31	✓✓✓	0238 - MP38 Packer - 74mm (5F/1.5M)	19309	160 / 140
		✓✓✓	0205 - MP38 Measurement Port	8654	
	30	✓	020110 - MP38 Casing 1 (10F/3M)		
		✓✓✓	0206 - MP38 Hydraulic Pumping Port	346	
	29	✓	020110 - MP38 Casing 1 (10F/3M)		
		✓✓✓			
	28	✓	020110 - MP38 Casing 1 (10F/3M)		

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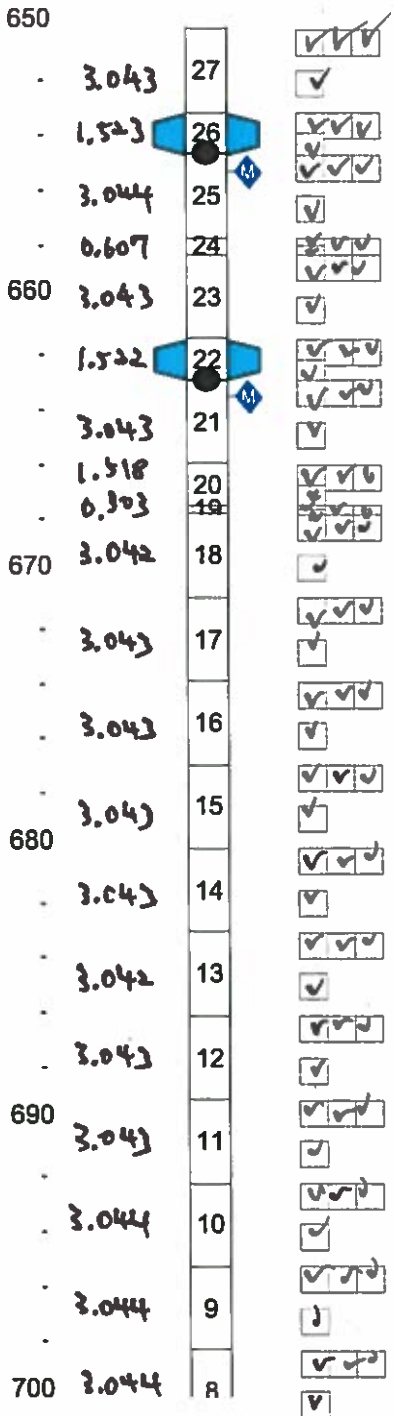
Westbay Completion Log
HD MINING

Job No: WB946
Well: DH-02



MP Casing Description	Serial Numbers	
020110 - MP38 Casing 1 (10F/3M)		
0238 - MP38 Packer - 74mm (5F/1.5M) 0205 - MP38 Measurement Port	19329 8658	175/155
020110 - MP38 Casing 1 (10F/3M)		
020102 - MP38 Casing 3 (2F/0.6M)		
020110 - MP38 Casing 1 (10F/3M)		
0238 - MP38 Packer - 74mm (5F/1.5M) 0205 - MP38 Measurement Port	19326 8655	170/150
020110 - MP38 Casing 1 (10F/3M)		
020105 - MP38 Casing 2 (5F/1.5M) 020101 - MP38 Casing 4 (1F/0.3M)		
020110 - MP38 Casing 1 (10F/3M)		
020110 - MP38 Casing 1 (10F/3M)		
020110 - MP38 Casing 1 (10F/3M)		
020110 - MP38 Casing 1 (10F/3M)		
020110 - MP38 Casing 1 (10F/3M)		
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020110 - MP38 Casing 1 (10F/3M)		
020110 - MP38 Casing 1 (10F/3M)		

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Westbay Completion Log
HD MINING

Job No: WB946
Well: DH-02

Scale Meters	Westbay Casing	QA Tested OK	MP Casing Description	Serial Numbers	
700					
1.520	7		0238 - MP38 Packer - 74mm (5F/1.5M) 0205 - MP38 Measurement Port	19327 8640	165 / 140
3.044	6		020110 - MP38 Casing 1 (10F/3M)		
1.598	5		0206 - MP38 Hydraulic Pumping Port 020105 - MP38 Casing 2 (5F/1.5M)	348	
0.606	4		020102 - MP38 Casing 3 (2F/0.6M)		
710 3.043	3		020110 - MP38 Casing 1 (10F/3M)		
1.521	2		0238 - MP38 Packer - 74mm (5F/1.5M) 0205 - MP38 Measurement Port	19328 8643	173 / 135
3.098	1		020110 - MP38 Casing 1 (10F/3M)		
			0203 - MP38 End Cap		
720					
730					
740					
750					

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Sheet 1 of 20

Westbay Packer Inflation Record

Project: HD MINING Project No.: WD 946 Well No.: DH-02

Location: Tumbler Ridge Completed by: TK Date Inflated: Dec 9/15

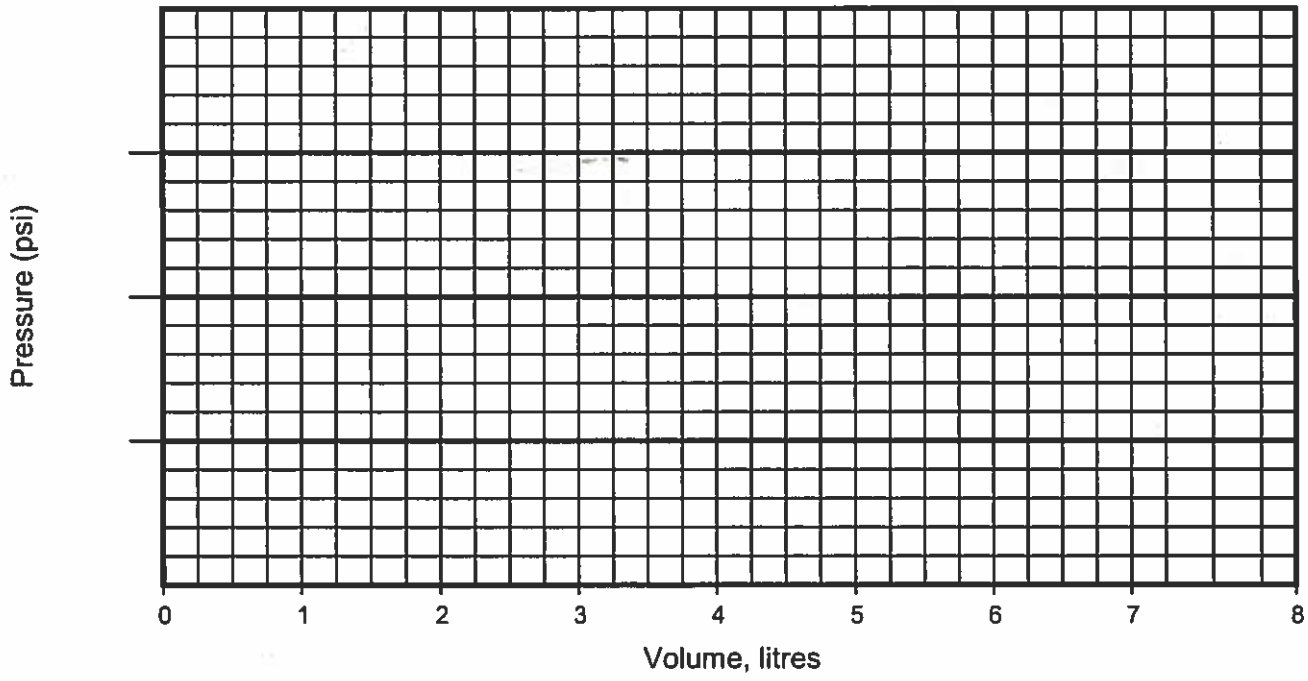
Packer No. Blank wall. Depth (ft / (m)) 716 Inflation Tool No.: TIW 852

Packer Valve Pressure, P_V: N/A psi Final Line Pressure, P_L: N/A psi Tool Pressure, P_T: 680 psi

Borehole Water Level: N/A (ft / m) = N/A psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = _____ psi

Volume, litres	0.25	0.5	0.75	1.0	1.2	1.25	1.3			
Pressure, psi	300	350	530	640	810	800	850			
Volume, litres										
Pressure, psi										



Comments: Packer # Time - 12:45

Westbay Packer Inflation Record

Project: HD MINING | Project No.: WB946 | Well No.: DH-01

Location: Tumbler Ridge. | Completed by: TK | Date Inflated: Dec 9/12

Packer No. S/N 19328 Comp #2 | Depth (ft / (m)): 711.2 | Inflation Tool No.: TIW 852

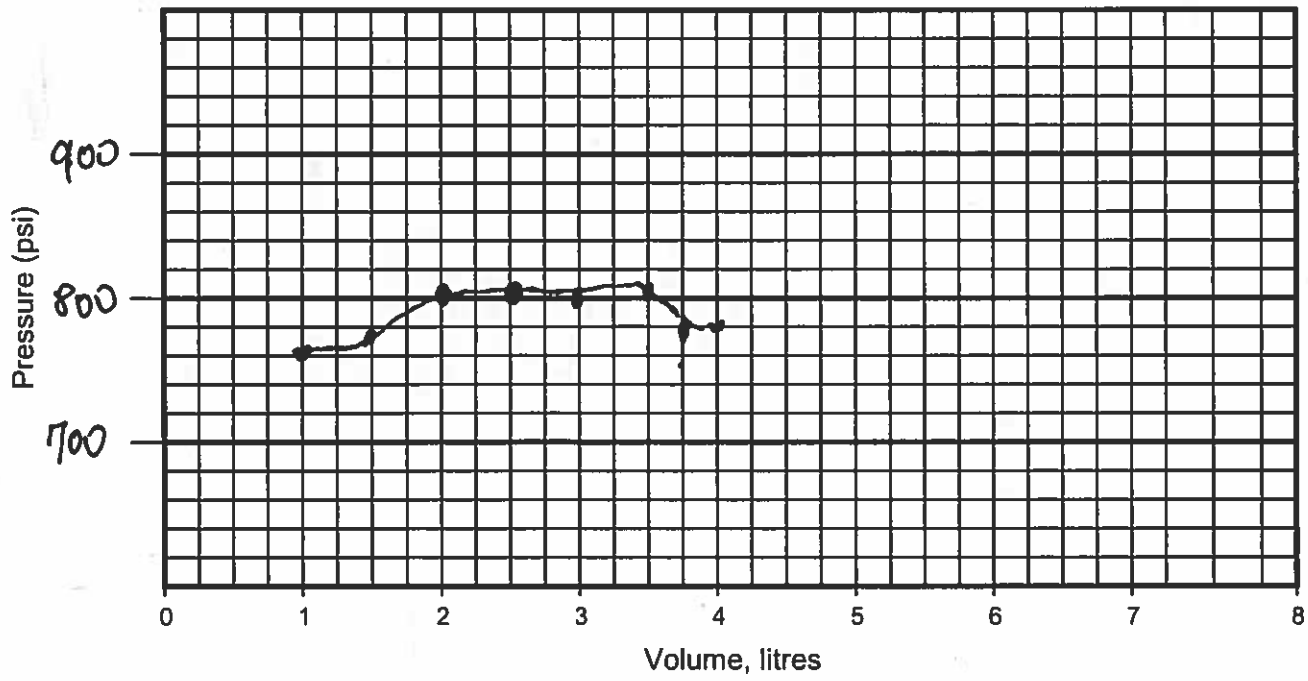
Packer Valve Pressure, P_V: 151 psi | Final Line Pressure, P_L: 750 psi | Tool Pressure, P_T: ~~760~~ 680 psi

Borehole Water Level: 133 (ft / (m)) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 105 psi

930

Volume, litres	0.5	1.0	1.5	2.0	2.5	3.0	3.5	3.75	4.00	4.25
Pressure, psi	450	760	770	800	800	800	800	750	750	750
Volume, litres	~~0~~	3.3								
Pressure, psi	~~33~~	0								



Comments: Packer # 1 | Time - 1:43

Westbay Packer Inflation Record

Project: HD MINING Project No.: WB 0946 Well No.: DH – 02

Location: Tumble Ridge. Completed by: TK Date Inflated: Dec. 9/15

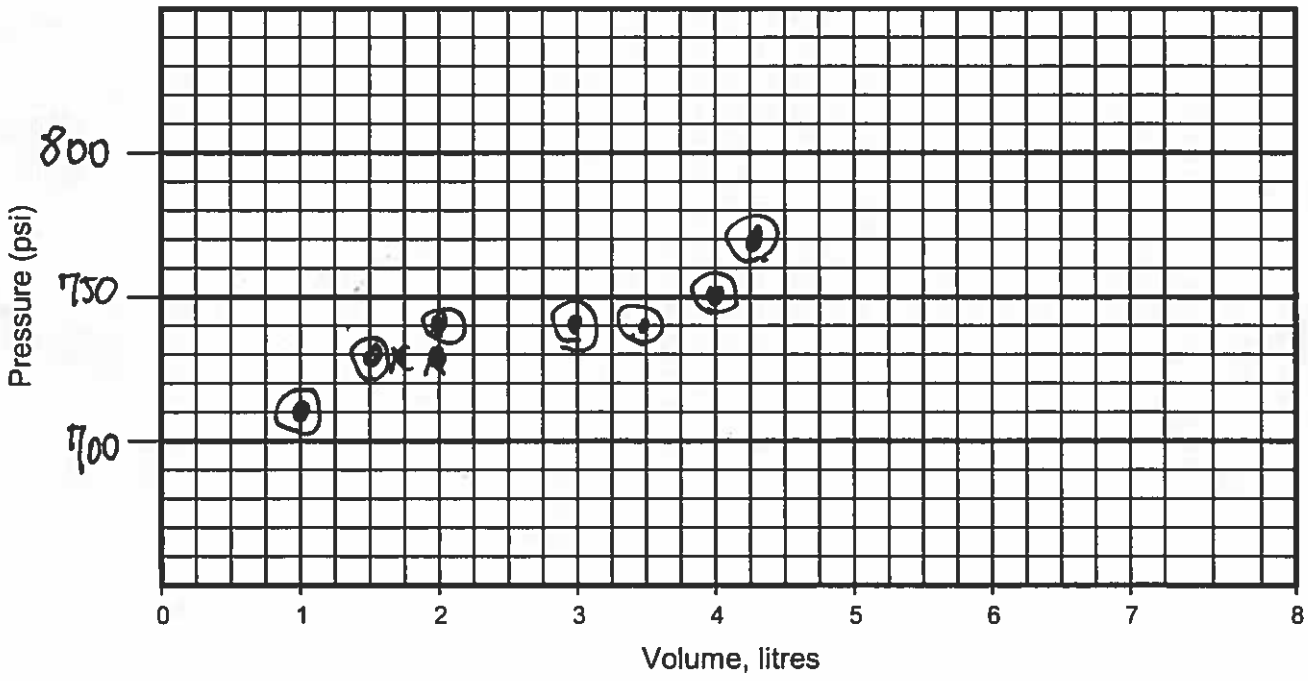
Packer No. S/N 19327 comp #7 Depth (ft / m): 721.1 Inflation Tool No.: TIW 852

Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 760 psi Tool Pressure, P_T: 680 psi

Borehole Water Level: 133 (ft / (m)) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 130 psi

Volume, litres	1L.	1.5L	2L	3L.	3.5L	4.0L	4.1L.	4.2L.	3.3	
Pressure, psi	710	730	740	740	740	750	750	760	Ø	
Volume, litres										
Pressure, psi										



Comments: Packer # 2 Time - 5:50

Westbay Packer Inflation Record

Project: HD MINING | Project No.: WB946 | Well No.: DH-02

Location: Tumbler Ridge | Completed by: TK | Date Inflated: Dec 10/15

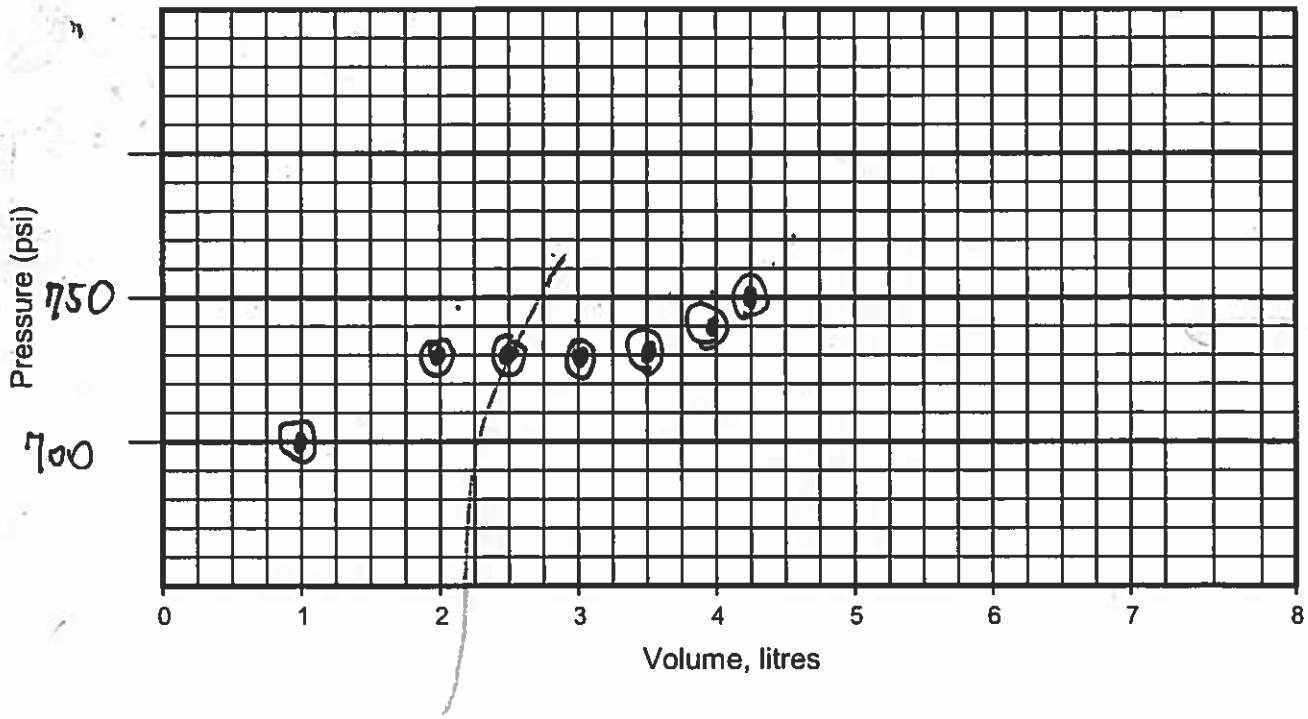
Packer No. S/N 19326 comp # 22 | Depth (ft / m): 659.7 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 150 psi | Final Line Pressure, P_L: 760 psi | Tool Pressure, P_T: 700 psi

Borehole Water Level: 133 (ft (m) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 100 psi

Volume, litres	1.0	2.0	2.5	3.0	3.5	4.0	4.25	4.3	~~0~~	3.5
Pressure, psi	700	730	730	730	730	740	750	760	~~3.5~~	0
Volume, litres										
Pressure, psi										



Comments: Packer # 3 | Time - 10:35

Westbay Packer Inflation Record

Project: HD MINING Project No.: WB946 Well No.: DH-02

Location: Tumbler Ridge Completed by: TK Date Inflated: Dec 10/15

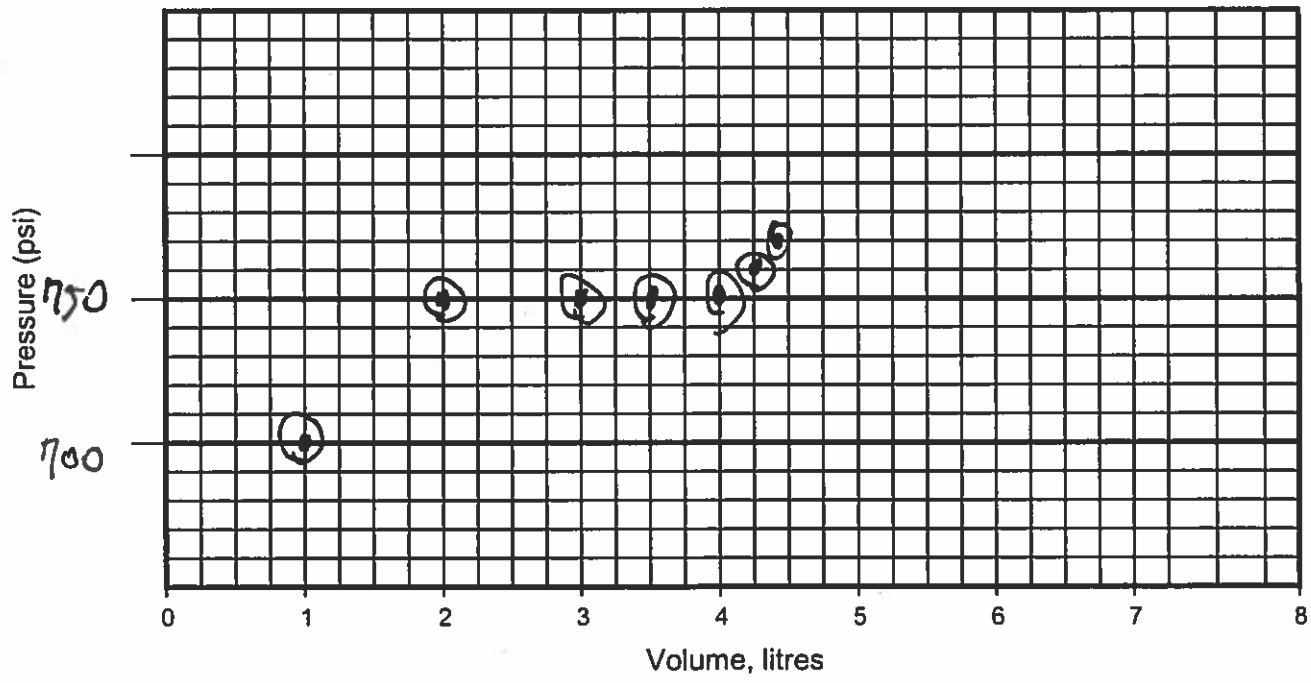
Packer No. S/N 19329 cmp #26 Depth (ft / m): 651.5 Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 155 psi Final Line Pressure, P_L: 770 psi Tool Pressure, P_T: 700 psi

Borehole Water Level: 133 (ft (m)) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 105 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.25	4.3	~~4~~	3.55	
Pressure, psi	700	750	750	750	750	760	770	~~3.55~~	∅	
Volume, litres										
Pressure, psi										



Comments: Packer # 4 Time - 11:05

Sheet 6 of 20

Westbay Packer Inflation Record

Project: HD MINING | Project No.: 10B946 | Well No.: DH-02

Location: Tumbler Ridge | Completed by: TK | Date Inflated: ~~Dec 10~~ Dec 11/15

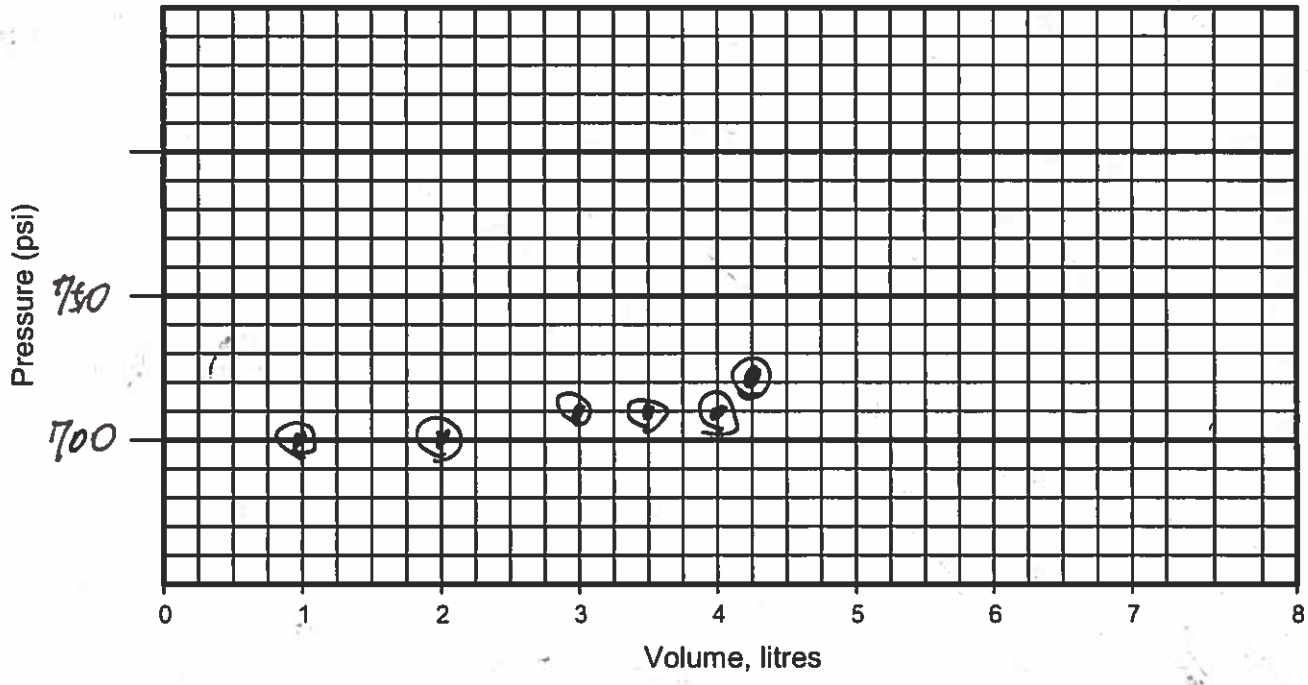
Packer No. S/N 19309 comp# 81 | Depth (ft / m): 637.72 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 730 psi | Tool Pressure, P_T: ~~700~~ 680 psi

Borehole Water Level: 133 (ft / (m)) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = ~~80~~ 100 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.25	4.3	~~0~~	3.6	
Pressure, psi	700	700	710	710	710	720	730	~~3.6~~	0	
Volume, litres										
Pressure, psi										



Comments: Packer # 5 | Time - 9:35

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Westbay Packer Inflation Record

Project: HD MINING | Project No.: WB946 | Well No.: DH-02

Location: Tumbler Ridge. | Completed by: TK | Date Inflated: Dec 11/15

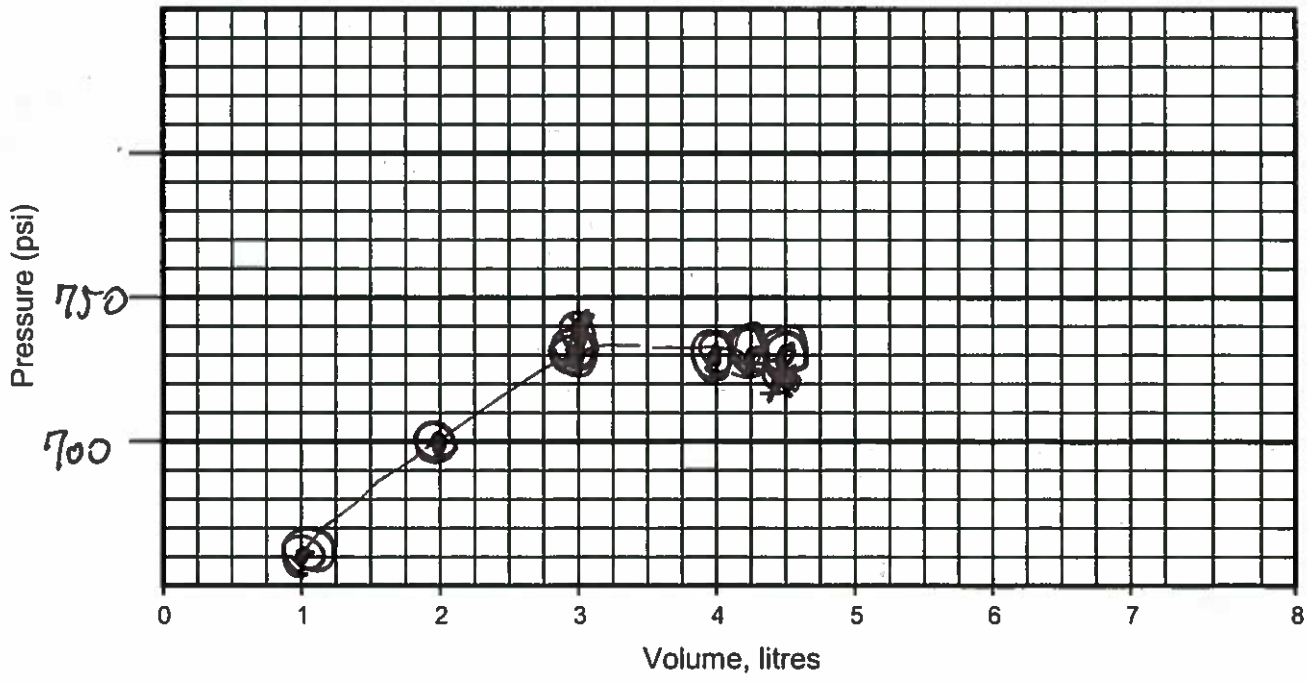
Packer No. S/N 19310 comp #36 | Depth (ft / (m)) 629.4 | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 730 psi | Tool Pressure, P_T: ~~700~~ 680 psi

Borehole Water Level: 133 (ft (m) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = ~~80~~ 100 psi

Volume, litres	1.0	2.0	3.0	4.0	4.25	4.3	4.5	~~4~~	3.75	
Pressure, psi	660	700	~~730~~ 720	730	730	720	730	~~3.95~~	0	
Volume, litres										
Pressure, psi										



Comments: Packer # 6 | Time - 10:15

Westbay Packer Inflation Record

Project: HD MINING. Project No.: W3946 Well No.: DH-02

Location: Tumbler Ridges Completed by: TK Date Inflated: Dec 11/15

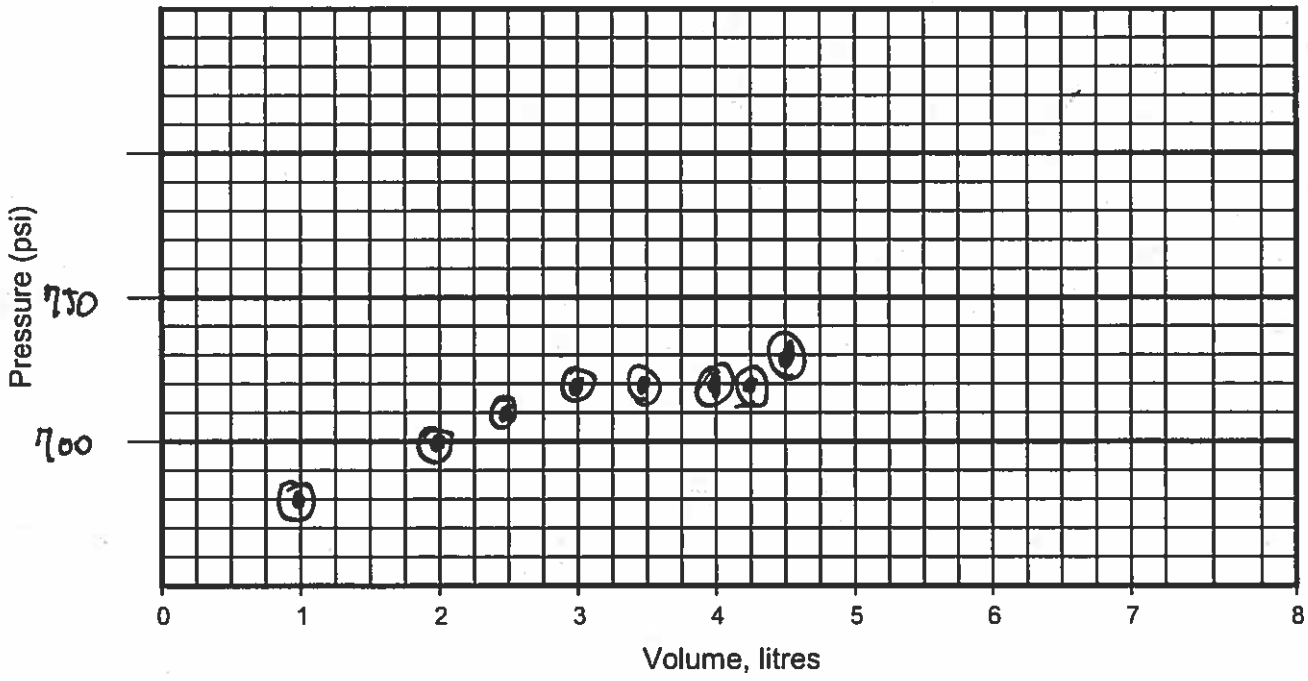
Packer No. S/N 19331 comp # 43 Depth (ft / (m)): 613.49 Inflation Tool No.: TIW BSR

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 730 psi Tool Pressure, P_T: ~~700~~ 680 psi

Borehole Water Level: 133 (ft / (m)) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = ~~70~~ 90 psi

Volume, litres	1.0	2.0	2.5	3.0	3.5	4.0	4.25	4.5	~~0~~	3.75
Pressure, psi	680	700	710	720	720	720	720	730	~~3.95~~	ø
Volume, litres										
Pressure, psi										



Comments: Packer # 7 Time - 11:00

Sheet 9 of 20

Westbay Packer Inflation Record

Project: HD MINING | Project No.: WB946 | Well No.: DH-02

Location: Tumbler Ridge | Completed by: TK | Date Inflated: Dec 11/15

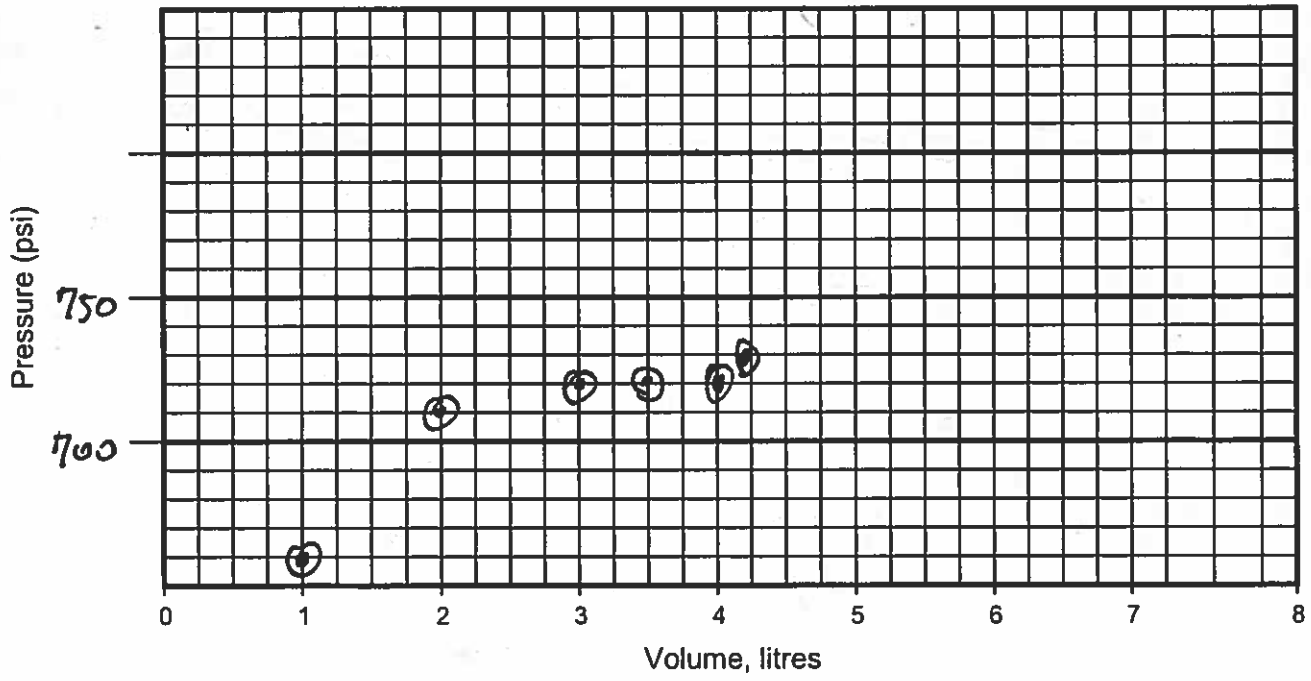
Packer No. S/N 19332 Comp#49 | Depth (ft / m): 606.1 | Inflation Tool No.: TLW 852

Packer Valve Pressure, P_V: 150 psi | Final Line Pressure, P_L: 730 psi | Tool Pressure, P_T: ~~730~~ 680 psi

Borehole Water Level: 133 (ft / m) = 100 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = ~~70~~ 90 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.2	~~0~~	3.5		
Pressure, psi	660	710	720	720	720	730	~~3.5~~	0		
Volume, litres										
Pressure, psi										



Comments: Packer # B | Time - 11:30

Westbay Packer Inflation Record

Project: HD MINING | Project No.: WB946 | Well No.: DH-02

Location: Tumbler Ridge | Completed by: TK | Date Inflated: Dec 11/13

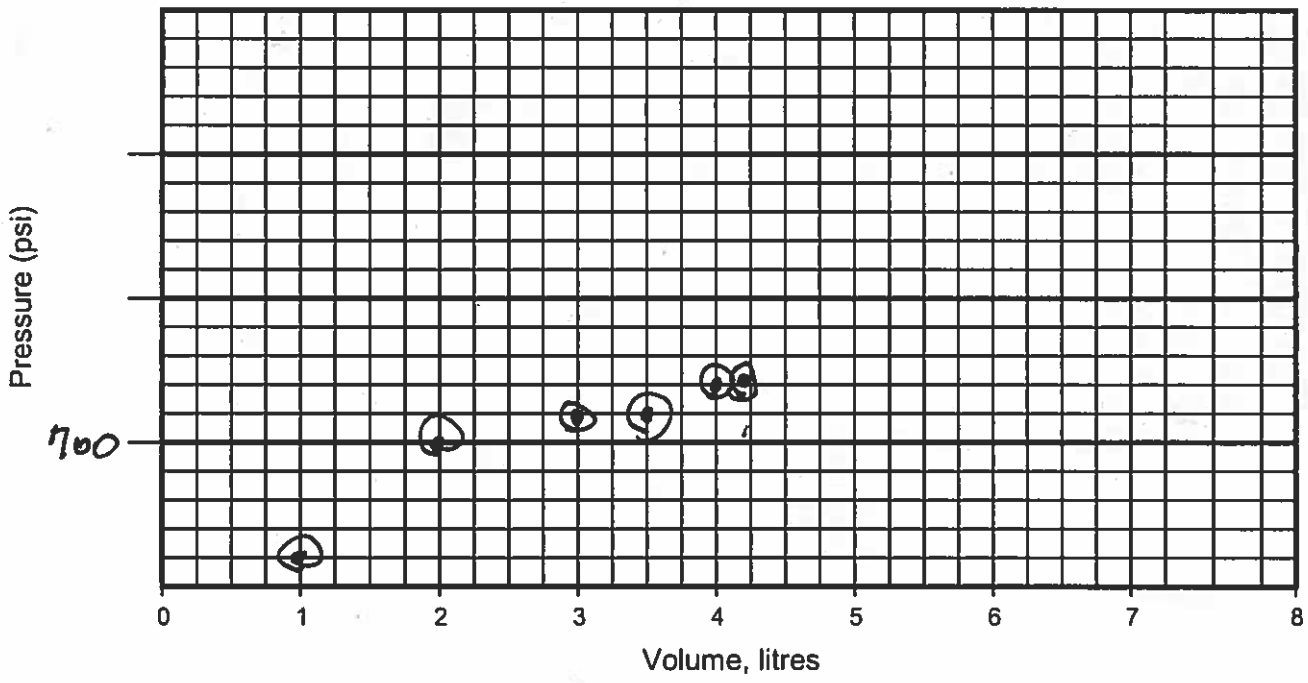
Packer No. S/N 19323 Comp#54 | Depth (ft / m): 592.3 | Inflation Tool No.: TIU 832

Packer Valve Pressure, P_V: 145 psi | Final Line Pressure, P_L: 720 psi | Tool Pressure, P_T: ~~700~~ 680 psi

Borehole Water Level: 133 (ft / (m)) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = ~~64~~ 85 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.2	~~3.4~~ ~~3.7~~			
Pressure, psi	660	700	710	710	720	720	~~[illegible]~~			
Volume, litres										
Pressure, psi										



Comments: Packer # 9 | Time - 12:00

Sheet 11 of 20

Westbay Packer Inflation Record

Project: HD MINING | Project No.: WB946 | Well No.: DH-02

Location: Tumbler Ridge | Completed by: TK | Date Inflated: Dec 11/11

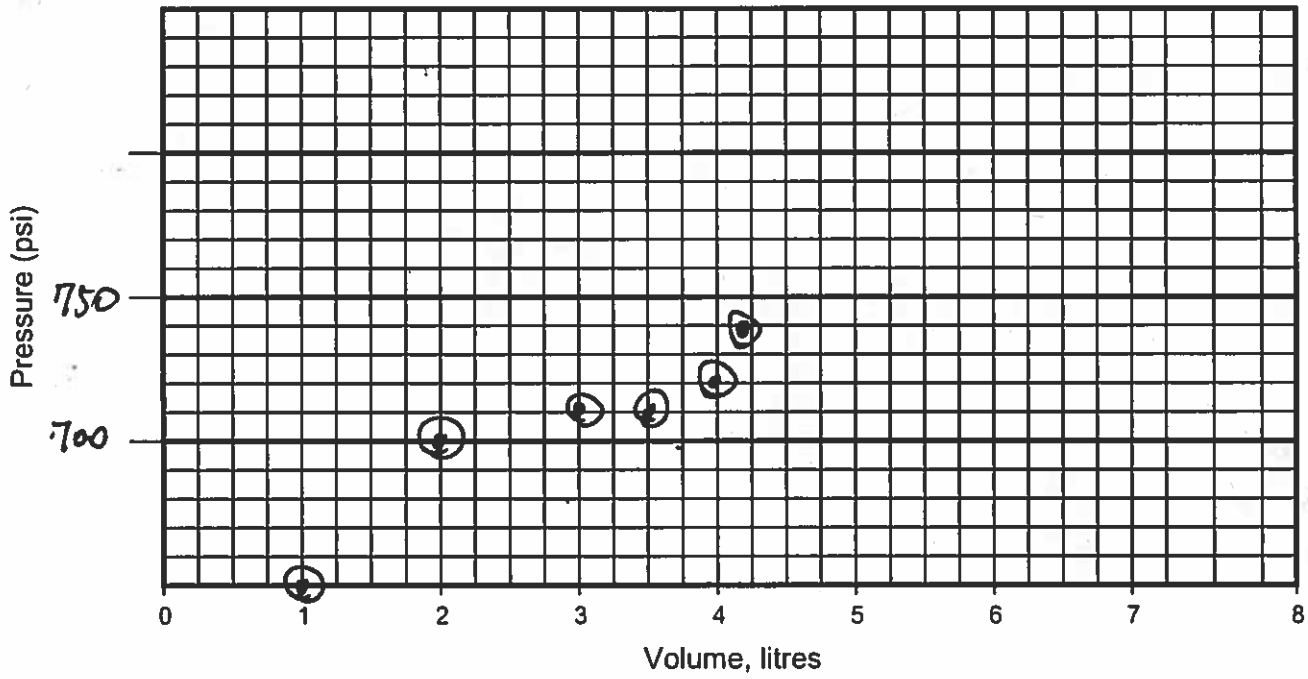
Packer No. S/N 19320 comp #76 | Depth (ft / m): 530.74 | Inflation Tool No.: IW852

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 740 psi | Tool Pressure, P_T: ~~700~~ 680 psi

Borehole Water Level: 133 (ft / (m)) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = ~~90~~ 110 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.2	3.3			
Pressure, psi	650	700	710	710	720	740	Ø			
Volume, litres										
Pressure, psi										



Comments: Packer # 10 | Time - 12:35

Sheet 12 of 20

Westbay Packer Inflation Record

Project: HD MINING | Project No.: WB 946 | Well No.: DH-02

Location: Tumbler Ridge | Completed by: TK | Date Inflated: Dec 11/13

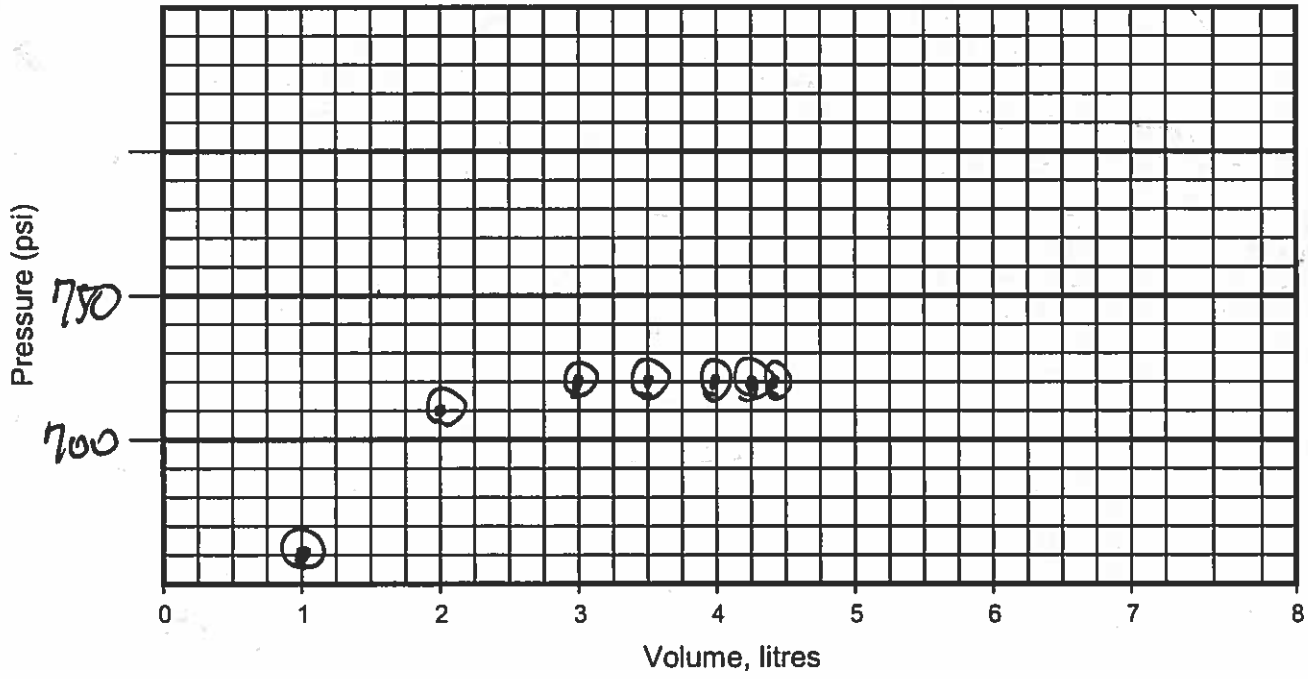
Packer No. S/N 19319 comp. 81 | Depth (ft (m): 520.91 | Inflation Tool No.: TIW BT2

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 720 psi | Tool Pressure, P_T: ~~700~~ 680 psi

Borehole Water Level: 133 (ft (m) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = ~~70~~ 90 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.2	4.3	3.5		
Pressure, psi	660	710	720	720	720	720	720	Ø		
Volume, litres										
Pressure, psi										



Comments: Packer # 11 | Time - 1:10 pm.

Westbay Packer Inflation Record

Project: HD MINING Project No.: WR946 Well No.: DH-02

Location: Trimbler Ridge Completed by: TK Date Inflated: Dec 11/19

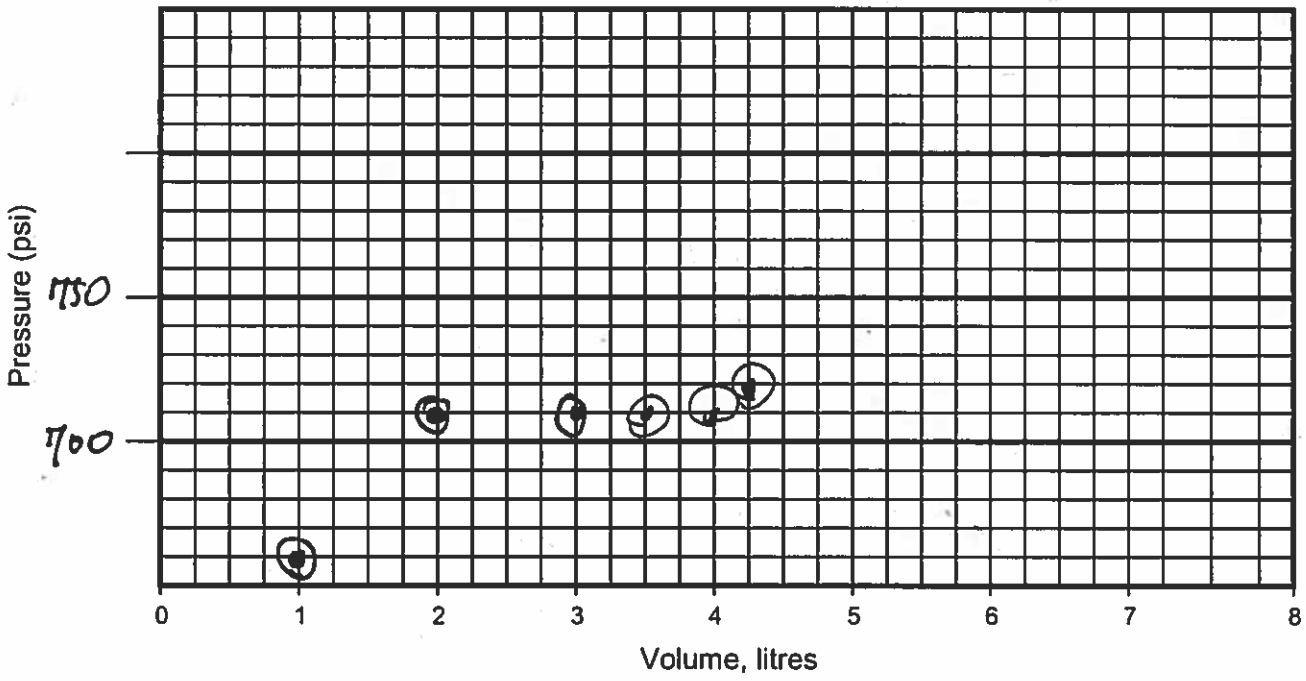
Packer No. S/N 19318 comp # 86 Depth (ft / m): 508.65 Inflation Tool No.: TIW 852

Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 720 psi Tool Pressure, P_T: ~~700~~ 680 psi

Borehole Water Level: 133 (ft / (m) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = ~~770~~ 90 psi

Volume, litres	1.0	2.0	3.0	3.5	4.0	4.25	3.5			
Pressure, psi	660	710	710	710	710	720	Ø			
Volume, litres										
Pressure, psi										



Comments: Packer # 12 Time - 1:50

Westbay Packer Inflation Record

Project: HD MINING | Project No.: WP 946 | Well No.: DH-02

Location: Tumbler Ridge | Completed by: TK | Date Inflated: Dec 11/18

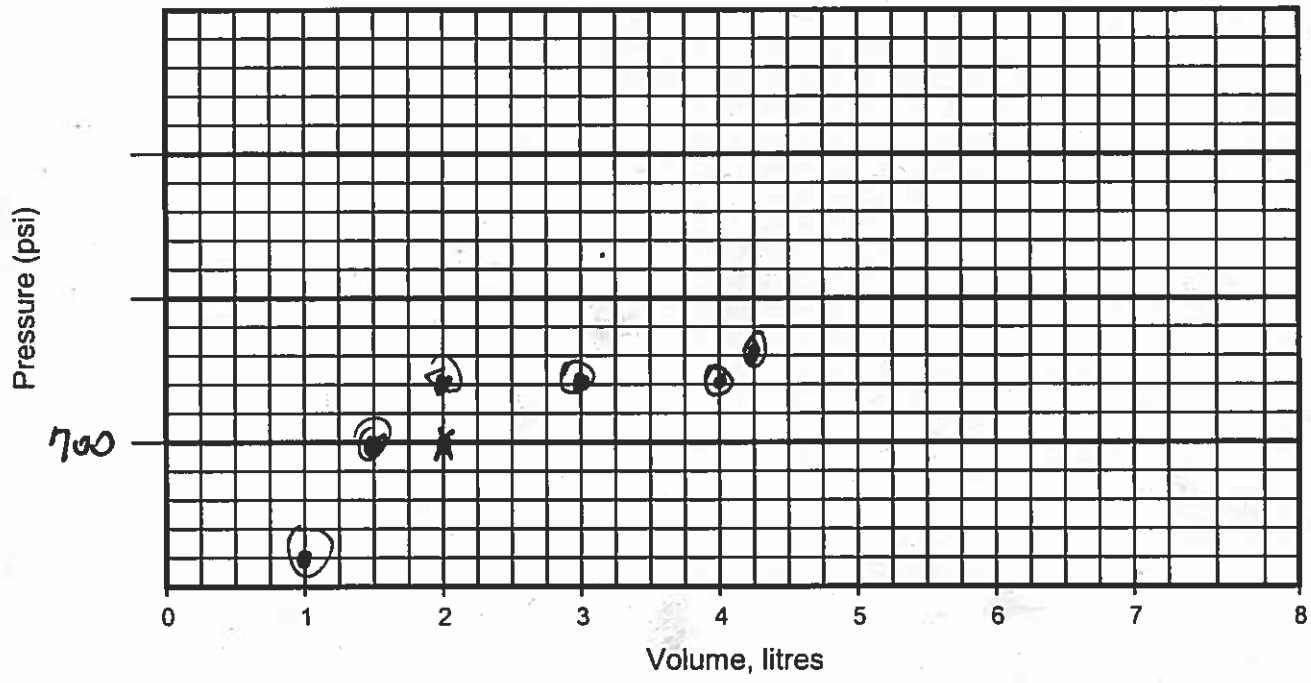
Packer No. S/N 19317 . Comp # 104 | Depth (ft (m): 456.83 | Inflation Tool No.: TIW 853

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 730 psi | Tool Pressure, P_T: ~~700~~ 680 psi

Borehole Water Level: 133 (ft / (m) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = ~~80~~ 100 psi

Volume, litres	1.0	1.5 2.0	2.0	3.0	4.0	4.25	3.5			
Pressure, psi	~~800~~ 740	700	720	720	720	730	0			
Volume, litres										
Pressure, psi										



Comments: Packer # 13 tool landed a coupling lower Time - 3:20

Westbay Packer Inflation Record

Project: HD MINING | Project No.: WB946 | Well No.: DH-02

Location: Tumbler Ridge | Completed by: TK | Date Inflated: Dec 11/15

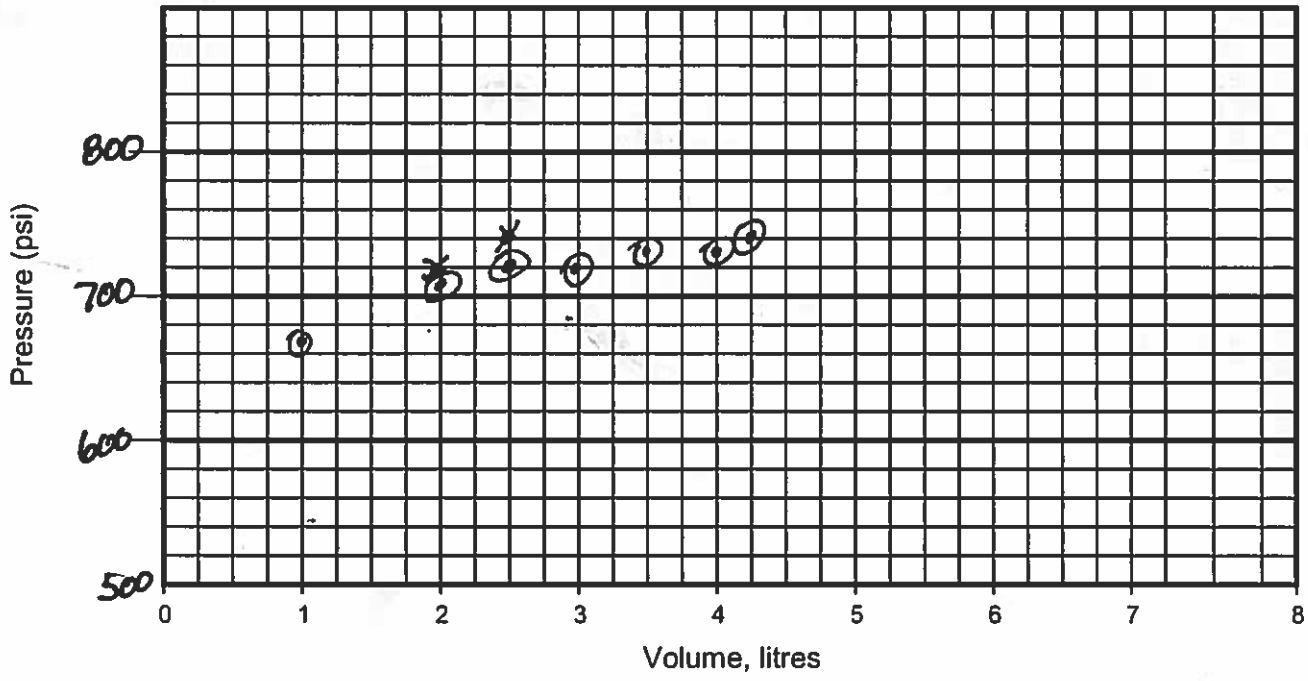
Packer No. S/N 19316 comp # 108 | Depth (ft / m): 450 est. | Inflation Tool No.: TIW852

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 740 psi | Tool Pressure, P_T: ~~700~~ 680 psi

Borehole Water Level: 133 (ft / (m)) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = ~~90~~ 110 psi

Volume, litres	0	1.0	2.0	2.5	3.0	3.5	4.0	4.25	3.3	
Pressure, psi	0	670	710	720	720	730	730	740	0	
Volume, litres										
Pressure, psi										



Comments: Packer # 14 | Time - 3:55

Westbay Packer Inflation Record

Project: HD MINING | Project No.: WB946 | Well No.: DH-02

Location: Tumbler Ridge | Completed by: TK | Date Inflated: Dec 11/15

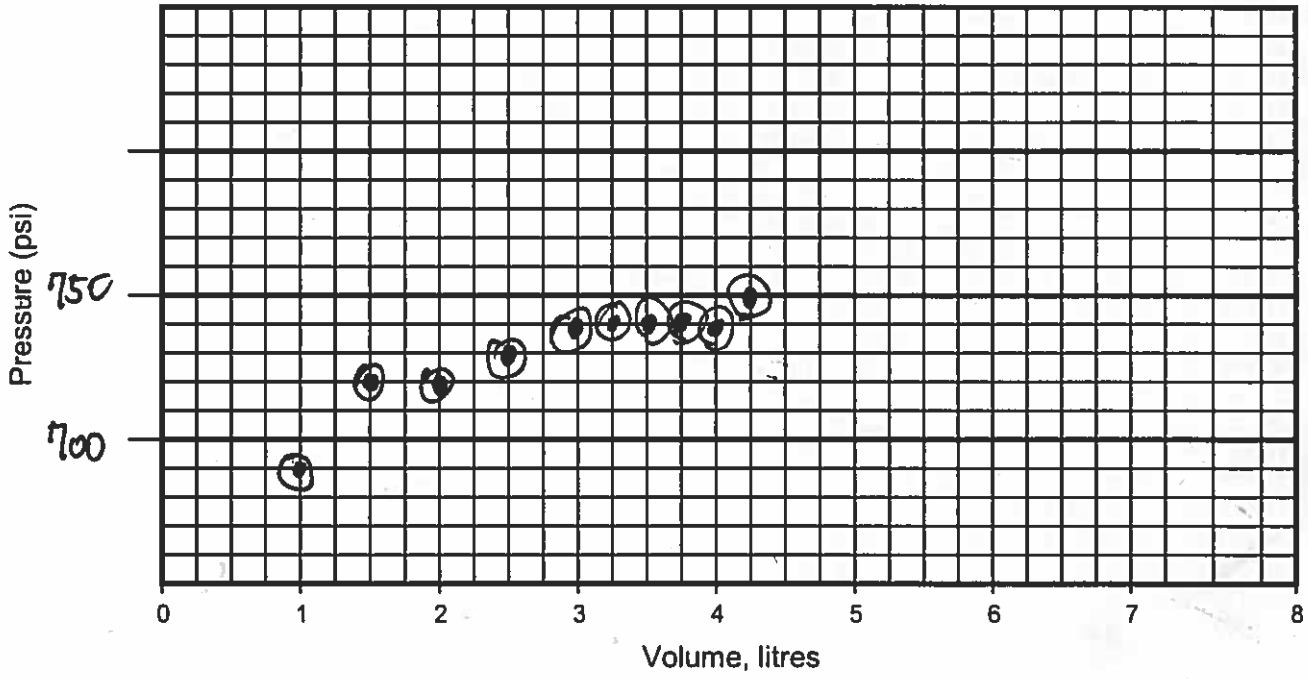
Packer No. S/N 14313 cmp 129. | Depth (ft (m)): 384.09 | Inflation Tool No.: TLW 852

Packer Valve Pressure, P_V: 145. psi | Final Line Pressure, P_L: _____ psi | Tool Pressure, P_T: ~~700~~ 680 psi

Borehole Water Level: 133 (ft (m)) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = ~~95~~ 115. psi

Volume, litres	1.0	1.5	2.0	2.5	3.0	3.25	3.5	3.75	4.0	4.25
Pressure, psi	690	720	720	730	740	740	740	740	740	750
Volume, litres	3.3									
Pressure, psi	Ø									



Comments: Packer # 15 | Time - 4:50 p.m.

Westbay Packer Inflation Record

Project: HD MINING | Project No.: WB946 | Well No.: DH-02

Location: Tumbler Ridge | Completed by: TK | Date Inflated: Dec 11/15

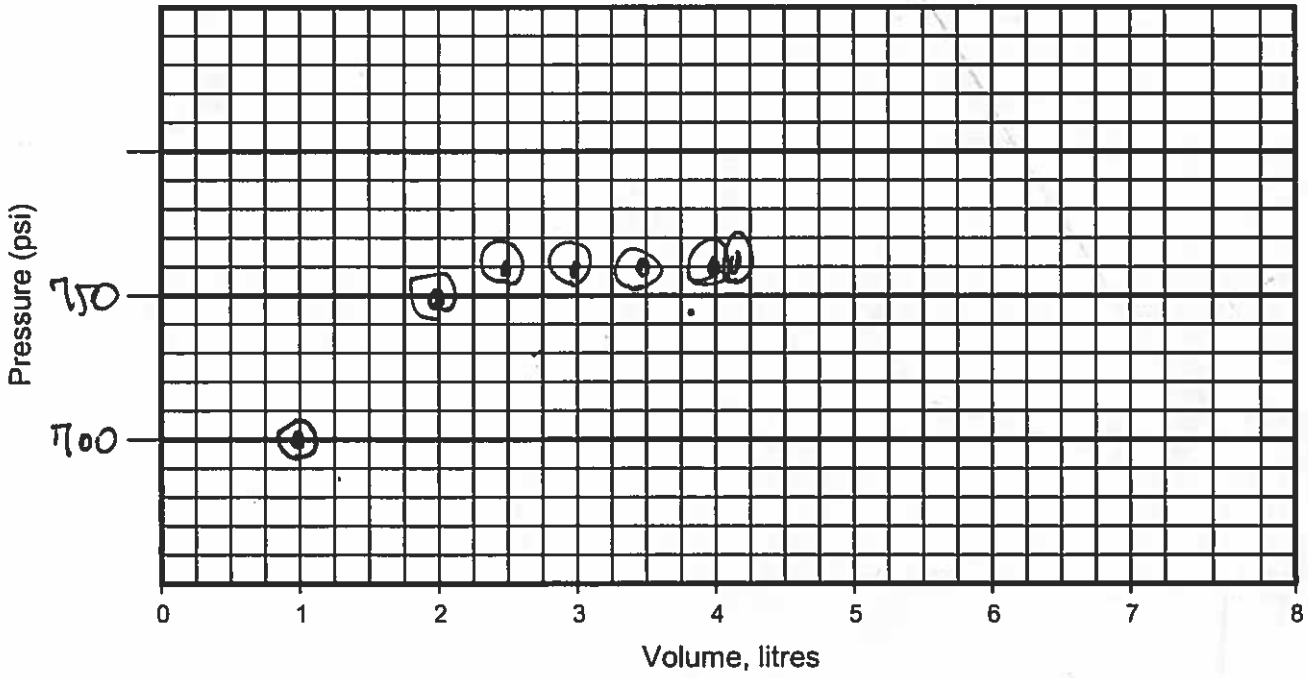
Packer No. S/N 19312 comp 143 | Depth (ft / (m)): 347.95 | Inflation Tool No.: TIW 852

Packer Valve Pressure, P_V: 145 psi | Final Line Pressure, P_L: 760 psi | Tool Pressure, P_T: ~~700~~ 650 psi

Borehole Water Level: 133 (ft / (m)) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = ~~705~~ 125 psi

Volume, litres	1.0	2.0	2.5	3.0	3.5	4.0	4.15	3.25		
Pressure, psi	700	750	760	760	760	760	760	0		
Volume, litres										
Pressure, psi										



Comments: Packer # 16 | Time - 5:30

Changed battery after 2.5L of injection.

Westbay Packer Inflation Record

Project: HD MINING | Project No.: WP946 | Well No.: DH-02

Location: Tumbler Ridge | Completed by: TK | Date Inflated: Dec 12/15

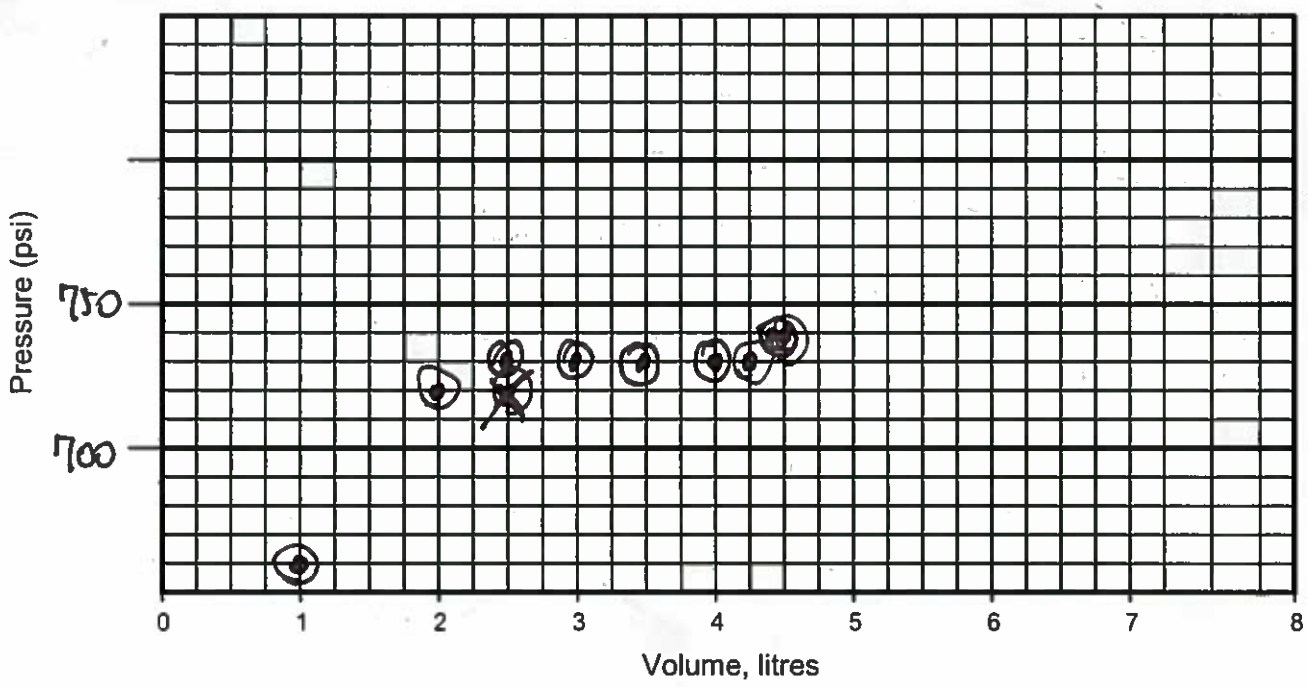
Packer No. S/N 19311 comp #178 | Depth (ft / m): 242.8 | Inflation Tool No.: TLW BJ2

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 740 psi | Tool Pressure, P_T: ~~700~~ 680 psi

Borehole Water Level: 133 (ft / m) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = ~~90~~ 110 psi

Volume, litres	1.0	2.0	2.5	3.0	3.5	4.0	4.25	4.30	3.5	
Pressure, psi	660	720	730	730	730	730	730	740	Ø	
Volume, litres										
Pressure, psi				–						



Comments: Packer # 17 | Time - 9:10 am

Westbay Packer Inflation Record

Project: HD MINING | Project No.: UBJ 946 | Well No.: DH-02

Location: Tumbler Ridge | Completed by: TK | Date Inflated: Dec 12/15

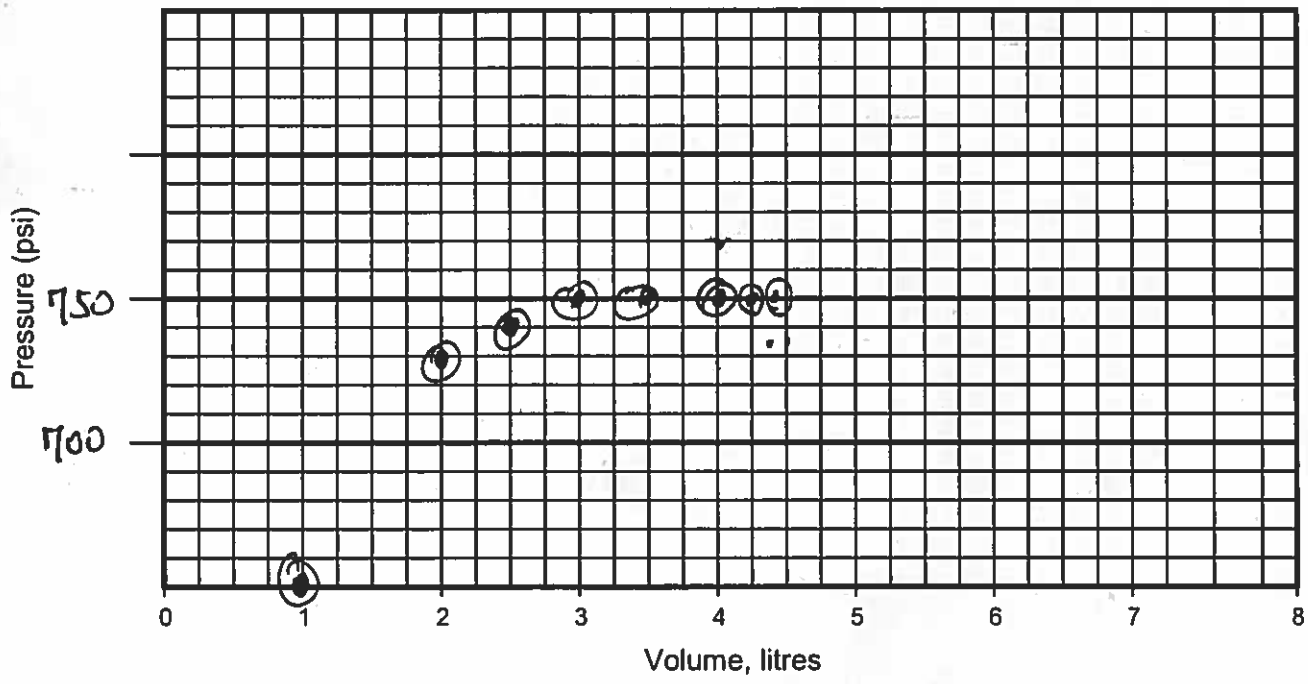
Packer No. S/N 19314 Comp #211 | Depth (ft (m): 143.74 | Inflation Tool No.: TW852

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 750 psi | Tool Pressure, P_T: ~~700~~ 680 psi

Borehole Water Level: 133 (ft / (m) = 190 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = ~~600~~ 120 psi

Volume, litres	1.0	2.0	2.5	3.0	3.5	4.0.	4.25	4.3	3.4	
Pressure, psi	650	730	740	750	750	750	750	750	Ø	
Volume, litres										
Pressure, psi										



Comments: Packer # 18 | Time - 10:00

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Westbay Packer Inflation Record

Project: HD MINING Project No.: WB 946 Well No.: DH-02

Location: Tumbler Ridge Completed by: TK Date Inflated: Dec 12/15

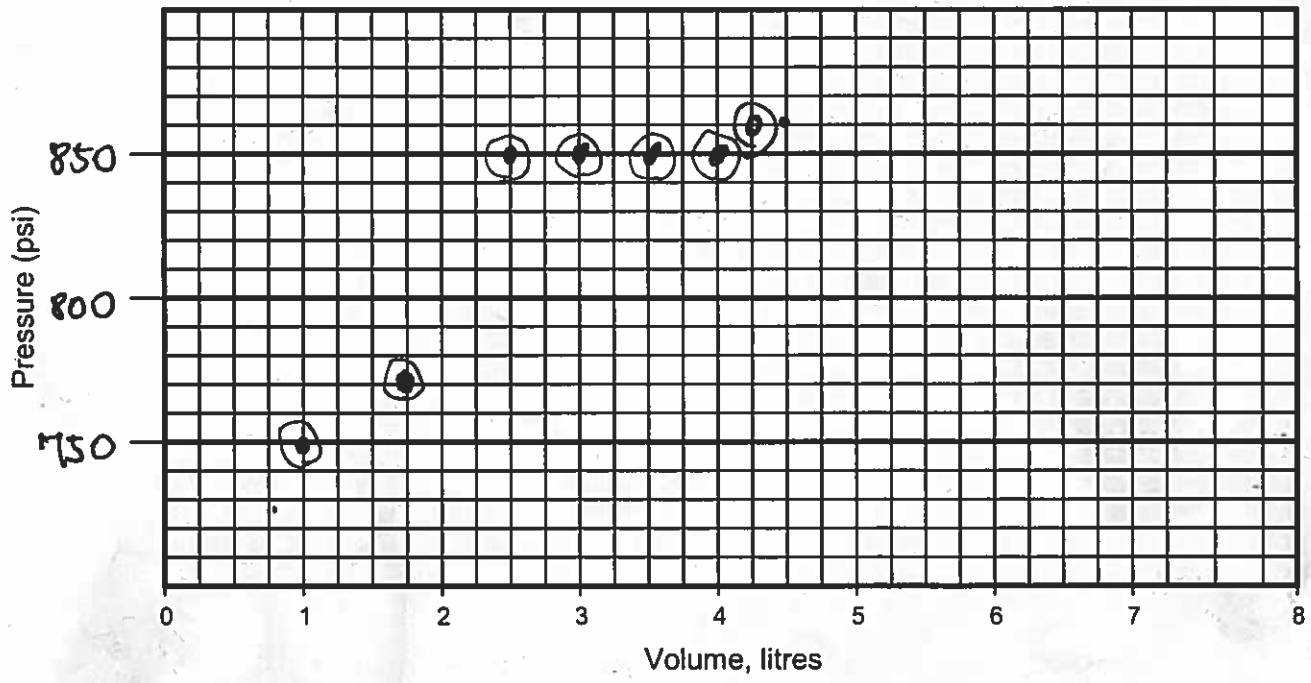
Packer No. S/N 19313 comp 245 Depth (ft / (m)): 41.64 Inflation Tool No.: TIW BJ2

Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 860 psi Tool Pressure, P_T: ~~700~~ 680 psi

Borehole Water Level: 0 / 60 (ft / m) = 0 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 100 psi

Volume, litres	~~1.0~~	1.0	1.75	~~2.5~~	3.0	3.5	4.0	4.25	3.3	
Pressure, psi	~~440~~	750	820	850	850	850	850	860	0	
Volume, litres										
Pressure, psi										



Comments: Packer # 19 Time - 11:45

deflate valve was activated. / confirm the tool 'P = 680

Westbay
Instruments