Technical Report

Title:	***Westbay MP38 Casing Completions in US-3, US-7 & US-8***
Document ID:	**TR-07-20**
Authors:	**Kenneth Raven & Sean Sterling**
Revision:	**2**
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DGR Site Characterization Document
Intera Engineering Project 06-219

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0	April 7, 2009	Initial Release
1	May 20, 2010	Minor editorial changes to address NWMO comments
2	June 23, 2010	Minor revision to ground surface elevation and Westbay monitoring interval elevations for US-3 (Table E.1) and US-7 (Table E.2).

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1 Introduction

The activities described in this Technical Report (TR) constitute one component of the Intera Engineering Ltd. Geoscientific Site Characterization Plan (GSCP) for the Deep Geologic Repository (DGR) for long-term management of low- and intermediate-level radioactive waste at the Bruce nuclear site near Tiverton, Ontario. The GSCP describes recommended methods and approaches to acquire the necessary geoscientific information to support the development of descriptive geosphere models of the Bruce site and the preparation of a DGR environmental assessment and site preparation/construction license application to the Canadian Nuclear Safety Commission. The GSCP is described by Intera Engineering Ltd. (2006, 2008a).

This report summarizes the refurbishment of existing wells US-3 and US-7; the development and sampling of open boreholes US-3, US-7 and US-8; the review of borehole drilling, logging and testing results and development of MP-38 casing system designs for boreholes US-3, US-7 and US-8; installation of MP38 casing systems in each borehole; and initial testing of the installed casing systems to verify successful installation. These three US-series boreholes are part of the shallow to intermediate depth (0-200 mBGS) groundwater monitoring network for the Bruce DGR project.

Work described in this Technical Report was completed in accordance with Test Plan TP-06-03 – Refurbishment of US-3 & US-7 (Intera Engineering Ltd., 2007a) and Test Plan TP-07-07- Completion of US-3, US-7 & US-8 with Westbay MP38 Casing (Intera Engineering Ltd., 2008b) which was prepared following the requirements of the Intera DGR Project Quality Plan (Intera Engineering Ltd., 2009a).

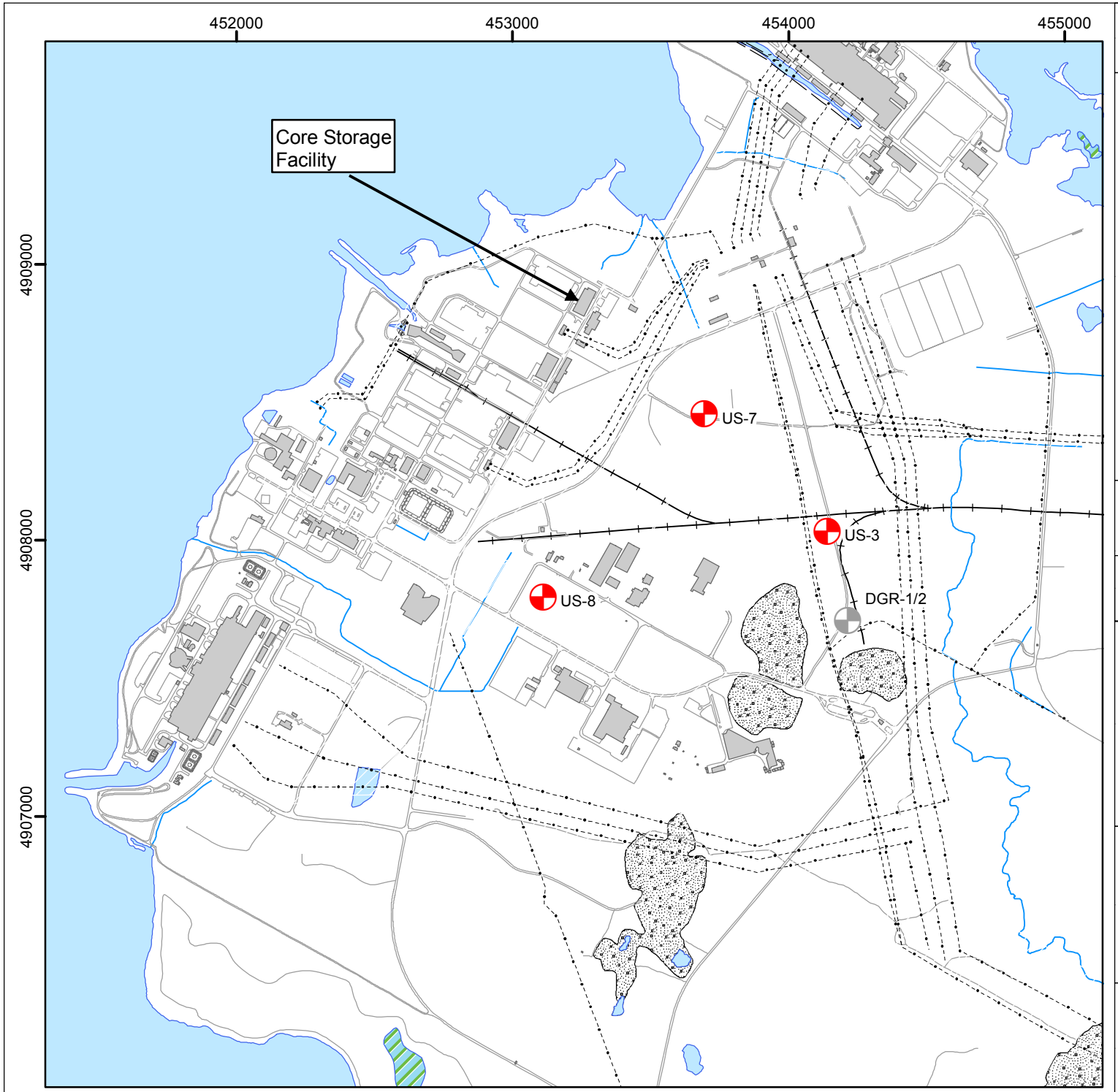
2 Background

As part of Phase 1 of the GSCP, two existing boreholes and monitoring wells located on the Bruce site in the vicinity of the proposed DGR (i.e., US-3 and US-7) completed into the upper 100 m of the bedrock were refurbished and a new well (US-8) was drilled and tested. Figure 1 shows the location of these US-series boreholes and monitoring wells on the Bruce site. One of the two existing boreholes (US-7) was instrumented with a Westbay MP38 multi-level groundwater monitoring system (Lee et al.,1995) that required removal, and one of the existing boreholes (US-3) remained open since drilling in September 1987 (Lukajic, 1988). Appendix A of TP-06-03 provides the original stratigraphic and casing installation logs for these two wells.

Refurbishment of existing boreholes was undertaken to prepare for installation of new Westbay MP38 multi-level groundwater monitoring systems to establish future shallow to intermediate bedrock monitoring wells for the Bruce DGR project. These activities include removal of existing monitoring casings, pumping/ development of open boreholes, and acoustic televiewer, natural gamma and video logging of open boreholes. TR-08-03 (Intera Engineering Ltd., 2009b) describes the completion of borehole geophysical logging of boreholes US-3 and US-7,

Borehole US-8 was drilled to the top of the Salina F Unit dolomitic shale in November, 2007 to allow for future groundwater monitoring of the shallow to intermediate depth bedrock. The drilling, drill water tracing and sampling, chip logging, borehole geophysical logging, and development and groundwater sampling of US-8 are described in TR-07-19 (Intera Engineering Ltd., 2009c). Based on the results of logging US-8 and DGR-1 (TR-07-05, Intera Engineering Ltd., 2010) that shows the Lucas Formation dolostone is the uppermost bedrock unit, it is assumed that this formation is also present in US-3 and US-7, although Lukajic (1988) did not identify it.

The refurbished monitoring wells US-3 and US-7 and the new monitoring well US-8 will provide shallow to intermediate depth bedrock monitoring intervals in the vicinity of the proposed DGR. Historically groundwater monitoring has been performed in monitoring well US-7 since installation in the late 1980's until about 1994. This historical information will allow for continuity of groundwater monitoring in the vicinity of the proposed DGR



OPG DGR
Site Characterization Plan

Legend

- Location of US-series Boreholes
- Location of DGR-1/2
- Buildings
- Roads
- Railway
- Transmission Line
- Pits or Landfills
- Stream or Drainage

Location of US-3, US-7 and US-8

Figure 1

N

Scale 1:20,000 (approx.)

0 125 250 500 750 1,000 Meters

Date: 17-Jun-08 Drawn: SNG
Project: 06-219 Checked: KGR

P:/QMS_DGR/TR_WorkingFiles/TR-07-20/TR-07-20_Figure 1.mxd

Projection: UTM NAD 83 Zone 17

Data Credits:
NRVIS/OBM, MNR, Ontario Power Generation, Bruce Power

INTERA

facility for over a 14 year period.

Boreholes US-3, US-7 and US-8 were completed with MP38 multi-level monitoring casings manufactured by Westbay Instruments Inc. (also operating as Schlumberger Water Services). These bedrock monitoring wells allow for monitoring of formation pressures, performance of borehole hydraulic tests and collection of groundwater and gas samples from packer-isolated test intervals. All work completed by Westbay Instruments was performed under the requirements of the Schlumberger Water Services Quality Management System (Westbay Instruments Ltd, 2005).

Monitoring intervals are defined using MP38 inflatable-deflatable packers. Intervals are defined to isolate identified or suspected permeable and impermeable horizons within each borehole and to create intervals representative of stratigraphic formations defined based on borehole logging, core logging and testing results. Monitoring and sampling of intervals are accomplished using MP38 measurement ports and pumping ports, and MOSDAX sampler probes. The MP38 casing system and related tools are described in TP-07-07 (Intera Engineering Ltd., 2008b) and in TP-07-06 (Intera Engineering Ltd, 2007b).

Removal of existing MP38 casing from US-7 and installation of new MP38 casing systems in boreholes US-3, US-7 and US-8 were conducted by staff of Westbay Instruments with field support provided by staff of Intera Engineering Ltd. During the course of the MP38 casing removal and installations, Intera staff were trained by Westbay on operation of MP38 casing systems and MOSDAX sampler probe usage.

3 Methodology and Testing Procedures

3.1 Removal of Casing from US-7

The existing MP38 casing installed in US-7 in 1988 was removed in November 2007 using the following procedure:

- The fluid column within the central casing string was evacuated to depth of 65 mBGS by nitrogen lift using a gas-lift tool.
- The six MP38 casing packers were punctured by staff of Westbay Instruments using a packer puncturing tool (see Figure 2) that created a puncture slit in the interior PVC casing of each packer.
- Using a workover rig, a central rod was placed down the centre of the entire casing length to stabilize the casing in the event of casing breakage during recovery operations.
- H-size drill casing equipped with a customized overshot assembly was pushed over the upper-most casing packer using the workover rig and the H-size casing, together with the entire MP38 casing string, was recovered from the borehole.

3.2 Development and Sampling of Open Boreholes

Following removal of existing casing from US-7 and completion of drilling of US-8, open boreholes US-3, US-7 and US-8 were developed and purged using a combination of air lift and pumping with a submersible electric pump. The development and purging were in preparation of the boreholes for installation of Westbay MP38 casings. Single representative grab samples of groundwaters from the open boreholes of US-3, US-7 and US-8 were collected and analysed for Na Fluorescein (only for US-8), major and trace metals, major anions, tritium, ^{18}O and ^{2}H and retained in archive following the completion of development and purging. Field measurements of general geochemical parameters (e.g., pH, Eh, conductivity, alkalinity, dissolved oxygen) were not collected during the grab sampling of open borehole groundwater.

Figure 2 Packer Puncturing Tool Used to Deflate Packers in US-7

Table 1 summarizes the well development and purging activities and the collection of open hole groundwater (OHGW) samples from boreholes US-3, US-7 and US-8. OHGW samples were collected to quantify the initial groundwater chemistry that would be present in packer-isolated monitoring intervals following casing installation.

Table 1 Summary of Open Hole Development, Purging and Sampling of US-3, US-7 and US-8

Borehole	*Dates Developed and Purged*	*Total Volume Removed (L)*	*Number of Well Volumes Removed*	*Open Hole Sample Collected*
US-3	Nov 22 and 23, 2008	3,186	9.4	OHGW-US3-01
US-7	Nov 22 and 23, 2008	3,623	5.5	OHGW-US7-01
US-8	Nov 25 and 26, 2008	25,000	16.6	OHGW-US8-01

OHGW samples collected following development and purging of US boreholes were identified by OHGW-XXXX-YY, where XXXX is the borehole identifier and YY is the index number of the sample. All open hole groundwater samples required the time and date of sampling to be recorded on the sample label, as well as the name of the person who collected the sample.

Samples collected for NaFl analyses were collected as well-mixed grab samples in 250 millilitre (mL) high density polyethylene (HDPE) containers that were protected from heat and light and stored in refrigerators. Approximately 20 mL of sample was filtered with a 0.45µm filter using a syringe. A 2 mL sample of the casing installation fluid was collected with a 1-5 mL pipettor and was mixed with 18 mL of deionized water, which was collected with a 2-10 mL pipettor, to generate a 20 mL water sample for analysis of NaFl content.

OHGW samples were collected and preserved for specific analytical tests in high density polyethylene (HDPE) bottles as described in TP-06-03 and TP-07-12 (Intera Engineering Ltd., 2007c). Samples were kept in the refrigerators in the Core Storage Facility, at approximately 4°C until analysis or shipment to laboratories.

Archived water samples were also stored in the Core Storage Facility refrigerators.

NaFl concentrations were measured in the field laboratory using a Turner Designs Trilogy Model 7200-000 fluorometer (MTE ID: FL-01). The fluorometer was calibrated once per batch of NaFl tracer stock solution mixed using prepared NaFl standards. The NaFl standards were prepared using treated Lake Huron water. The calibration was checked using manufacturer-prepared solid state standards each time the fluorometer was used to measure casing installation water tracer concentrations. Both standards and collected samples were diluted 1:10 to optimize tracer measurement within the fluorometer linearity range.

Tritium analyses were completed by the Environmental Isotope Laboratory, University of Waterloo in Waterloo, Ontario. Major and Trace Metals and Major Anions analyses were completed by Activation Laboratories Ltd. in Ancaster, Ontario. ^{18}O and ^{2}H analyses were completed by the University of Ottawa in Ottawa, Ontario. Results of the field and laboratory analyses of open hole groundwater samples are presented in Table A.1 in Appendix A.

3.3 Design of MP38 Casing Systems

The general approach to design of MP38 casing systems in boreholes US-3, US-7 and US-8 is described in TP-07-07. As described in TP-07-07, the existing casing plan for US-7 was replicated with minor revision to provide continuity of monitoring intervals. These minor revisions included slight repositioning of 2ft and 5ft casing lengths in interval #6 of US-7 to allow for easier access to pumping and pressure measurement ports within this short test interval. For US-3 and US-8 the available borehole information from drilling, core logging, geophysical logging and borehole hydraulic testing were reviewed by Intera and used to generate a design plan of required depth locations of Westbay packers, measurement ports, pumping ports and casing lengths.

The rationale for selecting locations for packers and measurement/pumping ports in US-3 and US-8 is outlined below.

- Start from basic design assumptions developed in DGR Project budget concerning number of packer-isolated test intervals in each borehole (i.e., 6 intervals for US-3, 16 intervals for US-8) and divide this number into the length of open borehole to obtain average interval length for each borehole.
- Review bedrock formation information and borehole core logs (Lucajic, 1988; TR-07-19), borehole packer test data (Lukajic, 1988), drilling observations (Lukajic, 1988; TR-07-19) and borehole geophysical logging data (TR-08-03, TR-07-19) that assist in identification of permeable intervals within each borehole and isolate those intervals with packers with monitoring access by pressure measurement ports and pumping ports. Permeable intervals are considered intervals that would yield sufficient water to allow for interval purging through the pumping port. Typically, this is defined as intervals with estimated or measured hydraulic conductivity greater than 1×10^{-8} m/s.
- Set remaining packers to isolate separate stratigraphic units considering thickness of units and number of allowable intervals. Double up on packer placement in selected critical zones.
- Modify packer placement locations to avoid zones of increased borehole diameter evident from borehole geophysical or video logging that may compromise seating and sealing of packers.
- Place one measurement port below each packer and one magnetic locating collar below each measurement port.
- Place pumping ports within middle of each interval requiring a pumping port and below measurement ports.
- Maximize use of 1.5 m and 3 m length casing sections.

The proposed casing installation plans for boreholes US-3, US-7 and US-8 prepared by Intera using the above rationale were forwarded to staff of Westbay Instruments for review and verification. Following review by

Westbay Instruments, the proposed casing installation plans were finalized by Intera and became the basis for the casing installations as formalized by Westbay in Casing Installation Logs.

Application of the general design considerations described above resulted in final MP38 casing plans for boreholes US-3, US-7 and US-8 with the general features summarized in Table 2.

Table 2 Summary of Main Elements of US-3, US-7 and US-8 MP38 Casing Completions

MP38 Casing Element	***US-3***	***US-7***	***US-8***
Monitored Depth Range (mBGS)	22.9 to 74.3	21.2 to 89.6	14.6 to 200.4
Number of Packers	6	7	18
Number of Formation Monitoring Intervals	6	7	18
Range: Average Monitoring Interval Length (m)	6.7 to 9.8: 7.8	6.5 to 17.3: 12.1	5.8 to 26.4: 13.3
Number of Formation Pressure Measurement Ports	6	7	18
Number of Formation Pumping Ports	6	7	11

3.4 MP38 Casing Installations

Installation of Westbay MP38 multilevel monitoring casings was performed by staff of Westbay Instruments with support provided by staff of Intera Engineering Ltd. in accordance with standard Westbay casing installation procedures as described in TP-07-07. MP38 casing was installed in US-3 and US-7 on December 10 and 11, 2007. MP38 casing was installed in US-8 on March 5 and 6, 2008.

As described in TP-07-07, the following common activities comprised the installation of MP38 casing in boreholes US-3, US-7 and US-8.

- Preparation of Casing Installation Log by Westbay and acceptance of the Casing Installation Log by Intera.
- Layout, numbering and visual inspection of all MP38 casing components at the well head, including measurement of the length of each Westbay casing section. Figure 3 shows the layout of MP38 casing components at borehole US-8.
- Lowering of MP38 casing components into the borehole in the sequence indicated on the approved Casing Installation Log. Lowering was completed by hand as buoyancy conditions allowed. Traced water was added to the inside of the casing to overcome buoyancy and for pressure testing of each casing joint. Sampling and testing of casing installation water is described in Section 3.5. Each MP38 component was checked on the Casing Installation Log as it entered the borehole.
- Pressure testing each casing joint and port for a minute at an internal pressure of 150 psi to confirm integrity of hydraulic seals.
- After the complete casing string was assembled and lowered into the borehole, the hydraulic integrity of the complete casing string was tested by monitoring depressed water levels within the casing for a minimum of 30 minutes.

- After confirmation of hydraulic integrity of the complete casing string, the casing string was positioned in the borehole as shown on the Casing Installation Log.

Figure 3 Layout and Installation of MP38 Casing Components at US-8

- Each MP casing packer was inflated using traced water. Packers were inflated in sequence beginning with the lowest. The results of the inflation of each packer including injection pressures and pumped volume were recorded on Westbay Packer Inflation Field Records. .

- A Summary Casing Log was prepared showing the "as-built" construction of the MP38 casings. The Summary Casing Log and related table summarizes the locations of all packers, measurement ports, pumping ports and casing lengths, and a schematic of the entire casing completion.

The complete detailed descriptions of the installation of MP38 casings in boreholes US-3, US-7 and US-8, including Summary Casing Logs, as-built tables and schematics, and Westbay Packer Inflation Records, are given in Westbay Completion Reports provided in Appendices B, C and D, respectively. Hoists and dynamometers were not required for the installation of MP38 casings in US-3, US-7 and US-8.

3.5 Characterization of Casing Installation Water

Water required for lowering of the casing, for pressure testing of casing couplings and for inflation of casing packers was traced Lake Huron water. All water used to install the MP38 casing systems was traced using a target tracer concentration of 1000 µg/L Na Fluorescein following the general procedures of TP-06-08 – DGR-1 & DGR-2 Drilling Fluid Management (Intera Engineering Ltd., 2007d). Elevated tritium as a tracer was also present within the casing installation water. Traced casing installation water was prepared in several 20 L polyethylene plastic containers.

Single representative grab samples of casing installation waters for US-3 and US-7 (one sample as both installations were completed on the same day) and US-8 were collected and analysed for Na Fluorescein, major and trace metals, major anions, tritium, ^{18}O and ^{2}H and retained in archive following the procedures described in Section 3.2 for collection and testing of open hole groundwater samples.

Casing installation water samples collected from the casing installation water tank were identified by CIW-XXXX-YY, where XXXX is the borehole identifier and YY is the index number of the sample. All casing installation water samples required the time and date of sampling to be recorded on the sample label, as well as the name of the person who collected the sample.

Results of the field and laboratory analyses of casing installation water are presented in Table A.2 in Appendix A.

3.6 Initial Pressure Profiles

As part of the casing installation procedure, two sets of pressure profile measurements are performed, prior to and following inflation of packers.

The pressure profile measurements taken before packer inflation are intended to confirm the operation of all pressure measurement ports downhole, while there is an opportunity to easily retrieve and replace any faulty pressure measurement ports. A secondary purpose of the pre-inflation pressure profile is to establish the open-hole pressure and fluid density profile that can be used as surrogate of the formation fluid density profile in initial calculations of environmental head from subsequent pressure profiles of packer-isolated intervals. This secondary purpose is principally applicable for the deeper borehole US-8, where variations in groundwater density are anticipated.

The post-inflation pressure profile measurements were taken within 6 to 12 hours of completion of the inflation of packers and are intended to document the initial performance of the installed MP38 casing systems.

4 Results

4.1 Open Hole Groundwater

Review of Table A.1 and earlier groundwater quality data of Lee et al. (1995) shows that the open hole groundwater from US-3, US-7 and US-8 are primarily Ca-SO_4 waters with Na-HCO_3 as less dominant dissolved ions. Chloride levels are all low ranging from 17.9 to 36.8 mg/L. Total dissolved solids (TDS) levels range from 511 mg/L for US-8 to 1320 mg/L for US-7 to 1700 mg/L for US-3. Detailed geochemical analysis of the open hole groundwater quality is not possible due to detection limitations on ion concentrations reported by the analytical laboratory on key analytes of calcium and bicarbonate/carbonate.

The tritium and environmental isotope (^{18}O, ^{2}H) analyses show similar open hole groundwaters in US-3 and US-7 that are dissimilar to those in US-8. The US-3 and US-7 groundwaters have low (<1 TU) tritium contents, higher TDS, and depleted ^{18}O (-14.4 and -14.3 ‰) and ^{2}H (-101 and -102 ‰) contents relative to groundwaters sampled from US-8. The tritium content of US-8 open hole groundwater at 431 TU was more than twice the maximum amount measured in drill water during drilling of US-8 (TR-07-19, Intera Engineering Ltd., 2008c). However, this tritium concentration is within the range of tritium contents that may occur within Lake Huron water that is used as drilling fluid at the Bruce site, suggesting the measured open hole tritium content may be reflective of higher tritium content drilling fluid that was not tested for tritium during drilling of US-8.

The available geochemical and environmental isotope results suggest that the open hole groundwater in US-3 and US-7 is recharged from deeper parts of these boreholes. In contrast, the open hole groundwater in US-8 has lower TDS than US-3 and US-7 suggesting that the open hole of US-8 is preferentially recharged from shallow low TDS sources. Groundwater purging and sampling within the MP38 well completions in each borehole will be required to determine the depth profile of groundwater quality within boreholes US-3, US-7 and US-8.

4.2 Casing Installation Water

Table A.2 shows the casing installation water for boreholes US-3, US-7 and US-8 had low TDS (<200 mg/L), as expected for Lake Huron water. The environmental isotope contents of the casing installation water show typical surface water enrichment due to evaporation. The casing installation water for US-3/US-7 (sample CIW-US3-01) and US-8 (sample CIW-US8-01) was effectively traced with tritium at concentrations of 118 and 174 TU, respectively, and NaFl at concentrations of 1162 and 1166 µg/L, respectively. This tracing of casing installation water will be of assistance in determining presence or absence of casing water contamination in future groundwater sampling efforts that may be completed in MP38 packer-isolated intervals in boreholes US-3, US-7 and US-8.

4.3 MP38 Casing Installations

Review of the Casing Completion Reports provided in Appendices B, C and D, shows that all pressure measurement ports in US-3, US-7 and US-8 operated successfully, and all packers inflated successfully.

4.4 Packer-Isolated Test Intervals

Tables E.1, E.2 and E.3 of Appendix E summarize the depth and elevation of the measurement ports and the top and bottom seals of all packer-isolated MP38 monitoring intervals in US-3, US-7 and US-8. Tables E.1, E.2 and E.3 also list the zone length and the bedrock formations intersected by each of the MP38 monitoring intervals in US-3, US-7 and US-8, respectively.

The depths and elevations of the top and bottom of each MP38 monitoring interval listed in Tables E.1, E.2 and E.3 are based on actual packer seal distances and are more accurate than the nominal packer depths that are recorded in Tables 3 of each of the Westbay Completion Reports given in Appendices B, C and D.

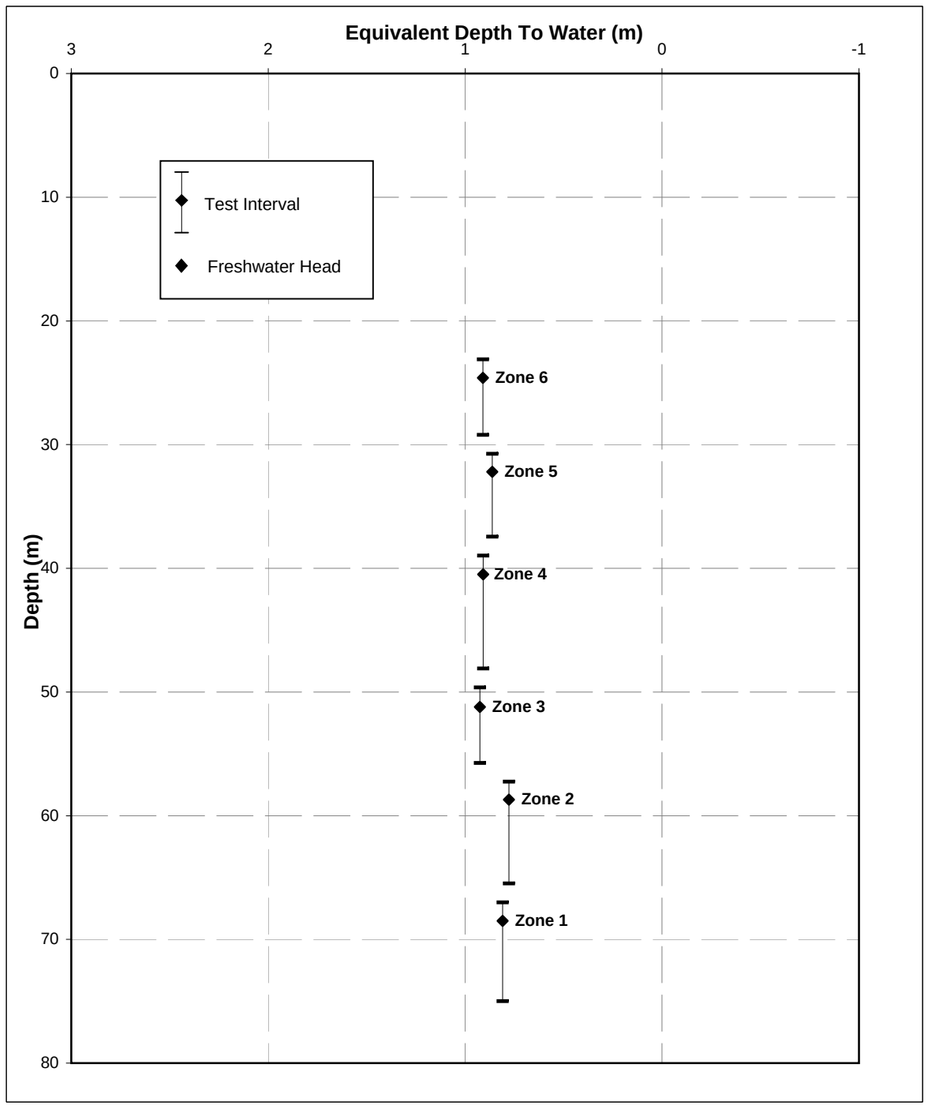
4.5 Pressure Profiles

The pre-inflation and post-inflation pressure profiles for boreholes US-3, US-7 and US-8 expressed as fresh water heads in depths below ground surface are presented in Figures 1 and 2 of each of the Completion Reports given in Appendices B, C and D, respectively.

These pressure data, expressed as fresh water heads, are plotted as depths below ground surface against the bedrock stratigraphic column of US-3, US-7 and US-8 in Figures 4, 5 and 6, respectively. Figures 4, 5 and 6 are all plotted with a common head scale of 4 m. Bedrock stratigraphy in Figure 4 (US-3) and Figure 5 (US-7) is the originally stratigraphy from Lukajic (1988) modified to include the Lucas Formation as the upper bedrock. There is some inconsistency evident in the logging of Lukajic compared to logging completed in DGR boreholes, in particular the depth of the Bois Blanc Formation. In US-3 and US-7 the Bois Blanc Formation is identified at depths of about 56 and 48 mBGS, respectively, whereas in DGR-1 the top of this formation is logged at depths of about 75 mBGS. As boreholes US-3 and US-7 were not re-logged this inconsistency remains. Bedrock stratigraphy in Figure 6 (US-8) is from TR-07-19.

Because of the very short elapsed time since packer inflation for the first post-inflation pressure profile, these pressure data are most useful in determining that the MP38 casing systems are operating as intended and will provide useful data from longer-term monitoring rounds. The initial post-inflation pressure data provide only a very limited indication of actual long-term formation pressure conditions that will develop in boreholes US-3, US-7 and US-8.

Pre-Inflation Profile
December 11, 2007



US-3

Bedrock Stratigraphy*

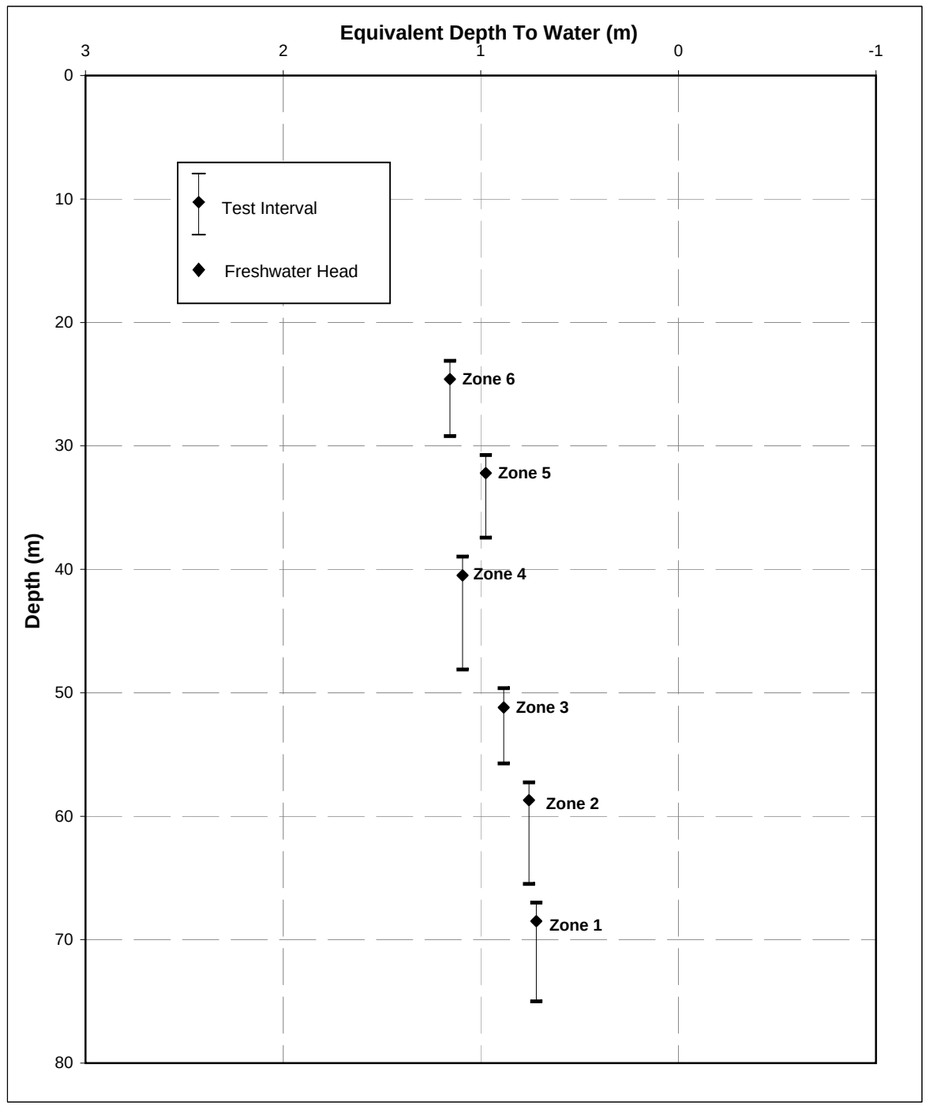
Surficial Deposits, Till

Lucas Formation, Dolostone

Amherstburg Formation, Dolostone

Bois Blanc Formation, Cherty Dolostone

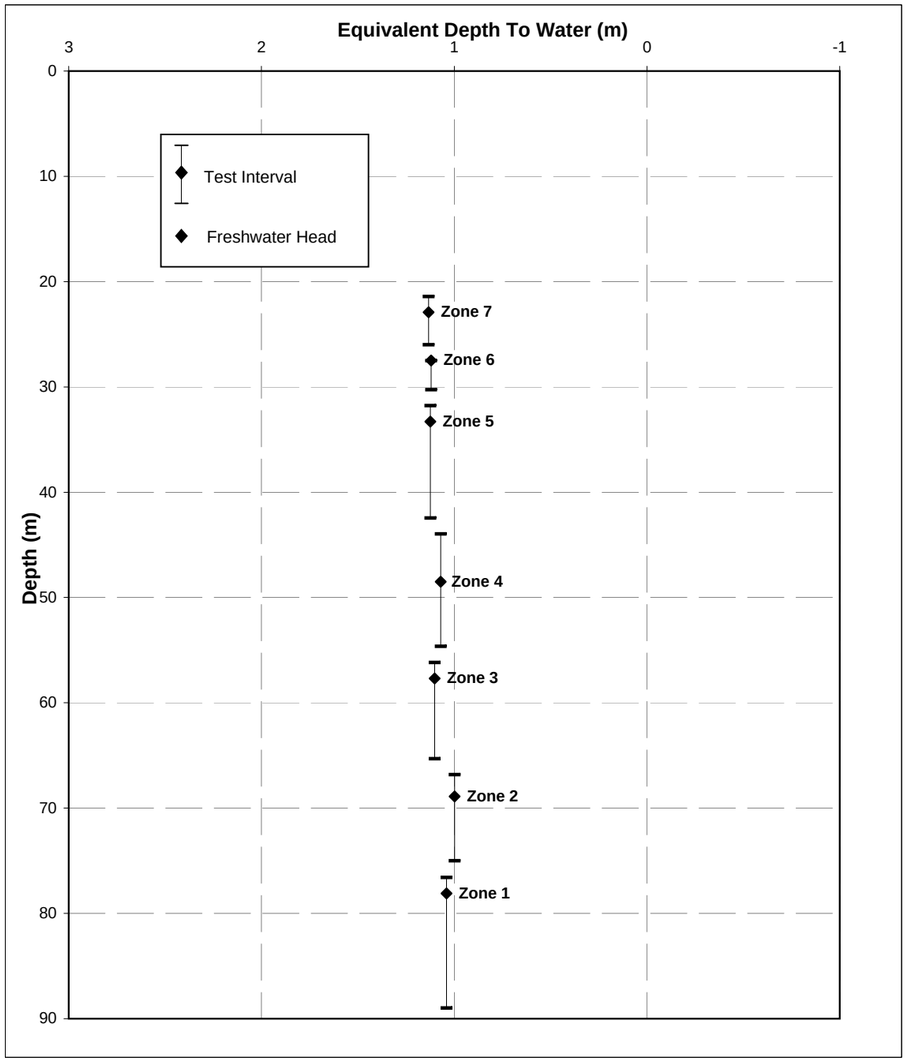
Post-Inflation Profile
December 11, 2007



US-3 Pre- and Post-Inflation Pressure Profiles		Prepared by: SNG
		Reviewed by: KGR
FIGURE 4	Doc No.: TR-07-20_US-3 Pressure Profiles_R0.xls	Date: Apr 7, 2009

* after Lukajic, 1988

Pre-Inflation Profile
December 10, 2007



US-7

Bedrock Stratigraphy*

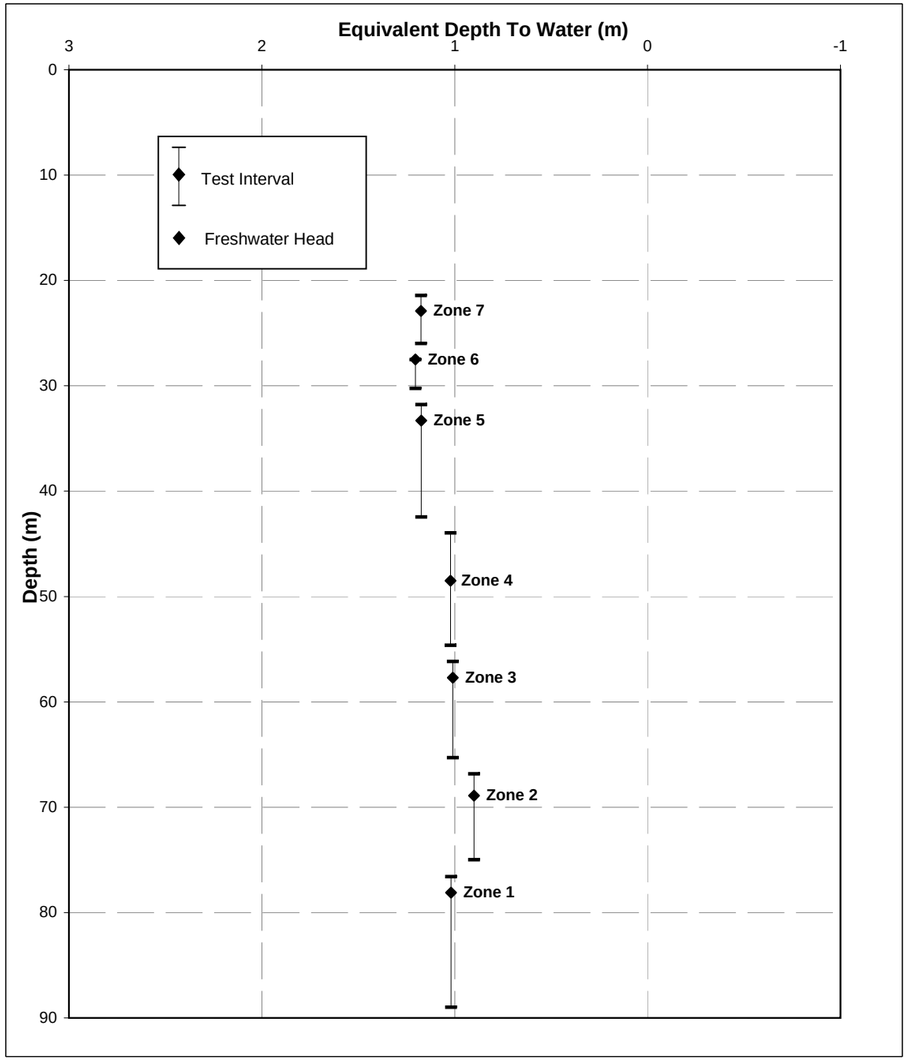
Surficial Deposits, Till

Lucas Formation, Dolostone

Amherstburg Formation, Dolostone

Bois Blanc Formation, Cherty Dolostone

Post-Inflation Profile
December 11, 2007

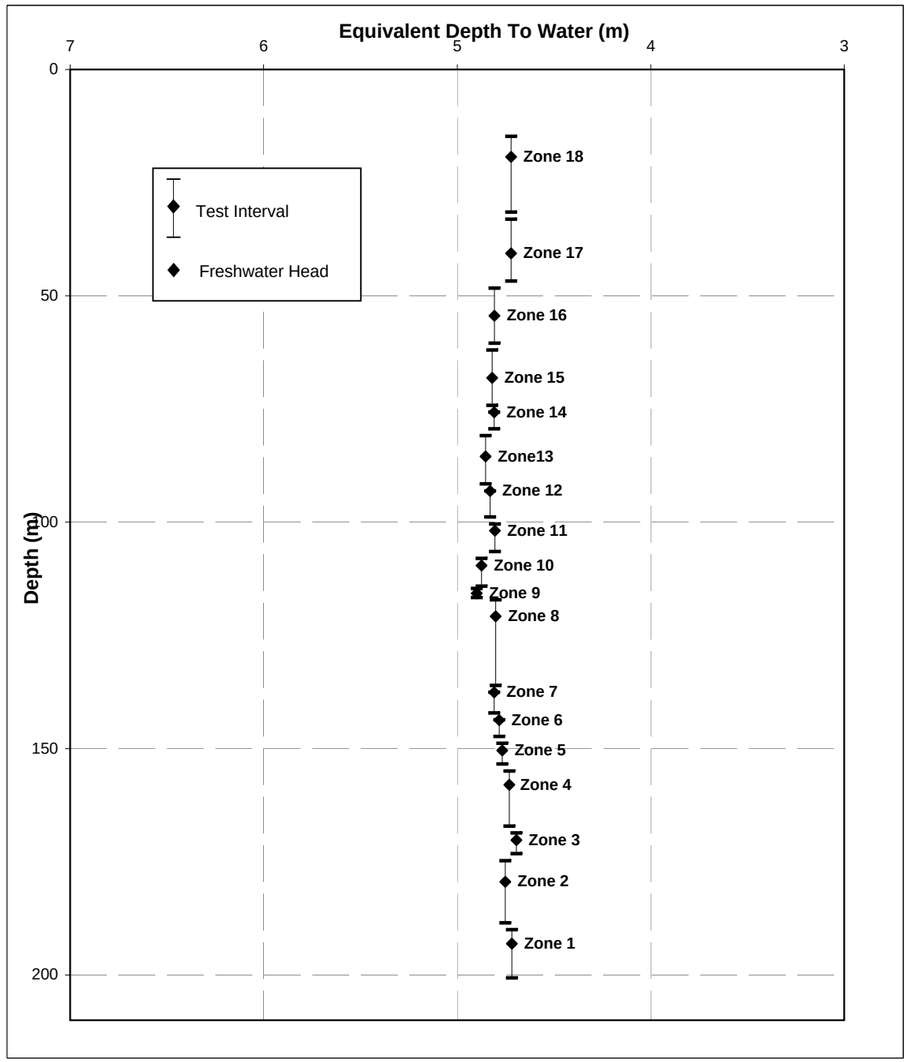


US-7 Pre- and Post-Inflation Pressure Profiles		Prepared by: SNG
		Reviewed by: KGR
FIGURE 5	Doc No.: TR-07-20_US-7 Pressure Profiles_R0.xls	Date: Apr 7, 2009

* after Lukajic, 1988

US-8

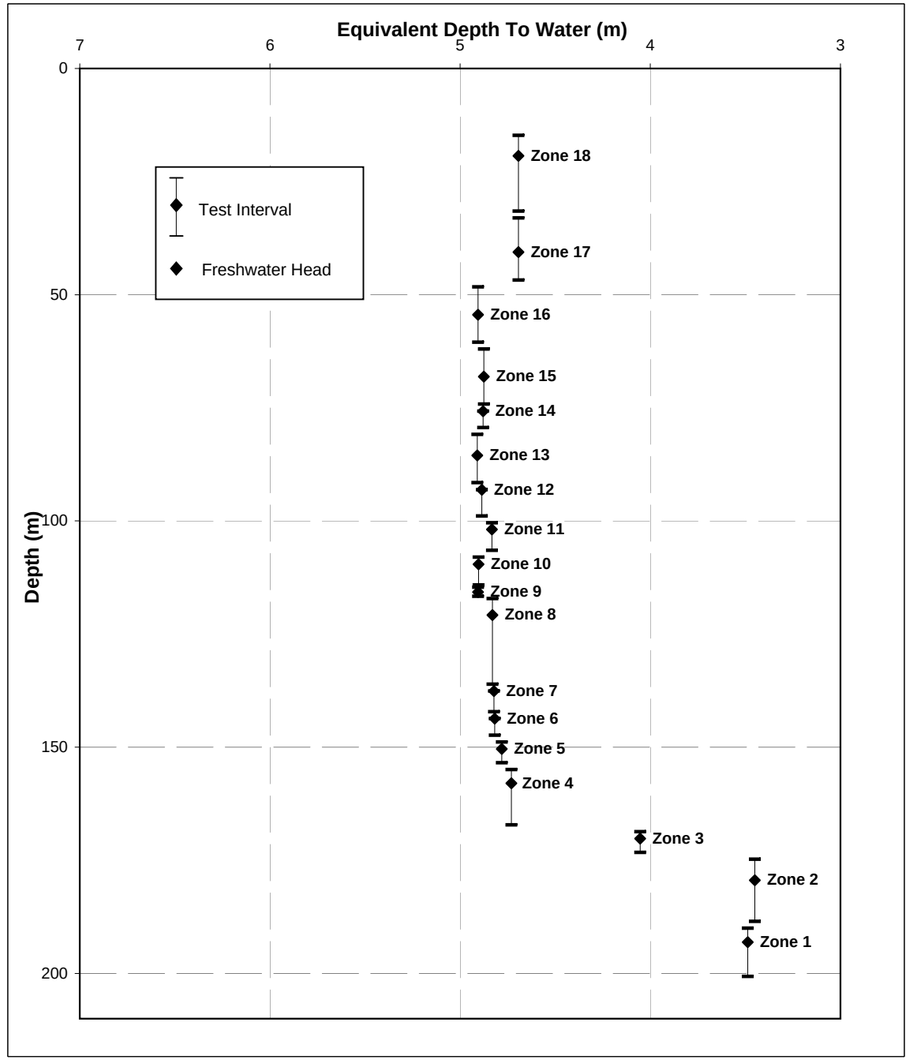
Pre-Inflation Profile
March 5, 2008



Bedrock Stratigraphy

- Surficial Deposits, Till
- Lucas Formation, Dolostone
- Amherstburg Formation, Dolostone
- Bois Blanc Formation, Cherty Dolostone
- Bass Islands Formation, Dolostone
- Salina Formation - G Unit, Argillaceous Dolostone
- Salina Formation - F Unit, Dolomitic Shale

Post-Inflation Profile
March 6, 2008



US-8 Pre- and Post-Inflation Pressure Profiles

Prepared by: SNG
Reviewed by: KGR
Date: Apr 7, 2009

FIGURE 6

Doc No.: TR-07-20_US-8 Pressure Profiles_R0.xls

INTERA

4.5.1 US-3

Figure 4 shows a pre-inflation fresh water head profile for US-3 that increases slightly with depth suggesting a very minor increase in TDS and density with depth in US-3 under open-hole conditions. The increase in fresh water head is about 12 cm, which is close to the measurement limit of the MOSDAX pressure probe at about 3.2 cm or less (TP-07-07).

The post-inflation pressure profiles for US-3 show a minor but noticeable change from open-hole pressures. The calculated heads show minor increases at depth in zones 1 to 3 and minor decreases in head in shallow zones 4 to 6. These changes indicate the MP38 casing packers are sealing and that there appears to be upward flow in the bedrock formations intersected by US-3.

4.5.2 US-7

Figure 5 illustrates a pre-inflation fresh water head profile for US-7 that also increases slightly with depth suggesting a very minor increase in TDS and density with depth in US-7 under open-hole conditions. The increase in fresh water head is again about 12 cm, which is close to the measurement limit of the MOSDAX pressure probe.

The post-inflation pressure profiles for US-7 show a minor but noticeable change from open-hole pressures. The calculated heads show minor increases at depth in zones 1 to 4 and minor decreases in head in shallow zones 5 to 7. These changes indicate the MP38 casing packers are sealing and that there appears to be upward flows in the bedrock formations intersected by US-7.

4.5.3 US-8

Figure 6 shows a pre-inflation fresh water head profile for US-8 that is remarkably similar considering the depth of the borehole at 200 m. This uniform head profile indicates that the water in borehole is fresh and of uniform low density, as confirmed by the relatively low TDS of 511 mg/L measured on the open hole groundwater sample.

The post-inflation pressure profiles for US-8 show significant changes from open-hole pressures. The calculated heads show large increases at depth in zones 1 to 3 and minor decreases in head in intermediate zones 10 to 16. The uppermost two zones (17 and 18) do not appear to show any change, inferring the upper 50 m of borehole covered by these two zones is likely the source of the groundwater observed under open hole conditions. This inference is supported by the observations of drilling fluid loss and video logging (TR-07-19) that showed the upper 50 m of US-8 was very permeable compared to the remainder of the borehole. The post inflation pressures and heads indicate the MP38 casing packers are sealing and that there appears to be upward flow in the bedrock formations intersected by US-8.

5 Data Quality and Use

Data presented in this report describe the installation and completion of Westbay MP38 multilevel monitoring casings in boreholes US-3, US-7 and US-8 as well as the rationale for selection of multilevel monitoring intervals. Initial post-inflation pressure data obtained from these completions support the conclusion that the MP38 casing systems are operating as intended and that longer monitoring periods, in the range of several weeks, will be required before meaningful and representative pressure data will be obtained from boreholes US-3, US-7 and US-8.

The data presented in this Technical Report are suitable for providing the framework for interpreting shallow to intermediate depth formation pressures and heads and groundwater samples that may be collected from such

formations. These data will assist in development of geological, hydrogeological and geomechanical descriptive site models of the Bruce DGR site.

These data will also provide a baseline of groundwater conditions within the shallow to intermediate depth, permeable to moderately permeable bedrock (i.e., 0 to 200 mBGS) in the vicinity of the proposed Bruce DGR.

6 References

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APPENDIX A

Open Hole Groundwater and Casing Installation Water Quality

Table A.1 Analytical Results – Open Hole Groundwater – US-3, US-7 and US-8

Table A.2 Analytical Results – Casing Installation Water – US-3, US-7 and US-8

Table A.1 - Analytical Results - Open Hole Groundwater - US-3, US-7 and US-8

Parameter Depth (mBGS)> Date Sampled>	MDL	Units	OHGW-US3-01 Open Hole 24-Nov-07	OHGW-US7-01 Open Hole 22-Nov-07	OHGW-US8-01 Open Hole 25-Nov-07
General Parameters					
pH	0.1	pH units	--	--	--
Total Dissolved Solids	NV	mg/L	1700	1320	511
Alkalinity	2	mg/L $CaCO_3$	--	--	--
Fluid Density	NV	g/L	1005	997.5	1003.7
Na Fluorescein	1	µg/L	--	--	113.2
Cations					
Calcium	0.7	mg/L	>200	>200	>20
Iron	0.01	mg/L	0.690	0.230	<0.01
Magnesium	0.001	mg/L	135	105	>20
Manganese	0.0001	mg/L	0.0071	0.0041	0.0164
Potassium	0.03	mg/L	2.73	2.65	2.19
Silicon	0.2	mg/L	3.40	3.40	8.50
Sodium	0.005	mg/L	41.50	53.7	>35
Strontium	0.00004	mg/L	>2	>2	>0.2
Anions					
Bromide	0.003	mg/L	0.144	0.123	0.038
Chloride	0.03	mg/L	18.9	36.8	17.9
Fluoride	0.01	mg/L	1.47	1.29	1.88
Iodide	0.001	mg/L	<0.01	<0.01	<0.001
Bicarbonate	1	mg/L	--	--	--
Carbonate	1	mg/L	--	--	--
Nitrate	0.01	mg/L	<0.1	<0.1	<0.02
Nitrite	0.01	mg/L	<0.1	<0.1	0.05
Phosphate	0.02	mg/L	<0.3	<0.3	<0.04
Sulphate	0.03	mg/L	1,420	886	97.9
Isotopes					
Tritium, ^{3}H	$\pm$ 0.3	TU	<0.8	0.9	431.4
Deuterium, ^{2}H	$\pm$ 1.0	δD (‰)	-101.25	-102.36	-74.50
Oxygen-18, ^{18}O	$\pm$ 1.5	$\delta^{18}O$ (‰)	-14.37	-14.29	-10.68
Selected Trace Elements					
Aluminum	2	µg/L	<20	20.0	2.0
Antimony	0.01	µg/L	<0.1	<0.1	2.5
Arsenic	0.03	µg/L	0.52	0.52	4.27
Barium	0.1	µg/L	4.8	6.7	>400
Beryllium	0.1	µg/L	<1	<1	<0.1
Bismuth	0.3	µg/L	<3	<3	<0.3
Cadmium	0.01	µg/L	<0.1	<0.1	0.06
Cesium	0.001	µg/L	0.010	0.018	0.026
Chromium	0.5	µg/L	<5	<5	<0.5
Cobalt	0.005	µg/L	<0.05	0.054	0.69
Copper	0.2	µg/L	<2	<2	0.4
Gadolinium	0.001	µg/L	<0.01	<0.01	0.002

Parameter Depth (mBGS)> Date Sampled>	MDL	Units	OHGW-US3-01 Open Hole 24-Nov-07	OHGW-US7-01 Open Hole 22-Nov-07	OHGW-US8-01 Open Hole 25-Nov-07
Gallium	0.01	µg/L	<0.1	<0.1	0.02
Lead	0.01	µg/L	0.15	<0.1	0.01
Lithium	1	µg/L	33.0	30.0	12.0
Mercury	0.2	µg/L	<2	<2	<0.2
Molybdenum	0.1	µg/L	3.2	4.1	11.1
Nickel	0.3	µg/L	<3	3.2	16.9
Rubidium	0.01	µg/L	<0.1	<0.1	2.64
Selenium	0.2	µg/L	<2	<2	19.4
Thallium	0.001	ug/L	<0.01	<0.01	0.033
Titanium	0.1	µg/L	17.6	13.0	3.8
Tungsten	0.02	µg/L	<0.2	<0.2	0.1
Uranium	0.001	µg/L	2.99	1.95	15.3
Vanadium	0.1	µg/L	<1	<1	2.5
Zinc	0.5	µg/L	6.2	<5	7.6

Notes:

mBGS = metres below ground surface.

MDL = Method Detection Limit.

-- = Parameter not analyzed.

<0.01 = Not detected above MDL.

Table A.2 - Analytical Results - Casing Installation Water - US-3, US-7 and US-8

Parameter / Date Sampled>	MDL	Units	CIW-US3-01 11-Dec-07	CIW-US8-13 6-Mar-08
General Parameters				
pH	0.1	pH units	--	--
Total Dissolved Solids	NV	mg/L	155	199
Alkalinity (as $CaCO_3$)	2	mg/L	--	--
Fluid Density	NV	g/L	1005	999
Na Fluorescein	0.01	µg/L	1162.5	1166.2
Major Cations				
Calcium	0.7	mg/L	>20	>20
Iron	0.01	mg/L	ND	0.08
Magnesium	0.001	mg/L	9.31	8.64
Manganese	0.0001	mg/L	0.0004	0.0237
Potassium	0.03	mg/L	1.72	1.11
Silicon	0.2	mg/L	1.0	1.1
Sodium	0.005	mg/L	7.31	8.01
Strontium	0.00004	mg/L	0.115	0.130
Major Anions				
Bromide	0.003	mg/L	ND	0.14
Chloride	0.03	mg/L	11.9	11.3
Fluoride	0.01	mg/L	0.07	0.07
Iodide	0.001	mg/L	ND	ND
Bicarbonate	1	mg/L	--	--
Carbonate	1	mg/L	--	--
Nitrate	0.01	mg/L	0.33	0.43
Nitrite	0.01	mg/L	ND	ND
Phosphate	0.02	mg/L	ND	0.05
Sulphate	0.03	mg/L	16.1	16.6
Environmental Isotopes				
Tritium, ^{3}H	$\pm$ 8.0	TU	118.0	173.8
Deuterium, ^{2}H	$\pm$ 1.0	δD (‰)	-57.0	-55.6
Oxygen-18, ^{18}O	$\pm$ 1.5	$\delta^{18}O$ (‰)	-6.90	-7.22
Selected Trace Elements				
Aluminum	2	µg/L	ND	7
Antimony	0.01	µg/L	0.1	0.12
Arsenic	0.03	µg/L	0.35	0.54
Barium	0.1	µg/L	68.4	15.2
Beryllium	0.1	µg/L	ND	ND
Bismuth	0.3	µg/L	ND	ND
Cadmium	0.01	µg/L	0.14	0.04
Cesium	0.001	µg/L	ND	0.001
Chromium	0.5	µg/L	ND	ND
Cobalt	0.005	µg/L	0.034	0.208
Copper	0.2	µg/L	47.8	169.0
Gadolinium	0.001	µg/L	ND	0.004
Gallium	0.01	µg/L	ND	ND
Lead	0.01	µg/L	0.16	4.00
Lithium	1	µg/L	2	2
Mercury	0.2	µg/L	ND	ND
Molybdenum	0.1	µg/L	0.4	0.5
Nickel	0.3	µg/L	ND	1.4
Rubidium	0.005	µg/L	0.906	0.950
Selenium	0.2	µg/L	ND	ND
Thallium	0.001	µg/L	0.001	0.002
Titanium	0.1	µg/L	3.1	1.8
Tungsten	0.02	µg/L	0.02	ND
Uranium	0.001	µg/L	0.223	0.280
Vanadium	0.1	µg/L	ND	0.2
Zinc	0.5	µg/L	66.4	157.0

Notes:

MDL = Method Detection Limit.

-- = Parameter not analyzed.

ND = Not detected above MDL.

N/A = Not available; awaiting receipt of results from laboratory.

APPENDIX B

Westbay Casing Completion Report – US-3

Completion Report

Monitoring Well

US-3

OPG

Deep Geologic Repository Investigation

Ontario, Canada

Prepared for:

Intera Engineering Ltd.
Canada

Prepared by:

Westbay Instruments Inc.
WB860
January 30, 2008

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2.	INSTALLATION	1
	2.1 Previous Activities	1
	2.2 Preparation of Monitoring Well Design	1
	2.3 Layout of Westbay Casing Components	1
	2.4 Lowering of Westbay Components	2
	2.5 Hydraulic Integrity Testing	2
	2.6 Positioning of Westbay Components	2
	2.7 Pre-Inflation Profile	3
	2.8 Inflation of Westbay Packers	3
3.	FLUID PRESSURE MEASUREMENTS	3

APPENDIX

APPENDIX: Monitoring Well: US-3

1. Introduction

This report and the attached Appendix document the technical services carried out by Westbay Instruments Inc. under Intera Engineering Ltd. Purchase Order 06-219-25.20-2 The Westbay System for groundwater monitoring was installed in an open borehole at the OPG Deep Geologic Repository near Tiverton, Ontario.

Westbay technical services representative Mr. Andrew Bessant was on site for the installation on December 11, 2007. This report documents the installation tasks and related QA checks.

2. Installation

The monitoring well was installed as indicated below.

(Note: all depths are with respect to ground surface. Monitoring well reference elevation was not available at the time of writing).

Table 1, Summary of Westbay Well Installation

Monitoring Well No.	Installation Date	Borehole Depth (m)	Steel Casing Depth (m)	MP38 Casing Length (m)	No. Monitoring Zones
US-3	Dec 11, 2007	74	20	72.24	6

The well was installed according to the procedures described below.

2.1 Previous Activities

As reported by Intera nominal 4-inch diameter borehole was drilled using rotary diamond coring methods. A steel 4 inch diameter (4.25-inch) casing was installed in the borehole to a depth of 20m. A video log was conducted prior to installation of the Westbay well.

2.2 Preparation of Monitoring Well Design

Preliminary monitoring zone locations for the Westbay System well were sent to Westbay by Mr. Sean Sterling of Intera. The casing design was used to construct a preliminary Casing Installation Log, which specifies the location of components in the well. The Casing Installation Log was reviewed in the field with Intera prior to installation of the well. The Casing Installation 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 zone to provide the capability to measure fluid pressures and collect fluid samples. A pumping port coupling was also included in each zone to provide purging and hydraulic conductivity testing capabilities.

2.3 Layout of Westbay Casing Components

Prior to Westbay System installation, the Westbay System casing components were set out at the borehole according to the sequence indicated on the Casing Installation 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 the casing sections. Magnetic location collars were attached 2 feet below the top of the measurement port in each sampling zone.

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

2.4 Lowering of Westbay Components

The Westbay System casing components were lowered into the well by hand as buoyancy conditions allowed. Fluorescein labeled drinking water supplied by Intera was added to the Westbay System casing when necessary to counter buoyancy effects while components were lowered into the borehole and for testing of joint seals during lowering. Each casing 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 casing component are noted on the Casing Installation Log by check marks.

2.5 Hydraulic Integrity Testing

After the Westbay casing string was lowered into the borehole, the water inside the Westbay casing was monitored at depth different from the open borehole water level for a minimum period of thirty minutes to confirm hydraulic integrity of the casing. The data from the hydraulic integrity test is shown on the first page of the Casing Installation Log in the Appendix. And in Table 2 below

Table 2, Borehole and Westbay Casing Water Levels

Monitoring Well No.	Borehole water level (top of 4-inch casing)	Westbay Water Level (top of casing)
US-3	1.32 m	19.35 m

2.6 Positioning of Westbay Components

After the components were lowered into the well, the Westbay casing string was positioned as indicated on the Casing Installation Log. Ground surface was used as the borehole datum. The Westbay casing string was supported in this position while packer inflation was carried out.

The positioning of the Westbay casing components is based on the "nominal" lengths of Westbay casing components. The positioning calculations do not include allowances for borehole temperature or deviation effects, which for this site are expected to be minimal. The attached figure titled "MOSDAX Transducer Position" provides information to correlate the position of MOSDAX Transducer sensors 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 centerline depths and zone length. The Summary Casing Log, which shows the final "as-

built" locations of the components in the well, is included in the Appendix. The depths of key items in the well are shown on Table 3.

2.7 Pre-inflation Profile

A pre-inflation pressure profile was carried out at the well prior to inflating the packers to confirm the proper operation and position of measurement ports and magnetic collars. The data confirmed that the ports operated properly and are positioned correctly. The data for the pre-inflation profile is located in the Appendix (Figure 1) and on the Field Data and Calculation Sheet.

2.8 Inflation of Westbay System Packers

The Westbay system packers were inflated sequentially beginning at the bottom of the well using Fluorescein labeled drinking water provided by Intera. The Westbay Model No. 6055 vented inflation tool was used for packer inflation. All of 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. 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. Longer term monitoring may be required to establish representative fluid pressures.

A plot of the Piezometric levels in all zones in the well is shown on Figure 2 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 the pressure profile of the Westbay monitoring well are also enclosed in the Appendix.

Table 3, Depths of Key Items for MP monitoring well US-3.

Zone No.	Zone Interval* (m)	MP Casing No. (from MP Log)	Packer No.	Packer Serial No.	Nominal Packer Position *** (m)	Magnetic Collar Depth (m)	Measurement Port Depth** (m)	Pumping Port Depth** (m)	Port Name
Zone 1	75 – 67.0	1-4	1	15854	65.5	69.1	68.5	70.1	Zone 1
Zone 2	65.5 – 57.3	6-10	2	15853	55.7	59.4	58.8	61.8	Zone 2
Zone 3	55.7 – 49.6	12-14	3	15851	48.1	51.8	51.2	54.2	Zone 3
Zone 4	48.1 – 38.9	16-19	4	15837	37.4	41.1	40.5	43.5	Zone 4
Zone 5	37.4 – 30.7	21-25	5	15838	29.2	33.1	32.3	35.3	Zone 5
Zone 6	29.2 – 23.1	27-30	6	15838	21.6	25.2	24.6	26.2	Zone 6

* Depths are with respect to ground level.

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

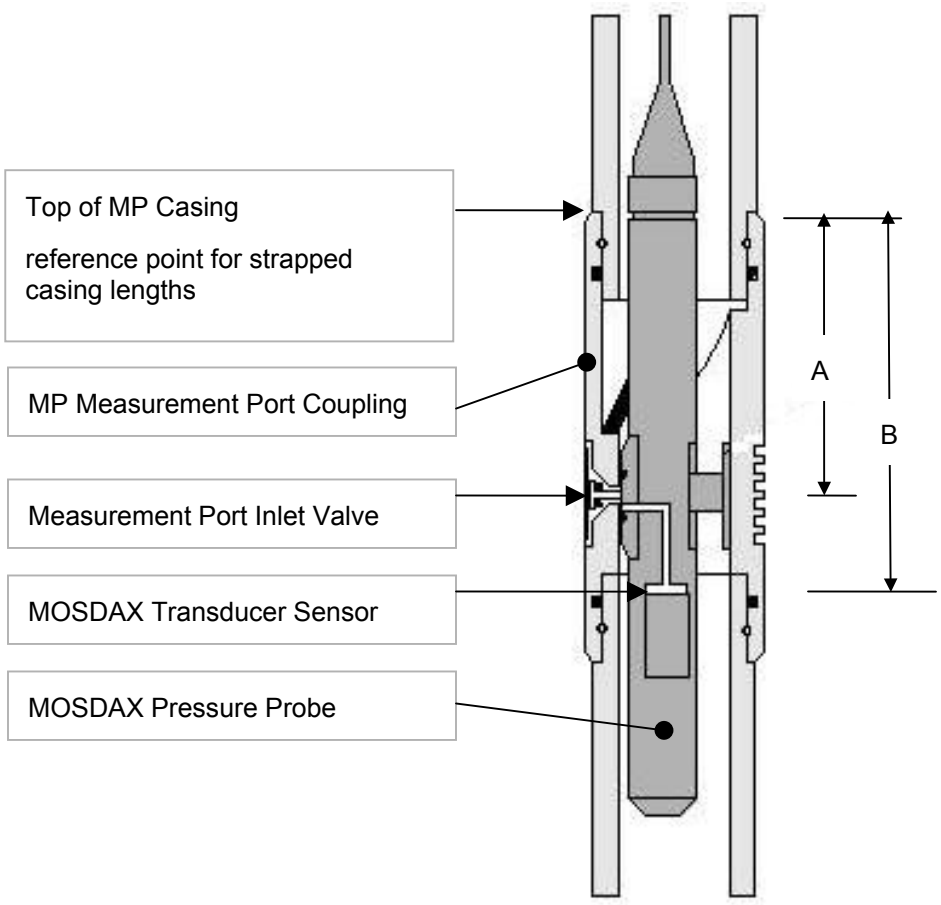
*** Packer positions are referenced to the top Westbay System coupling on the packer.

Technical Note

Schlumberger WATER SERVICES

MOSDAX Transducer Position

In an MP System Measurement Port Coupling



System	Measurement Port Type	A	B
Plastic MP38	0205	4.5" (114.3 mm)	6.5" (165.1 mm)

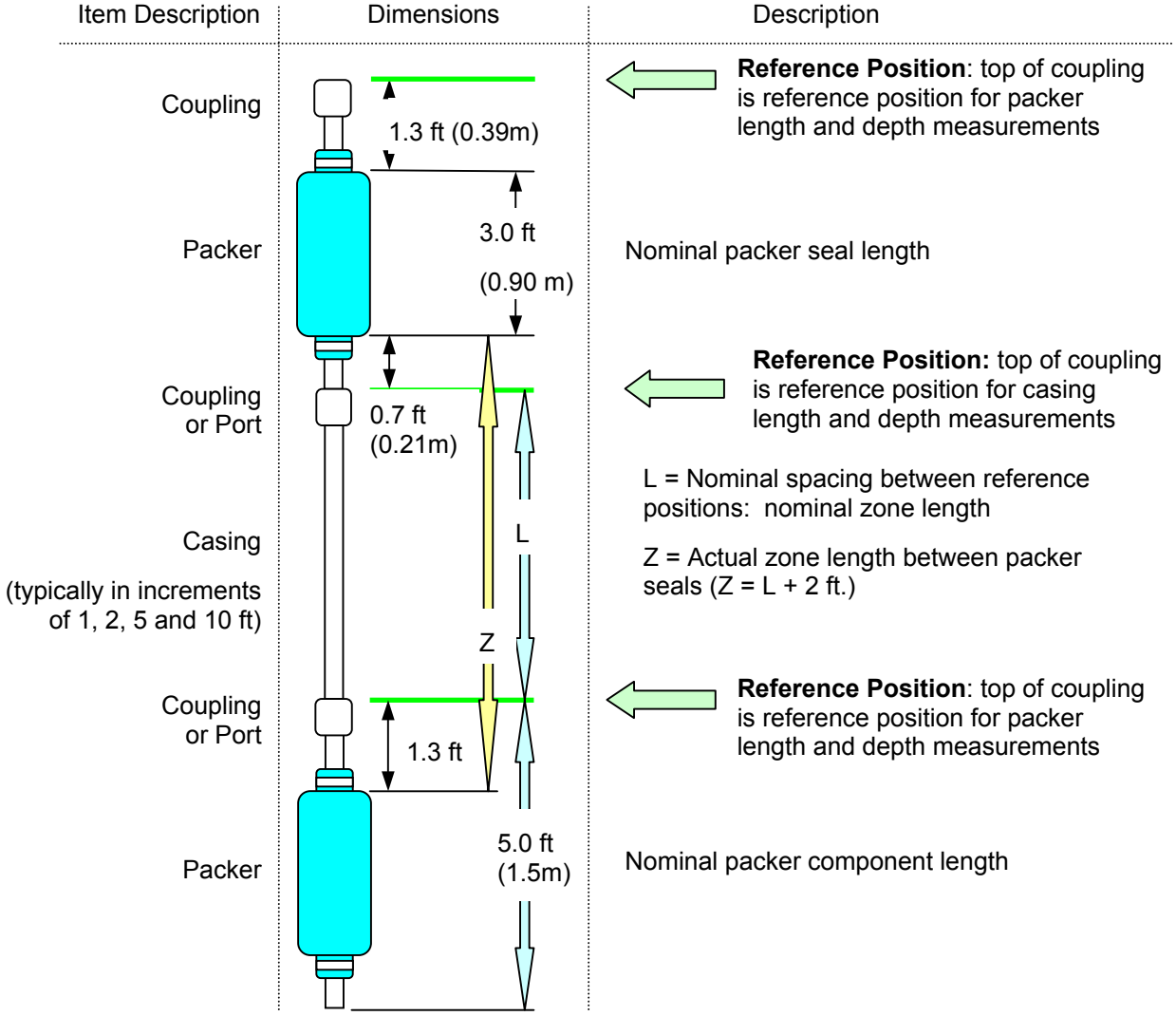
DL July 11, 2006

Technical Note

Schlumberger WATER SERVICES

Dimensions of Packer Seals and Monitoring Zones

Westbay System – Plastic MP38



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 1

Monitoring Well US-3

Summary Casing Log	- 3 pages
Figure 1, Pre-Inflation Pressure Profile	- 1 page
Pre-inflation Piezometric Pressure/Levels	
Field Data and Calculation Sheet (Dec 11, 2008)	- 1 page
Figures 2, Piezometric Pressure Profile	- 1 page
Piezometric Pressure/Levels	
Field Data and Calculation Sheet (Dec 11, 2008)	- 1 page
Casing Installation Log (field copy)	- 5 pages
MP Packer Inflation Records	- 6 pages

Summary Casing Log

Company:
Well: US-3 2007
Site:
Project:

Job No: WB 860
Author: AJB

Well Information

Reference Datum:
Elevation of Datum: 0.00 m.
MP Casing Top: 0.00 m.
MP Casing Length: 72.24 m.

Borehole Depth: 90.00 m.
Borehole Inclination:
Borehole Diameter: 0.00 mm

Well Description:

Other References:

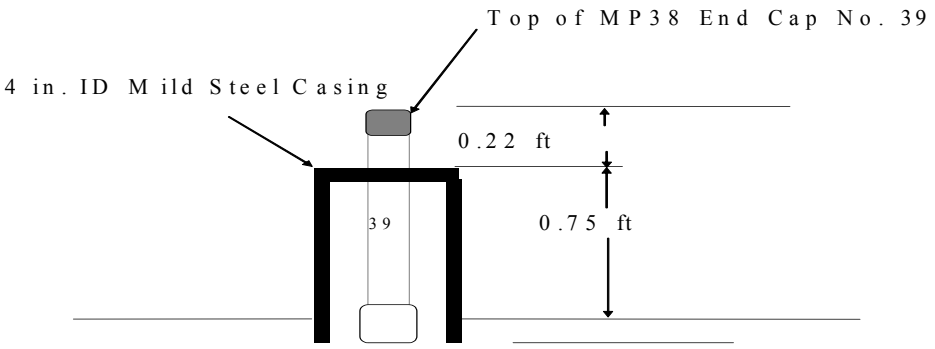
File Information

File Name: US3.WWD
Report Date: Wed Feb 20 13:58:56 2008

File Date: Jan 18 09:58:09 2008

Sketch of Wellhead Completion

U S - 3 S u r f a c e C o m p l e t i o n

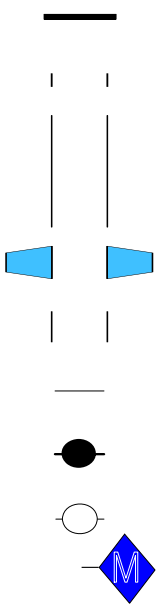


Legend

(Qty) MP Components
(Library - WD Library 7/27/00)

Geology

Backfill/Casing



(2) 0203 - MP38 End Cap

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

(11) 020110 - MP38 Casing 1 (10F/3M)

(6) 0238 - MP38 Packer 74mm (5F/1.5M)

(18) 020105 - MP38 Casing 2 (5F/1.5M)

(27) 0202 - MP38 Regular Coupling

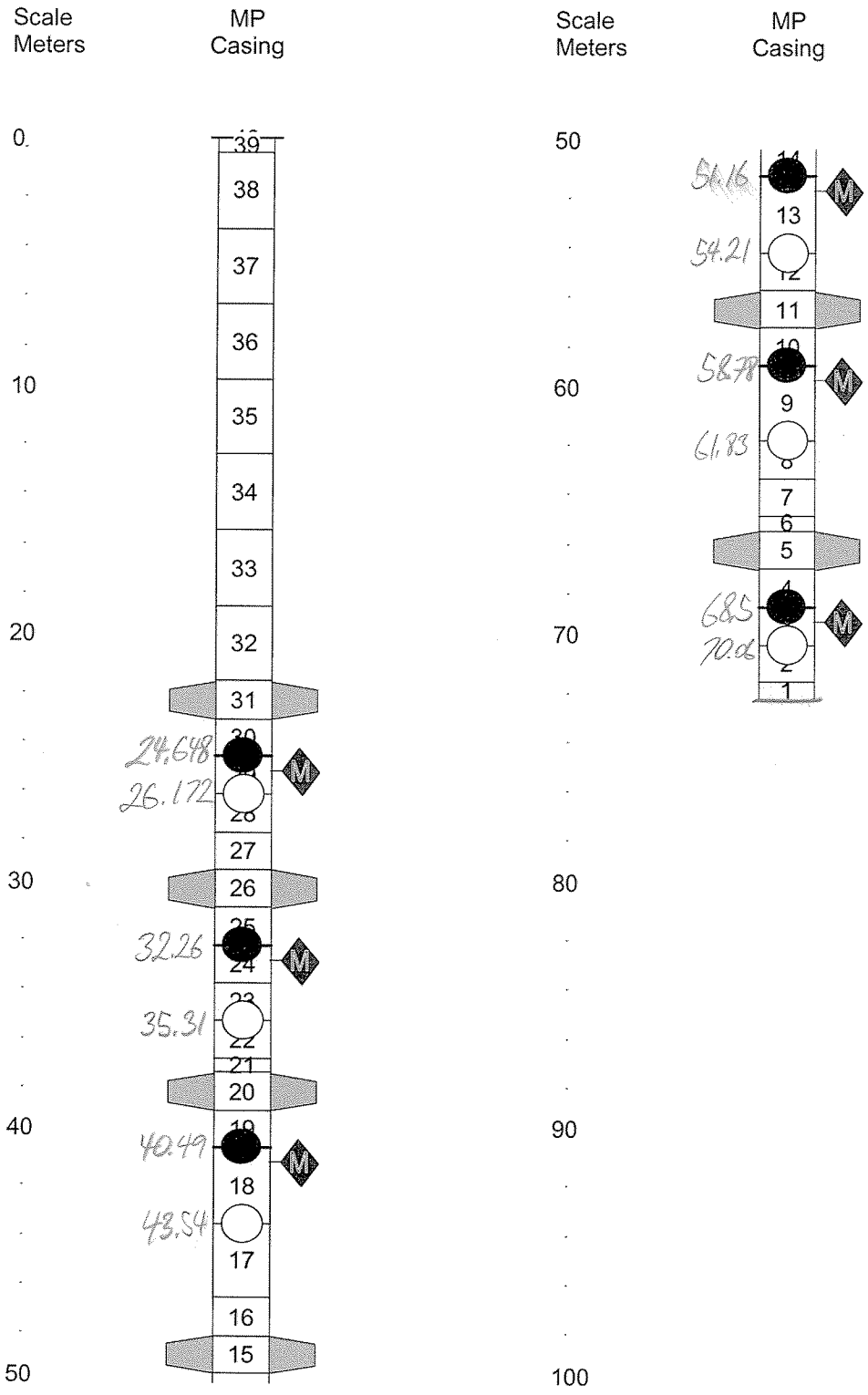
(6) 0205 - MP38 Measurment Port

(6) 0224 - MP38 Pumping Port

(6) 0216 - Magnetic Location Collar

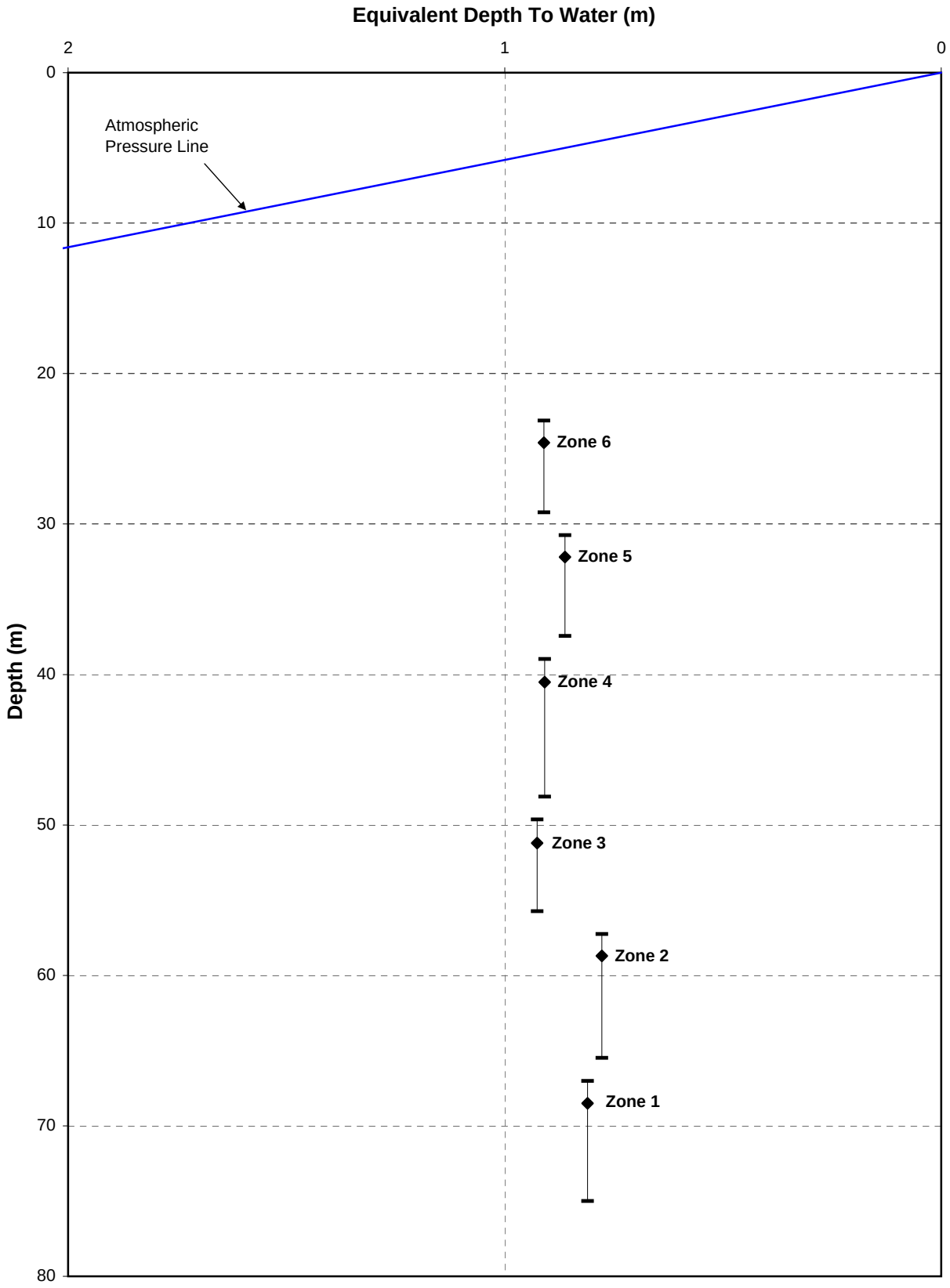
Summary Casing Log

Job No: WB 860
Well: US-3 2007



Piezometric Profile:
Monitoring Well: US-3

Profile Date: December 11, 2007
Comments:Pre-Inflation



Client:OPG
Site:Bruce
Datum:Ground Surface

Figure 1

Plot By:_AJB_ Date:____
Checked By:____Date:____
Westbay Project:WB 860
Piezometric Pressures--Level US-3.xls

Schlumberger WATER SERVICES

Westbay Piezometric Pressures/Levels

Pre-Injection Field Data and Calculation Sheet

Well No.: US-3
Datum: _____
Elev. G.S.: _____
Height of Westbay above G.S.: _____
Elev. top of Westbay Casing: _____
Reference Elevation: _____
Borehole angle: _____

Probe Type: _____
Serial No.: _____
Probe Range: 1000
Westbay Casing Type: _____

Date: DEC/07
Client: QA
Job No.: WB 560
Location: Exca
Weather: Sunny
Operator: AB

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).

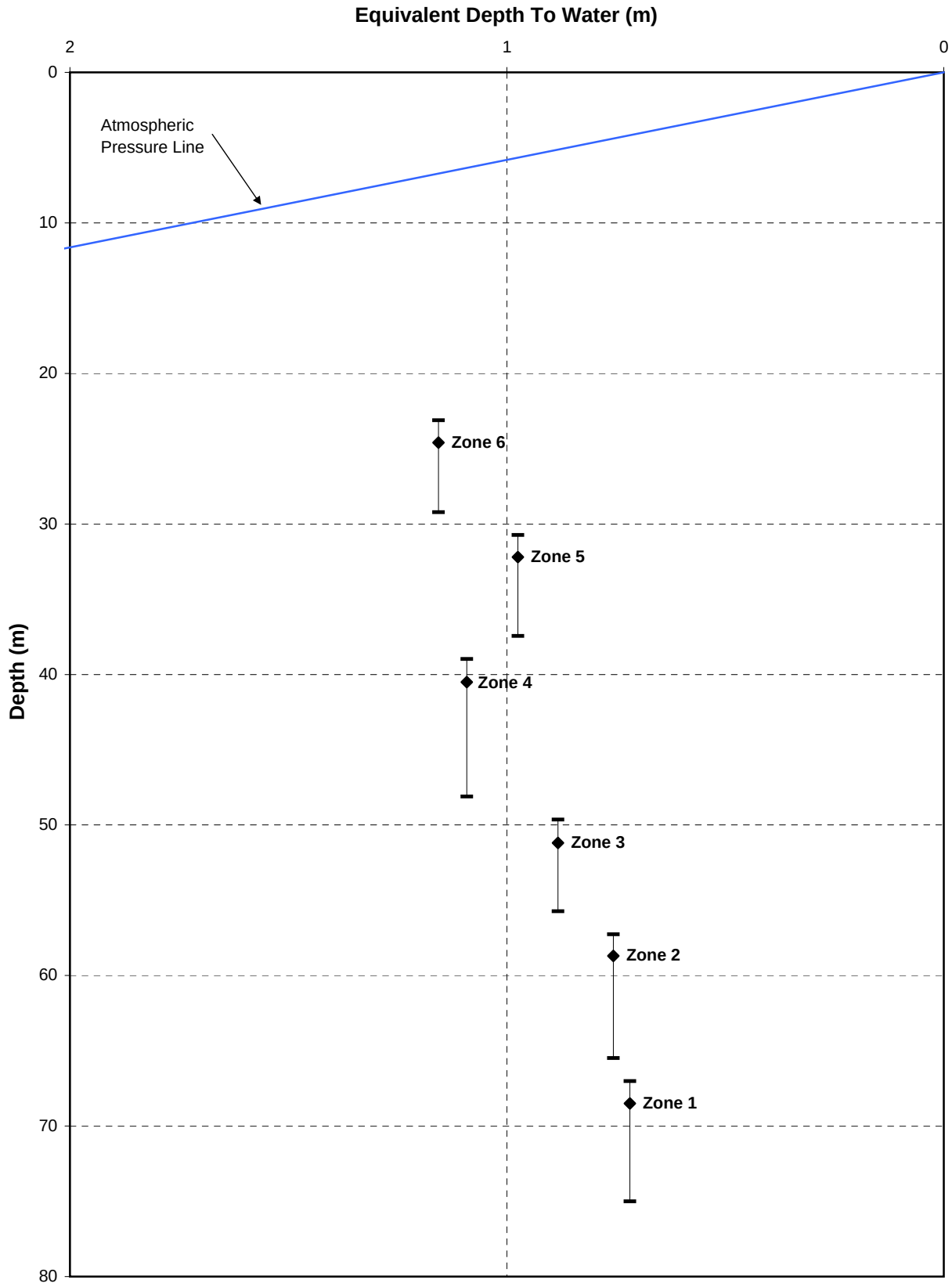
Ambient Reading (P_{atm}) (pressure, temperature, time)
Start: 14.60 Finish: _____
P_{atm} _____ **psi**

Port No.	Port Position From Log ( )	Port Position From Cable ( )	True Port Depth "Dp" ( )	Fluid Pressure Readings			Probe Temp. (°C)	Time H:M:S	Pressure Head Outside Port ( ) H = (P2-Patm)/w	Piez. Level Outside Port ( ) Dz = Dp - H	Comments
				Inside Casing (P1)	Outside Casing (P2)	Inside Casing (P1)					
1	68.5			91.25	110.22	91.25			67.69	0.81	
2	58.7			77.33	96.85	77.33			57.90	0.77	
3	51.2			65.45	85.39	65.45			50.27	0.92	
4	40.5			51.17	70.82	51.17			39.59	0.91	
5	32.2			39.40	59.10	39.40			31.33	0.86	
6	24.6			28.53	49.24	28.53			23.69	0.90	

Notes: w = 0.433 psi/ ft (1.422psi/m) of H_2O
H = pressure head of water in zone
Dz = piezometric level in zone
Dp = true depth of measurement port
Patm = atmospheric pressure

Piezometric Profile
Monitoring Well: US-3

Profile Date:December 11, 2007
Comments:Post-Inflation Profile



Client:OPG
Site:Bruce
Datum:Ground Surface

Figure 2

Plot By:__AJB_ Date:____
Checked By:____ Date:____
Westbay Project:WB 860
Piezometric Pressures--Level US-3.xls

Schlumberger WATER SERVICES

Westbay Piezometric Pressures/Levels

Post-Injection Field Data and Calculation Sheet

Well No.: US-3
Datum: _____
Elev. G.S.: _____
Height of Westbay above G.S.: _____
Elev. top of Westbay Casing: _____
Reference Elevation: _____
Borehole angle: _____

Probe Type: _____
Serial No.: _____
Probe Range: _____
Westbay Casing Type: _____

Date: Dec 11/07
Client: GHL
Job No.: WB880
Location: Buce
Weather: Snow
Operator: AB

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: 14:57 Finish: _____
P_{atm} _____ **psi**

Port No.	Port Position From Log ( )	Port Position From Cable ( )	True Port Depth "Dp" ( )	Fluid Pressure Readings			Probe Temp. (°C)	Time H:M:S	Pressure Head Outside Port ( ) H = (P2-Patm)/w	Piez. Level Outside Port ( ) Dz = Dp - H	Comments
				Inside Casing (P1)	Outside Casing (P2)	Inside Casing (P1)					
1	68.5			91.83	110.82	91.83			67.78	0.71	
2	58.7			77.85	96.85	77.85			57.94	0.76	
3	51.2			66.97	86.02	66.97			50.32	0.88	
4	40.5			51.71	70.53	51.71			39.40	1.09	
5	32.2			39.95	58.91	39.95			31.23	0.97	
6	24.6			29.04	47.86	29.04			23.44	1.16	

Notes: w = 0.433 psi/ ft (1.422psi/m) of H_2O
H = pressure head of water in zone
Dz = piezometric level in zone
Dp = true depth of measurement port
Patm = atmospheric pressure

Casing Installation Log

Company:
Well: US-3 2007
Site:
Project:

Job No: WB 860
Author: AJB

Well Information

Reference Datum:
Elevation of Datum: 0.00 m.
MP Casing Top: 0.00 m.
MP Casing Length: 72.24 m.

Borehole Depth: 90.00 m.
Borehole Inclination:
Borehole Diameter: 0.00 mm

Well Description:

Other References:

File Information

File Name: US3.WWD
Report Date: Sun Dec 09 17:51:40 2007

File Date: Nov 27 14:51:27 2007

Comments

Log Information

Borehole condition confirmed.	(method) VIDEO	Date: 11/27
MP well design & preparation.	By: SS AB	Date: Dec 07
MP well design checked.	By: [signature]	Date: Dec 07
MP well and borehole approved to install.	By: [signature]	Date: Dec 10/07

Casing Installation Log

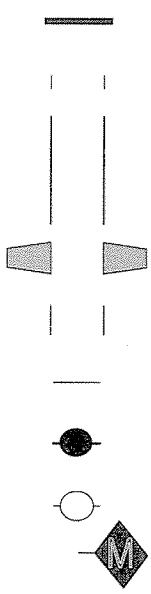
Job No: WB 860
Well: US-3 2007

Legend

(Qty) MP Components (Library - WD Library 7/27/00)

Geology

Backfill/Casing



(2) 0203 - MP38 End Cap

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

(11) 020110 - MP38 Casing 1 (10F/3M)

(6) 0238 - MP38 Packer 74mm (5F/1.5M)

(18) 020105 - MP38 Casing 2 (5F/1.5M)

(27) 0202 - MP38 Regular Coupling

(6) 0205 - MP38 Measurment Port

(6) 0224 - MP38 Pumping Port

(6) 0216 - Magnetic Location Collar

Casing Installation Log

Job No: WB 860
Well: US-3 2007

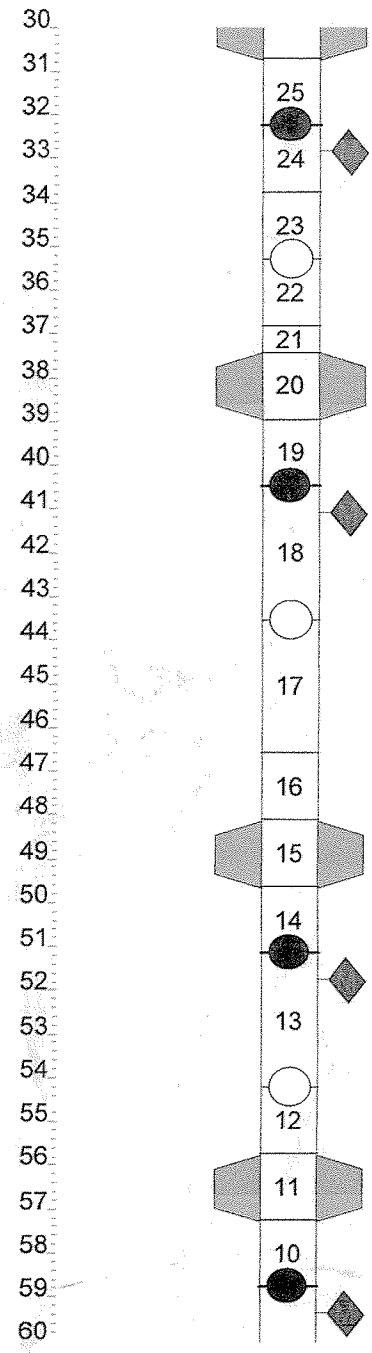
DTW = 19.35m @ 8:30am
DTW = 19.35m @ 9:00am

Scale Meters	MP Casing	QA Tested OK	MP Casing Description
0	39		
1			
2	38		020110 - MP38 Casing 1 (10F/3M)
3			
4			
5	37		020110 - MP38 Casing 1 (10F/3M)
6			
7			
8	36		020110 - MP38 Casing 1 (10F/3M)
9			
10			
11	35		020110 - MP38 Casing 1 (10F/3M)
12			
13			
14	34		020110 - MP38 Casing 1 (10F/3M)
15			
16			
17	33		020110 - MP38 Casing 1 (10F/3M)
18			
19			
20	32		020110 - MP38 Casing 1 (10F/3M)
21			
22			
23	31		0238 - MP38 Packer 74mm (5F/1.5M) 15543
24	30		020105 - MP38 Casing 2 (5F/1.5M)
25			0205 - MP38 Measurment Port 4495
26	29		020105 - MP38 Casing 2 (5F/1.5M)
27	28		0224 - MP38 Pumping Port 7301 020105 - MP38 Casing 2 (5F/1.5M)
28			
29	27		020105 - MP38 Casing 2 (5F/1.5M)
30	26		0238 - MP38 Packer 74mm (5F/1.5M) 15538

 Mon Dec 09 17:50:34 2007

Casing Installation Log

Job No: WB 860
Well: US-3 2007



Casing Installation Log

Job No: WB 860
Well: US-3 2007

Scale Meters	MP Casing	QA Tested OK	MP Casing Description
60			
61			
62	9		020110 - MP38 Casing 1 (10F/3M)
63	8		0224 - MP38 Pumping Port 7459 020105 - MP38 Casing 2 (5F/1.5M)
64	7		020105 - MP38 Casing 2 (5F/1.5M)
65	6		020102 - MP38 Casing 3 (2F/0.6M)
66	5		0238 - MP38 Packer 74mm (5F/1.5M) 15854
67			
68	4		020105 - MP38 Casing 2 (5F/1.5M)
69			0205 - MP38 Measurment Port 4490
70	3		020105 - MP38 Casing 2 (5F/1.5M) 0224 - MP38 Pumping Port 7458
71	2		020105 - MP38 Casing 2 (5F/1.5M)
72	1		020102 - MP38 Casing 3 (2F/0.6M) 0203 - MP38 End Cap
73			
74			
75			
76			
77			
78			
79			
80			
81			
82			
83			
84			
85			
86			
87			
88			
89			
90			

 Dec 09 17:50:34 2007

Schlumberger WATER SERVICES

Sheet ____ of ____

Westbay Packer Inflation Record

Project: Bruce Project No.: 13860 Well No.: US-3

Location: _____ Completed by: AB Date Inflated: —

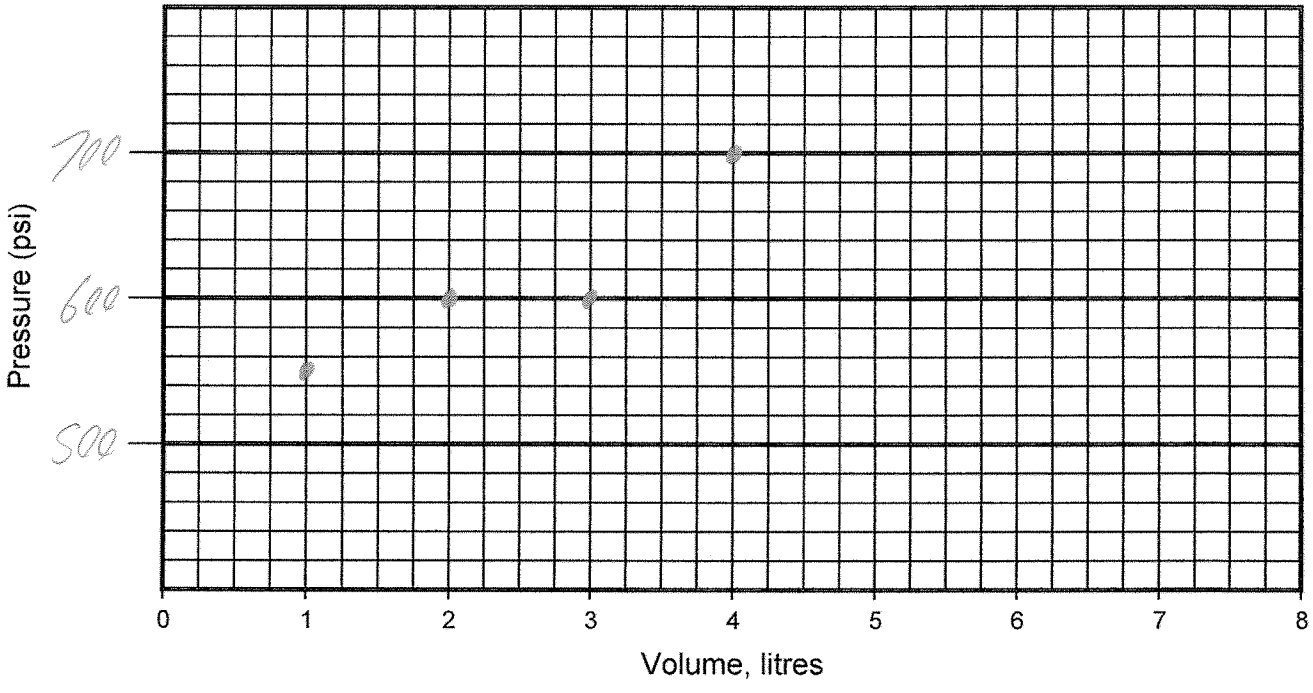
Packer No. 1 Depth (ft / m): — Inflation Tool No.: —

Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 700 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 132 (ft / m) = 187 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 162 psi

Volume, litres	1	2	3	4	—	375				
Pressure, psi	550	600	600	700	—	0				
Volume, litres										
Pressure, psi										



Comments: Packer # Time -

Schlumberger WATER SERVICES

Sheet ____ of ____

Westbay Packer Inflation Record

Project: Bruce Project No.: WB760 Well No.: US-3

Location: _____ Completed by: AB Date Inflated: —

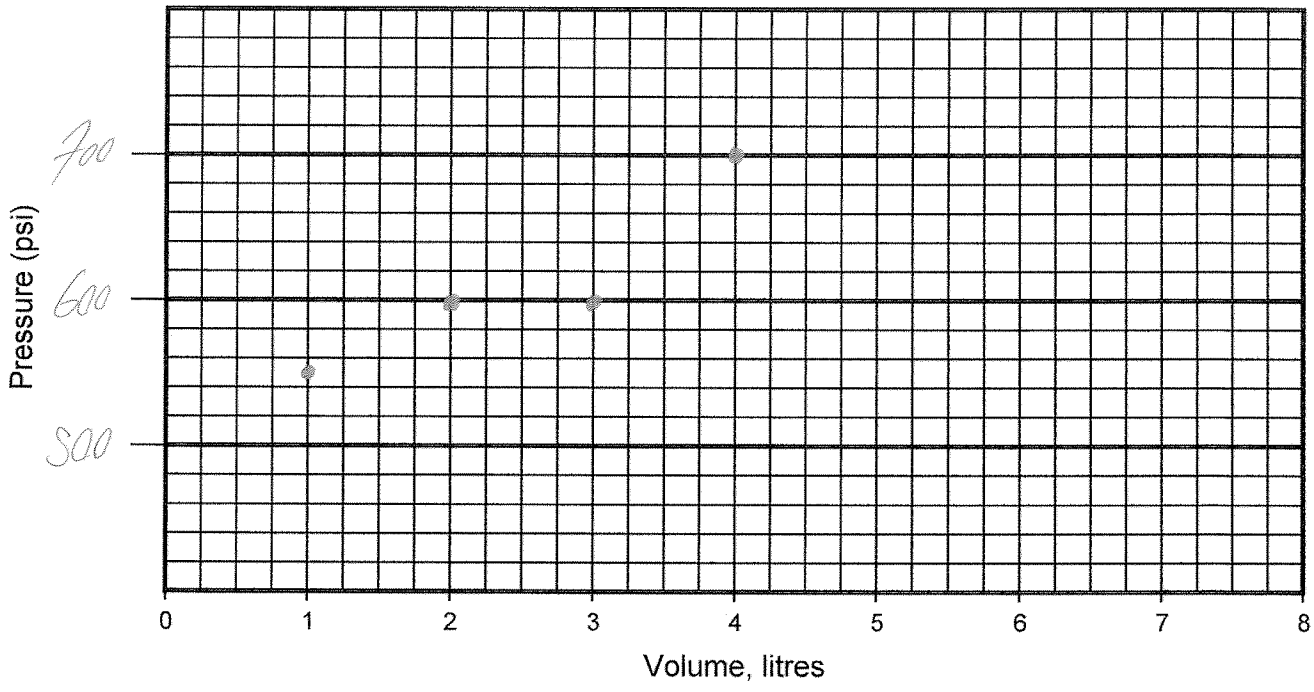
Packer No. 2 Depth (ft / m): — Inflation Tool No.: —

Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 700 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 1.32 (ft / m) = 1.87 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 162 psi

Volume, litres	1	2	3	4	—	3.75				
Pressure, psi	550	600	600	700	—	0				
Volume, litres										
Pressure, psi										



Comments: Packer # Time -

Schlumberger WATER SERVICES

Sheet ____ of ____

Westbay Packer Inflation Record

Project: Bruce Project No.: 42860 Well No.: US-3

Location: _____ Completed by: AB Date Inflated: —

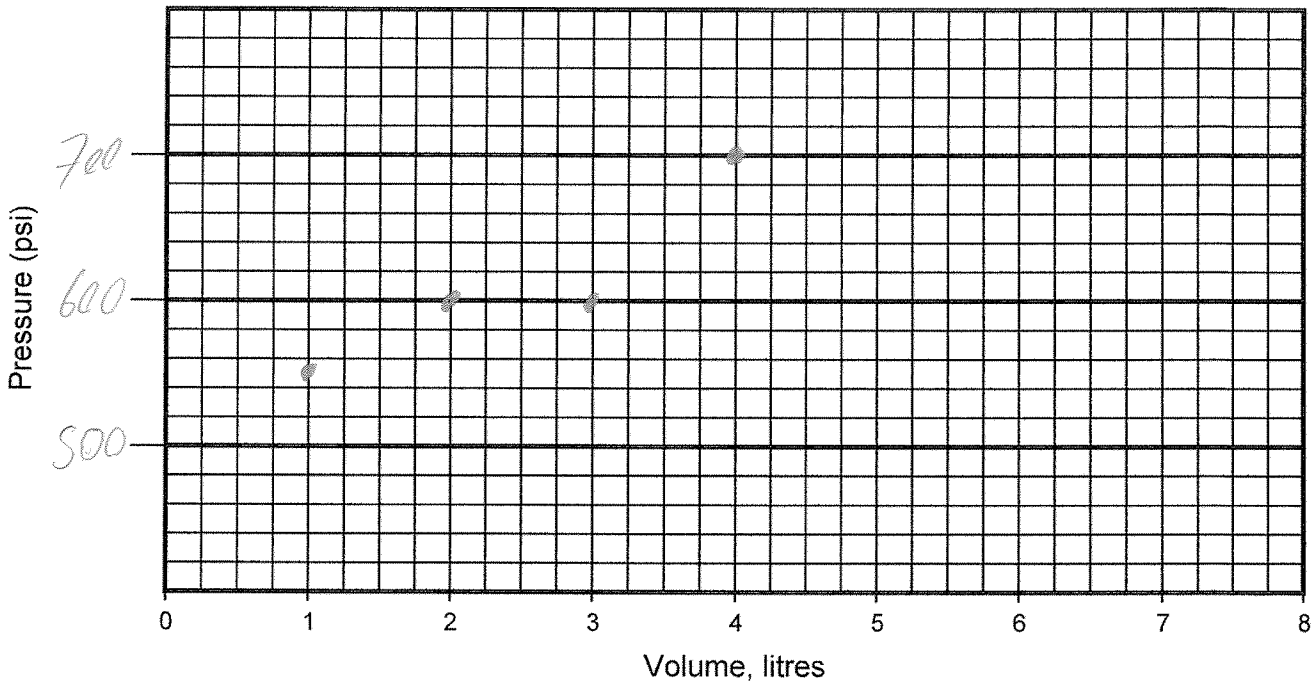
Packer No. 3 Depth (ft / m): — Inflation Tool No.: —

Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 700 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 132 (ft / m) = 1,87 psi (P_W)

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

Volume, litres	1	2	3	4	—	3,75				
Pressure, psi	550	600	600	700	—	0				
Volume, litres										
Pressure, psi										



Comments: Packer # Time -

Schlumberger WATER SERVICES

Sheet ____ of ____

Westbay Packer Inflation Record

Project: Bruce Project No.: 60380 Well No.: US-3

Location: _____ Completed by: AB Date Inflated: —

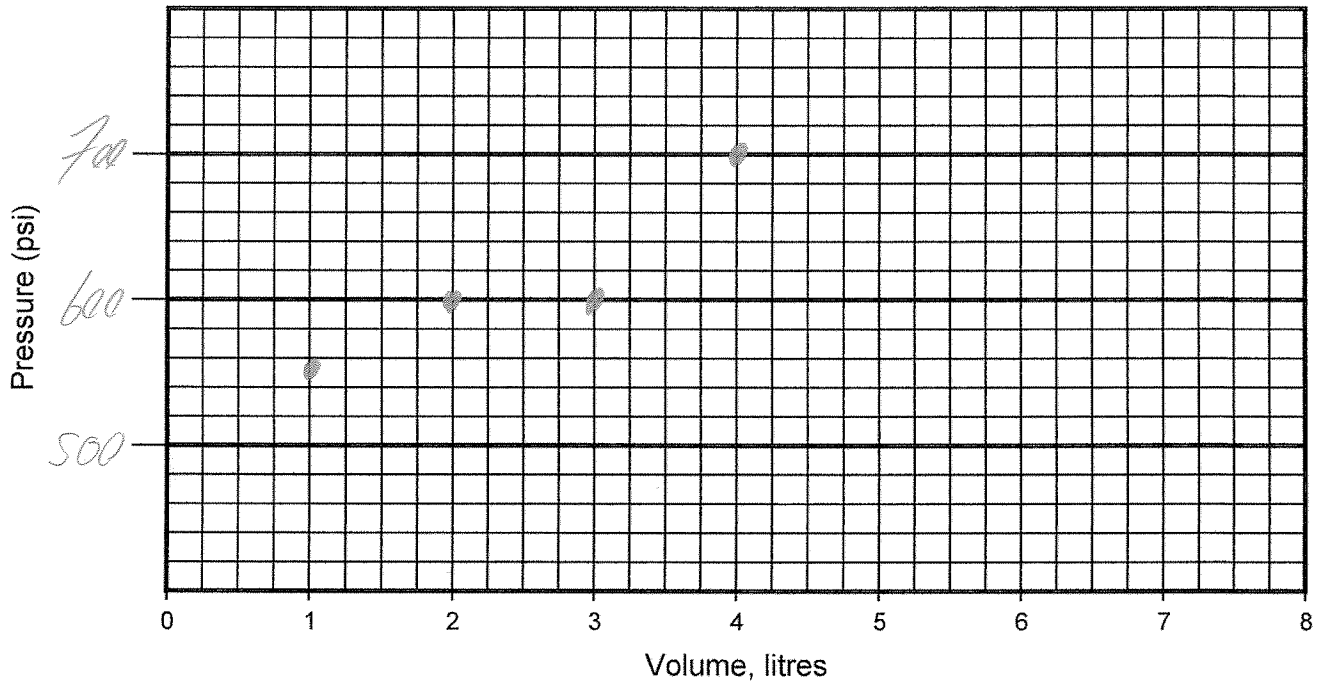
Packer No. 4 Depth (ft / m): _____ Inflation Tool No.: —

Packer Valve Pressure, P_V: 145 psi Final Line Pressure, P_L: 700 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 132 (ft / m) = 187 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 187 psi

Volume, litres	1	2	3	4	—	3.75				
Pressure, psi	550	600	600	700	—	0				
Volume, litres										
Pressure, psi										



Comments: Packer # Time -

Schlumberger WATER SERVICES

Sheet ____ of ____

Westbay Packer Inflation Record

Project: Ennis Project No.: 14360 Well No.: US-3

Location: _____ Completed by: _____ Date Inflated: _____

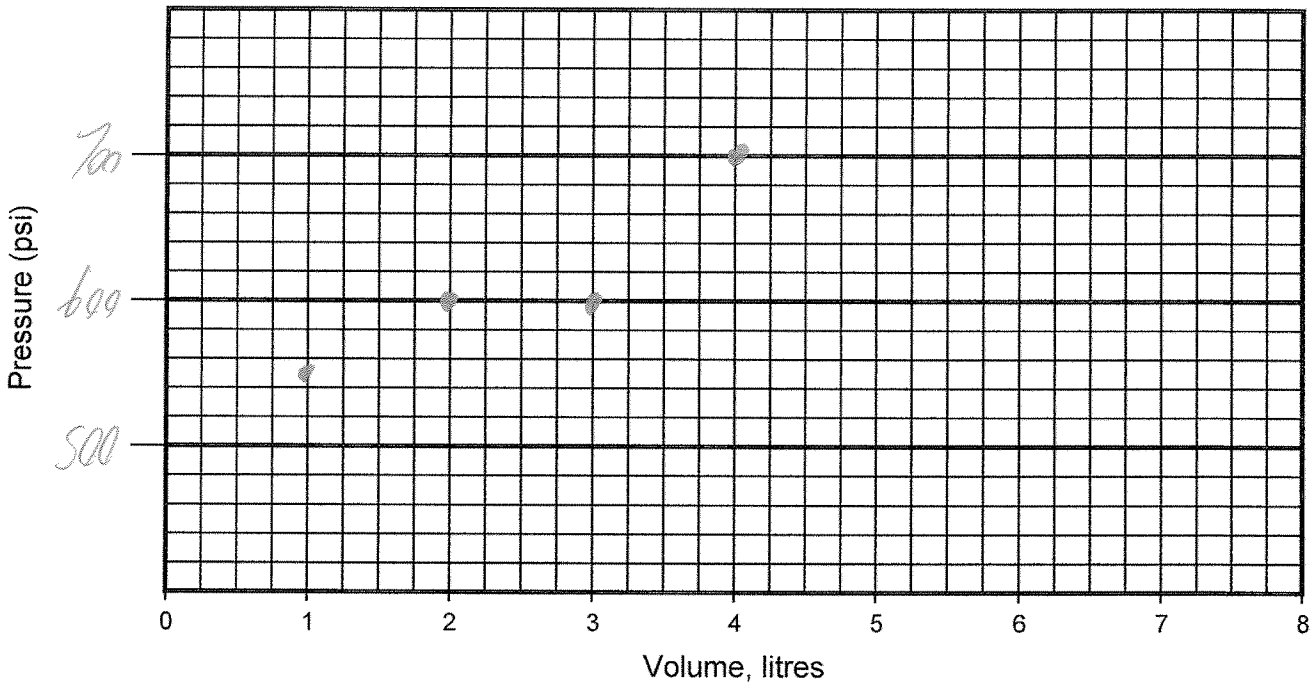
Packer No. 5 Depth (ft / m): _____ Inflation Tool No.: _____

Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 700 psi Tool Pressure, P_T: 400 psi

Borehole Water Level: 632 (ft / m) = 1.87 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 162 psi

Volume, litres	1	2	3	4	—	3.75				
Pressure, psi	550	600	600	700	—	0				
Volume, litres										
Pressure, psi										



Comments: Packer # Time -

Schlumberger WATER SERVICES

Sheet ____ of ____

Westbay Packer Inflation Record

Project: Bruce | Project No.: 41860 | Well No.: US-3

Location: | Completed by: AB | Date Inflated: —

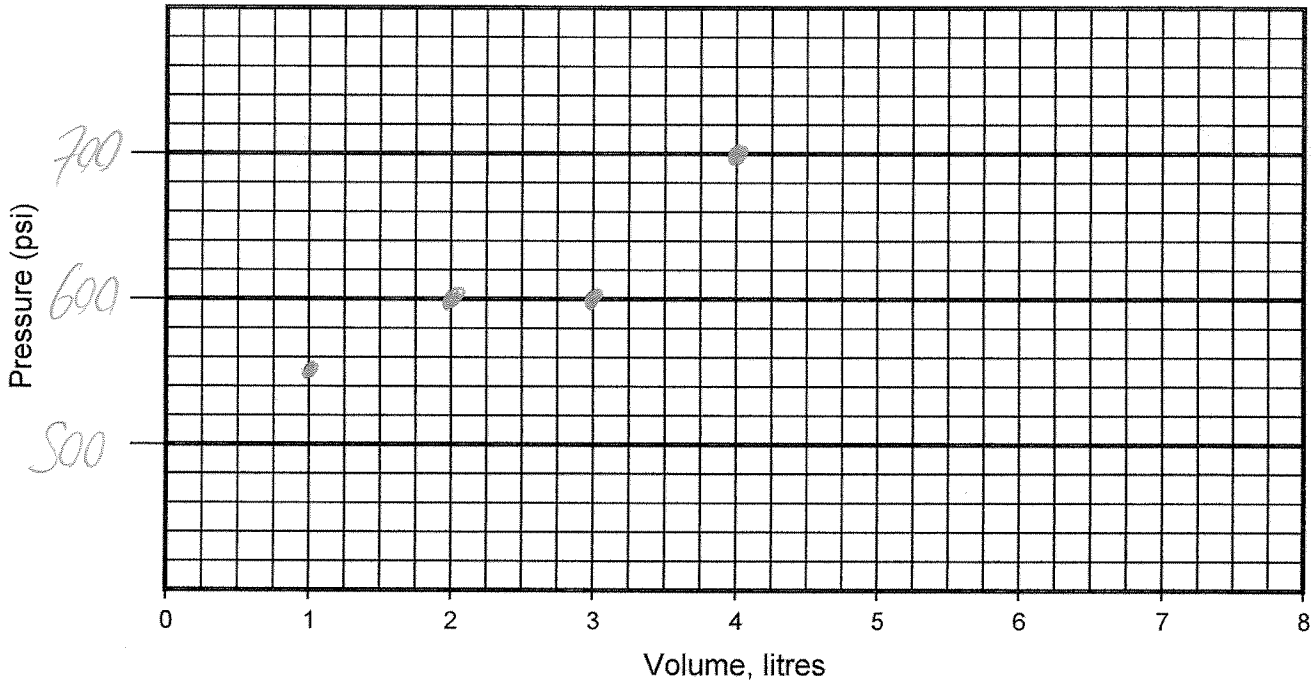
Packer No. 6 | Depth (ft / m): — | Inflation Tool No.: —

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 700 psi | Tool Pressure, P_T: 400 psi

Borehole Water Level: 132 (ft / m) = 187 psi (P_W)

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

Volume, litres	1	2	3	4	—	375				
Pressure, psi	550	600	600	700	—	0				
Volume, litres										
Pressure, psi										



Comments: Packer # | Time -

APPENDIX C

Westbay Casing Completion Report – US-7

Completion Report

Monitoring Well

US-7

OPG

Deep Geologic Repository Investigation

Ontario, Canada

Prepared for:

Intera Engineering Ltd.
Canada

Prepared by:

Westbay Instruments Inc.
WB860
January 30, 2008

CONTENTS:

		Page
1.	INTRODUCTION	1
2.	INSTALLATION	1
	2.1 Previous Activities	1
	2.2 Preparation of Monitoring Well Design	1
	2.3 Layout of Westbay Casing Components	1
	2.4 Lowering of Westbay Components	2
	2.5 Hydraulic Integrity Testing	2
	2.6 Positioning of Westbay Components	2
	2.7 Pre-Inflation Profile	3
	2.8 Inflation of Westbay Packers	3
3.	FLUID PRESSURE MEASUREMENTS	3

APPENDIX

APPENDIX: Monitoring Well: US-7

1. Introduction

This report and the attached Appendix document the technical services carried out by Westbay Instruments Inc under Intera Engineering Ltd. Purchase Order 06-219-25.20-2 The Westbay System for groundwater monitoring was installed in an open borehole at the OPG Deep Geologic Repository near Tiverton, Ontario.

Westbay technical services representative Mr. Andrew Bessant was on site for the installation on December 10, 2007. This report documents the installation tasks and related QA checks.

2. Installation

The monitoring well was installed as indicated below.

(Note: all depths are with respect to ground surface. Monitoring well reference elevation was not available at the time of writing).

Table 1, Summary of Westbay Well Installation

Monitoring Well No.	Installation Date	Borehole Depth (m)	Steel Casing Depth (m)	MP38 Casing Length (m)	No. Monitoring Zones
US-7	Dec 10, 2007	90	20	84.3	7

The well was installed according to the procedures described below.

2.1 Previous Activities

As reported by Intera nominal 4-inch diameter borehole was drilled using rotary diamond coring methods in October 1986. A steel 4 inch diameter (4.25-inch) casing was installed in the borehole to a depth of 20m. In 1988 Westbay Instruments Inc. install the first US-7 monitoring well, and in December 2007 US-7 was removed. A video log was conducted prior to installation of the Westbay well.

2.2 Preparation of Monitoring Well Design

Preliminary monitoring zone locations for the Westbay System well were sent to Westbay by Mr. Sean Sterling of Intera. The casing design was used to construct a preliminary Casing Installation Log, which specifies the location of components in the well. The Casing Installation Log was reviewed in the field with Intera prior to installation of the well. The Casing Installation 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 zone to provide the capability to measure fluid pressures and collect fluid samples. A pumping port coupling was also included in each zone to provide purging and hydraulic conductivity testing capabilities.

2.3 Layout of Westbay Casing Components

Prior to Westbay System installation, the Westbay System casing components were set out at the borehole according to the sequence indicated on the Casing Installation 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 the casing sections. Magnetic location collars were attached 2 feet below the top of the measurement port in each sampling zone.

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

2.4 Lowering of Westbay Components

The Westbay System casing components were lowered into the well by hand as buoyancy conditions allowed. Fluorescein labeled drinking water supplied by Intera was added to the Westbay System casing when necessary to counter buoyancy effects while components were lowered into the borehole and for testing of joint seals during lowering. Each casing 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 casing component are noted on the Casing Installation Log by check marks.

2.5 Hydraulic Integrity Testing

After the Westbay casing string was lowered into the borehole, the water inside the Westbay casing was monitored at depth different from the open borehole water level for a minimum period of thirty minutes to confirm hydraulic integrity of the casing. The data from the hydraulic integrity test is shown on the first page of the Casing Installation Log in the Appendix. And in Table 2 below

Table 2, Borehole and Westbay Casing Water Levels

Monitoring Well No.	Borehole water level (top of 4-inch casing)	Westbay Water Level (top of casing)
US-7	1.67 m	18.10 m

2.6 Positioning of Westbay Components

After the components were lowered into the well, the Westbay casing string was positioned as indicated on the cover page of the Casing Installation Log. Ground surface was used as the borehole datum. The Westbay casing string was supported in this position while packer inflation was carried out.

The positioning of the Westbay casing components is based on the "nominal" lengths of Westbay casing components. The positioning calculations do not include allowances for borehole temperature or deviation effects, which for this site are expected to be minimal. The attached figure titled "MOSDAX Transducer Position" provides information to correlate the position of MOSDAX Transducer sensors 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 centerline depths and zone length. The Summary Casing Log, which shows the final "as-

built" locations of the components in the well, is included in the Appendix. The depths of key items in the well are shown on Table 3.

2.7 Pre-inflation Profile

A pre-inflation pressure profile was carried out at the well prior to inflating the packers to confirm the proper operation and position of measurement ports and magnetic collars. The data confirmed that the ports operated properly and are positioned correctly. The data for the pre-inflation profile is located in the Appendix (Figure 1) and on the Field Data and Calculation Sheet.

2.8 Inflation of Westbay System Packers

The Westbay system packers were inflated sequentially beginning at the bottom of the well using Fluorescein labeled drinking water provided by Intera. The Westbay Model No. 6055 vented inflation tool was used for packer inflation. All of 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. 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. Longer term monitoring may be required to establish representative fluid pressures.

A plot of the Piezometric levels in all zones in the well is shown on Figure 2 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 the pressure profile of the MP monitoring well are also enclosed in the Appendix.

Table 3, Depths of Key Items for MP monitoring well US-7.

Zone No.	Zone Interval* (m)	MP Casing No. (from MP Log)	Packer No.	Packer Serial No.	Nominal Packer Position *** (m)	Magnetic Collar Depth (m)	Measurement Port Depth** (m)	Pumping Port Depth** (m)	Port Name
Zone 1	89 – 76.6	1-4	1	15850	75.1	78.7	78.1	81.6	Zone 1
Zone 2	75 – 66.8	6-10	2	15849	65.3	69.5	68.9	72.0	Zone 2
Zone 3	65.3 – 56.2	12-15	3	15852	54.6	58.3	57.7	60.7	Zone 3
Zone 4	54.6 – 43.9	17-21	4	15847	42.5	49.1	48.5	45.5	Zone 4
Zone 5	42.5 – 31.8	23-26	5	15856	30.3	33.9	33.3	36.3	Zone 5
Zone 6	30.3 – 27.5	28-30	6	15856	25.9	28.9	28.3	29.6	Zone 6
Zone 7	25.9 – 21.4	32-34	7	15848	19.9	23.5	22.9	24.5	Zone 7

* Depths are with respect to ground level.

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

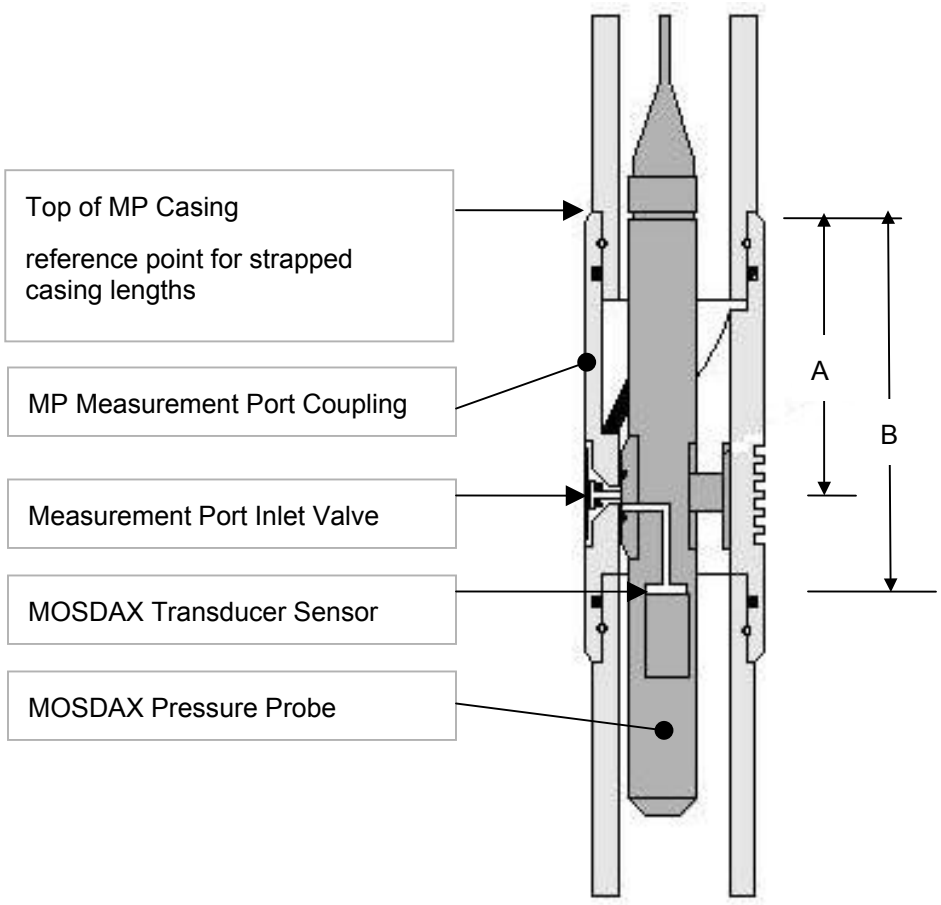
*** Packer positions are referenced to the top Westbay System coupling on the packer.

Technical Note

Schlumberger WATER SERVICES

MOSDAX Transducer Position

In an MP System Measurement Port Coupling



System	Measurement Port Type	A	B
Plastic MP38	0205	4.5" (114.3 mm)	6.5" (165.1 mm)

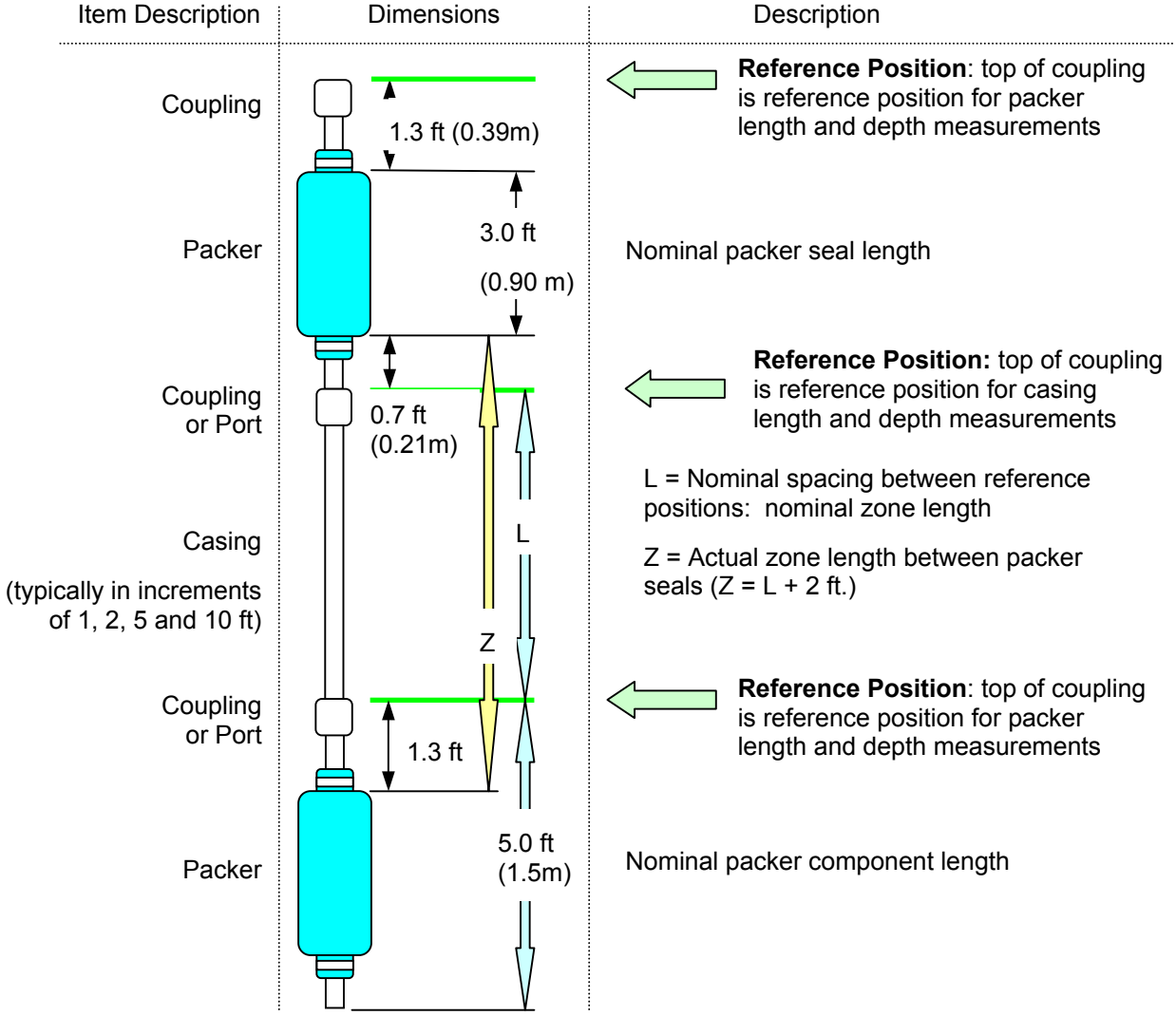
DL July 11, 2006

Technical Note

Schlumberger WATER SERVICES

Dimensions of Packer Seals and Monitoring Zones

Westbay System – Plastic MP38



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 1

Monitoring Well US-7

Summary Casing Log	- 3 pages
Figure 1, Pre-Inflation Pressure Profile	- 1 page
Pre-inflation Piezometric Pressure/Levels	
Field Data and Calculation Sheet (Dec 10, 2008)	- 1 page
Figures 2, Piezometric Pressure Profile	- 1 page
Piezometric Pressure/Levels	
Field Data and Calculation Sheet (Dec 11, 2008)	- 1 page
Casing Installation Log (field copy)	- 5 pages
MP Packer Inflation Records	- 7 pages

Summary Casing Log

Company:
Well: US-7 2007
Site:
Project:

Job No: WB 860
Author: AJB

Well Information

Reference Datum:
Elevation of Datum: 0.00 m.
MP Casing Top: 0.00 m.
MP Casing Length: 84.26 m.

Borehole Depth: 90.00 m.
Borehole Inclination:
Borehole Diameter: 0.00 mm

Well Description:

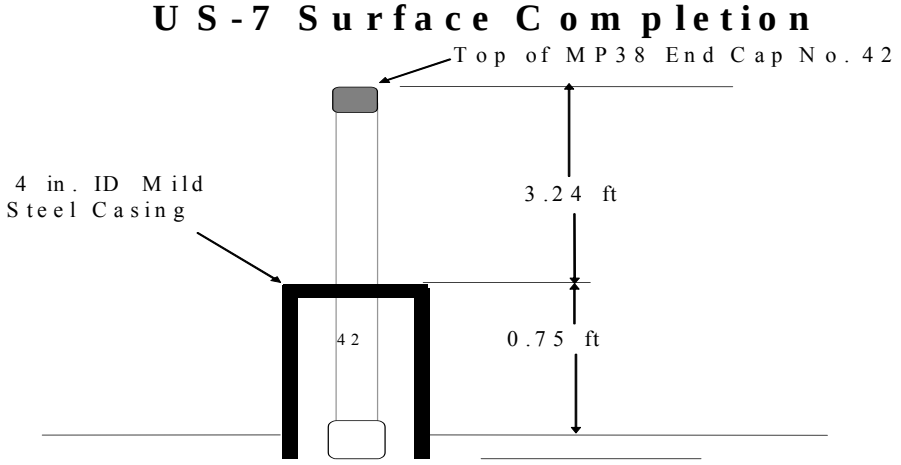
Other References:

File Information

File Name: US7.WWD
Report Date: Wed Feb 20 14:10:57 2008

File Date: Jan 18 15:15:07 2008

Sketch of Wellhead Completion

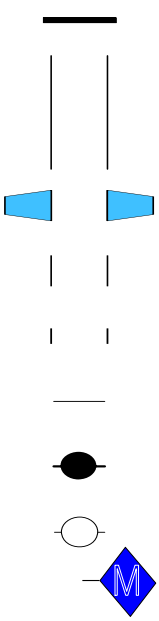


Legend

(Qty) MP Components (Library - WD Library 7/27/00)

Geology

Backfill/Casing



(2) 0203 - MP38 End Cap

(16) 020110 - MP38 Casing 1 (10F/3M)

(7) 0238 - MP38 Packer 74mm (5F/1.5M)

(16) 020105 - MP38 Casing 2 (5F/1.5M)

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

(28) 0202 - MP38 Regular Coupling

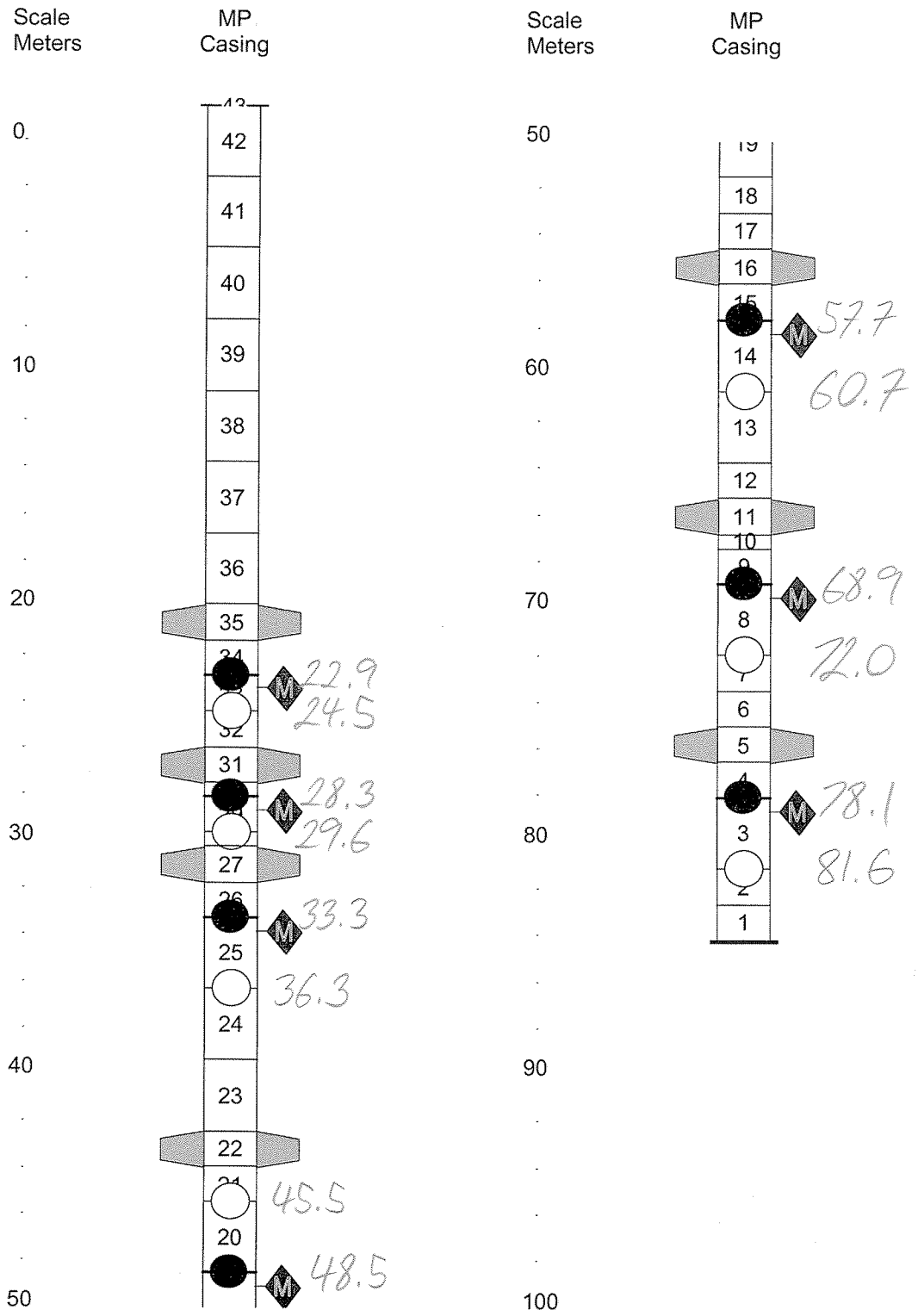
(7) 0205 - MP38 Measurment Port

(7) 0224 - MP38 Pumping Port

(7) 0216 - Magnetic Location Collar

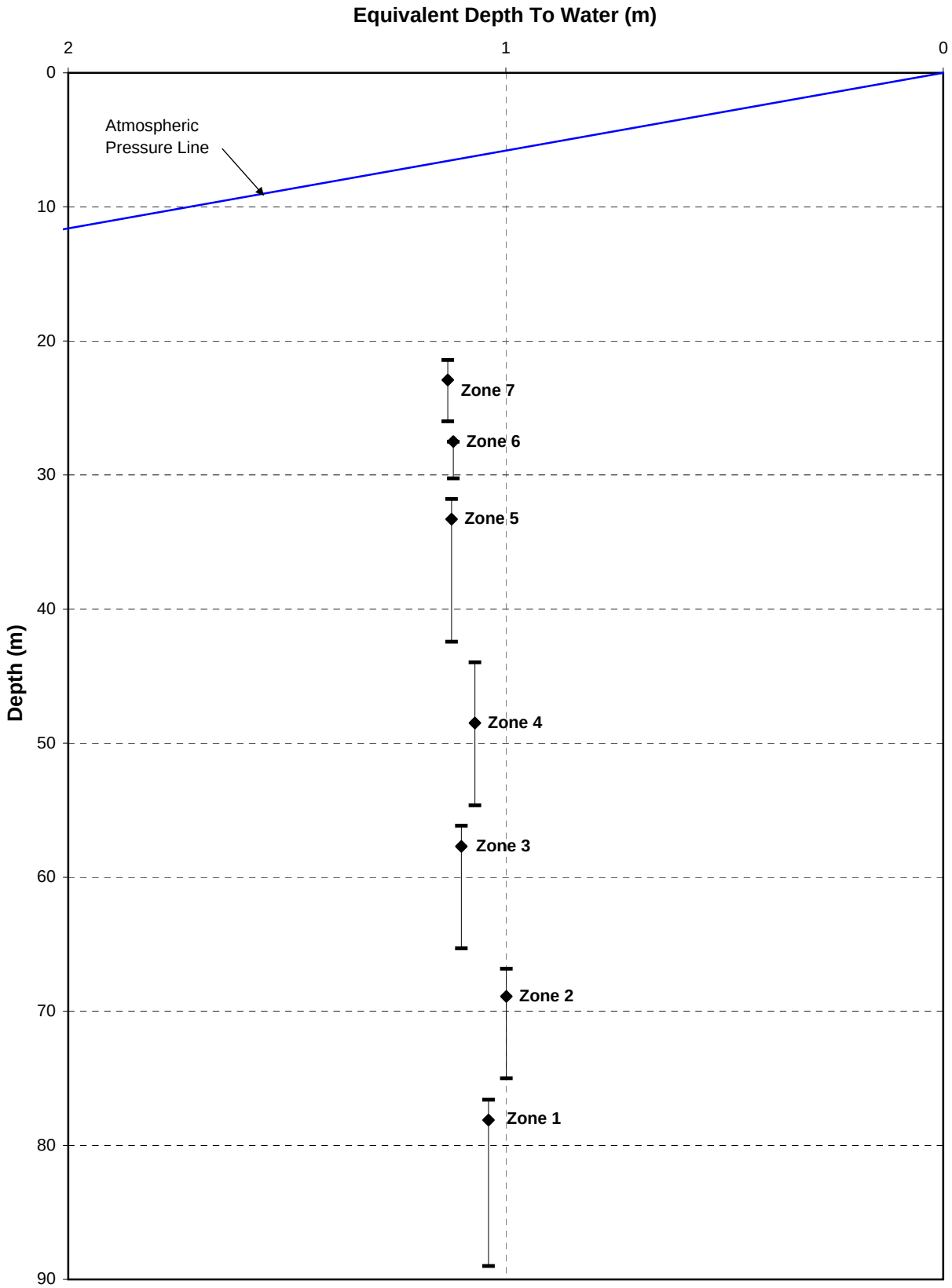
Summary Casing Log

Job No: WB 860
Well: US-7 2007



Piezometric Profile:
Monitoring Well: US-7

Profile Date: December 10, 2007
Comments:Pre-Inflation



Client:OPG
Site:Bruce
Datum:Ground Surface

Figure 1

Plot By:_AJB_ Date:____
Checked By:____Date:____
Westbay Project:WB 860
Piezometric Pressures--Level US-7.xls

Schlumberger WATER SERVICES

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Well No.: US-7
Datum:
Elev. G.S.:
Height of Westbay above G.S.:
Elev. top of Westbay Casing:
Reference Elevation:
Borehole angle:

Probe Type: FMS
Serial No.: 3554
Probe Range:
Westbay Casing Type:

Date: Dec 10/07
Client:
Job No.:
Location:
Weather:
Operator:

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).

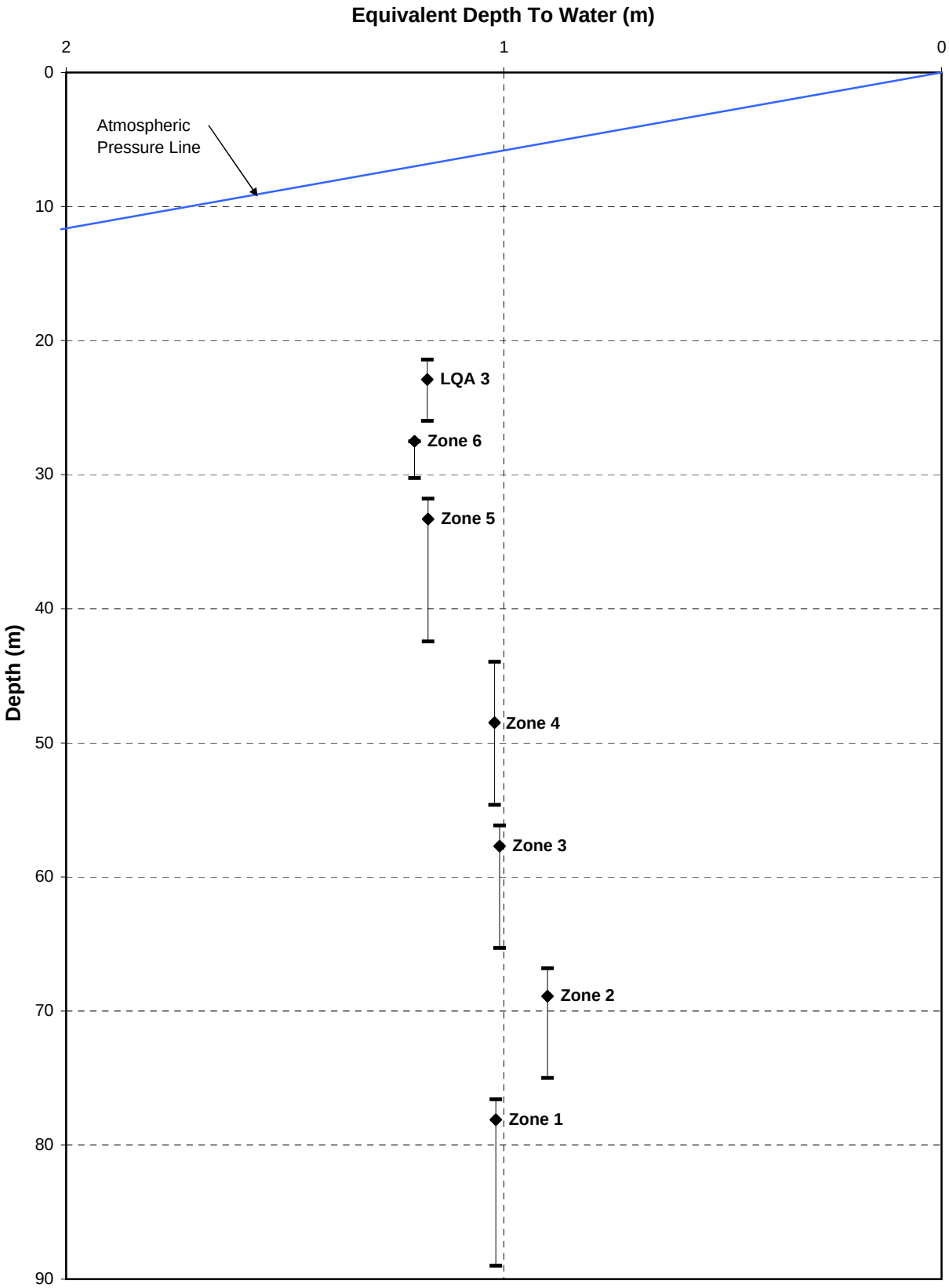
Ambient Reading (P_{atm}) (pressure, temperature, time)
Start: 11:45am Finish: 12:17
14.60 P_{atm} 14.58 **psi**

Port No.	Port Position From Log ( )	Port Position From Cable ( )	True Port Depth "Dp" ( )	Fluid Pressure Readings			Probe Temp. (°C)	Time H:M:S	Pressure Head Outside Port ( ) H = (P2-Patm)/w	Piez. Level Outside Port ( ) Dz = Dp - H	Comments
				Inside Casing (P1)	Outside Casing (P2)	Inside Casing (P1)					
1	73.11			94.7	124.09	94.7			72.07	1.04	✓
2	68.9			81.6	111.02	81.6			67.90	1.00	✓
3	57.88			65.5	94.97	65.5			56.60	1.10	✓
*4	45.5	48		52.4	81.95	52.4			47.43	1.07	✓
5	33.3			30.6	60.29	30.6			32.18	1.12	✓
6	27.5			22.4	52.06	22.4			26.38	1.12	✓
7	22.9			15.85	45.51	15.85			21.77	1.13	✓

Notes: w = 0.433 psi/ ft (1.422psi/m) of H_2O
H = pressure head of water in zone
Dz = piezometric level in zone
Dp = true depth of measurement port
Patm = atmospheric pressure

Piezometric Profile
Monitoring Well: US-7

Profile Date:December 11, 2007
Comments:Post-Inflation Profile



Plot By:__AJB_ Date:____
Checked By:____ Date:____

Client:OPG
Site:Bruce
Datum:Ground Surface

Figure 2

Westbay Project:WB 860
Piezometric Pressures--Level US-7.xls

Schlumberger
WATER SERVICES

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Well No.: US-7
Datum:
Elev. G.S.:
Height of Westbay above G.S.:
Elev. top of Westbay Casing:
Reference Elevation:
Borehole angle:

Probe Type: EMS
Serial No.: 3554
Probe Range: 1000
Westbay Casing Type: 38

Date: Dec 11/07
Client: ORC
Job No.: WP860
Location: Bruce
Weather: Snow
Operator: AB

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: 14:52 Finish:
P_{atm} _____ **psi**

Port No.	Port Position From Log (m)	Port Position From Cable (m)	True Port Depth "Dp" (m)	Fluid Pressure Readings			Probe Temp. (°C)	Time H:M:S	Pressure Head Outside Port (m) H = (P2-Patm)/w	Piez. Level Outside Port (m) Dz = Dp - H	Comments
				Inside Casing (P1)	Outside Casing (P2)	Inside Casing (P1)					
1	78.1		---	101.69	124.04	101.69			77.09	1.02	
2	68.9		---	88.67	111.13	88.65			68.00	0.98	
3	57.7		---	72.49	95.04	72.49			56.69	1.01	
4	48.5		---	59.42	81.99	59.42			47.48	1.02	
5	33.3		---	37.63	60.19	37.63			32.13	1.17	
6	27.5		---	29.33	51.91	29.33			26.30	1.20	
7	22.9		---	22.35	45.42	22.35			21.73	1.17	

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

Casing Installation Log

Company:
Well: US-7 2007
Site:
Project:

Job No: WB 860
Author: AJB

Well Information

Reference Datum:
Elevation of Datum: 0.00 m.
MP Casing Top: 0.00 m.
MP Casing Length: 84.26 m.

Borehole Depth: 90.00 m.
Borehole Inclination:
Borehole Diameter: 0.00 mm

Well Description:

Other References:

File Information

File Name: US7.WWD
Report Date: Sun Dec 09 17:48:44 2007

File Date: Nov 27 13:58:26 2007

Comments

Log Information

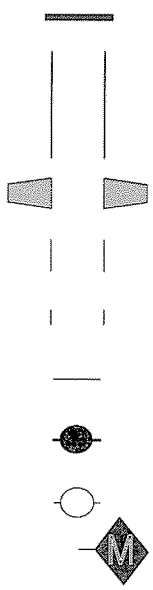
Borehole condition confirmed.	(method)	Date:
MP well design & preparation.	By:	Date:
MP well design checked.	By:	Date:
MP well and borehole approved to install.	By:	Date:

Legend

(Qty) MP Components (Library - WD Library 7/27/00)

Geology

Backfill/Casing



(2) 0203 - MP38 End Cap

(16) 020110 - MP38 Casing 1 (10F/3M)

(7) 0238 - MP38 Packer 74mm (5F/1.5M)

(16) 020105 - MP38 Casing 2 (5F/1.5M)

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

(28) 0202 - MP38 Regular Coupling

(7) 0205 - MP38 Measurment Port

(7) 0224 - MP38 Pumping Port

(7) 0216 - Magnetic Location Collar

Casing Installation Log

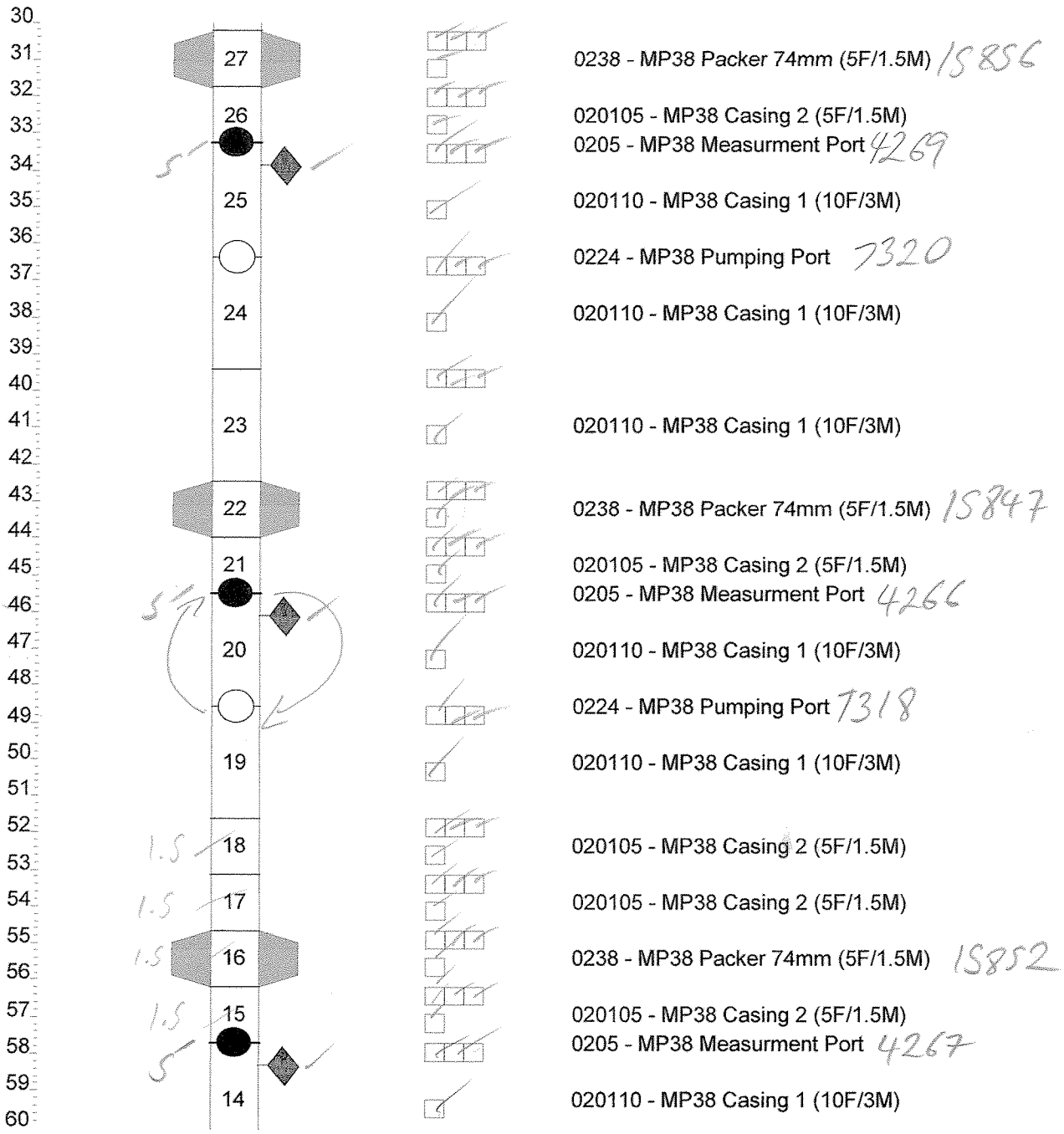
Job No: WB 860
Well: US-7 2007

Drw = 18.10m @ 12:32
18.10 @ 12:37
18.10 @ 1:00

Scale Meters	MP Casing	QA Tested OK	MP Casing Description
0	42		020110 - MP38 Casing 1 (10F/3M)
1			
2			
3	41		020110 - MP38 Casing 1 (10F/3M)
4			
5			
6	40		020110 - MP38 Casing 1 (10F/3M)
7			
8			
9	39		020110 - MP38 Casing 1 (10F/3M)
10			
11			
12	38		020110 - MP38 Casing 1 (10F/3M)
13			
14			
15	37		020110 - MP38 Casing 1 (10F/3M)
16			
17			
18	36		020110 - MP38 Casing 1 (10F/3M)
19			
20			
21	35		0238 - MP38 Packer 74mm (5F/1.5M) 15848
22			
23	34		020105 - MP38 Casing 2 (5F/1.5M)
24	33		0205 - MP38 Measurment Port 4270 020105 - MP38 Casing 2 (5F/1.5M)
25			0224 - MP38 Pumping Port 7316
26	32		020105 - MP38 Casing 2 (5F/1.5M)
27	31		0238 - MP38 Packer 74mm (5F/1.5M) 15856
28			020102 - MP38 Casing 3 (2F/0.6M)
29	29		0205 - MP38 Measurment Port 4268 020105 - MP38 Casing 2 (5F/1.5M)
30			0224 - MP38 Pumping Port 7345 020102 - MP38 Casing 3 (2F/0.6M)

Casing Installation Log

Job No: WB 860
Well: US-7 2007



Casing Installation Log

Job No: WB 860
Well: US-7 2007

Scale Meters	MP Casing	QA Tested OK	MP Casing Description
60			
61			0224 - MP38 Pumping Port 7321
62	13		020110 - MP38 Casing 1 (10F/3M)
63			
64			
65	12		020105 - MP38 Casing 2 (5F/1.5M)
66	11		0238 - MP38 Packer 74mm (5F/1.5M) 15849
67			
68	10		020102 - MP38 Casing 3 (2F/0.6M)
69	9		020105 - MP38 Casing 2 (5F/1.5M)
70			0205 - MP38 Measurment Port 4264
71	8		020110 - MP38 Casing 1 (10F/3M)
72			0224 - MP38 Pumping Port 7317
73	7		020105 - MP38 Casing 2 (5F/1.5M)
74			
75	6		020105 - MP38 Casing 2 (5F/1.5M)
76	5		0238 - MP38 Packer 74mm (5F/1.5M) 15850
77			
78	4		020105 - MP38 Casing 2 (5F/1.5M)
79			0205 - MP38 Measurment Port 4265
80	3		020110 - MP38 Casing 1 (10F/3M)
81			
82	2		0224 - MP38 Pumping Port 7319 020105 - MP38 Casing 2 (5F/1.5M)
83			
84	1		020105 - MP38 Casing 2 (5F/1.5M)
85			0203 - MP38 End Cap
86			
87			
88			
89			
90			

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Sheet____of____

Westbay Packer Inflation Record

Project: OPG Project No.: WB860 Well No.: US-7

Location: Bruce Completed by: AB Date Inflated: Dec 10/07

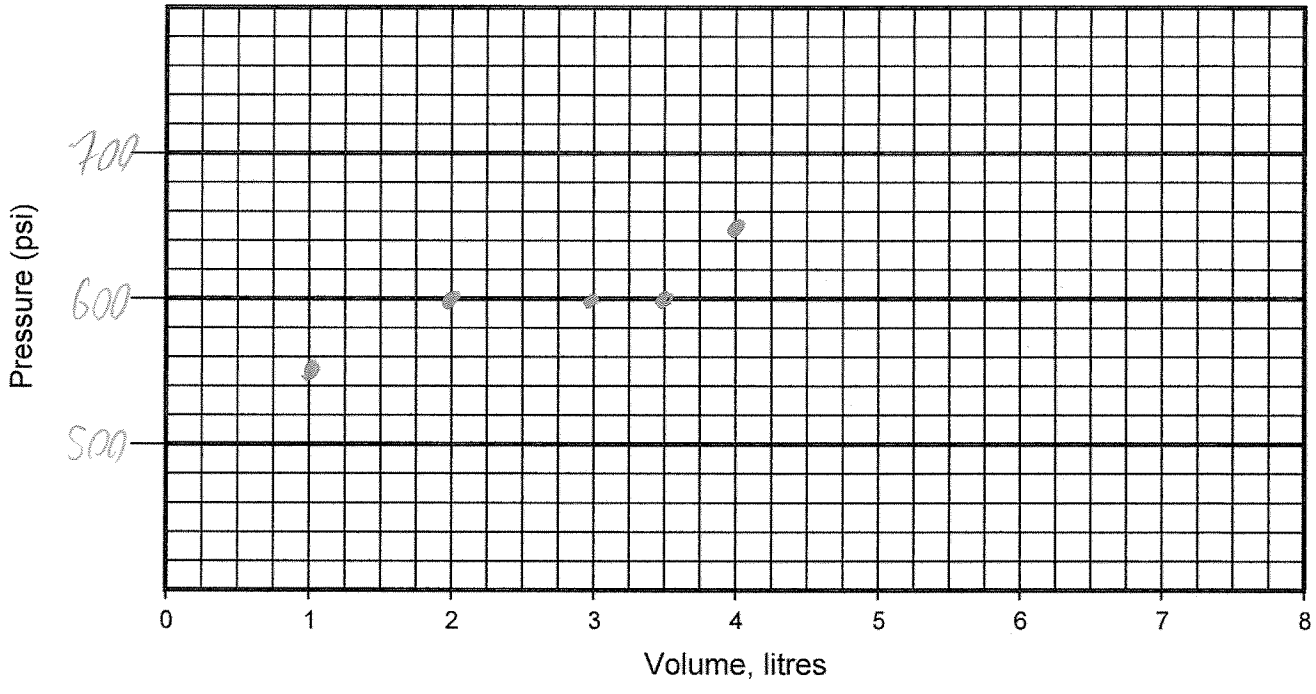
Packer No. 1 Depth (ft / m): — Inflation Tool No.: ____

Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 650 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 1.18 (ft / m) = 1.4 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 142 psi

Volume, litres	1	2	3	3.5	4	/	3.75			
Pressure, psi	550	600	600	600	650	/	0			
Volume, litres										
Pressure, psi										



Comments: Packer # Time -

350+140 = 490 650

Schlumberger WATER SERVICES

Sheet ____ of ____

Westbay Packer Inflation Record

Project: OPG | Project No.: 412860 | Well No.: US-7

Location: Bruce | Completed by: AB | Date Inflated: Dec 10/07

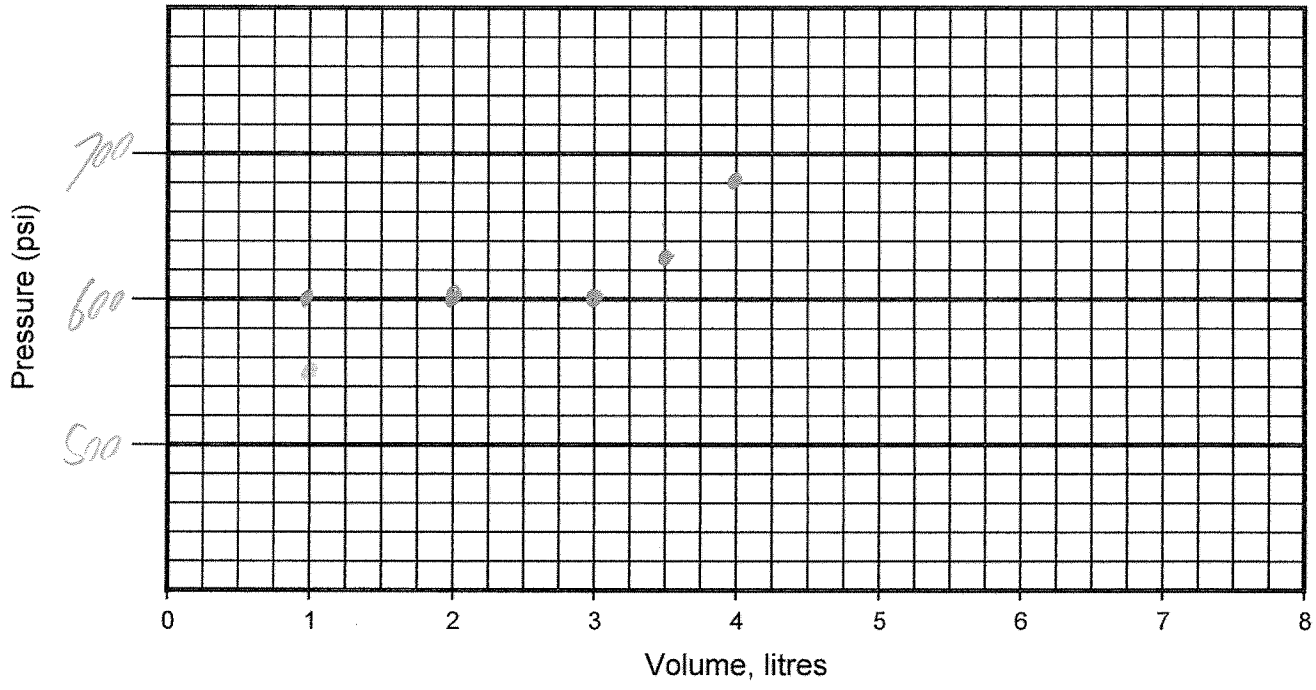
Packer No. 2 | Depth (ft / m): — | Inflation Tool No.: —

Packer Valve Pressure, P_V: 155 psi | Final Line Pressure, P_L: 690 psi | Tool Pressure, P_T: 350 psi

Borehole Water Level: 4.18 (ft / m) = 1.4 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 185 psi

Volume, litres	1	2	3	3.5	4	/	3.75			
Pressure, psi	600	600	600	625	690	/	0			
Volume, litres										
Pressure, psi										



Comments: Packer # | Time -

Schlumberger WATER SERVICES

Sheet____of____

Westbay Packer Inflation Record

Project: OPG Project No.: WB860 Well No.: US-7

Location: Bruce Completed by: _____ Date Inflated: Dec 10/07

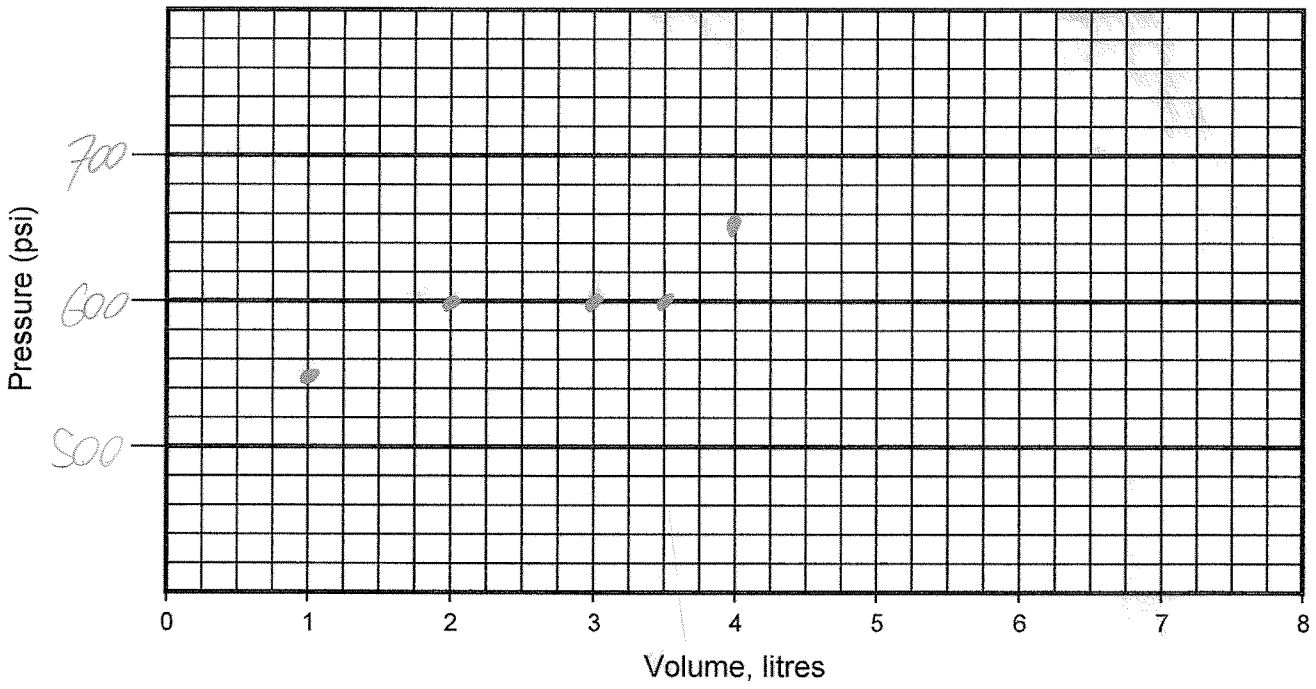
Packer No. 3 Depth (ft / m): _____ Inflation Tool No.: _____

Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 650 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 1.18 (ft / m) = 14 psi (P_W)

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

Volume, litres	1	2	3	3.5	4	/	3.75			
Pressure, psi	550	600	600	600	650	/	0			
Volume, litres										
Pressure, psi										



Comments: Packer # Time -

Schlumberger WATER SERVICES

Sheet ____ of ____

Westbay Packer Inflation Record

Project: OPG Project No.: WB 860 Well No.: US-7

Location: Bruce Completed by: AB Date Inflated: Dec 10/07

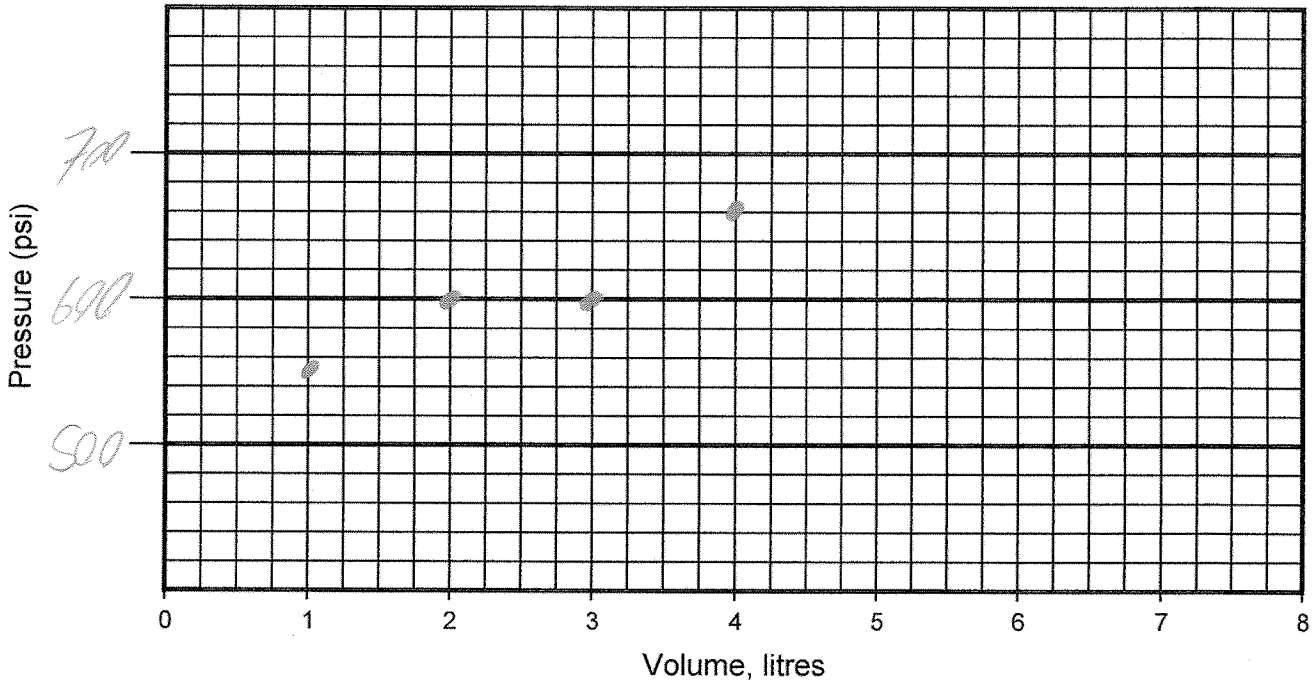
Packer No. 4 Depth (ft / m): — Inflation Tool No.: —

Packer Valve Pressure, P_V: 140 psi Final Line Pressure, P_L: 660 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 4.8 (ft / m) = 1.4 psi (P_W)

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

Volume, litres	1	2	3	4	—	3.75				
Pressure, psi	550	600	600	660	—	0				
Volume, litres										
Pressure, psi										



Comments: Packer # Time -

Schlumberger WATER SERVICES

Sheet ____ of ____

Westbay Packer Inflation Record

Project: OPG Project No.: WB860 Well No.: US-7

Location: Bruce Completed by: AB Date Inflated: Dec 10/07

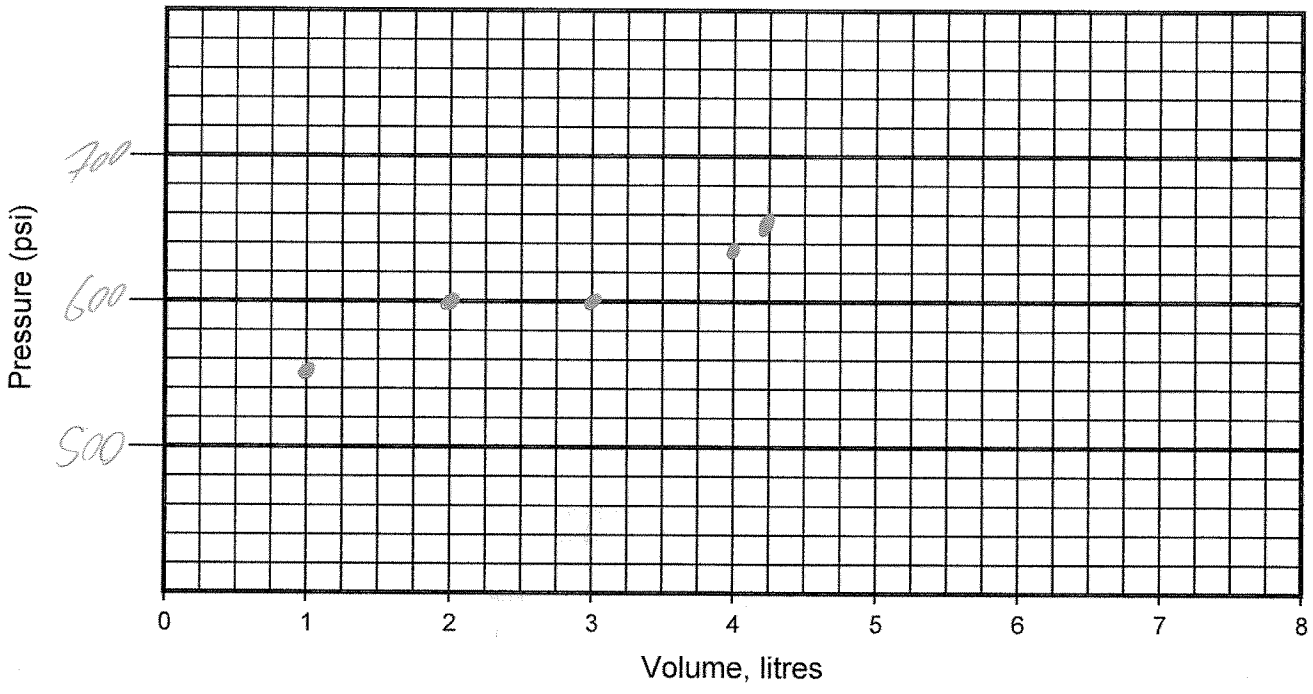
Packer No. 5 Depth (ft / m): — Inflation Tool No.: —

Packer Valve Pressure, P_V: 160 psi Final Line Pressure, P_L: 650 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 4.8 (ft / m) = 1.4 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 140 psi

Volume, litres	1	2	3	4	4.15	/	3.78			
Pressure, psi	~~550~~	600	600	625	650	/	~~0~~			
Volume, litres										
Pressure, psi										



Comments: Packer # Time -

Schlumberger WATER SERVICES

Sheet ____ of ____

Westbay Packer Inflation Record

Project: OPG Project No.: WB860 Well No.: US-7

Location: Bruce Completed by: AB Date Inflated: Dec 10/07

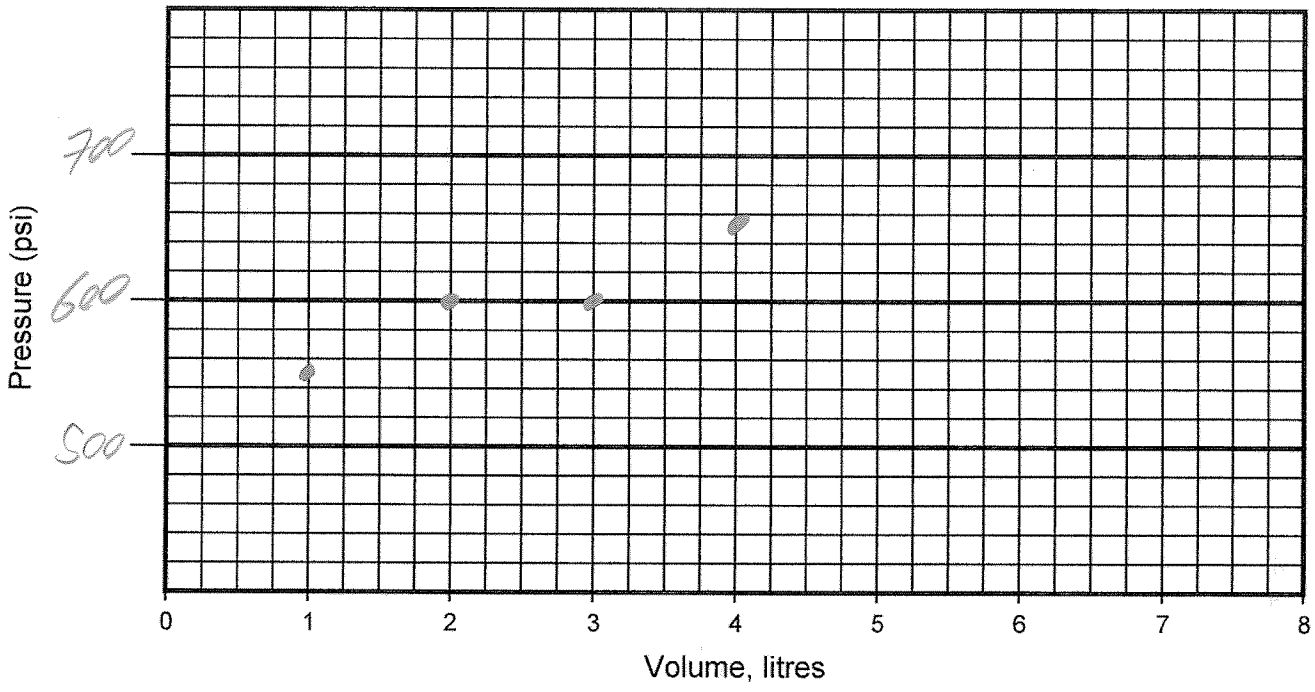
Packer No. 6 Depth (ft / m): — Inflation Tool No.: —

Packer Valve Pressure, P_V: 148 psi Final Line Pressure, P_L: 690 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 4.8 (ft / m) = 1.4 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 200 psi

Volume, litres	1	2	3	4	3.75					
Pressure, psi	550	600	600	690	0					
Volume, litres										
Pressure, psi										



Comments: Packer # Time -

Schlumberger WATER SERVICES

Sheet ____ of ____

Westbay Packer Inflation Record

Project: OPG Project No.: 1B360 Well No.: US-7

Location: Bruce Completed by: AS Date Inflated: Dec 10/07

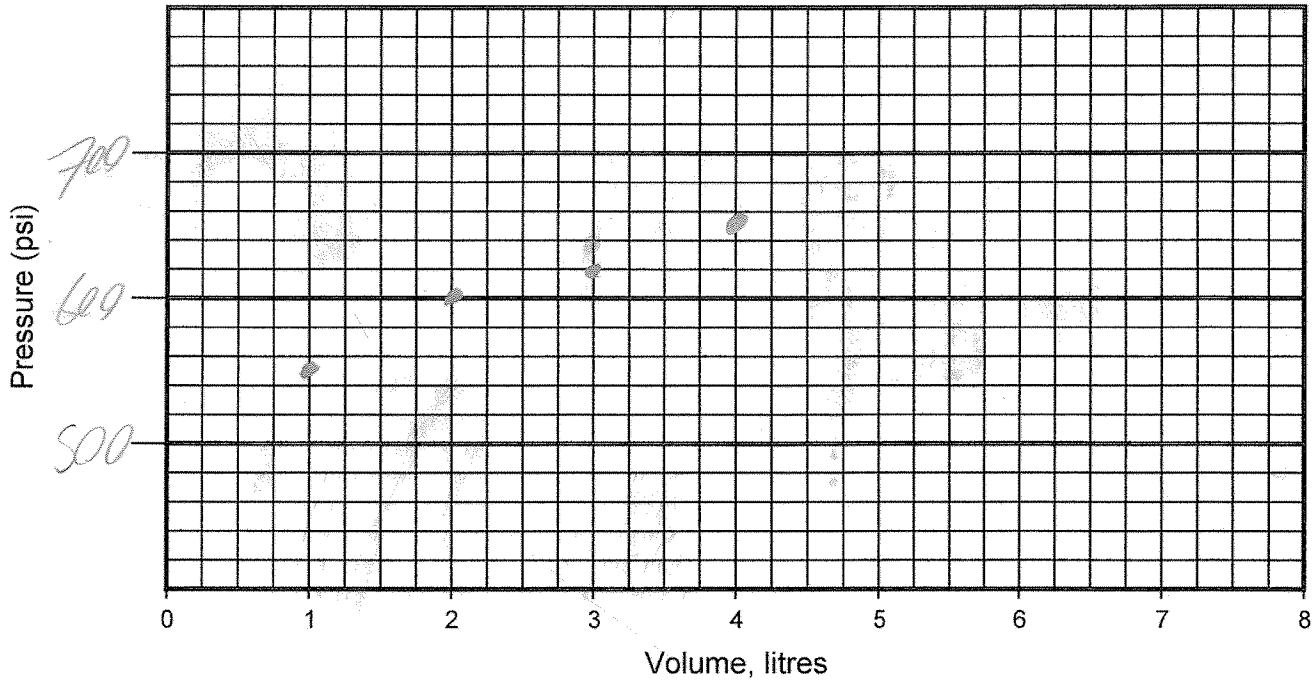
Packer No. 7 Depth (ft / m): — Inflation Tool No.: —

Packer Valve Pressure, P_V: 145 psi Final Line Pressure, P_L: 650 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 10 (ft / m) = 14 psi (P_W)

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

Volume, litres	1	2	3	4	/	3.75				
Pressure, psi	550	600	625	650	/	0				
Volume, litres										
Pressure, psi										



Comments: Packer # Time -

APPENDIX D

Westbay Casing Completion Report – US-8

Westbay Instruments Inc.
3480 Gilmore Way, Suite 110
Burnaby, BC V5G 4Y1
Canada
Tel. (604) 430-4272
Fax (604) 430-3538

Schlumberger WATER SERVICES

Completion Report

Monitoring Well

US-8

OPG

Deep Geologic Repository Investigation

Ontario, Canada

Prepared for:

Intera Engineering Ltd.
Canada

Prepared by:

Westbay Instruments Inc.
WB860
March 12, 2008

CONTENTS:

		Page
1.	INTRODUCTION	1
2.	INSTALLATION	1
	2.1 Previous Activities	1
	2.2 Preparation of Monitoring Well Design	1
	2.3 Layout of Westbay Casing Components	2
	2.4 Lowering of Westbay Components	2
	2.5 Hydraulic Integrity Testing	2
	2.6 Positioning of Westbay Components	2
	2.7 Pre-Inflation Profile	3
	2.8 Inflation of Westbay Packers	3
3.	FLUID PRESSURE MEASUREMENTS	3

APPENDIX

APPENDIX: Monitoring Well: US-8

1. Introduction

This report and the attached Appendix document the technical services carried out by Westbay Instruments Inc under Intera Engineering Ltd. Purchase Order 06-219-25.20-2 The Westbay System for groundwater monitoring was installed in an open borehole at the OPG Deep Geologic Repository near Tiverton, Ontario.

Westbay technical services representative Mr. Andrew Bessant and Mr. Mark Lessard were on site for the installation on March 5 to 6, 2008. This report documents the installation tasks and related QA checks.

2. Installation

The monitoring well was installed as indicated below.

(Note: all depths are with respect to ground surface. Monitoring well reference elevation was not available at the time of writing).

Table 1, Summary of Westbay Well Installation

Monitoring Well No.	Installation Date	Borehole Depth (m)	Steel Casing Depth (m)	MP38 Casing Length (m)	No. Monitoring Zones
US-8	March 5-6, 2008	200	14	196	18

The well was installed according to the procedures described below.

2.1 Previous Activities

As reported by Intera a nominal 4-inch diameter borehole was drilled using rotary diamond coring methods. A steel 4 inch diameter (4.25-inch) casing was installed in the borehole to a depth of 14m. A video log was conducted prior to installation of the Westbay well.

2.2 Preparation of Monitoring Well Design

Preliminary monitoring zone locations for the Westbay System well were sent to Westbay by Mr. Sean Sterling of Intera. The casing design was used to construct a preliminary Casing Installation Log, which specifies the location of components in the well. The Casing Installation Log was reviewed in the field with Intera prior to installation of the well. The Casing Installation 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 zone to provide the capability to measure fluid pressures and collect fluid samples. A pumping port coupling was also included in each zone to provide purging and hydraulic conductivity testing capabilities.

2.3 Layout of Westbay Casing Components

Prior to installation, the Westbay System casing components were set out at the borehole according to the sequence indicated on the Casing Installation 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 the casing sections. Magnetic location collars were attached 2 feet below the top of the measurement port in each sampling zone.

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

2.4 Lowering of Westbay Components

The Westbay System casing components were lowered into the well by hand as buoyancy conditions allowed. Fluorescein labeled drinking water supplied by Intera was added to the Westbay System casing when necessary to counter buoyancy effects while components were lowered into the borehole and for testing of joint seals during lowering. Each casing 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 casing component are noted on the Casing Installation Log by check marks.

2.5 Hydraulic Integrity Testing

After the Westbay casing string was lowered into the borehole, the water inside the Westbay casing was monitored at depth different from the open borehole water level for a minimum period of thirty minutes to confirm hydraulic integrity of the casing. The data from the hydraulic integrity test are shown on the first page of the Casing Installation Log in the Appendix. And in Table 2 below

Table 2, Borehole and Westbay Casing Water Levels

Monitoring Well No.	Borehole water level (top of 4-inch casing)	Westbay Water Level (top of casing)
US-8	5.8 m	62.9 m

2.6 Positioning of Westbay Components

After the components were lowered into the well, the Westbay casing string was positioned as indicated on the cover page of the Summary Log. Ground surface was used as the borehole datum. The Westbay casing string was supported in this position while packer inflation was carried out.

The positioning of the Westbay casing components is based on the "nominal" lengths of Westbay casing components. The positioning calculations do not include allowances for borehole temperature or deviation effects, which for this site are expected to be minimal. The attached figure titled "MOSDAX Transducer Position" provides information to correlate the position of MOSDAX Transducer sensors 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 centerline depths and zone length. The Summary Casing Log, which shows the final "as-built" locations of the components in the well, is included in the Appendix. The depths of key items in the well are shown on Table 3.

2.7 Pre-inflation Profile

A pre-inflation pressure profile was carried out at the well prior to inflating the packers to confirm the proper operation and position of measurement ports and magnetic collars. The data confirmed that the ports operated properly and are positioned correctly. The data for the pre-inflation profile are in the Appendix (Figure 1) and on the Field Data and Calculation Sheet.

2.8 Inflation of Westbay System Packers

The Westbay system packers were inflated sequentially beginning at the bottom of the well using Fluorescein labeled drinking water provided by Intera. The Westbay Model No. 6055 vented inflation tool was used for packer inflation. All of 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. 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. Longer term monitoring may be required to establish representative fluid pressures.

A plot of the Piezometric levels in all zones in the well is shown on Figure 2 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 the pressure profile of the MP monitoring well are also enclosed in the Appendix.

Table 3, Depths of Key Items for MP monitoring well US-8.

Zone No.	Zone Interval* (m)	MP Casing No. (from MP Log)	Packer No.	Packer Serial No.	Nominal Packer Position *** (m)	Magnetic Collar Depth (m)	Measurement Port Depth** (m)	Pumping Port Depth** (m)	Port Name
Zone 1	200.7-190.02	1-2 1		15540	188.5	193.7	193.1 ---		Zone 1
Zone 2	188.50-174.78	4-8 2		15542	173.3	180	179.4 ----		Zone 2
Zone 3	173.26-168.68	10-12	3	15541	167.2	170.8	170.2	171.7	Zone 3
Zone 4	167.16-154.97	14-17 4		15539	153.4	158.6	158.0 ---		Zone 4
Zone 5	153.45-148.87	19-20 5		15530	147.3	151	150.4	---	Zone 5
Zone 6	147.35-143.69	22-23	6	15529	142.2	144.3	143.7	147.3	Zone 6
Zone 7	142.17-137.60	25-26 7		15523	136.1	138.2	137.6 ---		Zone 7
Zone 8	136.07-117.18	28-34	8	15526	116.6	121.4	120.8	126.8	Zone 8
Zone 9	116.65-114.65	35-36 9		15527	114.1	116.3	115.7 ---		Zone 9
Zone 10	114.13-108.03	37-39	10	15528	106.5	110.2	109.6	111.1	Zone 10
Zone 11	106.51-100.41	41-43	11	15525	98.9	102.5	101.9	103.4	Zone 11
Zone 12	98.89-93.1	45-48	12	15524	91.6	93.7	93.1	95.8	Zone 12
Zone 13	91.57-80.9	50-53	13	15536	79.4	86.1	85.5	88.5	Zone 13
Zone 14	79.38-75.73	55-57	14	15535	74.2	76.3	75.7	77.2	Zone 14
Zone 15	74.2-62.01	59-62	15	15533	60.5	68.7	68.1	71.1	Zone 15
Zone 16	60.49-48.29	64-67	16	15534	46.8	55	54.4	57.4	Zone 16
Zone 17	46.77-33.06	69-73	17	15532	31.5	41.2	40.6	43.6	Zone 17
Zone 18	31.53-14.77	75-80 18		15531	13.3	19.9	19.3 ---		Zone 18

* 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.

APPENDIX 1

Monitoring Well US-8

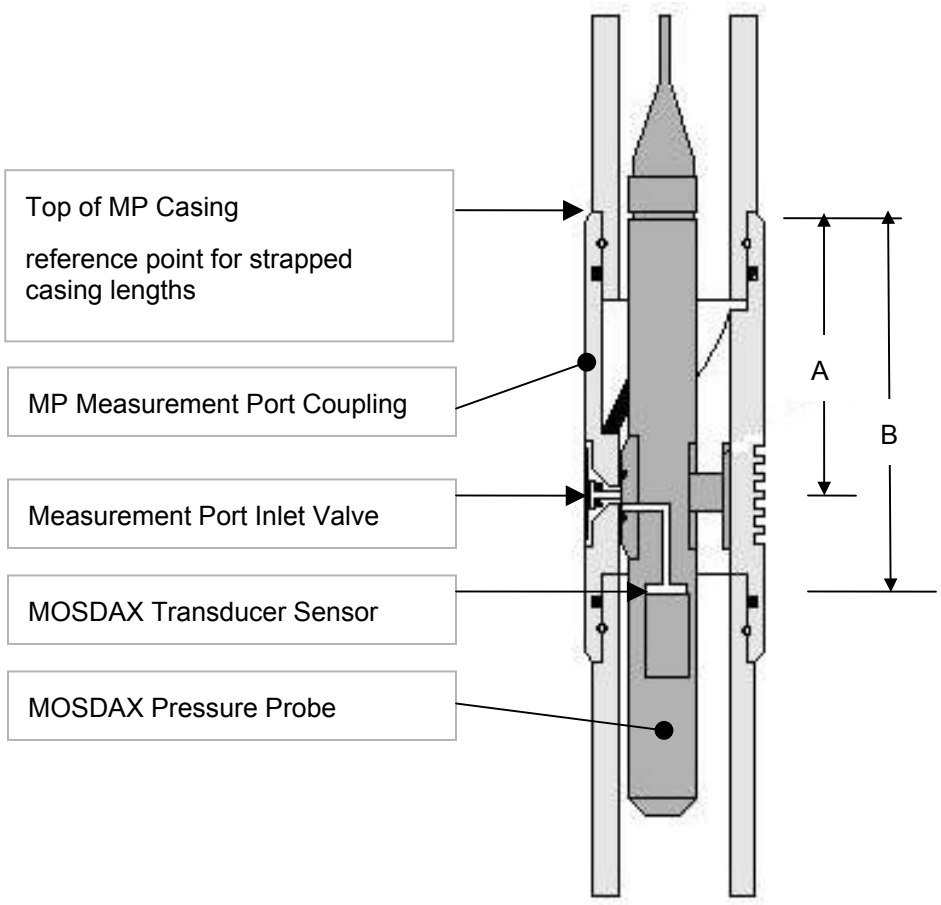
Summary Casing Log	- 3 pages
Figure 1, Pre-Inflation Pressure Profile	- 1 page
Pre-inflation Piezometric Pressure/Levels	
Field Data and Calculation Sheet (Mar 5, 2008)	- 1 page
Figures 2, Piezometric Pressure Profile	- 1 page
Piezometric Pressure/Levels	
Field Data and Calculation Sheet (Mar 6, 2008)	- 1 page
Casing Installation Log (field copy)	- 5 pages
MP Packer Inflation Records	- 19 pages

Technical Note

Schlumberger WATER SERVICES

MOSDAX Transducer Position

In an MP System Measurement Port Coupling



System	Measurement Port Type	A	B
Plastic MP38	0205	4.5" (114.3 mm)	6.5" (165.1 mm)

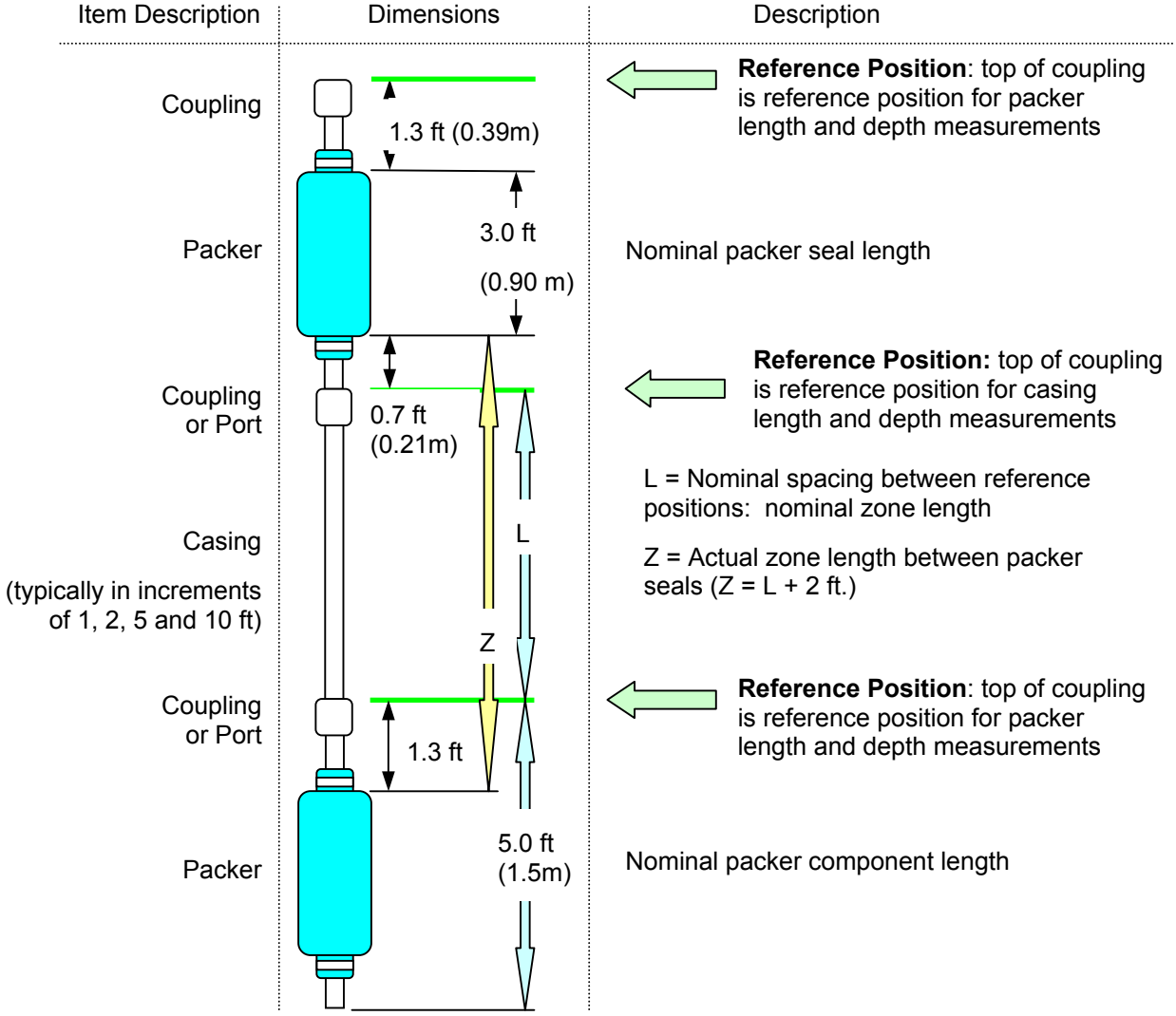
DL July 11, 2006

Technical Note

Schlumberger WATER SERVICES

Dimensions of Packer Seals and Monitoring Zones

Westbay System – Plastic MP38

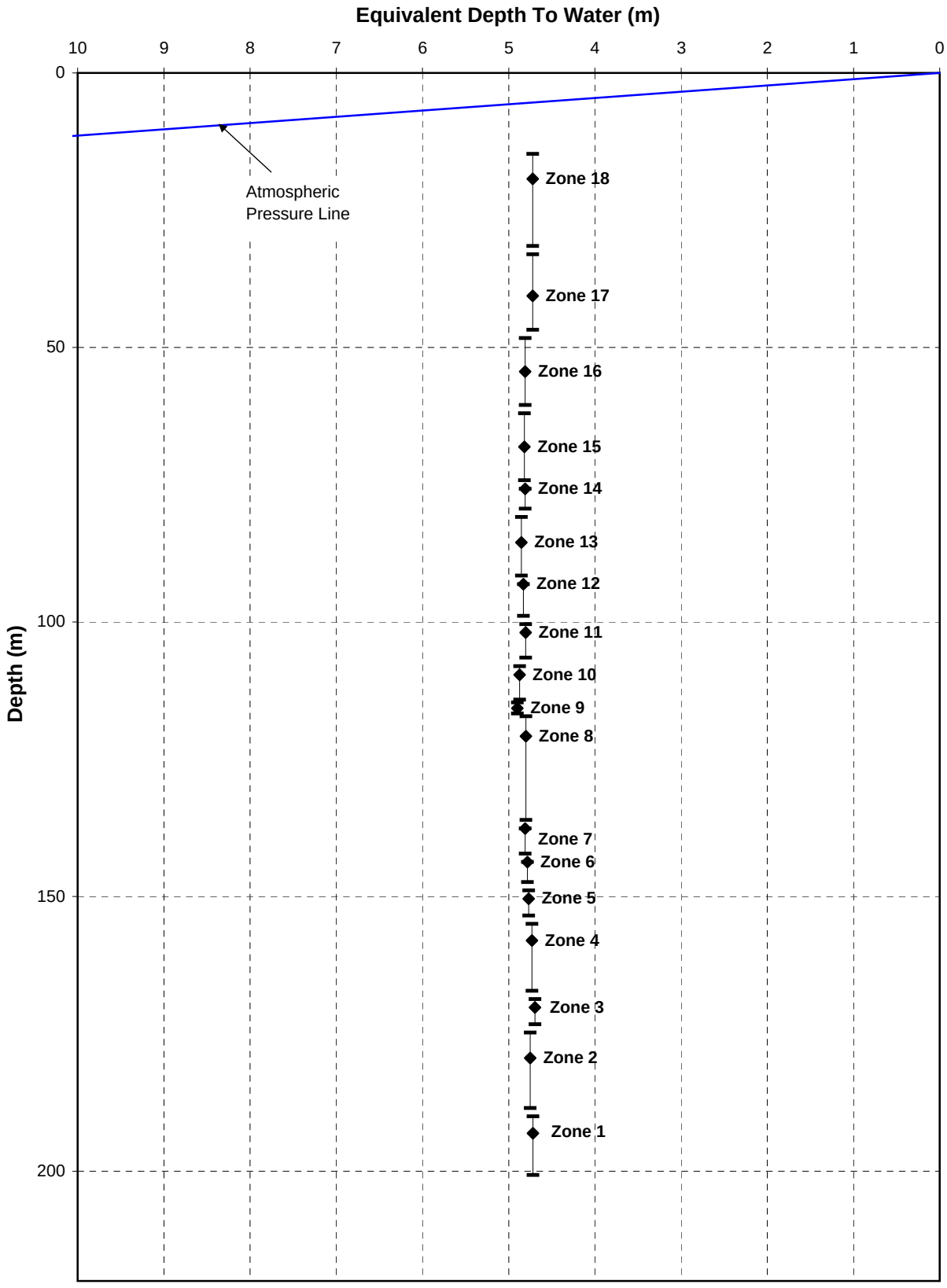


Discussion Points:

- 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.

Piezometric Profile:
Monitoring Well: US-8

Profile Date: March 5, 2008
Comments:Pre-Inflation



Client:OPG
Site:Bruce
Datum:Ground Surface

Figure 1

Plot By:_AJB_ Date:____
Checked By:____Date:____
Westbay Project:WB 860
Piezometric Pressures--Level US-8.xls

Schlumberger
WATER SERVICES

Westbay Piezometric Pressures/Levels

Pre-deflation — Field Data and Calculation Sheet

Well No.: US-8
Datum: —
Elev. G.S.: —
Height of Westbay above G.S.: —
Elev. top of Westbay Casing: —
Reference Elevation: —
Borehole angle: —

Probe Type: EMS
Serial No.: 8554
Probe Range: 1000
Westbay Casing Type: 38

Date: March 5/08
Client: Tarmac
Job No.: WB260
Location: Barry
Weather: Sunny / Cold
Operator: DTR / KDP / DCS

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: 17:00, 15.49 psi, 14.34 psia. Finish: 18:10, 8.95°C
P_{atm} 14.49 psi

Port No.	Port Position From Log ( )	Port Position From Cable ( )	True Port Depth "Dp" ( )	Fluid Pressure Readings: Inside Casing (P1)	Fluid Pressure Readings: Outside Casing (P2)	Fluid Pressure Readings: Inside Casing (P1)	Probe Temp. (°C)	Time H:M:S (PM)	Pressure Head Outside Port ( ) H = (P2-Patm)/w	Piez. Level Outside Port ( ) Dz = Dp - H	Comments
1	193.1	192.88		202.83	282.22	202.85	9.39	5:12	188.38	4.7	
2	179.4	179.34		183.21	262.69	183.22	9.07	5:22	174.64	4.7	
3	170.2	170.23		170.16	249.69	170.17	8.92	5:25	165.51	4.6	
4	158.0			152.70	232.29	152.73	8.83	5:29	153.27	4.7	
5	150.4			141.82	221.43	141.82	8.76	5:31	145.63	4.7	
6	143.7			132.24	211.88	132.21	8.71	5:35	138.91	4.7	
7	137.6			123.54	203.17	123.55	8.67	5:38	132.79	4.8	no collar
8	120.8			99.54	179.29	99.53	8.59	5:40	115.99	4.8	
9	115.7			92.14	171.90	92.14	8.52	6:42	110.80	4.9	no collar
10	109.6			83.43	163.26	83.39	8.51	5:44	104.72	4.9	
11	101.9			72.52	152.41	72.55	8.47	5:47	97.09	4.8	
12	93.1			59.90	139.86	59.87	8.51	5:49	88.27	4.8	
13	85.5			49.01	129.02	49.02	8.59	5:52	80.64	4.8	
14	75.73			35.07	115.19	35.10	8.77	5:54	70.92	4.8	
15	68.11			24.17	104.34	24.17	8.86	5:57	63.29	4.8	

Notes: w = 0.433 psi/ ft (1.422psi/m) of H_2O
H = pressure head of water in zone
Dz = piezometric level in zone
Dp = true depth of measurement port
Patm = atmospheric pressure

Schlumberger WATER SERVICES

Westbay Piezometric Pressures/Levels

Pre-Injection Field Data and Calculation Sheet

Well No.: US-8
Datum: —
Elev. G.S.: —
Height of Westbay above G.S.: —
Elev. top of Westbay Casing: —
Reference Elevation: —
Borehole angle: —

Probe Type: EMS
Serial No.: 8554
Probe Range: 1000
Westbay Casing Type: 38

Date: March 05/08
Client: Inmet
Job No.: WB 860
Location: Bruce
Weather: Sunny/Cloud
Operator: DSR/LDP/DCS

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).

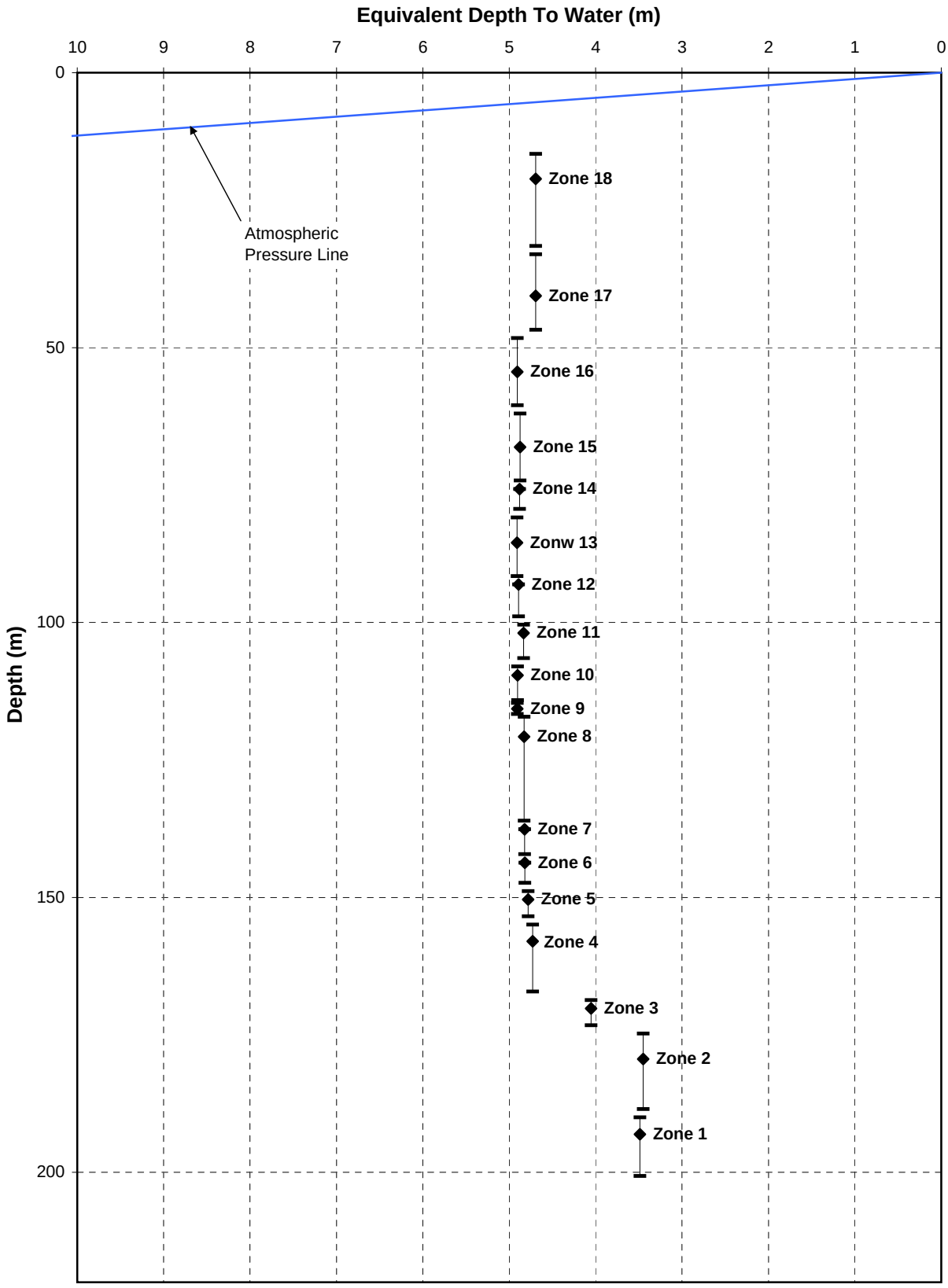
Ambient Reading (P_{atm}) (pressure, temperature, time)
Start: 17:00, 15.49 C Finish: 18:10, 8a5 C
Patm, 14.34 psi
P_{atm} 14.49 **psi**

Port No.	Port Position From Log ( )	Port Position From Cable ( )	True Port Depth "Dp" ( )	Fluid Pressure Readings			Probe Temp. (°C)	Time H:M:S (PM)	Pressure Head Outside Port ( ) H = (P2-Patm)/w	Piez. Level Outside Port ( ) Dz = Dp - H	Comments
				Inside Casing (P1)	Outside Casing (P2)	Inside Casing (P1)					
16	54.4			14.55	84.86	14.58	8.88	6:00	49.59	4.8	
17	40.6			14.52	65.36	14.52	8.91	6:02	35.87	4.7	
18	19.3			14.52	35.07	14.52	8.93	6:06	14.57	4.7	

Notes: w = 0.433 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: US-8

Profile Date:March 6, 2008
Comments:Post-Inflation Profile



Client:OPG
Site:Bruce
Datum:Ground Surface

Figure 2

Plot By:__AJB_ Date:____
Checked By:____ Date:____
Westbay Project:WB 860
Piezometric Pressures--Level US-8.xls

Schlumberger
WATER SERVICES

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Well No.: US-8
Datum:
Elev. G.S.:
Height of Westbay above G.S.:
Elev. top of Westbay Casing:
Reference Elevation:
Borehole angle:

Probe Type: GMS
Serial No.: 3554
Probe Range: 1000 psi
Westbay Casing Type: 38

Date: March 6 2008
Client: Intera
Job No.:
Location: Bruce
Weather: Sunny, -2, Windy
Operator: DJE & LDP

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: 14:30, 18.18C Finish:
14.49 psi P_{atm} _____ psi

Port No.	Port Position From Log ( )	Port Position From Cable ( )	True Port Depth "Dp" ( )	Fluid Pressure Readings: Inside Casing (P1)	Fluid Pressure Readings: Outside Casing (P2)	Fluid Pressure Readings: Inside Casing (P1)	Probe Temp. (°C)	Time H:M:S	Pressure Head Outside Port ( ) H = (P2-Patm)/w	Piez. Level Outside Port ( ) Dz = Dp - H	Comments
1	193.1	192.99		264.19	284.12	264.19	9.54	14:41	189.61	3.49	
2	179.4			244.55	264.69	244.57	9.22	14:44	175.95	3.45	
3	170.2			231.51	250.75	231.49	9.02	14:47	166.15	4.05	
4	168.0			214.04	232.44	214.08	8.88	14:50	153.27	4.73	
5	150.4			203.15	221.56	203.16	8.74	14:55	145.62	4.78	
6	143.7			193.58	211.98	193.55	8.67	14:58	138.88	4.82	
7	137.6			184.83	203.30	184.80	8.63	15:00	132.78	4.82	
8	120.8			160.80	179.40	160.77	8.50	15:04	115.97	4.83	
9	115.7			153.37	172.04	153.38	8.45	15:06	110.79	4.91	
10	109.6			144.66	163.37	144.66	8.42	15:09	104.70	4.90	
11	101.9			133.76	152.52	133.73	8.37	15:11	97.07	4.83	
12	93.1			121.13	139.93	121.07	8.34	15:13	88.21	4.89	
13	85.5			110.18	129.09	110.18	8.37	15:15	80.59	4.91	
14	75.73			96.28	115.24	96.28	8:45	15:17	70.85	4.88	
15	68.11			85.35	104.41	85.38	8:55	15:21	63.23	4.88	

Notes: w = 0.433 psi/ft (1.422 psi/m) of H_2O
H = pressure head of water in zone
Dz = piezometric level in zone
Dp = true depth of measurement port
Patm = atmospheric pressure

Schlumberger
WATER SERVICES

Westbay Piezometric Pressures/Levels

Field Data and Calculation Sheet

Well No.: MS-8
Datum:
Elev. G.S.:
Height of Westbay above G.S.:
Elev. top of Westbay Casing:
Reference Elevation:
Borehole angle:

Probe Type: CMS.
Serial No.: 3554
Probe Range: 1000 psi
Westbay Casing Type: 38

Date: March 6 2008
Client: Intera
Job No.:
Location: Bruce
Weather: Sunny, -2°C, windy
Operator: DIR & LDP

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: 14:30, 18.18°C Finish: 15:37, 8.90°C
14.49 psi
P_{atm} 14.49 psi

Port No.	Port Position From Log ( )	Port Position From Cable ( )	True Port Depth "Dp" ( )	Fluid Pressure Readings			Probe Temp. (°C)	Time H:M:S	Pressure Head Outside Port ( ) H = (P2-Patm)/w	Piez. Level Outside Port ( ) Dz = Dp - H	Comments
				Inside Casing (P1)	Outside Casing (P2)	Inside Casing (P1)					
16	84.4			65.75	84.87	65.78	8.67	15:25	49.49	4.91	
17	40.6			46.16	65.55	46.12	8.66	15:28	35.91	4.25	
18	19.3			15.64	35.26	15.67	8.81	15:31	14.61	4.69	

Notes: w = 0.433 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

Summary Casing Log

Company:
Well: US-8
Site:
Project:

Job No: WB 860
Author: AJB

Well Information

Reference Datum:
Elevation of Datum: 0.00 m.
MP Casing Top: 0.00 m.
MP Casing Length: 196.17 m.

Borehole Depth: 200.00 m.
Borehole Inclination:
Borehole Diameter: 0.00 mm

Well Description:

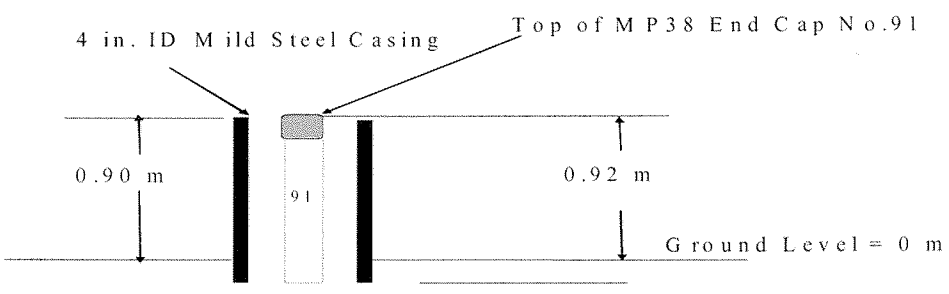
Other References:

File Information

File Name: US-8.WWD
Report Date: Thu Mar 13 10:55:24 2008

File Date: Mar 06 08:13:03 2008

Sketch of Wellhead Completion

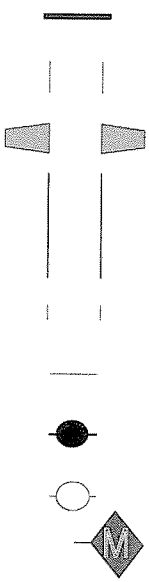


Legend

(Qty) MP Components (Library - WD Library 7/27/00)

Geology

Backfill/Casing



(2) 0203 - MP38 End Cap

(25) 020105 - MP38 Casing 2 (5F/1.5M)

(18) 0238 - MP38 Packer 74mm (5F/1.5M)

(42) 020110 - MP38 Casing 1 (10F/3M)

(5) 020102 - MP38 Casing 3 (2F/0.6M)

(61) 0202 - MP38 Regular Coupling

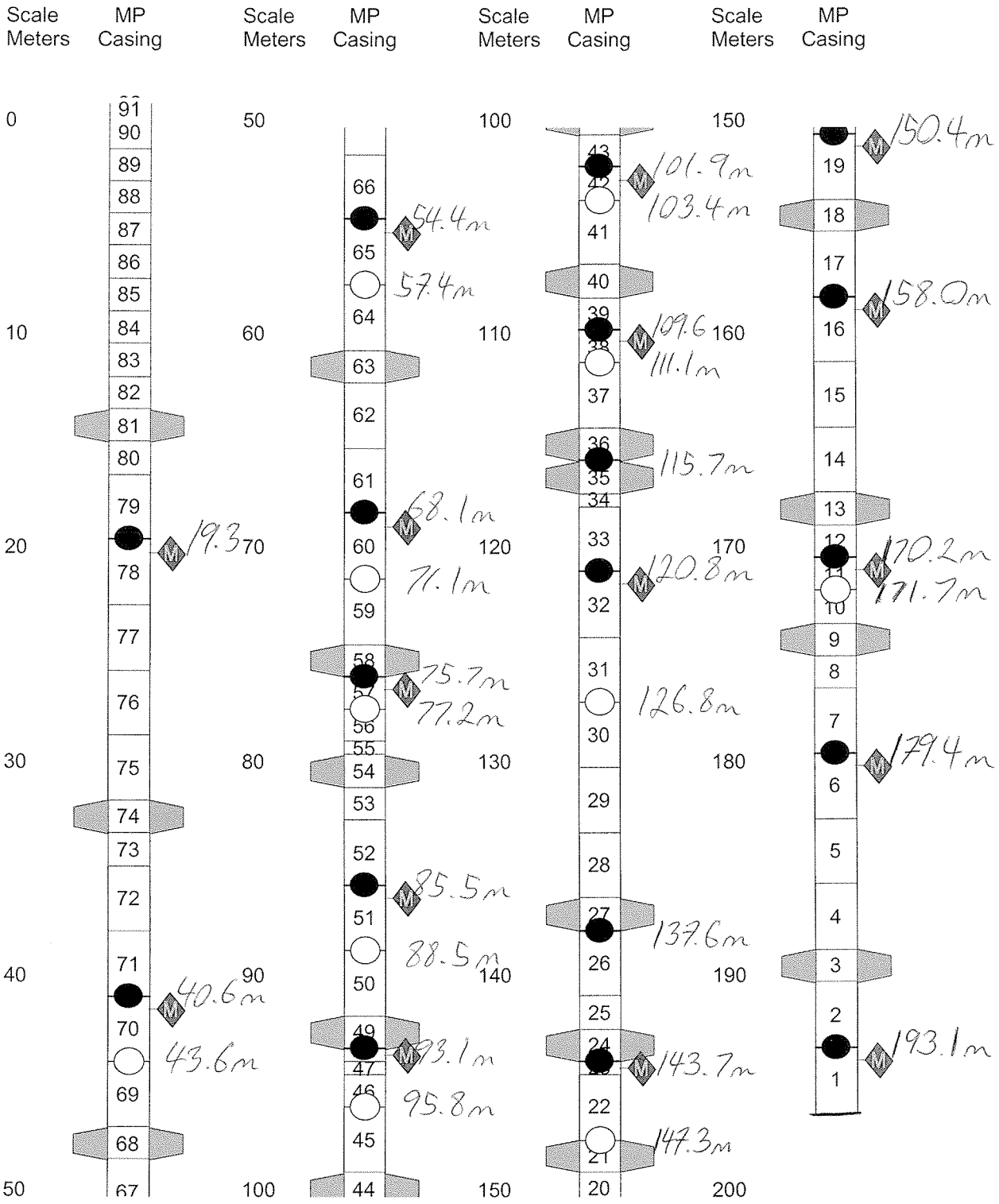
(18) 0205 - MP38 Measurment Port

(11) 0224 - MP38 Pumping Port

(16) 0216 - Magnetic Location Collar

Summary Casing Log

Job No: WB 860
Well: US-8



Summary Casing Log

Company:
Well: US-8
Site:
Project:

Job No: WB 860
Author: AJB

Well Information

Reference Datum:
Elevation of Datum: 0.00 m.
MP Casing Top: 0.00 m.
MP Casing Length: 196.17 m.

Borehole Depth: 200.00 m.
Borehole Inclination:
Borehole Diameter: 0.00 mm

Well Description:

Other References:

File Information

File Name: US-8.WWD
Report Date: Tue Feb 26 08:57:25 2008

File Date: Feb 25 16:10:06 2008

Comments

TD = 200m

Log Information

Borehole condition confirmed.
MP well design & preparation.
MP well design checked.
MP well and borehole approved to install.

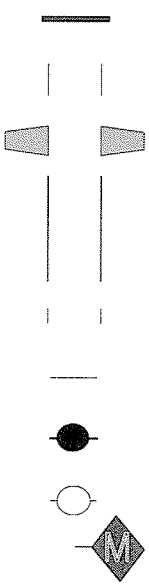
(method) Drill Rods TO BOTTOM Date: March 4/08
By: AJB Date: Dec 10/07
By: AJB ML Date: March 05/08
By: [signature] Date: March 5/08

Legend

(Qty) MP Components (Library - WD Library 7/27/00)

Geology

Backfill/Casing



(2) 0203 - MP38 End Cap

(25) 020105 - MP38 Casing 2 (5F/1.5M)

(18) 0238 - MP38 Packer 74mm (5F/1.5M)

(42) 020110 - MP38 Casing 1 (10F/3M)

(5) 020102 - MP38 Casing 3 (2F/0.6M)

(61) 0202 - MP38 Regular Coupling

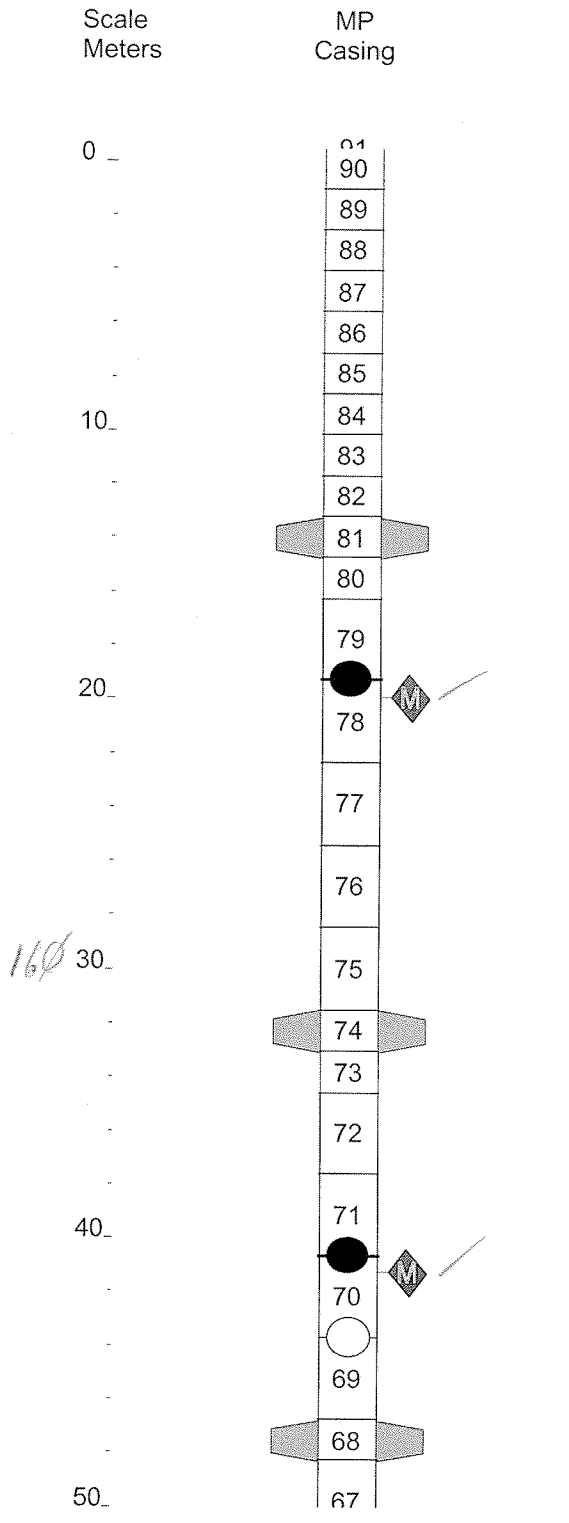
(18) 0205 - MP38 Measurment Port

(11) 0224 - MP38 Pumping Port

(16) 0216 - Magnetic Location Collar

Casing Installation Log

Job No: WB 860
Well: US-8



62.907 at 3:45
62.894 at 3:59
62.890 @ 4:05
62.890 @ 4:15
62.890 @ 4:30
OK

15531
4496
15532
4498
7311
15534

160

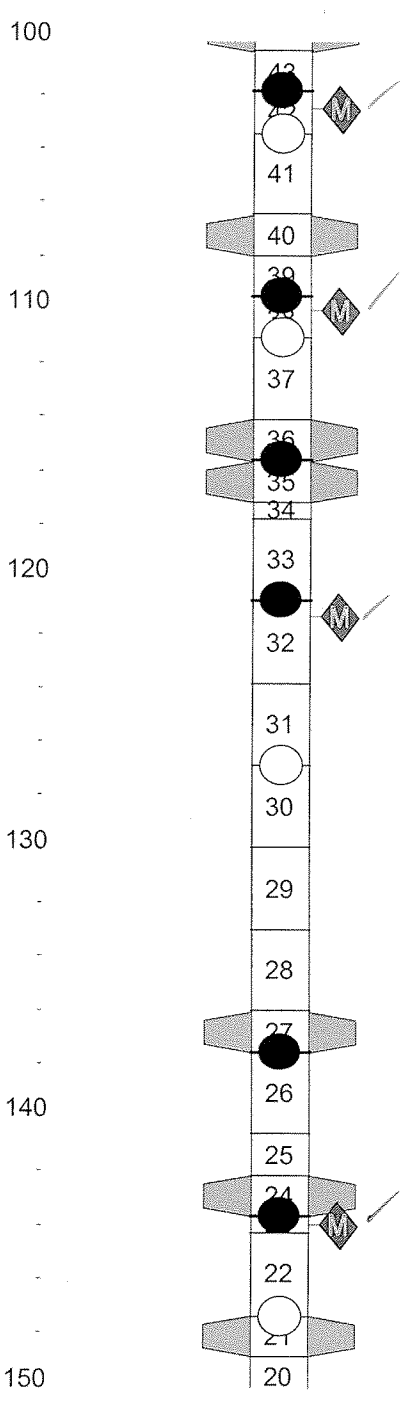
Casing Installation Log

Job No: WB 860
Well: US-8

Scale Meters	MP Casing	QA Tested OK	MP Casing Description
50			
	66		020110 - MP38 Casing 1 (10F/3M)
			0205 - MP38 Measurment Port 4257
	65		020110 - MP38 Casing 1 (10F/3M)
			0224 - MP38 Pumping Port 7310
	64		020110 - MP38 Casing 1 (10F/3M)
60	63		0238 - MP38 Packer 74mm (5F/1.5M) 15533
	62		020110 - MP38 Casing 1 (10F/3M)
	61		020110 - MP38 Casing 1 (10F/3M)
			0205 - MP38 Measurment Port 4256
70	60		020110 - MP38 Casing 1 (10F/3M)
			0224 - MP38 Pumping Port 7309
	59		020110 - MP38 Casing 1 (10F/3M)
	58		0238 - MP38 Packer 74mm (5F/1.5M) 15535
			0205 - MP38 Measurment Port
			020105 - MP38 Casing 2 (5F/1.5M) 4497
			0224 - MP38 Pumping Port 7305
	56		020105 - MP38 Casing 2 (5F/1.5M)
	55		020102 - MP38 Casing 3 (2F/0.6M)
80	54		0238 - MP38 Packer 74mm (5F/1.5M) 15536
	53		020105 - MP38 Casing 2 (5F/1.5M)
	52		020110 - MP38 Casing 1 (10F/3M)
			0205 - MP38 Measurment Port 4499
	51		020110 - MP38 Casing 1 (10F/3M)
			0224 - MP38 Pumping Port 7304
90	50		020110 - MP38 Casing 1 (10F/3M)
	49		0238 - MP38 Packer 74mm (5F/1.5M) 15524
			020102 - MP38 Casing 3 (2F/0.6M) 4253
	47		020102 - MP38 Casing 3 (2F/0.6M)
	46		020105 - MP38 Casing 2 (5F/1.5M)
			0224 - MP38 Pumping Port 7308
	45		020110 - MP38 Casing 1 (10F/3M)
100	44		0238 - MP38 Packer 74mm (5F/1.5M) 15525

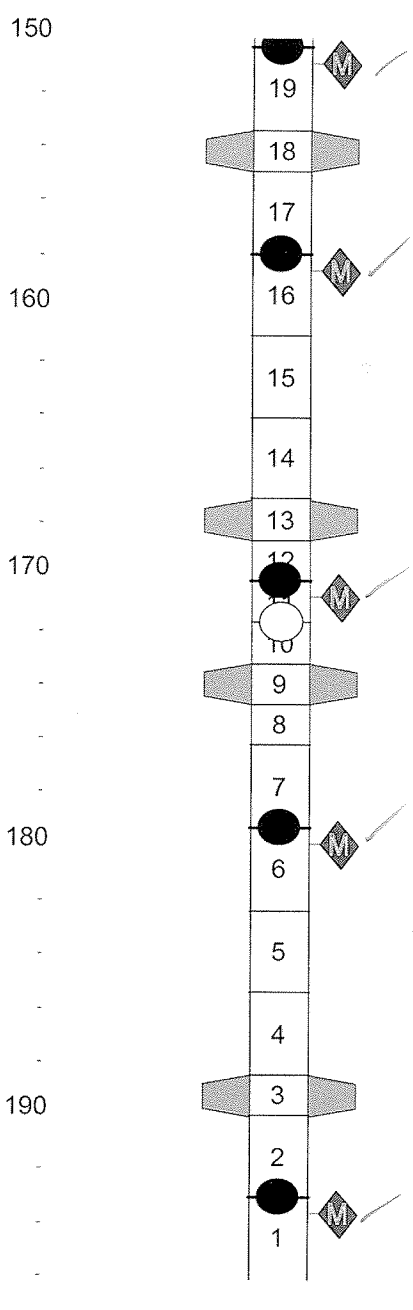
Casing Installation Log

Job No: WB 860
Well: US-8



Casing Installation Log

Job No: WB 860
Well: US-8



DTW = 5.842m @ 10:40am = TOC

START LOWERING
11:25 am Feb 5/08
Casing #1.

TOC = 90cm above GL

JTT = 209 psi

Schlumberger WATER SERVICES

Sheet 1 of 19

Westbay Packer Inflation Record

Project: Bruce Project No.: WB 860 Well No.: US-8

Location: Bruce Completed by: M. Lessard Date Inflated: March 6/08

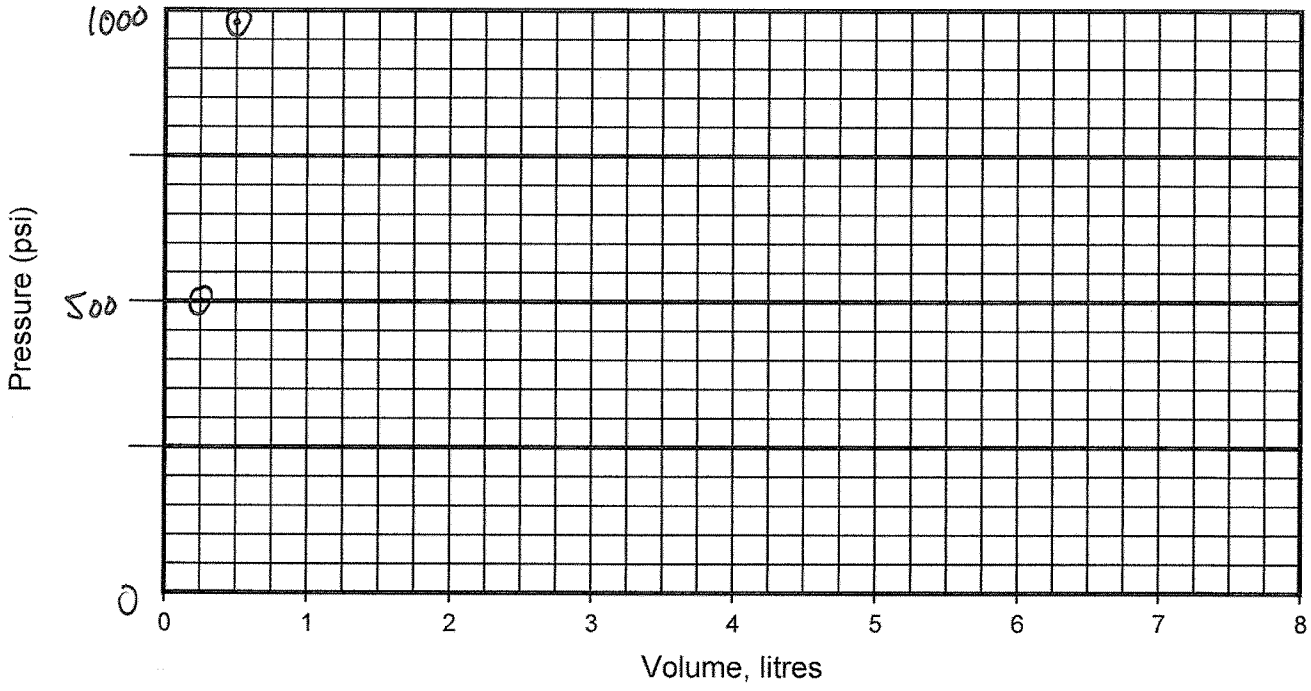
Packer No. BWT Depth (ft / m): 196 Inflation Tool No.: 3197

Packer Valve Pressure, P_V: n/a psi Final Line Pressure, P_L: 980 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / m) = 10 psi (P_W)

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

Volume, litres	0.25	0.5	/	0.1						
Pressure, psi	500	980	/	Ø						
Volume, litres										
Pressure, psi										



Comments: Packer # Blank Wall Test Time - 9:33 am

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce | Project No.: WB860 | Well No.: US-8

Location: Bruce | Completed by: M.Lessard | Date Inflated: March 6/08

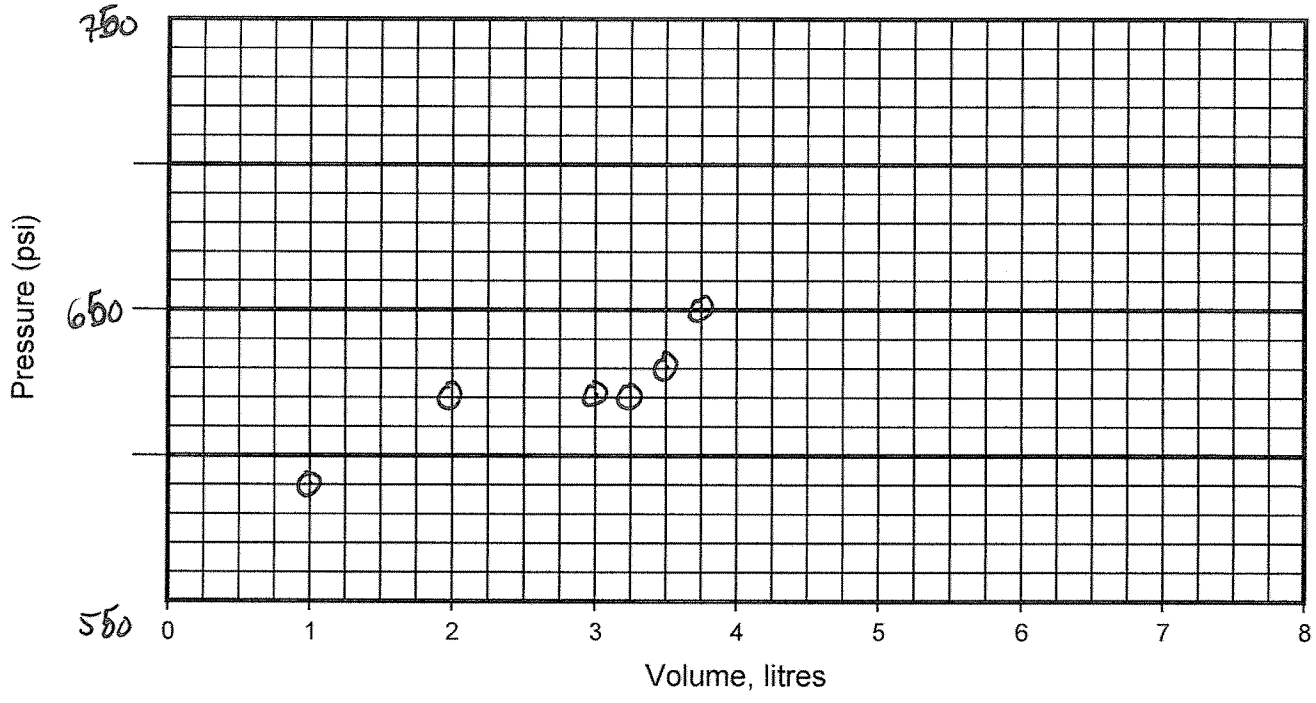
Packer No. 1, comp 3 SN# 15540 | Depth (ft /(m)): 188.50 | Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 155 psi | Final Line Pressure, P_L: 650 psi | Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft /(m)) = 10 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	3.25	3.5	3.75	/	3.4		
Pressure, psi	590	620	620	620	630	650	/	ø		
Volume, litres										
Pressure, psi										



Comments: Packer # 1 | Time - 9:48 am

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce | Project No.: WB 860 | Well No.: US-8

Location: Bruce | Completed by: M. Lessard | Date Inflated: March 6/08

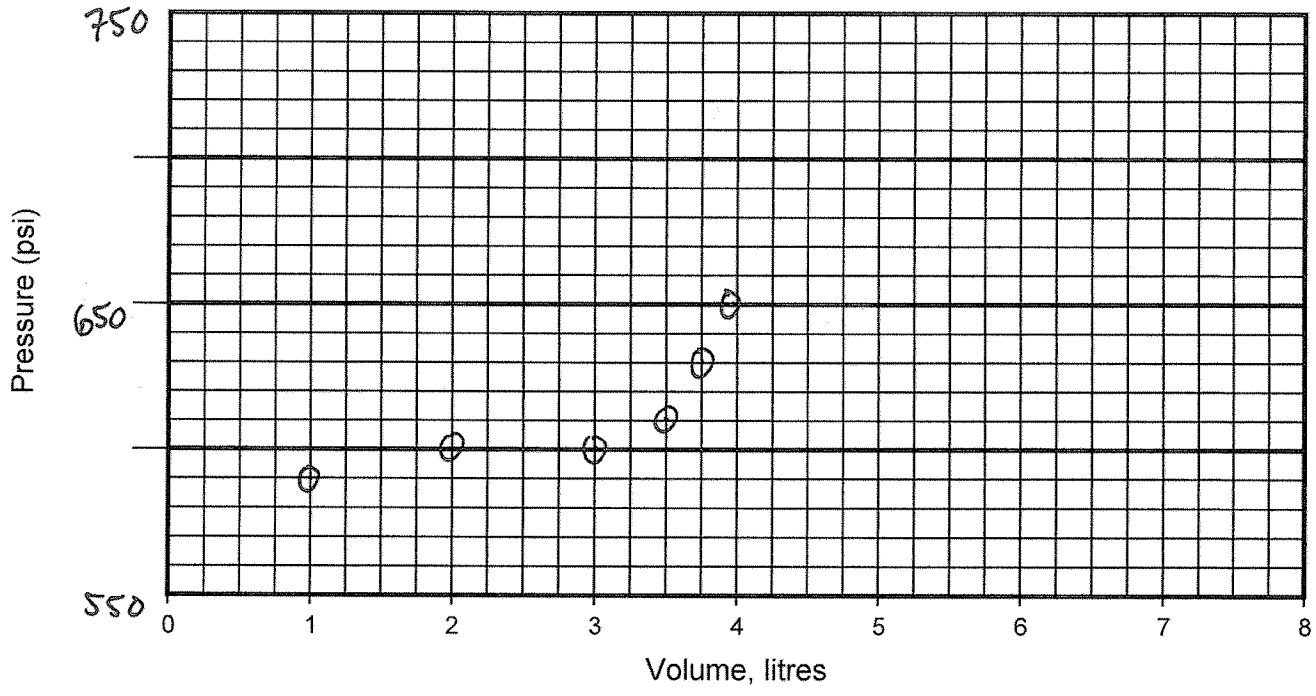
Packer No. 2, comp 9 S/N #15542 | Depth (ft / m): 173.26 | Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 650 psi | Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / m) = 10 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	3.25	3.5	3.75	3.9	/	3.6	
Pressure, psi	590	600	600	600	610	630	650	/	0	
Volume, litres										
Pressure, psi										



Comments: Packer # 2 | Time - 10:02 am

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce | Project No.: WB860 | Well No.: US-8

Location: Bruce | Completed by: M.Lessard | Date Inflated: March 6/08

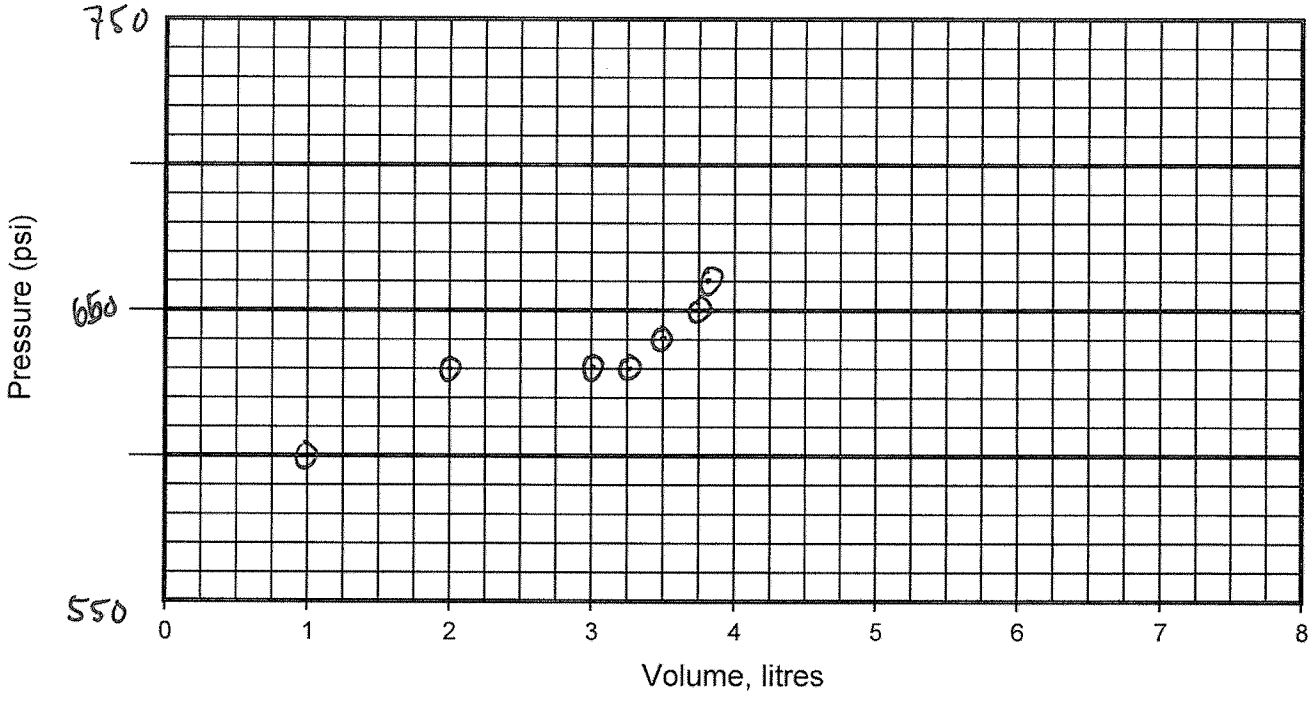
Packer No. 3, comp 13 SN# 15541 | Depth (ft / m): 167.17 | Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 155 psi | Final Line Pressure, P_L: 660 psi | Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / m) = 10 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 165 psi

Volume, litres	1.0	2.0	3.0	3.25	3.5	3.75	3.85	/	3.5	
Pressure, psi	600	630	630	630	640	650	660	/	ø	
Volume, litres										
Pressure, psi										



Comments: Packer # 3 | Time - 10:19 am

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce | Project No.: WB 860 | Well No.: US-8

Location: Bruce | Completed by: M. Lessard | Date Inflated: March 6/08

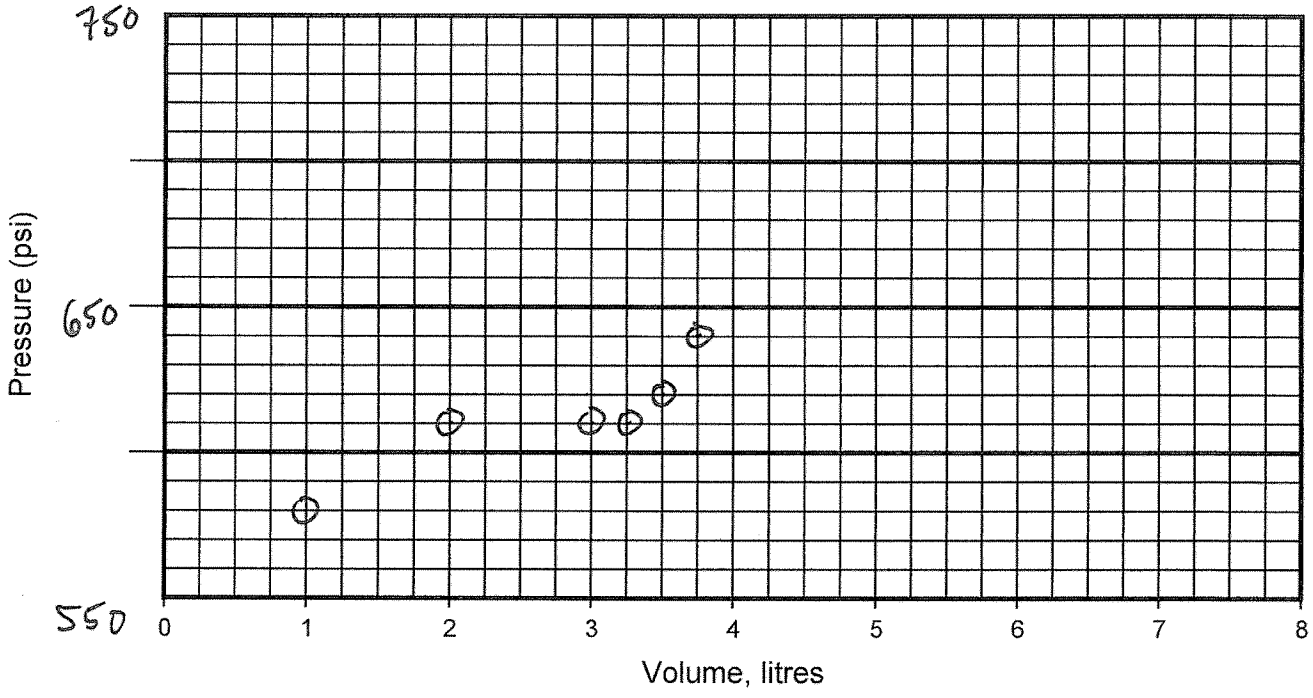
Packer No. 4, comp 18 SN# 15539 | Depth (ft / m): 153.45 | Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 640 psi | Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / m) = 10 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	3.25	3.5	3.75	/	3.5		
Pressure, psi	580	610	610	610	620	640	/	ø		
Volume, litres										
Pressure, psi										



Comments: Packer # 4 | Time - 10:33 am

Schlumberger
WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce Project No.: WB 960 Well No.: US-8

Location: Bruce Completed by: M. Lessard Date Inflated: March 6/08

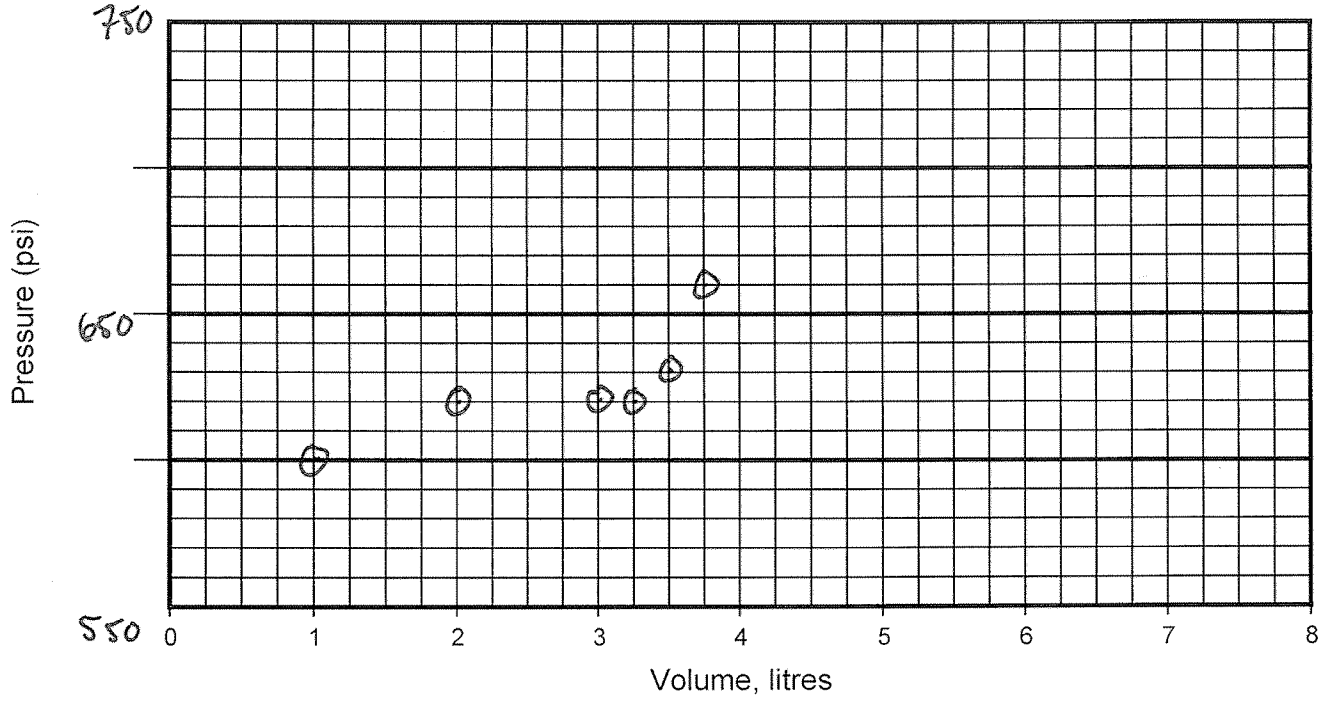
Packer No. 5, coup 21 SN# 15530 Depth (ft / m): 147.35 Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 160 psi Final Line Pressure, P_L: 660 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / m) = 10 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	3.25	3.5	3.75	/	3.4		
Pressure, psi	600	620	620	620	630	660	/	ø		
Volume, litres										
Pressure, psi										



Comments: Packer # 5 Time - 10:46 am

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce | Project No.: WB860 | Well No.: US-8

Location: Bruce | Completed by: M. Lessard | Date Inflated: March 6/08

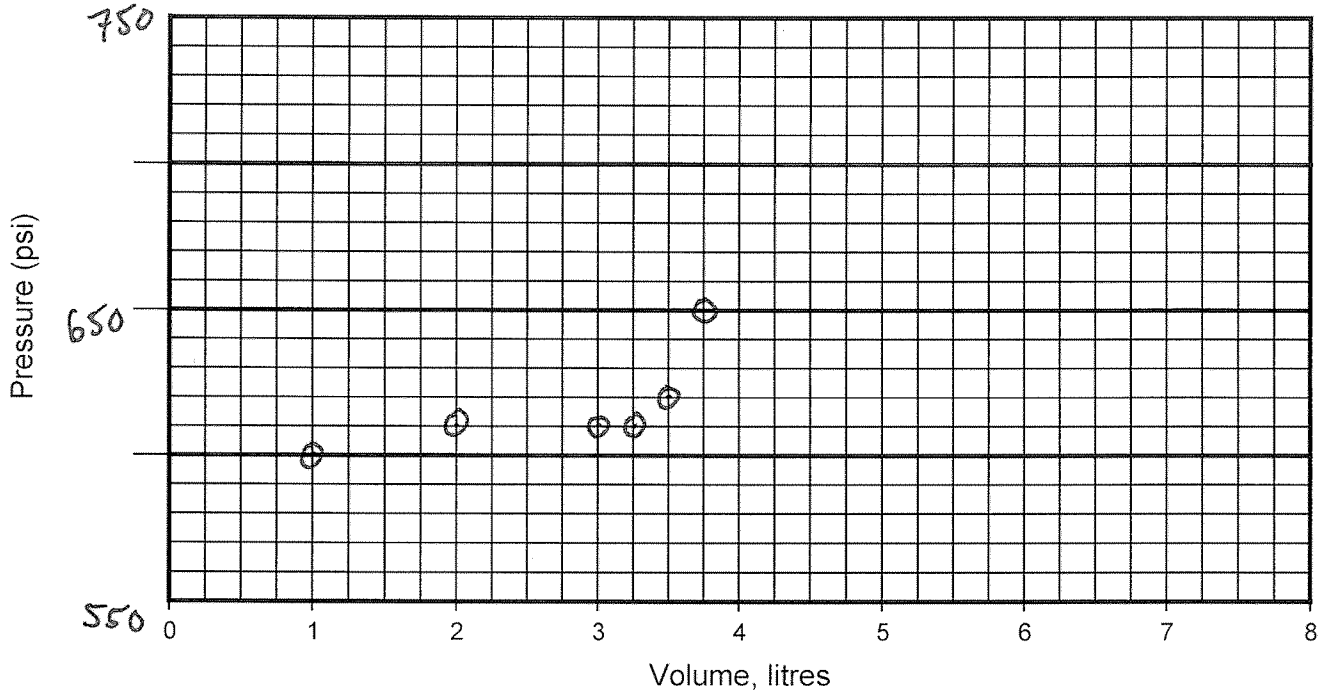
Packer No. 6, comp 24 Sn# 15529 | Depth (ft / m): 142.17 | Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi | Final Line Pressure, P_L: 650 psi | Tool Pressure, P_T: 750 psi

Borehole Water Level: 5.8 (ft / m) = 10 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	3.25	3.5	3.75	/	3.5		
Pressure, psi	600	610	610	610	620	650	/	Ø		
Volume, litres										
Pressure, psi										



Comments: Packer # 6 | Time - 10:59 am

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce | Project No.: WB860 | Well No.: US-8

Location: Bruce | Completed by: M. Lessard | Date Inflated: March 6/08

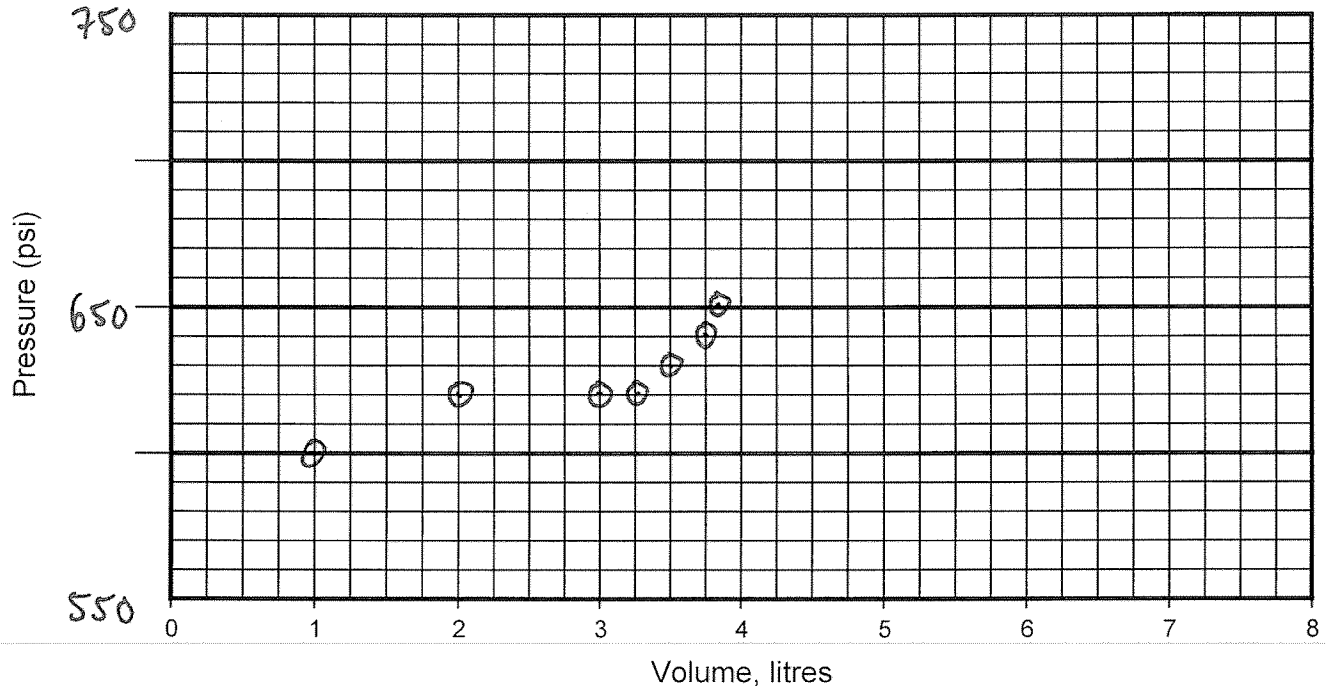
Packer No. 7, comp 27 SN# 15523 | Depth (ft / m): 136.08 | Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 650 psi | Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / m) = 10 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	3.25	3.5	3.75	3.85	/	3.6	
Pressure, psi	600	620	620	620	630	640	650	/	Ø	
Volume, litres										
Pressure, psi										



Comments: Packer # 7 | Time - 11:15 am

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce | Project No.: WB 860 | Well No.: US-8

Location: Bruce | Completed by: M. Lessard | Date Inflated: March 6/08

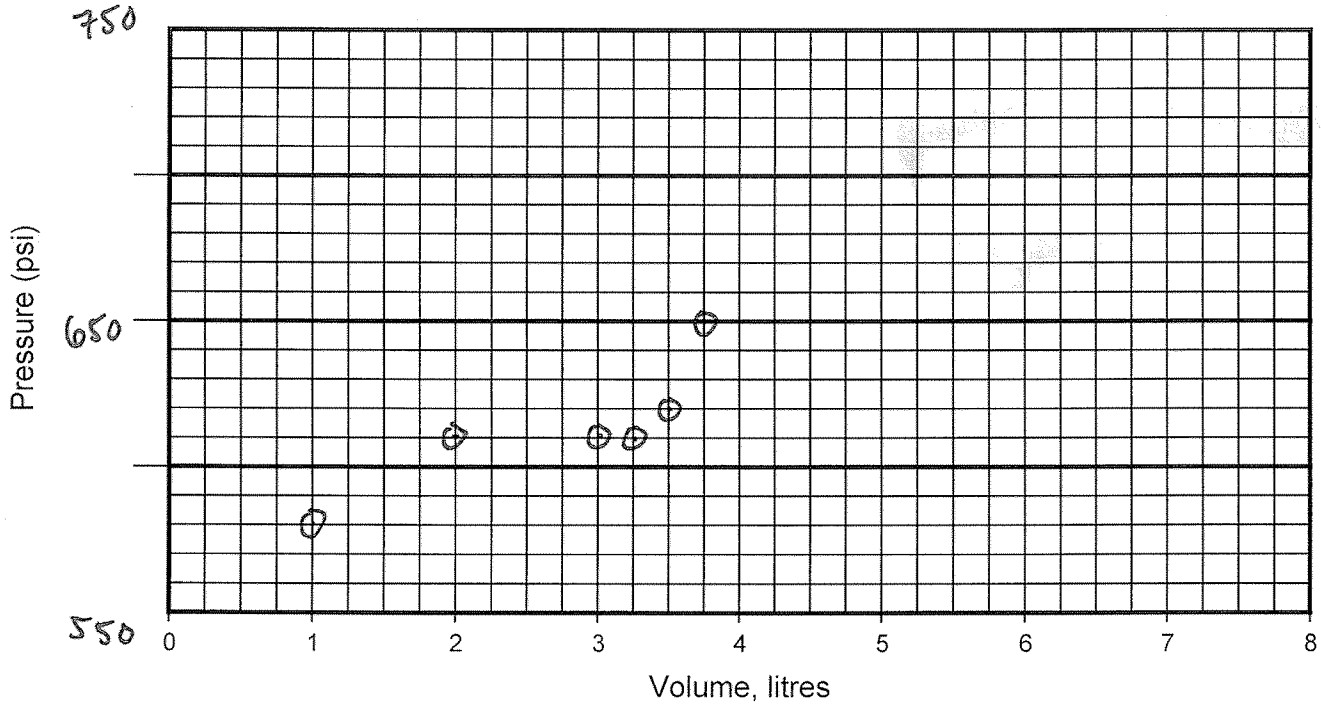
Packer No. 8 comp 35 SN# 15526 | Depth (ft / m): 115.66 | Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 650 psi | Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / m) = 10 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	3.25	3.5	3.75	/	3.5		
Pressure, psi	580	610	610	610	620	650	/	∅		
Volume, litres										
Pressure, psi										



Comments: Packer # 8 | Time - 11:28 am

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce Project No.: WB860 Well No.: US-8

Location: Bruce Completed by: M. Lessard Date Inflated: March 6/08

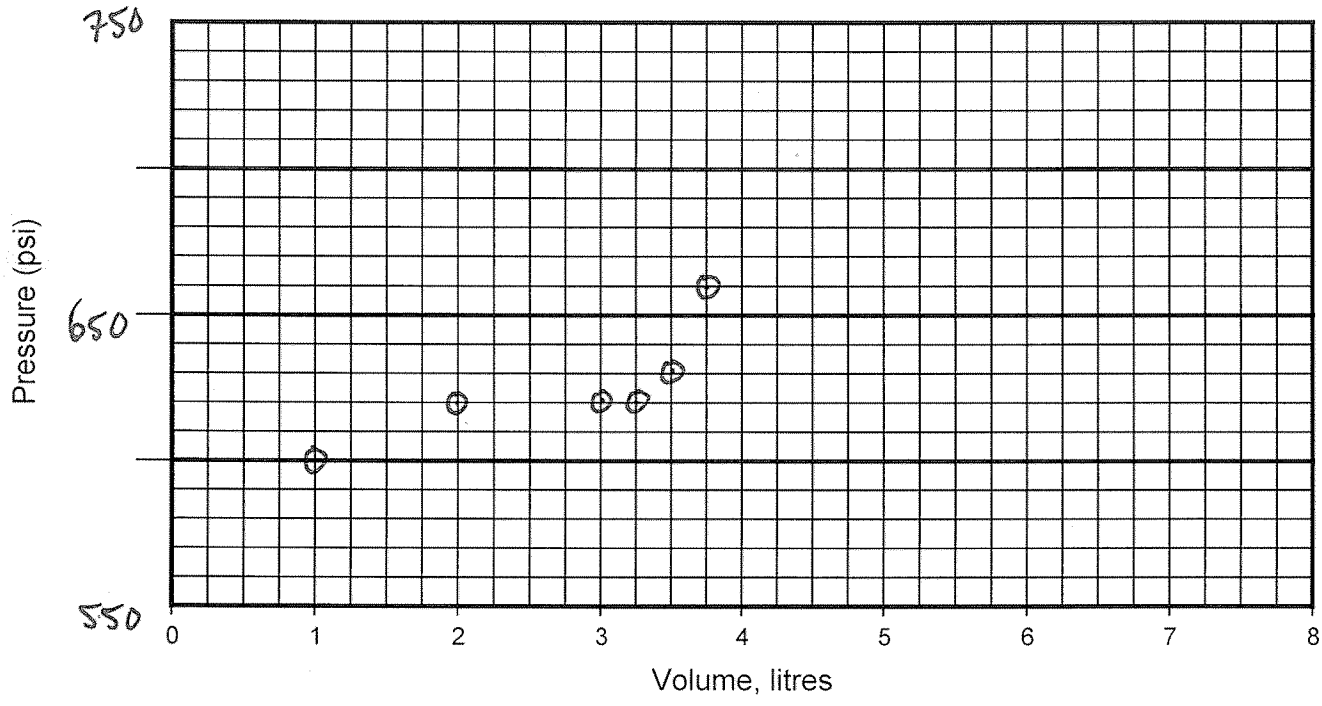
Packer No. 9, comp 36 SN# 15522 Depth (ft / m): 114.13 Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 660 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / m) = 10 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	3.25	3.5	3.75	/	3.5		
Pressure, psi	600	620	620	620	630	660	/	∅		
Volume, litres										
Pressure, psi										



Comments: Packer # 9 Time - 11:41 am

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce Project No.: WB 960 Well No.: US-8

Location: Bruce Completed by: M. Lessard Date Inflated: March 6/08

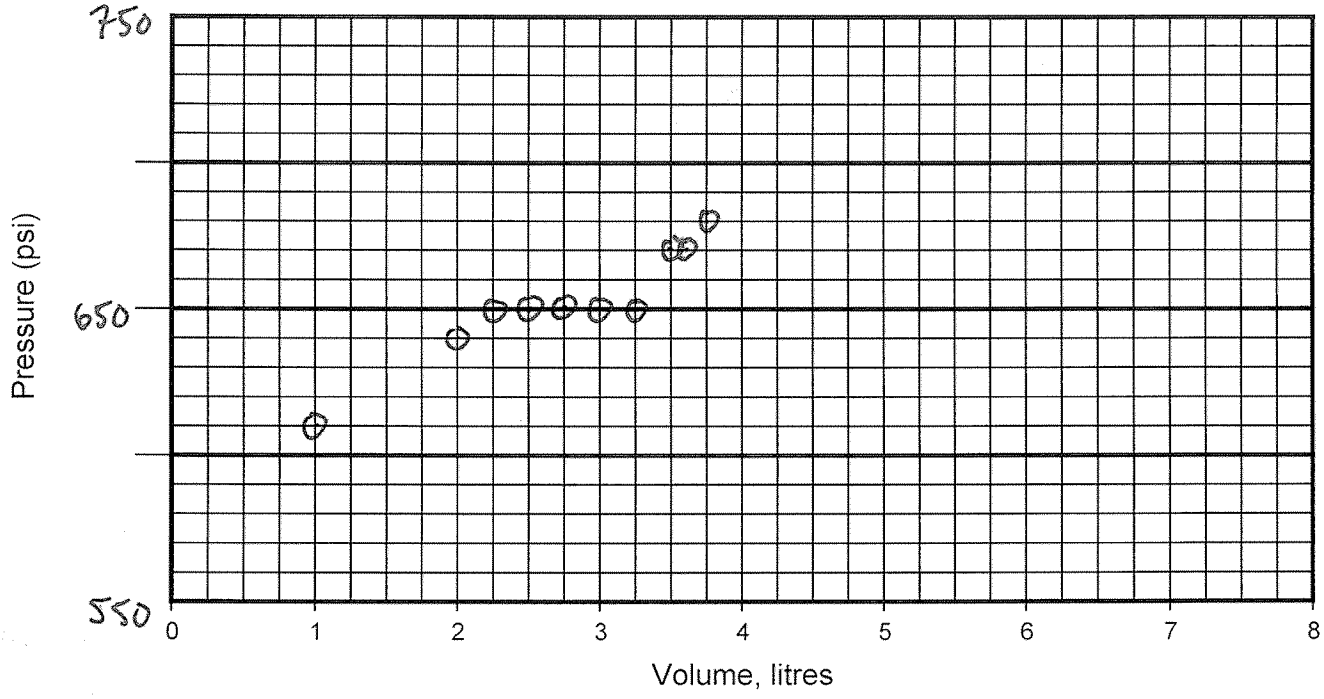
Packer No. 10, comp 40 SN# 15528 Depth (ft / m): 106.51 Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 155 psi Final Line Pressure, P_L: 680 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / m) = 10 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 185 psi

Volume, litres	1.0	2.0	2.25	2.5	2.75	3.0	3.25	3.5	3.6	3.75
Pressure, psi	610	640	650	650	650	650	650	670	670	680
Volume, litres	✓	3.5								
Pressure, psi	✓	0								



Comments: Packer # 10 Time - 11:57 am

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce | Project No.: WB860 | Well No.: US-8

Location: Bruce | Completed by: M. Lessard | Date Inflated: March 6/08

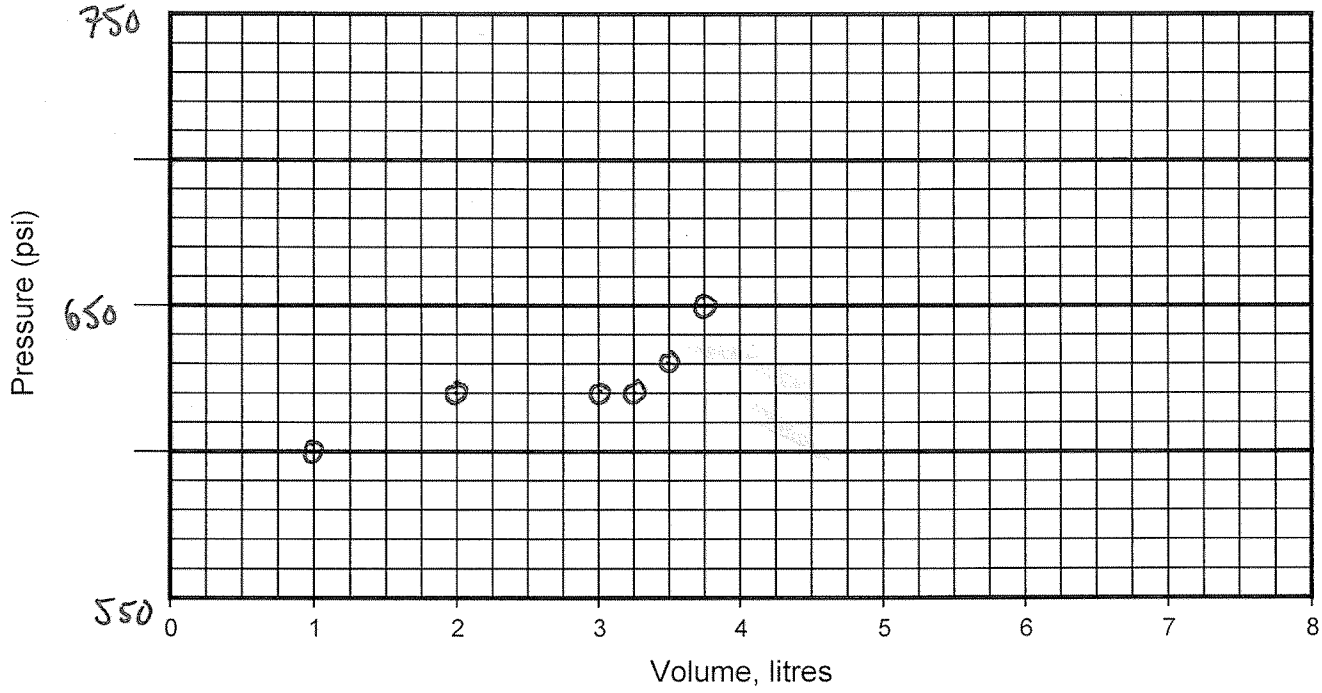
Packer No. 11 comp 44 SN# 15525 | Depth (ft / (m)): 98.89 | Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi | Final Line Pressure, P_L: 650 psi | Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / (m)) = 10 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	3.25	3.5	3.75	/	3.4		
Pressure, psi	600	620	620	620	630	650	/	∅		
Volume, litres										
Pressure, psi										



Comments: Packer # 11 | Time - 12:12 pm

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce | Project No.: WB 860 | Well No.: US-8

Location: Bruce | Completed by: M. Lessard | Date Inflated: March 6/08

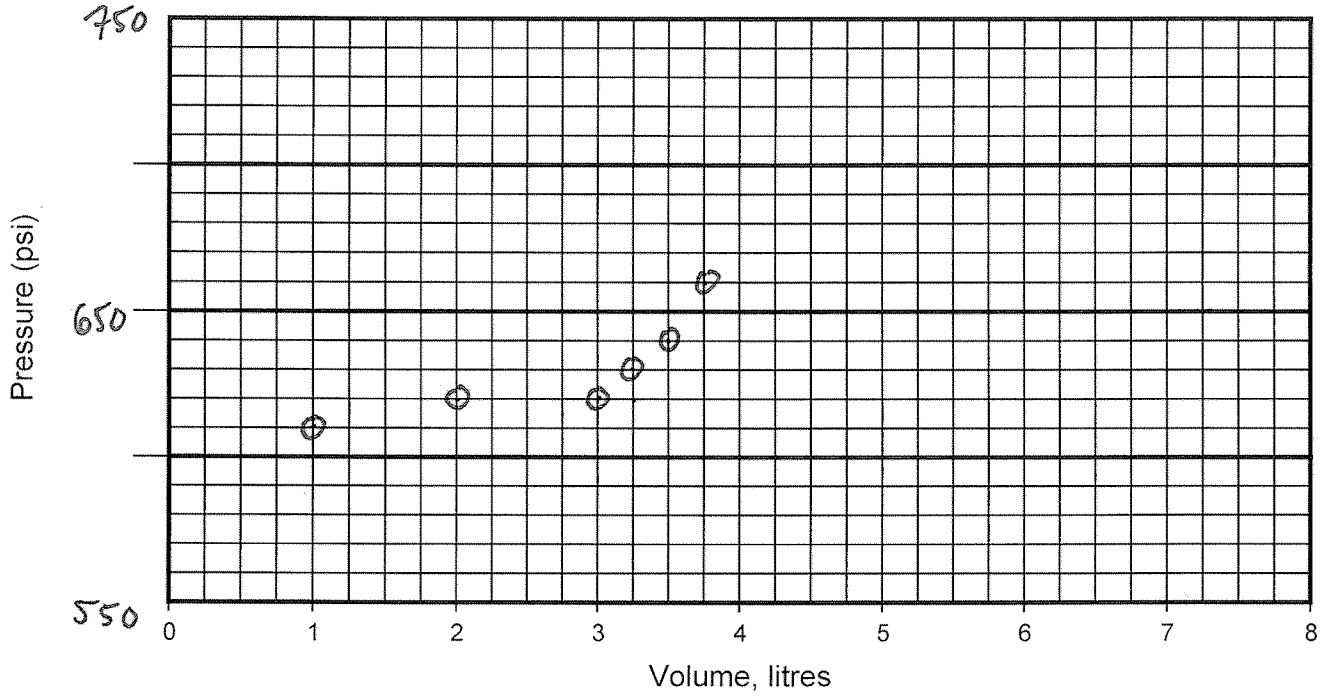
Packer No. 12, Comp 99 SN# 15524 | Depth (ft / m): 91.58 | Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi | Final Line Pressure, P_L: 660 psi | Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / m) = 10 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	3.25	3.5	3.75	/	3.5		
Pressure, psi	610	620	620	630	640	660	/	ø		
Volume, litres										
Pressure, psi										



Comments: Packer # 12 | Time - 12:26 pm

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce | Project No.: WB 860 | Well No.: US-8

Location: Bruce | Completed by: M. Lessard | Date Inflated: March 6/08

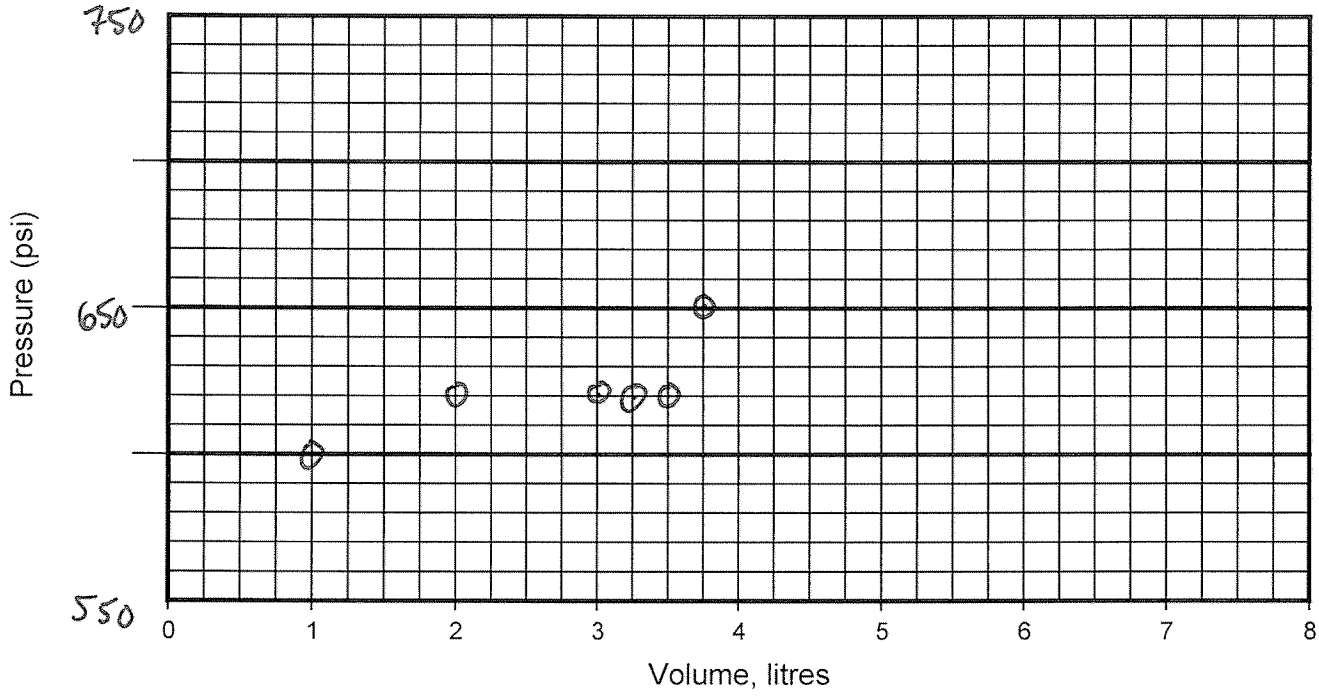
Packer No. 13, comp 54 SN# 15536 | Depth (ft / m): 79.39 | Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 650 psi | Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / m) = 10 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	3.25	3.5	3.75	/	3.5		
Pressure, psi	600	620	620	620	620	650	/	ø		
Volume, litres										
Pressure, psi										



Comments: Packer # 13 | Time - 12:38 pm

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce | Project No.: WB860 | Well No.: US-8

Location: Bruce | Completed by: M.Lessard | Date Inflated: March 6/08

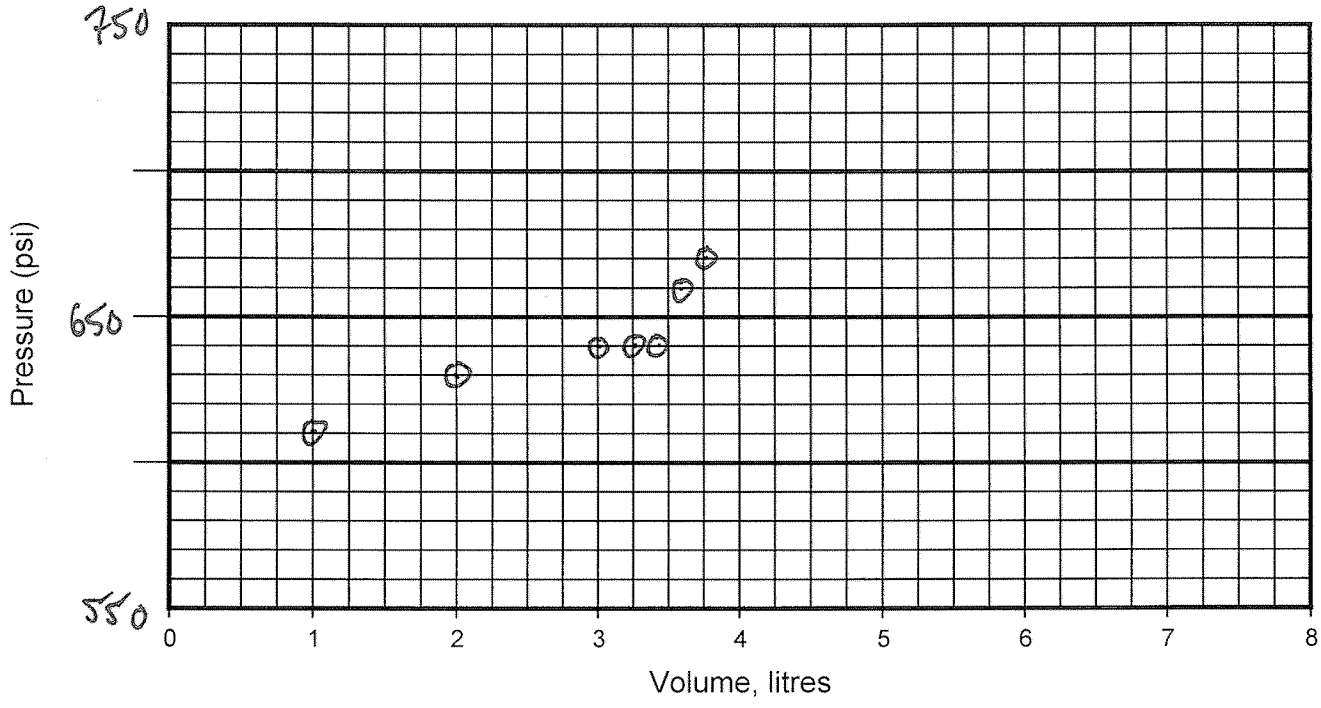
Packer No. 14, comp 58 Sn# 15535 | Depth (ft / ~~m~~): 79.21 | Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 155 psi | Final Line Pressure, P_L: 670 psi | Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / ~~m~~) = 10 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 175 psi

Volume, litres	1.0	2.0	3.0	3.25	3.4	3.6	3.75	/	3.5	
Pressure, psi	610	630	640	640	640	660	670	/	∅	
Volume, litres										
Pressure, psi										



Comments: Packer # 14 | Time - 12:53 pm

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce | Project No.: WB860 | Well No.: US-8

Location: Bruce | Completed by: M. Lessard | Date Inflated: March 6/08

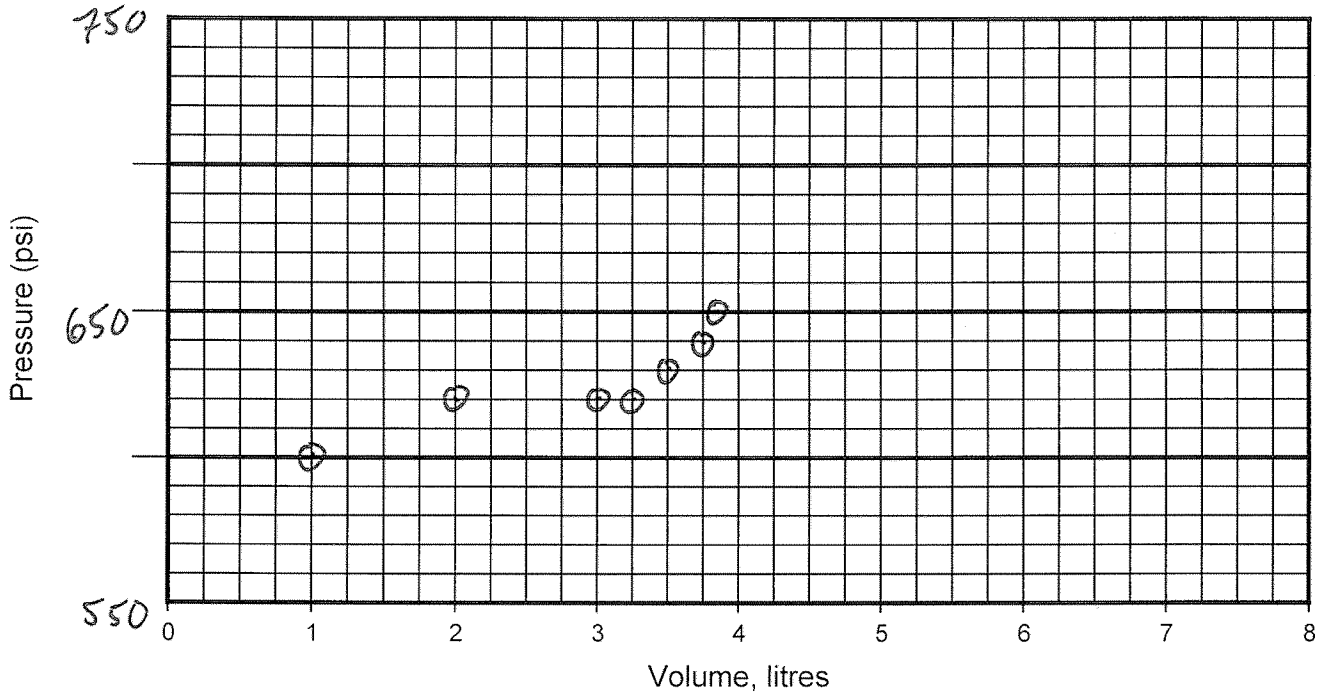
Packer No. 15, comp 63 SN# 15533 | Depth (ft / (m)): 60.49 | Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi | Final Line Pressure, P_L: 650 psi | Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / (m)) = 10 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	3.25	3.5	3.75	3.85	/	3.6	
Pressure, psi	600	620	620	620	630	640	650	/	Ø	
Volume, litres										
Pressure, psi										



Comments: Packer # 15 | Time - 1:08 pm

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce Project No.: WB860 Well No.: US-8

Location: Bruce Completed by: M. Lessard Date Inflated: March 6/08

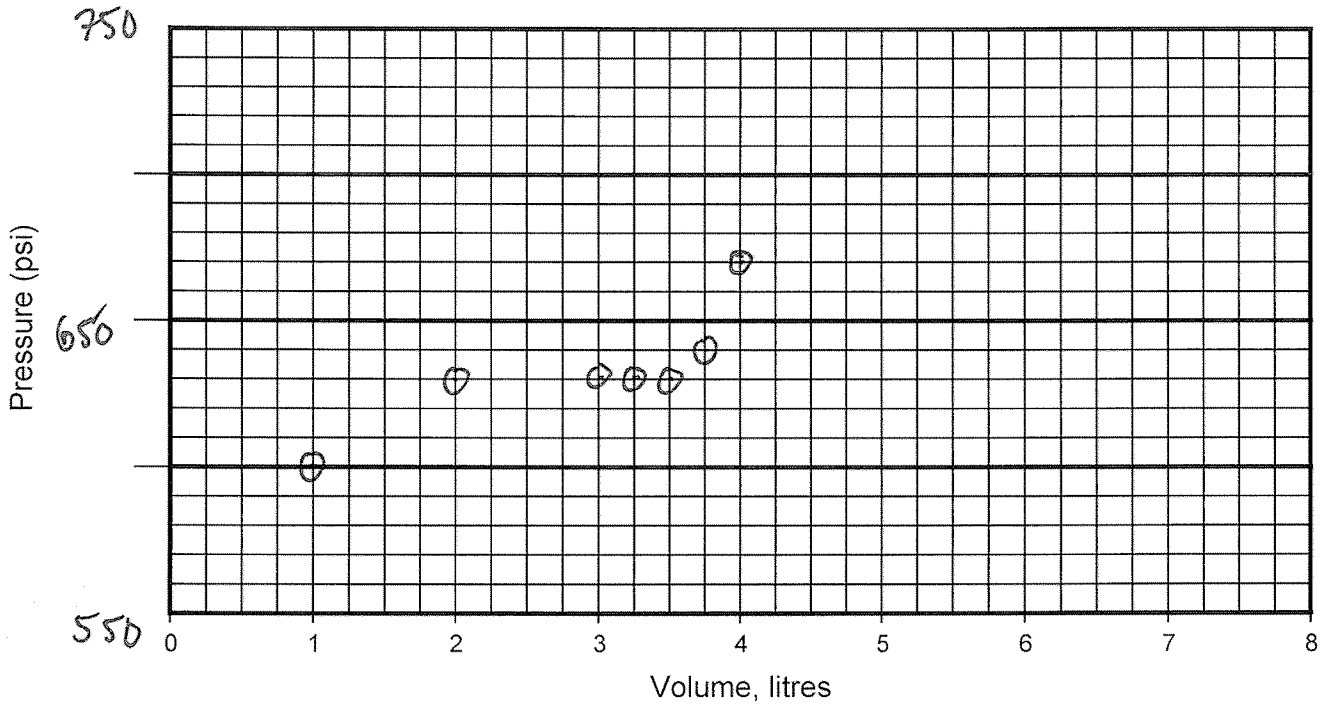
Packer No. 16, comp 68 SN#15534 Depth (ft / m): 46.78 Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 150 psi Final Line Pressure, P_L: 670 psi Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / m) = 10 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 180 psi

Volume, litres	1.0	2.0	3.0	3.25	3.5	3.75	4.0	/	3.7	
Pressure, psi	600	630	630	630	630	640	670	/	0	
Volume, litres										
Pressure, psi										



Comments: Packer # 16 Time - 1:23 pm

Schlumberger WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce | Project No.: WB 860 | Well No.: US-8

Location: Bruce | Completed by: M. Lessard | Date Inflated: March 6/08

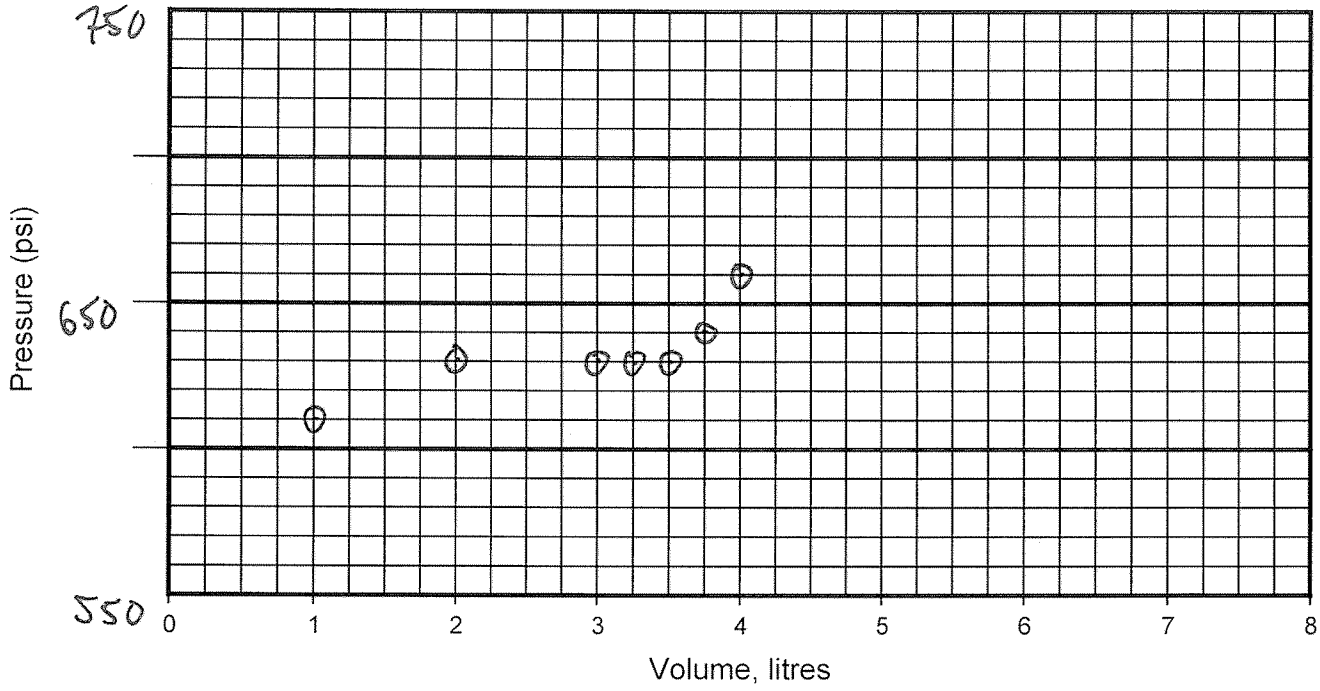
Packer No. 17, comp 7# SN# 15538 | Depth (ft / m): 31.54 | Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 145 psi | Final Line Pressure, P_L: 660 psi | Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / m) = 10 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 175 psi

Volume, litres	1.0	2.0	3.0	3.25	3.5	3.75	4.0	/	3.7	
Pressure, psi	610	630	630	630	630	640	660	ø	ø	
Volume, litres										
Pressure, psi										



Comments: Packer # 17 | Time - 1:38 pm

Schlumberger
WATER SERVICES

Westbay Packer Inflation Record

Project: Bruce | Project No.: WB860 | Well No.: BS-8

Location: Bruce | Completed by: M. Lessard | Date Inflated: March 6/08

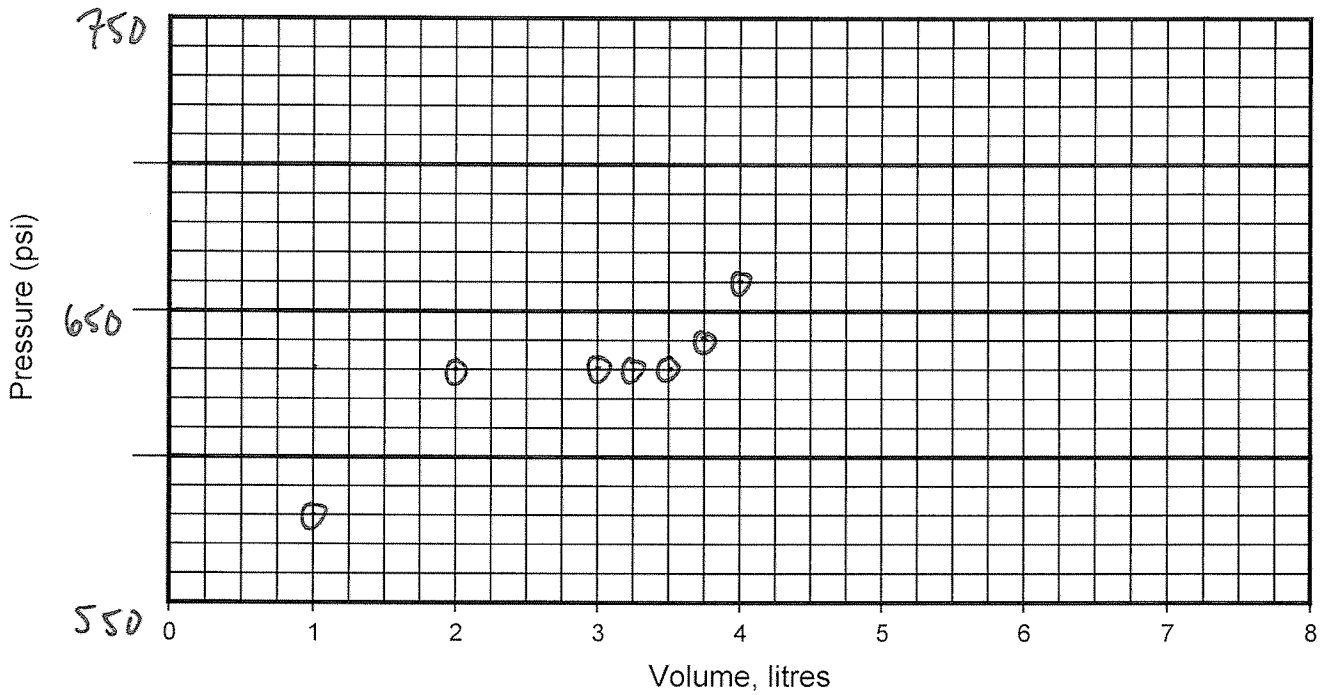
Packer No. 18, comp 81 SN# 15531 | Depth (ft / m): 13.25 | Inflation Tool No.: 3197

Packer Valve Pressure, P_V: 140 psi | Final Line Pressure, P_L: 660 psi | Tool Pressure, P_T: 350 psi

Borehole Water Level: 5.8 (ft / m) = 10 psi (P_W)

Calculated Packer Element Pressure, $P_E = P_L + P_W - P_V - P_T$ = 180 psi

Volume, litres	1.0	2.0	3.0	3.25	3.5	3.75	4.0	/	3.7	
Pressure, psi	580	630	630	630	630	630	660	/	ø	
Volume, litres										
Pressure, psi										



Comments: Packer # 18 | Time - 1:43 pm

APPENDIX E

Summary of MP38 Monitoring Intervals in US-3, US-7 and US-8

Table E.1 Summary of Packer-Isolated Mointoring Intervals in US-3

Port No.	Measurement Port Elevation (mASL)	Measurement Port Depth (mBGS)	Nominal Packer Position	Top of Zone (mASL)	Bottom of Zone (mASL)	Top of Zone (mBGS)	Bottom of Zone (mBGS)	Zone Length (m)	Bedrock Formation
1	116.1	68.5	65.5	117.8	110.3	66.8	74.3	7.5	Bois Blanc
2	125.8	58.8	55.7	127.6	118.7	57.0	65.9	8.9	Bois Blanc
3	133.4	51.2	48.1	135.2	128.5	49.4	56.1	6.7	Amherstburg - Bois Blanc
4	144.1	40.5	37.4	145.9	136.1	38.7	48.5	9.8	Amherstburg
5	152.3	32.3	29.2	154.1	146.8	30.5	37.8	7.3	Amherstburg
6	160.0	24.6	21.6	161.7	155.0	22.9	29.6	6.7	Lucas

Notes:

184.59 mASL US-3 ground surface elevation

Table E.2 Summary of Packer-Isolated Mointoring Intervals in US-7

Port No.	Measurement Port Elevation (mASL)	Measurement Port Depth (mBGS)	Top of Zone (mASL)	Bottom of Zone (mASL)	Top of Zone (mBGS)	Bottom of Zone (mBGS)	Zone Length (m)	Bedrock Formation
1	104.5	78.1	106.2	93.0	76.4	89.6	13.2	Bois Blanc
2	113.7	68.9	116.0	107.1	66.6	75.5	8.9	Bois Blanc
3	124.9	57.7	126.7	116.9	55.9	65.7	9.8	Bois Blanc
4	134.1	48.5	138.8	127.6	43.8	55.0	11.2	Amherstburg - Bois Blanc
5	149.3	33.3	151.0	139.7	31.6	42.9	11.3	Amherstburg
6	154.3	28.3	155.4	151.9	27.2	30.7	3.5	Lucas- Amherstburg
7	159.7	22.9	161.4	156.3	21.2	26.3	5.1	Lucas

Notes:

182.608 mASL US-7 ground surface elevation

Table E.3 Summary of Packer-Isolated Mointoring Intervals in US-8

Port No.	Measurement Port Elevation (mASL)	Measurement Port Depth (mBGS)	Top of Zone (mASL)	Bottom of Zone (mASL)	Top of Zone (mBGS)	Bottom of Zone (mBGS)	Zone Length (m)	Bedrock Formation
1	-5.9	193.1	-2.6	-13.2	189.8	200.4	10.6	Bass Islands
2	7.8	179.4	12.6	-1.7	174.6	188.9	14.3	Bass Islands
3	17.0	170.2	18.7	13.5	168.5	173.7	5.2	Bass Islands
4	29.2	158.0	32.5	19.6	154.7	167.6	12.9	Bass Islands
5	36.8	150.4	38.6	33.4	148.6	153.8	5.2	Bass Islands
6	43.5	143.7	43.7	39.5	143.5	147.7	4.2	Bois Blanc - Bass Islands
7	49.6	137.6	49.8	44.6	137.4	142.6	5.2	Bois Blanc
8	66.4	120.8	69.3	50.7	117.9	136.5	18.6	Bois Blanc
9	71.5	115.7	71.8	70.2	115.4	117.0	1.6	Bois Blanc
10	77.6	109.6	79.4	72.7	107.8	114.5	6.7	Bois Blanc
11	85.3	101.9	87.0	80.3	100.2	106.9	6.7	Bois Blanc
12	94.1	93.1	94.3	87.9	92.9	99.3	6.4	Bois Blanc
13	101.7	85.5	106.5	95.2	80.7	92.0	11.3	Amherstburg - Bois Blanc
14	111.5	75.7	111.7	107.4	75.5	79.8	4.3	Amherstburg
15	119.1	68.1	125.4	112.6	61.8	74.6	12.8	Amherstburg
16	132.8	54.4	139.1	126.3	48.1	60.9	12.8	Amherstburg
17	146.6	40.6	154.4	140.0	32.8	47.2	14.4	Lucas
18	167.9	19.3	172.6	155.3	14.6	31.9	17.3	Lucas

Note:

US-8 ground surface elevation = 187.2 mASL

Table E.3 Summary of Packer-Isolated Mointoring Intervals in US-8

Port No.	Measurement Port Elevation (mASL)	Measurement Port Depth (mBGS)	Top of Zone (mASL)	Bottom of Zone (mASL)	Top of Zone (mBGS)	Bottom of Zone (mBGS)	Zone Length (m)	Bedrock Formation
1	-5.9	193.1	-2.6	-13.2	189.8	200.4	10.6	Bass Islands
2	7.8	179.4	12.6	-1.7	174.6	188.9	14.3	Bass Islands
3	17.0	170.2	18.7	13.5	168.5	173.7	5.2	Bass Islands
4	29.2	158.0	32.5	19.6	154.7	167.6	12.9	Bass Islands
5	36.8	150.4	38.6	33.4	148.6	153.8	5.2	Bass Islands
6	43.5	143.7	43.7	39.5	143.5	147.7	4.2	Bois Blanc - Bass Islands
7	49.6	137.6	49.8	44.6	137.4	142.6	5.2	Bois Blanc
8	66.4	120.8	69.3	50.7	117.9	136.5	18.6	Bois Blanc
9	71.5	115.7	71.8	70.2	115.4	117.0	1.6	Bois Blanc
10	77.6	109.6	79.4	72.7	107.8	114.5	6.7	Bois Blanc
11	85.3	101.9	87.0	80.3	100.2	106.9	6.7	Bois Blanc
12	94.1	93.1	94.3	87.9	92.9	99.3	6.4	Bois Blanc
13	101.7	85.5	106.5	95.2	80.7	92.0	11.3	Amherstburg - Bois Blanc
14	111.5	75.7	111.7	107.4	75.5	79.8	4.3	Amherstburg
15	119.1	68.1	125.4	112.6	61.8	74.6	12.8	Amherstburg
16	132.8	54.4	139.1	126.3	48.1	60.9	12.8	Amherstburg
17	146.6	40.6	154.4	140.0	32.8	47.2	14.4	Lucas
18	167.9	19.3	172.6	155.3	14.6	31.9	17.3	Lucas

Note:

US-8 ground surface elevation = 187.2 mASL