July 16, 2013

Mr. Tom Meyer
Seattle City Light
700 Fifth Avenue, Suite 3316
Seattle, WA 98104

Re: Piezometer Installation and Testing
Diablo, Washington
17843-16

Dear Tom:

We are pleased to present this letter report summarizing our piezometer installation and testing services at Seattle City Light's (SCL) Diablo facility (Figure 1). The purpose of our activities at the site was to assess hydrogeologic conditions for the planned large on-site septic system (LOSS).

BACKGROUND

We understand that SCL owns and operates the town of Diablo, and is responsible for operation of a wastewater treatment facility in Diablo. SCL is working with the Washington State Department of Health to replace the wastewater treatment facility with a LOSS. By installing piezometers, SCL will be able to better understand groundwater conditions at the proposed location of the LOSS.

In October 2012, four hollow-stem auger borings were attempted at locations selected by SCL. Due to the rocky subsurface, three borings met with refusal between depths of 8 and 12.5 feet and only one boring (PZ-04) was completed as a piezometer. We returned to Diablo in April 2013 to drill and complete the remaining piezometers.

FIELD INVESTIGATION

The first phase of field work was completed on October 30, 2012, and included the following activities:

1700 Westlake Avenue North, Suite 200
Seattle, Washington 98109-6212
Fax 206.328.5581
Tel 206.324.9530

- Attempted four hollow-stem auger explorations (PZ-1 through PZ-4). PZ-1 through PZ-3 were met with refusal at depths of 8 to 12.5 feet. PZ-4 was extended to a depth of 20 feet bgs. Soil samples from each boring location were used for soil classification.

- Installed a 2-inch-diameter piezometer in boring location PZ-4. Groundwater was not encountered in PZ-1 through PZ-3, therefore groundwater monitoring wells were not completed in these soil borings at this time.

The second phase of field work was completed on April 25–26 and May 9–10, 2013, and included the following activities:

- Re-attempted and completed four boring locations (PZ-1 to PZ-3, and PZ-5) using sonic drilling methods to depths of 25 feet, and installed 2-inch-diameter piezometers.

- Developed and slug tested all five piezometers (PZ-1 to PZ-5).

- Sampled all five piezometers (PZ-1 to PZ-5) using low-flow sampling techniques.

- Submitted one groundwater sample from each piezometer to Edge Analytical Laboratories under subcontract to OnSite Environmental, Inc., laboratory for nitrates by EPA Method 300.0, and total and fecal coliform by Standard Method 9221B and 9222E, respectively.

The locations of the piezometers are shown on Figure 2. A detailed description of the field methods and logs of the explorations are presented in Appendix A. A chemical data quality review and laboratory reports are provided in Appendix B. Slug testing results are provided in Appendix C.

GEOLOGY AND HYDROGEOLOGY

Subsurface conditions observed during the installation of the piezometers consisted mostly of a gravely Sand with cobbles to a cobbly Sandy unit over a sandy Gravel with cobbles unit, except for in PZ-4. PZ-5 has a possible quarry spall fill unit from depths between 4 and 10 feet since only cobbles were observed from the sample sleeve. The sandy Gravel with cobbles unit could be river alluvium deposits.

The subsurface conditions observed at PZ-4 consisted of topsoil over Sand. PZ-4 is located in the Reflector Bar area of Diablo. The Sand unit could be alluvium from river deposits between Diablo Dam and George Lake.

Groundwater at the time of drilling was observed to be approximately 12 to 15 feet below ground surface. Groundwater flow is in a southward direction toward the Skagit River. Fluctuations in groundwater depths may be caused by variations in Ross Lake and Diablo dam control, river stage, rainfall, snow melt, temperature, season, and other factors.

GROUNDWATER CHEMICAL ANALYSIS RESULTS

Groundwater samples were collected from all five piezometers (PZ-1 to PZ-5) on May 10, 2013. The groundwater sample general chemistry and analytical results are presented in Table 1. Based on the groundwater chemistry results, we observed the following:

- Nitrate was not detected at or above the laboratory reporting limit in all five groundwater samples collected from PZ-1 through PZ-5.
- Total coliform was detected in wells PZ-1, PZ-3, and PZ-4 at low concentrations ranging between 2 and 17 MPN/100mL (most probable number per 100 milliliters). Total coliform was not detected at the laboratory reporting limit in wells PZ-2 and PZ-5.
- Fecal coliform was not detected at or above the laboratory reporting limit in all five groundwater samples collected from PZ-1 through PZ-5.
- Groundwater quality parameters measured during well stabilization included pH, temperature, conductivity, dissolved oxygen, oxidation reduction potential (ORP), and turbidity. All parameters were within normal ranges for fresh water.

SLUG TESTING RESULTS

Slug testing was conducted in piezometers PZ-1 to PZ-5 on May 9, 2013. A summary of piezometer construction details is provided in Table 2. Piezometers PZ-1 to PZ-3 and PZ-5 were screened in the sandy gravel alluvial deposits. Piezometer PZ-4 was screened in the Sand alluvium.

A summary of slug testing results is provided in Table 3. The slug test plots are provided in Appendix C as Figures C-1 through C-13. Two sets of falling and rising head tests were analyzed for each piezometer.

The results of the falling and rising head tests compare favorably. Hydraulic conductivities determined from slug tests for piezometers screened in the alluvial unit ranges from 3×10^{-2} to 6 x

10^{-2} cm/sec (84 to 171 ft/day). This hydraulic conductivity range is typical for sandy gravel deposits (Freeze and Cherry 1979). Piezometer PZ-4 that was screened in the Sand alluvium had a slightly lower hydraulic conductivities and ranges from 5 x 10^{-3} to 6 x 10^{-3} cm/sec (14 to 17 ft/day). This hydraulic conductivity range is typical for Sand (Freeze and Cherry 1979).

REFERENCE

Freeze, R.A. and J.A. Cherry 1979. Groundwater. Prentice-Hall, Englewood Cliffs, New Jersey.

LIMITATIONS

Work for this project was performed, and this letter report prepared, in accordance with generally accepted professional practices for the nature and conditions of the work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of Seattle City Light for specific application to the referenced property. This letter report is not meant to represent a legal opinion. No other warranty, express or implied, is made.

Any questions regarding our work and this letter report, the presentation of the information, and the interpretation of the data are welcome and should be referred to the undersigned.

We trust that this letter report meets your needs.

Sincerely,

HART CROWSER, INC.

ANGIE GOODWIN, LHG
Project Hydrogeologist
Angie.goodwin@hartcrowser.com

ROSS STAINSBY
Senior Associate
Ross.Stainsby@hartcrowser.com

Attachments:
Table 1 - Analytical Results and Water Quality Parameters for Groundwater Samples
Table 2 - Piezometer Construction Summary
Table 3 - Estimated Hydraulic Conductivity Summary
Figure 1 - Vicinity Map
Figure 2 - Site and Exploration Plan
Appendix A - Field Exploration Methods and Boring Logs
Appendix B - Chemical Data Quality Review and Laboratory Reports
Appendix C - Slug Test Analysis Figures

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Table 1 - Analytical Results and Water Quality Parameters for Groundwater Samples

Sample ID Sampling Date	PZ-1 5/10/2013	PZ-2 5/10/2013	PZ-3 5/10/2013	PZ-4 5/10/2013	PZ-5 5/10/2013
Nitrate-N in mg/L	0.10 U	0.10 U	0.10 U	0.10 U	0.10 U
Total Coliform in MPN/100 mL	2.0	1.8 U	13	17	1.8 U
Fecal Coliform in MPN/100 mL	1.8 U	1.8 U	1.8 U	1.8 U	1.8 U
Water Quality Parameters					
pH	6.56	6.60	6.32	6.10	6.33
Temperature in °C	5.86	6.87	6.39	9.48	7.36
Conductivity in mS/cm	0.009	0.009	0.014	0.063	0.011
Dissolved Oxygen in mg/L	11.28	11.32	10.42	8.72	11.13
ORP in mV	111	167	88	286	222
Turbidity in NTU	33	7	30	40	1

Notes:
U = Not detected at reporting limit indicated.
MPN/100 mL = Most probable number per 100 milliliters

Table 2 - Piezometer Construction Summary

Well ID	PZ-1	PZ-2	PZ-3	PZ-4	PZ-5
Boring Depth in Feet	25	25	25	20	25
Well Depth in Feet	24	25	25	19	25
Screen Interval Depth in Feet	9 to 24	10 to 25	10 to 25	9 to 19	15 to 25
Depth to Sediment in Feet (1)	23.00	24.00	23.79	18.41	23.30
Depth to Water in Feet (1)	12.13	11.65	15.05	12.91	13.20
Saturated Well Length in Feet	10.87	12.35	8.74	5.50	10.10
Screened Interval Soil Description	GP	GP	GP	SP	GP

Notes:
(1) Depth to sediment and depth to water was measured on May 9, 2013.
SP = Poorly graded SAND
GP = Poorly graded GRAVEL

Table 3 - Estimated Hydraulic Conductivity Summary

Well ID	Slug Test No.	Test Type	Bouwer and Rice		
			T in ft2/day	K in ft/day	K in cm/sec
PZ-1	Test 1	Falling Head	1663	153	5.4E-02
	Test 2	Rising Head	1250	115	4.1E-02
	Test 3	Falling Head	1359	125	4.4E-02
	Test 4	Rising Head	1185	109	3.8E-02
			Average	*126*	*4.4E-02*
PZ-2	Test 1	Falling Head	1037	84	3.0E-02
	Test 2	Rising Head	2112	171	6.0E-02
	Test 3	Falling Head	1099	89	3.1E-02
	Test 4	Rising Head	2100	170	6.0E-02
			Average	*129*	*4.5E-02*
PZ-3	Test 1	Falling Head	979	112	4.0E-02
	Test 2	Rising Head	1381	158	5.6E-02
	Test 3	Falling Head	1407	161	5.7E-02
	Test 4	Rising Head	1267	145	5.1E-02
			Average	*144*	*5.1E-02*
PZ-4	Test 1	Falling Head	77	14	4.9E-03
	Test 2	Rising Head	94	17	6.0E-03
	Test 3	Falling Head	77	14	4.9E-03
	Test 4	Rising Head	88	16	5.6E-03
			Average	*15*	*5.4E-03*
PZ-5	Test 1	Falling Head	1414	140	4.9E-02
	Test 2	Rising Head	1545	153	5.4E-02
	Test 3	Falling Head	1374	136	4.8E-02
	Test 4	Rising Head	1444	143	5.0E-02
			Average	*143*	*5.0E-02*

N

0 4000 8000

Scale in Feet

Source: Base map prepared from DeLorme Topo 7.0, 2007.

Seattle City Light - Diablo Subsurface Investigation
Diablo, Washington

Vicinity Map

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Figure **1**

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PZ-1 Piezometer Location and Number

884 Groundwater Elevation Contour in Feet

Inferred Groundwater Flow Direction

N

0 250 500

Scale in Feet

Source: **Aerial photograph from ArcGIS Online, 2013. Features from PDF file "2013 Diablo Drilling Program_Locations.pdf," provided by Seattle City Light.**

Seattle City Light - Diablo Piezometer Installation
Diablo, Washington

Site and Exploration Plan

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Figure
2

EAL 06/21/13 1784316-005.dwg

APPENDIX A
FIELD EXPLORATION METHODS AND BORING LOGS

APPENDIX A
FIELD EXPLORATION METHODS AND BORING LOGS

This appendix describes the field explorations methods we used to advance explorations and to conduct groundwater sampling. We also include the exploration logs at the end of this appendix.

Soil Exploration Activities and Characterization

Hollow-stem auger explorations were attempted at four locations on October 30, 2012. Three explorations (PZ-1 through PZ-3) were met with refusal at depths of 8 to 12.5 feet due to the rocky subsurface. These three locations plus one additional location (PZ-5) were reattempted using sonic drilling methods on April 25 and 26, 2013. The explorations locations are shown on Figure 2. The exploration locations were located and marked in the field by a Hart Crowser field representative. Each exploration was cleared for utilities to an approximate depth of 4 feet using a vac-truck.

The hollow-stem auger explorations used a 4-inch inside diameter auger and were advanced with a truck-mounted drill rig operated by Holocene Drilling subcontracted by Hart Crowser. The sonic explorations used a 6-inch-diameter steel casing with a carbide drill bit and were advanced with a track-mounted drill rig operated by Holt Services, Inc., subcontracted by Hart Crowser. The large-diameter casing is rotated and/or vibrated into the subsurface and collects a continuous core sample. Samples are collected by vibrating the core out of the casing and into a flexible plastic sleeve by the sonic rig. Sample sleeves are made of clear plastic for convenient inspection of the soil sample. Soil samples were generally collected in continuous 5-foot-depth intervals.

A Hart Crowser representative observed the drilling and conducted the soil sampling activities. Samples were classified in general accordance with ASTM D 2488. Detailed logs were prepared of each boring and are presented on Figures A-2 through A-6 at the end of this appendix.

Piezometer Well Installation Activities

One piezometer (PZ-4) was installed on October 30, 2012, and four piezometers (PZ-1 through PZ-3 and PZ-5) were installed on April 25, 2013, to assess groundwater quality at the property. Two-inch-diameter, Schedule 40 PVC riser pipe and 2-inch -diameter, 0.010-inch machine-slotted screen were

used for the well casings and screens. The well screen and casing riser were lowered down through the exploration borehole. Silica sand (10/20) was placed in the annular space from the base of the boring to approximately 2 to 3 feet above the top of the well screen.

Well seals were constructed by placing bentonite chips in the annular space on top of the filter sand to within approximately two feet of the ground surface. The remaining annular space was backfilled with concrete to complete the surface seal. For protection, the piezometers were completed with irrigation vaults set in concrete. The piezometer construction details are summarized on Table 2 and illustrated on the boring logs on Figures A-2 and A-5.

The piezometers were installed in accordance with Washington State Department of Ecology regulations.

Piezometer Well Development

Piezometers PZ-1 through PZ-5 were developed on April 26, 2013, using overpumping methods. Hart Crowser performed the well development activities. Sediment thickness at the bottom of the well was measured and recorded before and after well development. Sediment was removed from the bottom of the wells using a stainless steel bailer. The piezometers were developed for a minimum of ten casing volumes for each location using a pump. The bailer and pump equipment were cleaned between piezometers to prevent cross-contamination of wells.

Groundwater Sampling

Groundwater samples were collected from five piezometers on May 10, 2013, for chemical analysis. Equipment used for the collection of groundwater samples included:

- Water quality parameter meter;
- Water level indicator;
- Peristaltic pump with disposable polyethylene tubing;
- Laboratory-supplied pre-cleaned and preserved sample containers; and
- Coolers with ice.

Field personnel recorded conditions, depth to water, and depth to sediment in the wells using a water level indicator. Prior to sampling, wells were purged and

sampled using low-flow groundwater sampling techniques. Purging and sampling were conducted at a depth representing the middle of the water column of each well. Groundwater samples were collected once the field parameters of pH, specific conductivity, and temperature were stabilized. The sample bottles were filled directly from the polyethylene tubing at relatively low-flow rates. To prevent cross-contamination of the wells, disposable polyethylene tubing was used for each groundwater sample and the water level indicator was decontaminated between well locations using a non-phosphate-based cleaner and de-ionized water.

Sample Handling and Laboratory Analysis

Groundwater samples collected were submitted to Edge Analytical Laboratories in Burlington, Washington, under subcontract to OnSite Environmental, Inc., of Redmond, Washington, for chemical analysis. Samples were delivered to Edge Analytical Laboratories under chain of custody protocols.

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Key to Exploration Logs

Sample Description

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance. Soil density/consistency in test pits and probes is estimated based on visual observation and is presented parenthetically on the logs.

SAND or GRAVEL Density	Standard Penetration Resistance (N) in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance (N) in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 to 4	Very soft	0 to 2	<0.125
Loose	4 to 10	Soft	2 to 4	0.125 to 0.25
Medium dense	10 to 30	Medium stiff	4 to 8	0.25 to 0.5
Dense	30 to 50	Stiff	8 to 15	0.5 to 1.0
Very dense	>50	Very stiff	15 to 30	1.0 to 2.0
		Hard	>30	>2.0

Sampling Test Symbols

- 1.5" I.D. Split Spoon
- Grab (Jar)
- 3.0" I.D. Split Spoon
- Shelby Tube (Pushed)
- Bag
- Cuttings
- Core Run

SOIL CLASSIFICATION CHART

MAJOR DIVISIONS			SYMBOLS GRAPH	SYMBOLS LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS	GRAVEL AND GRAVELLY SOILS	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE			GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	SAND AND SANDY SOILS	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
	MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

Moisture

Dry	Little perceptible moisture
Damp	Some perceptible moisture, likely below optimum
Moist	Likely near optimum moisture content
Wet	Much perceptible moisture, likely above optimum

Minor Constituents	Estimated Percentage
Trace	<5
Slightly (clayey, silty, etc.)	5 - 12
Clayey, silty, sandy, gravelly	12 - 30
Very (clayey, silty, etc.)	30 - 50

Laboratory Test Symbols

GS	Grain Size Classification
CN	Consolidation
UU	Unconsolidated Undrained Triaxial
CU	Consolidated Undrained Triaxial
CD	Consolidated Drained Triaxial
QU	Unconfined Compression
DS	Direct Shear
K	Permeability
PP	Pocket Penetrometer Approximate Compressive Strength in TSF
TV	Torvane Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Relationship
AL	Atterberg Limits
	Water Content in Percent Liquid Limit Natural Plastic Limit
PID	Photoionization Detector Reading
CA	Chemical Analysis
DT	In Situ Density in PCF
OT	Tests by Others

Groundwater Indicators

- Groundwater Level on Date or (ATD) At Time of Drilling
- Groundwater Seepage (Test Pits)

Sample Key

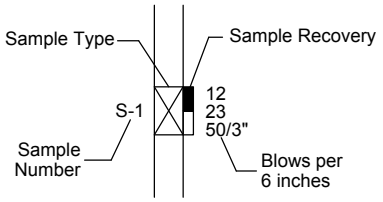

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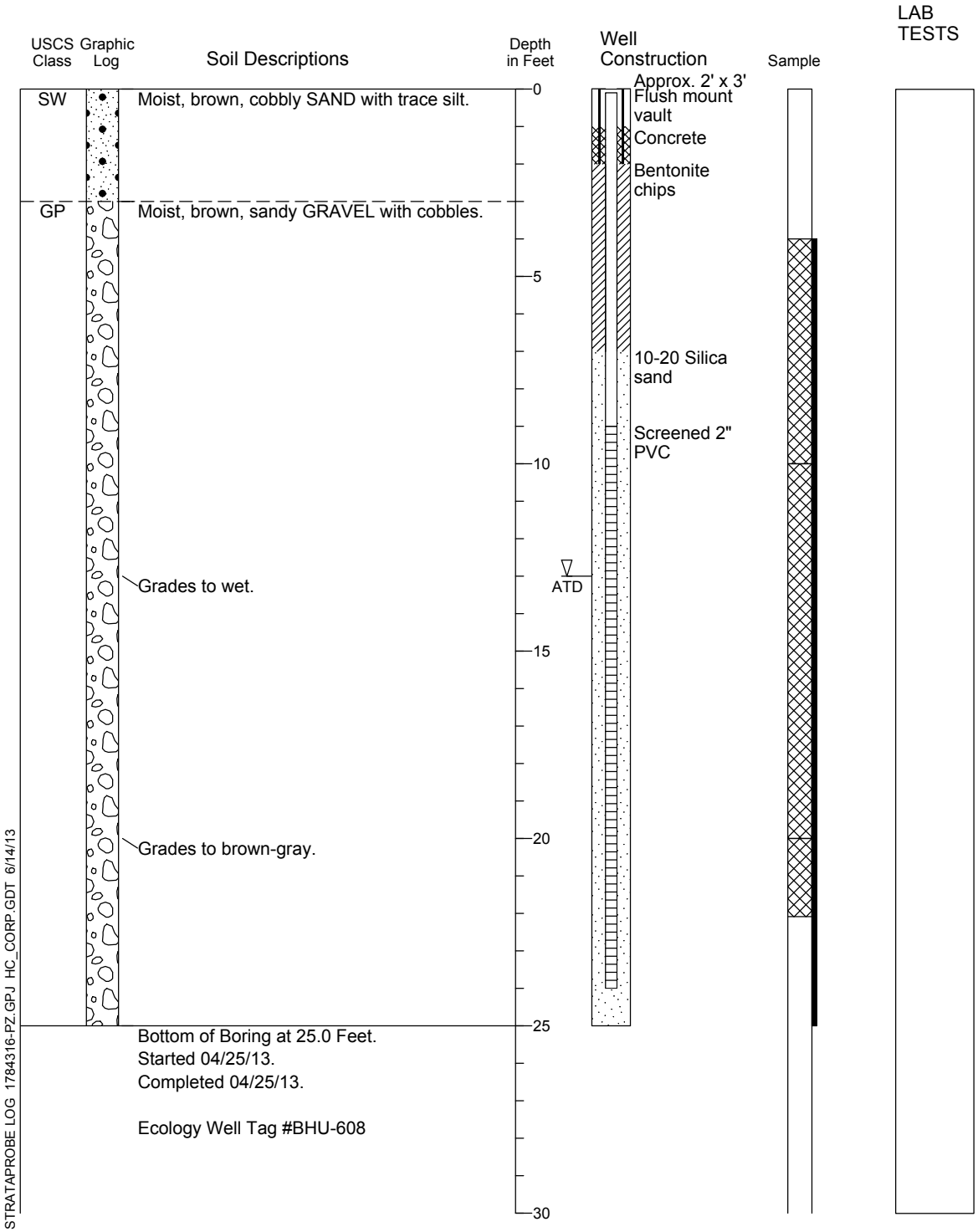
Figure A-1

KEY SHEET 1784316-PZ.GPJ HC_CORP.GDT 5/24/13

Boring Log & Construction Data for Monitoring Well PZ-1

Location: Diablo, WA
Approximate Ground Surface Elevation: 900 Feet
Horizontal Datum:
Vertical Datum:

Drill Equipment: Sonic
Hammer Type: Continuous Cores
Hole Diameter: 6 inches
Logged By: B. Payne Reviewed By: R. Stainsby



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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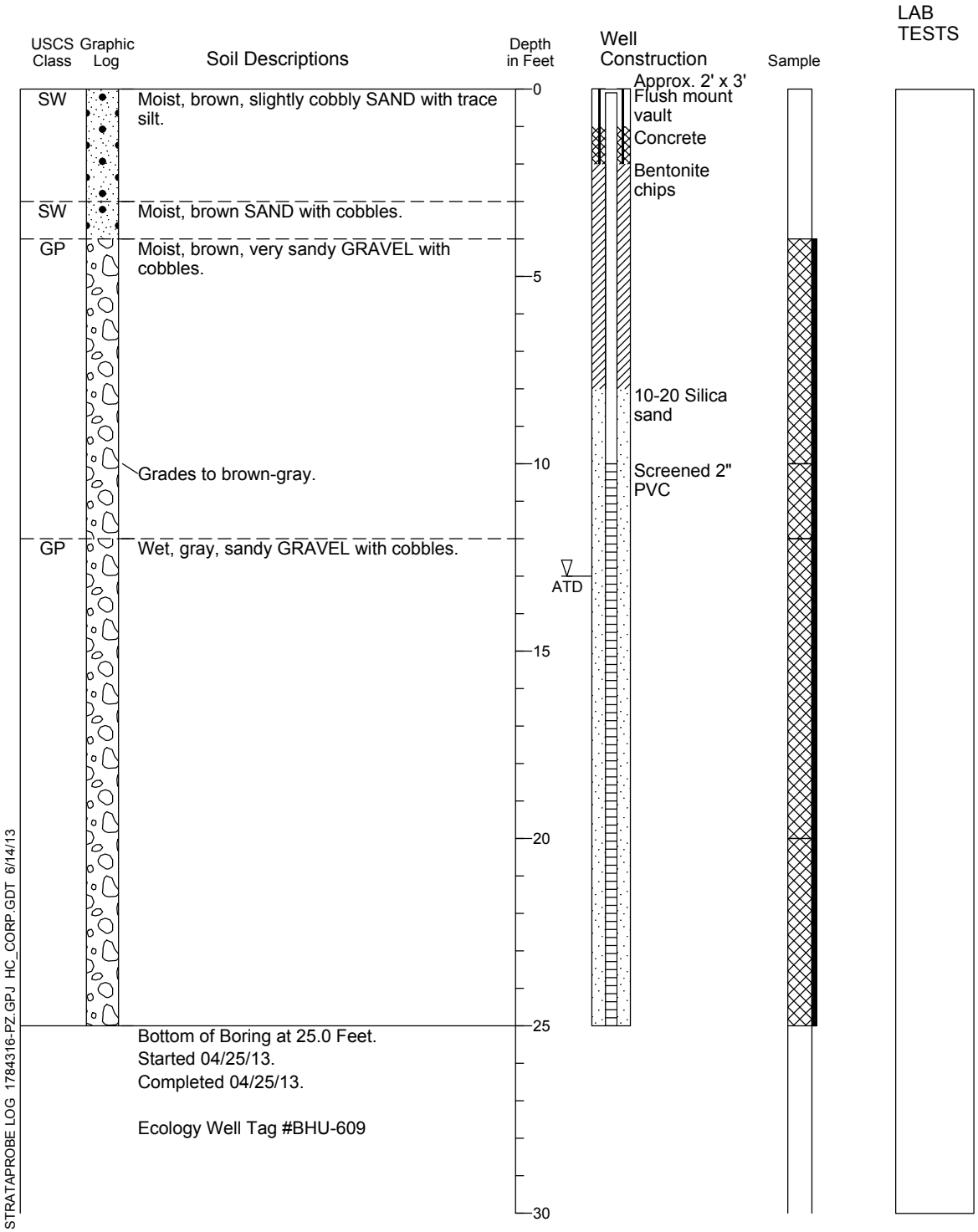
Figure A-2

Boring Log & Construction Data for Monitoring Well PZ-2

Location: Diablo, WA
Approximate Ground Surface Elevation: 900 Feet
Horizontal Datum:
Vertical Datum:

Drill Equipment: Sonic
Hammer Type: Continuous Cores
Hole Diameter: 6 inches
Logged By: B. Payne Reviewed By: R. Stainsby



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4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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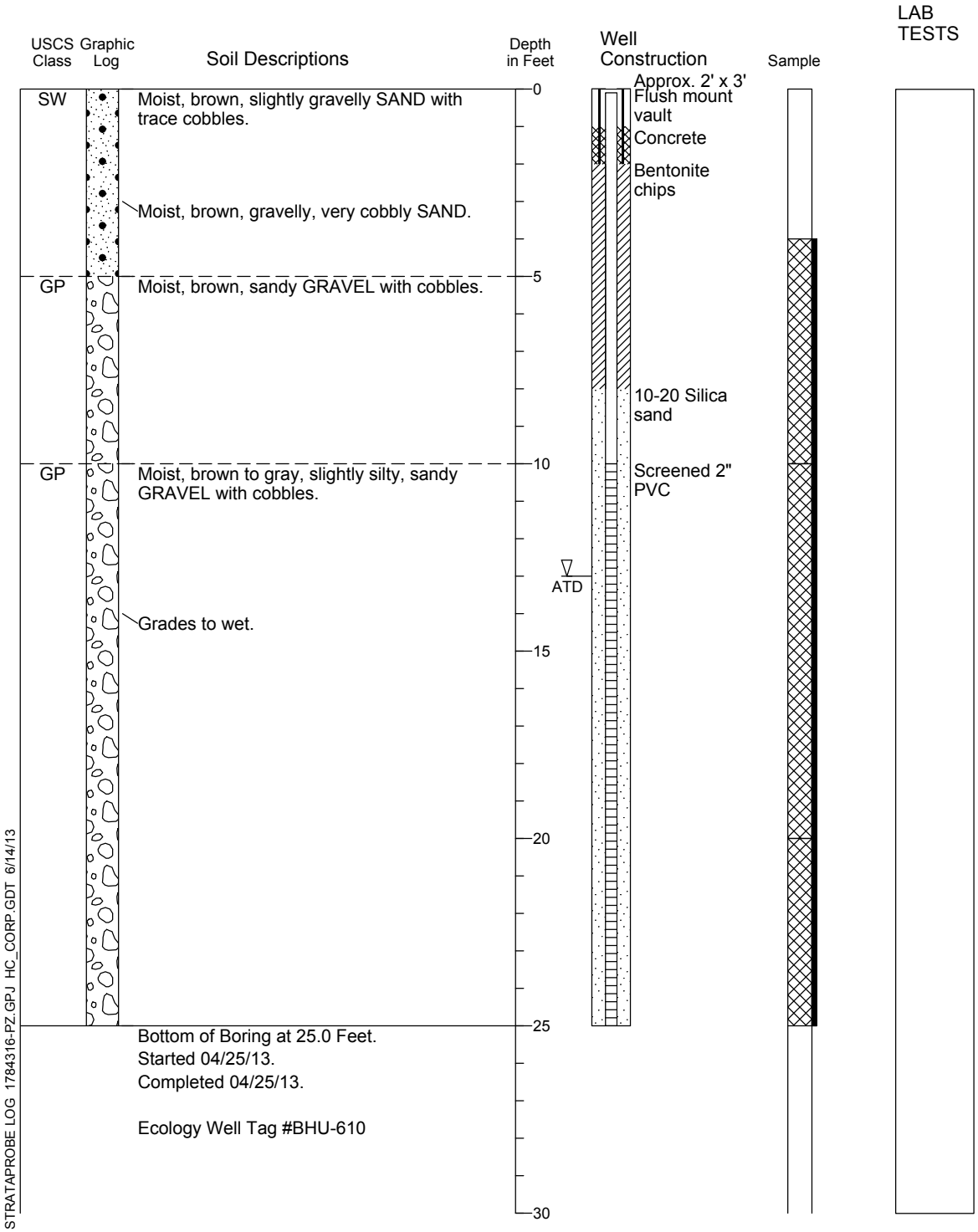
Figure A-3

Boring Log & Construction Data for Monitoring Well PZ-3

Location: Diablo, WA
Approximate Ground Surface Elevation: 900 Feet
Horizontal Datum:
Vertical Datum:

Drill Equipment: Sonic
Hammer Type: Continuous Cores
Hole Diameter: 6 inches
Logged By: B. Payne Reviewed By: R. Stainsby



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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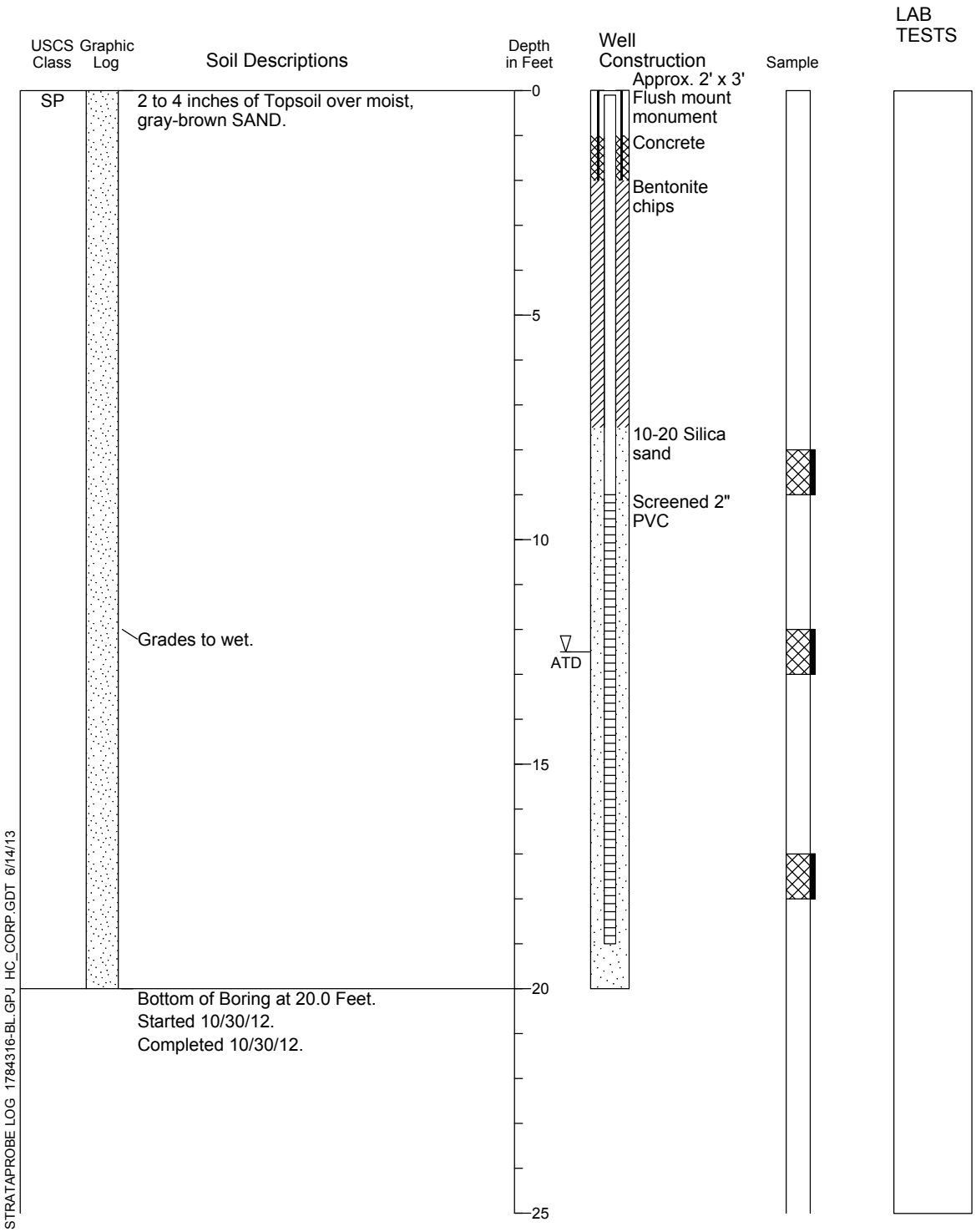
Figure A-4

Boring Log & Construction Data for Monitoring Well PZ-4

Location: Diablo, WA
Approximate Ground Surface Elevation: Feet
Horizontal Datum:
Vertical Datum:

Drill Equipment: Hollow Stem Auger
Hammer Type: None (Sample Type: Cuttings)
Hole Diameter: 10 inches
Logged By: B. Payne Reviewed By: R. Stainsby



STRATAPROBE LOG 1784316-BL.GPJ HC_CORP.GDT 6/14/13

1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. USCS designations are based on visual manual classification (ASTM D 2488) unless otherwise supported by laboratory testing (ASTM D 2487).
4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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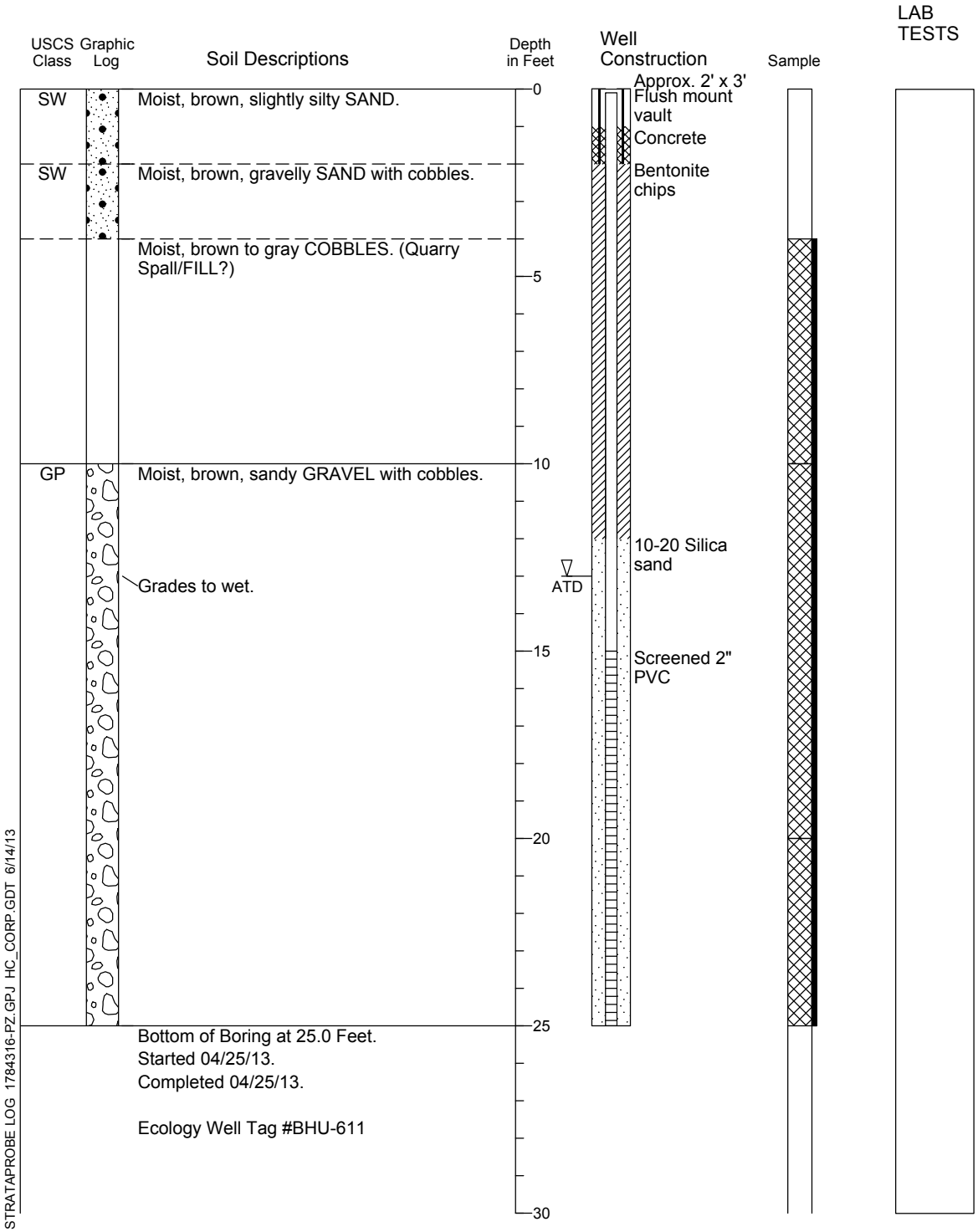
Figure A-5

Boring Log & Construction Data for Monitoring Well PZ-5

Location: Diablo, WA
Approximate Ground Surface Elevation: 900 Feet
Horizontal Datum:
Vertical Datum:

Drill Equipment: Sonic
Hammer Type: Continuous Cores
Hole Diameter: 6 inches
Logged By: B. Payne Reviewed By: R. Stainsby



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4. Groundwater level, if indicated, is at time of drilling (ATD) or for date specified. Level may vary with time.

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Figure A-6

APPENDIX B
CHEMICAL DATA QUALITY REVIEW AND LABORATORY REPORTS

APPENDIX B
CHEMICAL DATA QUALITY REVIEW AND LABORATORY REPORTS

Chemical Data Quality Review

Five water samples were collected on May 10, 2013. The samples were submitted to Edge Analytical Laboratories of Burlington, Washington, for analysis under subcontract to OnSite Environmental, Inc. The Edge Analytical Laboratories Reference number was 13-08026, and the OnSite Environmental, Inc. Laboratory Reference No. was 1305-135.

The water samples were analyzed for the following:

- Nitrate by EPA Method 300.0;
- Total coliforms by SM 9221B; and
- Fecal coliforms by SM 9221E.

The laboratories performed quality assurance/quality control (QA/QC) reviews on an ongoing basis. Hart Crowser reviewed the data to ensure they met data quality objectives for the project and recorded the results on laboratory quality control summary sheets.

The following criteria were evaluated during the standard data quality review process:

- Holding times;
- Reporting limits;
- Method blanks;
- Matrix spike recoveries;
- Laboratory duplicate relative percent differences (RPDs); and
- Laboratory control sample (LCS) recoveries.

The data were determined to be acceptable for use without qualification, and the complete laboratory reports are presented at the end of this appendix. The data review is summarized in the following pages.

Water Results

Nitrate by EPA 300.0

Holding times and reporting limits were acceptable. No method blank or trip blank contamination was detected. LCS and MS recoveries were within control limits.

Total Coliform by SM 9221B

The samples were analyzed for Most Probable Number (MPN) per 100 mL. Holding times and reporting limits were acceptable.

Fecal Coliform by SM 9221E

The samples were analyzed for Most Probable Number (MPN) per 100 mL. Holding times and reporting limits were acceptable.

L:\Jobs\1784316\Final Piezometer Report.doc

LABORATORY REPORTS
ONSITE ENVIRONMENTAL LABORATORIES

OnSite Environmental Inc.

14648 NE 95th Street, Redmond, WA 98052 • (425) 883-3881

May 21, 2013

Ross Stainsby
Hart Crowser, Inc.
1700 Westlake Avenue North, Suite 200
Seattle, WA 98109-3056

Re: Analytical Data for Project 17843-16
Laboratory Reference No. 1305-135

Dear Ross:

Enclosed are the analytical results and associated quality control data for samples submitted on May 10, 2013.

The standard policy of OnSite Environmental, Inc. is to store your samples for 30 days from the date of receipt. If you require longer storage, please contact the laboratory.

We appreciate the opportunity to be of service to you on this project. If you have any questions concerning the data, or need additional information, please feel free to call me.

Sincerely,

David Baumeister
Project Manager

Enclosures

EDGE ANALYTICAL LABORATORIES

Burlington WA
Corporate Office
1620 S Walnut St - 98233
800.755.9295 • 360.757.1400

Bellingham WA
Microbiology
805 Orchard Dr Ste 4 - 98225
360.671.0688

Portland OR
Microbiology/Chemistry
9150 SW Pioneer Ct Ste W- 97070
503.682.7802

Case Narrative

Reference: **13-08026**

Lab Sample ID	Sample Information
18497	**PZ-1 - 1**

Notes		Created by
Sample Note	DML spoke with client on 5/9/13 and they decided SM9221B,E was the bes test method for their purposes. This applies for all samples on this project. SLM 5/13/13	SLM

Lab Sample ID	Sample Information
18498	**PZ-2 - 2**

Notes		Created by
Sample Note	See note on 18497.	SLM

Lab Sample ID	Sample Information
18499	**PZ-3 - 3**

Notes		Created by
Sample Note	See note on 18497.	SLM

Lab Sample ID	Sample Information
18500	**PZ-4 - 4**

Notes		Created by
Sample Note	See note on 18497.	SLM

Lab Sample ID	Sample Information
18501	**PZ-5 - 5**

Notes		Created by
Sample Note	See note on 18497.	SLM

Case Narrative

Reference: **13-08026**

EDGE ANALYTICAL LABORATORIES

Burlington WA
Corporate Office
1620 S Walnut St - 98233
800.755.9295 • 360.757.1400

Bellingham WA
Microbiology
805 Orchard Dr Ste 4 - 98225
360.671.0688

Portland OR
Microbiology/Chemistry
9150 SW Pioneer Ct Ste W- 97070
503.682.7802

Data Report

Client Name: OnSite Environmental Inc.
14648 NE 95th Street
Redmond, WA 98052

Reference Number: **13-08026**
Project: Diablo

Report Date: 5/20/13
Date Received: 5/10/13
Reviewed by:

Sample Description: PZ-1 - 1 — Sample Date: 5/10/13
Lab Number: 18497 — Sample Comment: — Collected By: Angie Goodwin

CAS ID#	Parameter	Result	PQL	MRL	MDL	Units	DF	Method	Analyzed	Analyst	Batch	Comment
14797-55-8	**NITRATE-N**	ND	0.100	0.100	0.011	mg/L	1.00	300.0	5/11/13	BJ	I130510A	
	TOTAL COLIFORM	2.0	1.8	1.8		MPN/100mL	1.00	SM9221 B/MTF	5/14/13	JMM	MTTC_130510	
E-14551	**Fecal Coliform**	<1.8	1.8	1.8		MPN/100ml	1.00	SM9221 E/MTF	5/14/13	JMM	MTTC_130510	

Sample Description: PZ-2 - 2 — Sample Date: 5/10/13
Lab Number: 18498 — Sample Comment: — Collected By: Angie Goodwin

CAS ID#	Parameter	Result	PQL	MRL	MDL	Units	DF	Method	Analyzed	Analyst	Batch	Comment
14797-55-8	**NITRATE-N**	ND	0.100	0.100	0.011	mg/L	1.00	300.0	5/11/13	BJ	I130510A	
	TOTAL COLIFORM	<1.8	1.8	1.8		MPN/100mL	1.00	SM9221 B/MTF	5/14/13	JMM	MTTC_130510	
E-14551	**Fecal Coliform**	<1.8	1.8	1.8		MPN/100ml	1.00	SM9221 E/MTF	5/14/13	JMM	MTTC_130510	

Sample Description: PZ-3 - 3 — Sample Date: 5/10/13
Lab Number: 18499 — Sample Comment: — Collected By: Angie Goodwin

CAS ID#	Parameter	Result	PQL	MRL	MDL	Units	DF	Method	Analyzed	Analyst	Batch	Comment
14797-55-8	**NITRATE-N**	ND	0.100	0.100	0.011	mg/L	1.00	300.0	5/11/13	BJ	I130510A	
	TOTAL COLIFORM	13	1.8	1.8		MPN/100mL	1.00	SM9221 B/MTF	5/14/13	JMM	MTTC_130510	
E-14551	**Fecal Coliform**	<1.8	1.8	1.8		MPN/100ml	1.00	SM9221 E/MTF	5/14/13	JMM	MTTC_130510	

Sample Description: PZ-4 - 4 — Sample Date: 5/10/13
Lab Number: 18500 — Sample Comment: — Collected By: Angie Goodwin

CAS ID#	Parameter	Result	PQL	MRL	MDL	Units	DF	Method	Analyzed	Analyst	Batch	Comment
14797-55-8	**NITRATE-N**	ND	0.100	0.100	0.011	mg/L	1.00	300.0	5/11/13	BJ	I130510A	
	TOTAL COLIFORM	17	1.8	1.8		MPN/100mL	1.00	SM9221 B/MTF	5/14/13	JMM	MTTC_130510	
E-14551	**Fecal Coliform**	<1.8	1.8	1.8		MPN/100ml	1.00	SM9221 E/MTF	5/14/13	JMM	MTTC_130510	

Sample Description: PZ-5 - 5 — Sample Date: 5/10/13
Lab Number: 18501 — Sample Comment: — Collected By: Angie Goodwin

CAS ID#	Parameter	Result	PQL	MRL	MDL	Units	DF	Method	Analyzed	Analyst	Batch	Comment
14797-55-8	**NITRATE-N**	ND	0.100	0.100	0.011	mg/L	1.00	300.0	5/11/13	BJ	I130510A	
	TOTAL COLIFORM	<1.8	1.8	1.8		MPN/100mL	1.00	SM9221 B/MTF	5/14/13	JMM	MTTC_130510	

Notes:
ND = Not detected above the listed practical quantitation limit (PQL) or not above the Method Detection Limit (MDL), if requested.
PQL = Practical Quantitation Limit is the lowest level that can be achieved within specified limits of precision and accuracy during routine laboratory operating conditions.
D.F. - Dilution Factor

If you have any questions concerning this report contact Bryce Jensen at the above phone number.
Form: cRslt_2.rpt

Reference Number: **13-08026**
Report Date: 5/20/13

Data Report

E-14551	**Fecal Coliform**	<1.8	1.8	1.8	**MPN/100ml**	.00	SM9221 E/MTF	5/14/13	JMM	MTTC_130510

Notes:

ND = Not detected above the listed practical quantitation limit (PQL) or not above the Method Detection Limit (MDL), if requested.
PQL = Practical Quantitation Limit is the lowest level that can be achieved within specified limits of precision and accuracy during routine laboratory operating conditions.
D.F. - Dilution Factor

Sample Custody Record

1 of 1

Samples Shipped to: Edge Analytical

HART CROWSER

Hart Crowser, Inc.
1700 Westlake Avenue North, Suite 200
Seattle, Washington 98109-6212
Office: 206.324.9530 • Fax 206.328.5581

JOB 17843-16 LAB NUMBER

PROJECT NAME Diablo

HART CROWSER CONTACT Ross Stainsby

SAMPLED BY: Angie Goodwin

LAB NO.	SAMPLE ID	DESCRIPTION	DATE	TIME	MATRIX	REQUESTED ANALYSIS: Nitrates (353.2)	Total Coliform (9221B,E)	Fecal Coliform (9221D)	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
	PZ-1	500mL & 250mL Poly	5/10/13	0750	H_2O	X	X	X	2	
	PZ-2			0850		X	X	X	2	
	PZ-3			0925		X	X	X	2	
	PZ-4			1150		X	X	X	2	
	PZ-5			1030		X	X	X	2	

13-08026
18497 - 18501

13-08026

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE: Angie Goodwin	5/10/13	SIGNATURE	
PRINT NAME: Angie Goodwin	TIME	PRINT NAME	TIME
COMPANY: HC	1410	COMPANY	
RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE		SIGNATURE: Adie Vizcaya	
PRINT NAME	TIME	PRINT NAME	TIME
COMPANY		COMPANY: CT	2:26

SPECIAL SHIPMENT HANDLING OR STORAGE REQUIREMENTS:
David Baumeister @ OnSite is the Client

10 TOTAL NUMBER OF CONTAINERS

SAMPLE RECEIPT INFORMATION
CUSTODY SEALS: ☐YES ☐NO ☐N/A
GOOD CONDITION ☐YES ☐NO
TEMPERATURE _____
SHIPMENT METHOD: ☐HAND ☐COURIER ☐OVERNIGHT

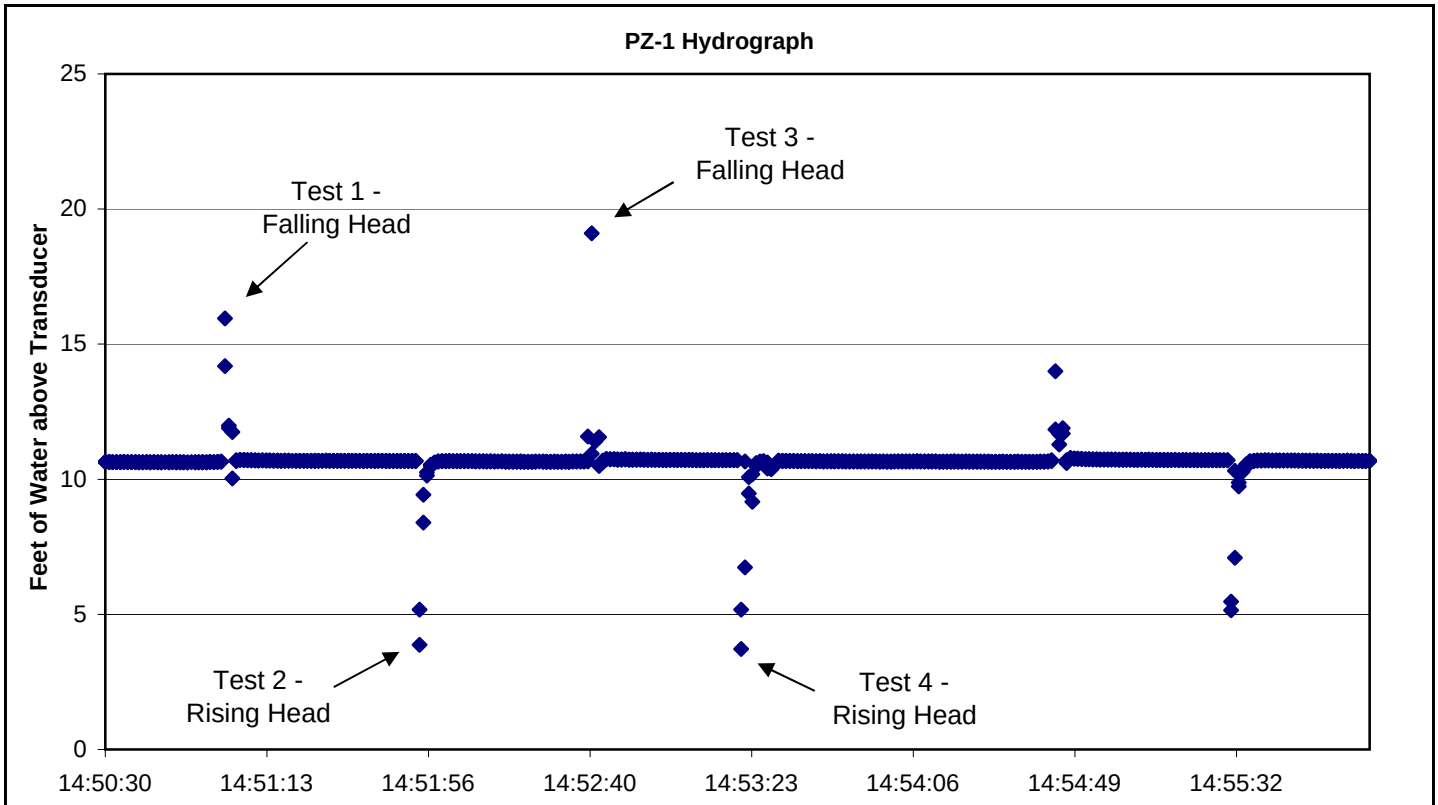
COOLER NO.: STORAGE LOCATION:

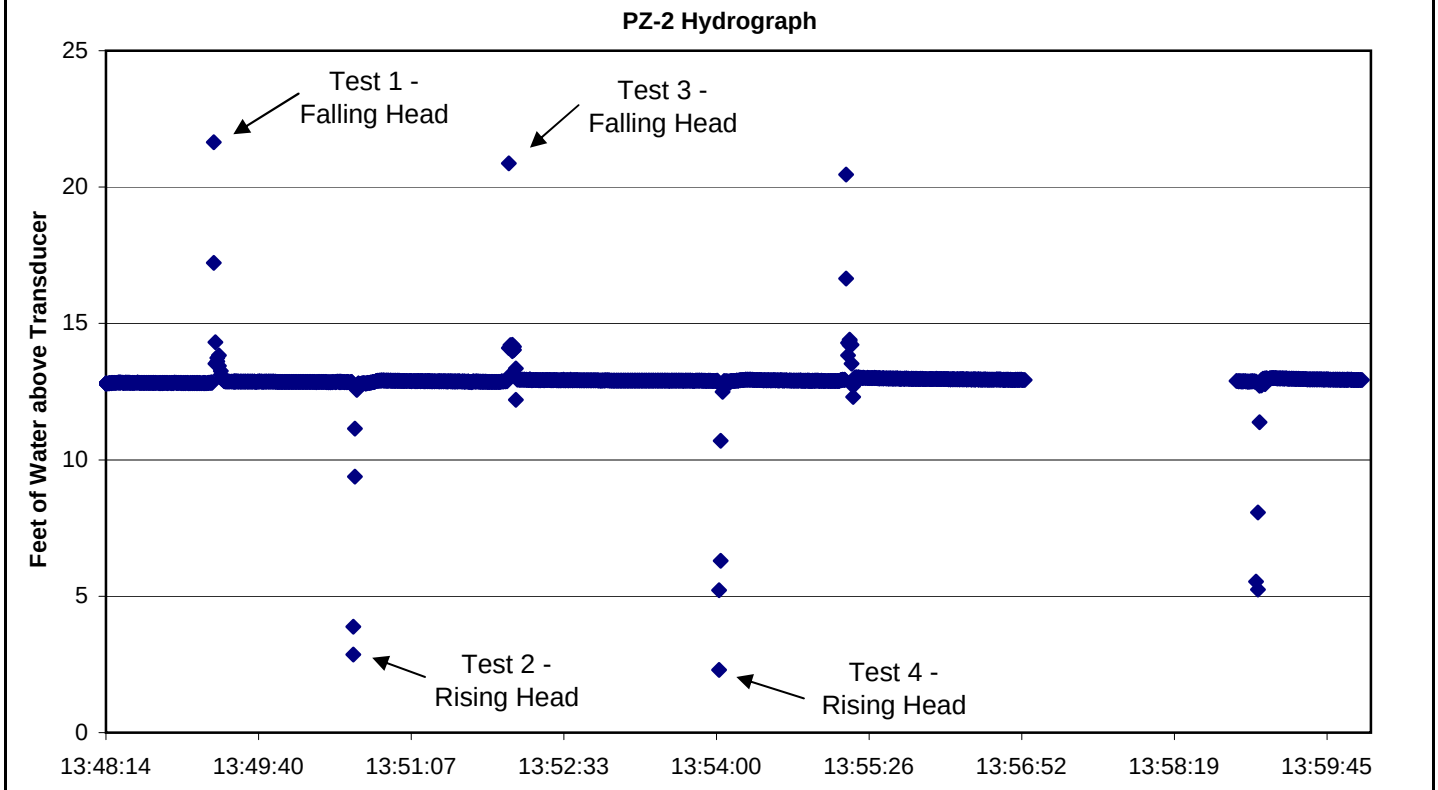
See Lab Work Order No. _____ for Other Contract Requirements

TURNAROUND TIME:
☐ 24 HOURS ☐ 1 WEEK
☐48 HOURS ☐STANDARD
☐72 HOURS OTHER _____

White and Yellow Copies to Lab Pink to Project Manager Lab to Return White Copy to Hart Crowser Gold to Sample Custodian

APPENDIX C
SLUG TEST
ANALYSIS FIGURES





Diablo Wastewater Facility
Diablo, Washington

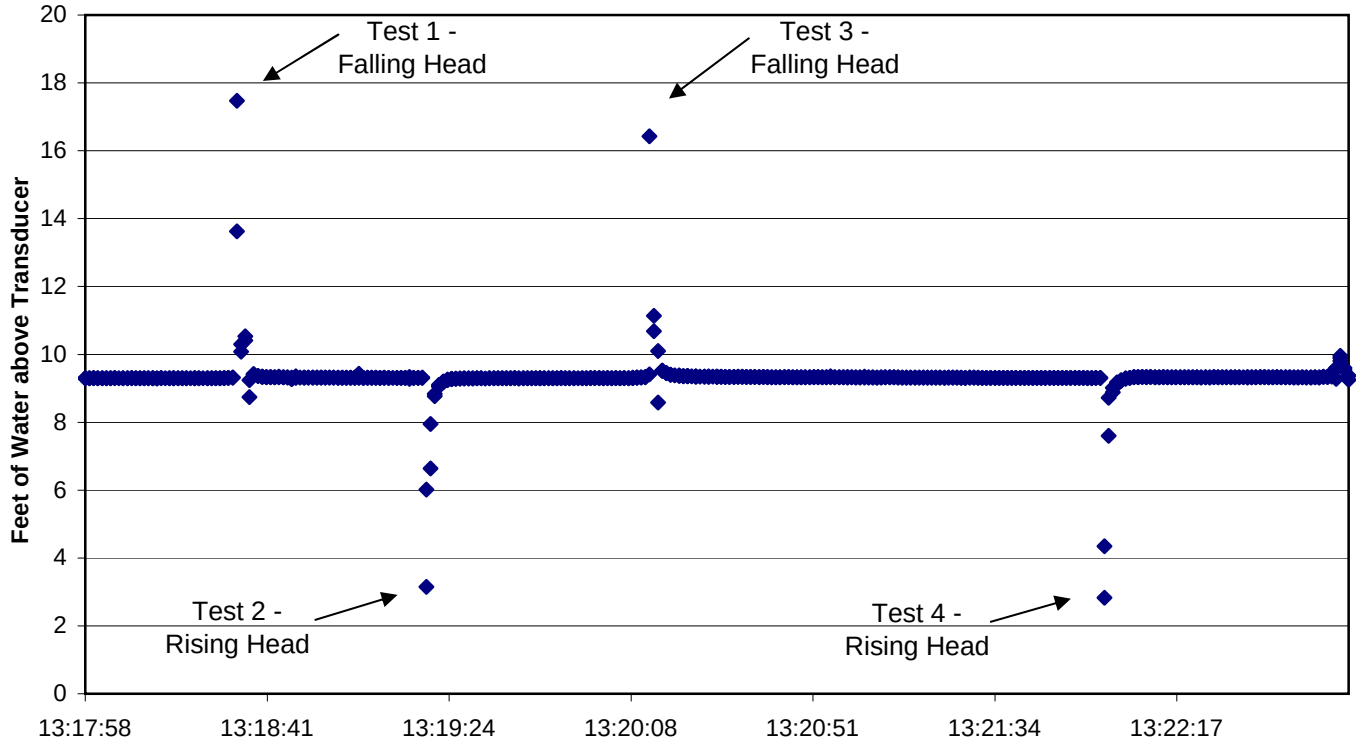
PZ-1 and PZ-2 Hydrographs

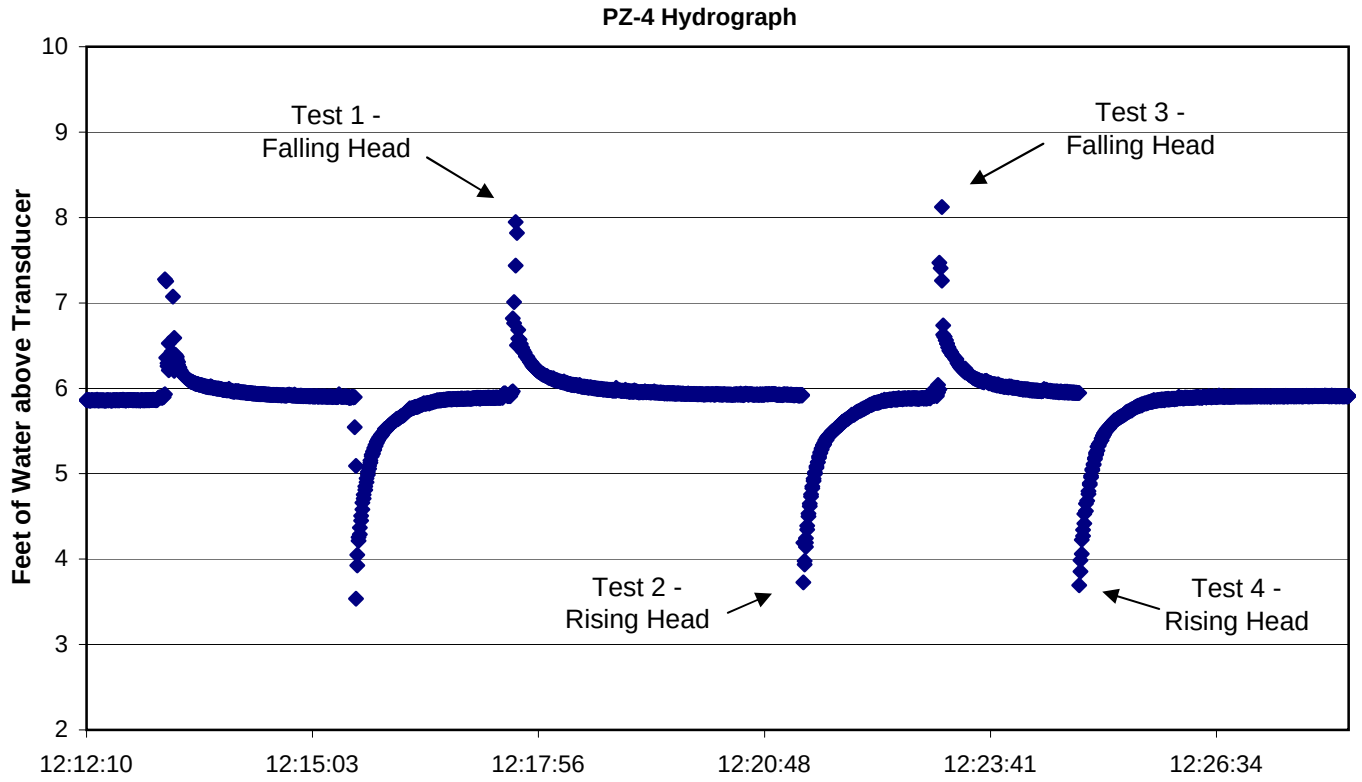
17843-16 5/13

HARTCROWSER

Figure
C-1

AJG 05/14/13 L:\Project Notebook\1784316 Diablo Lake\Slug Tests & GW Samp/ Slug Test .xls





Diablo Wastewater Facility
Diablo, Washington

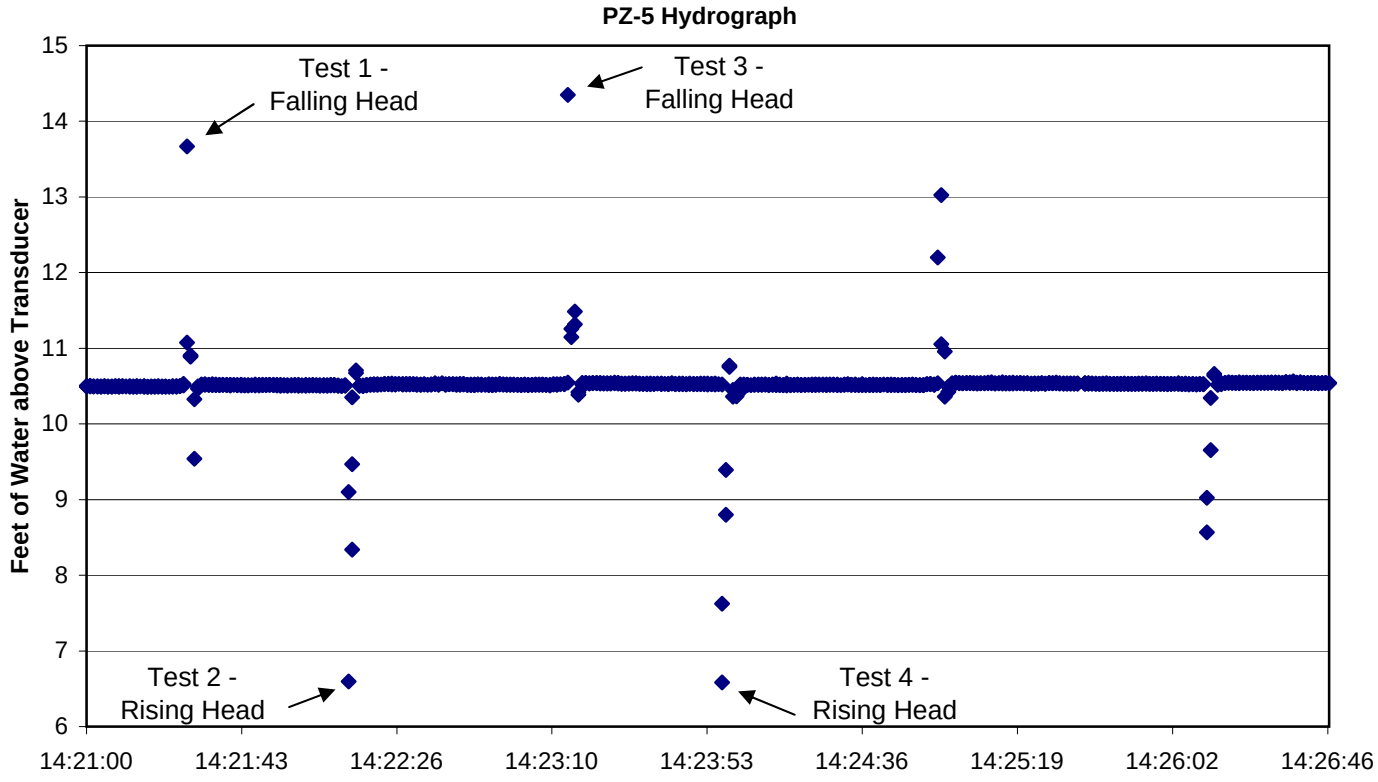
PZ-3 and PZ-4 Hydrographs

17843-16 5/13

HARTCROWSER

Figure
C-2

AJG 05/14/13 L:\Project Notebook\1784316 Diablo Lake\Slug Tests & GW Samp/ Slug Test .xls



Diablo Wastewater Facility
Diablo, Washington

PZ-5 Hydrograph

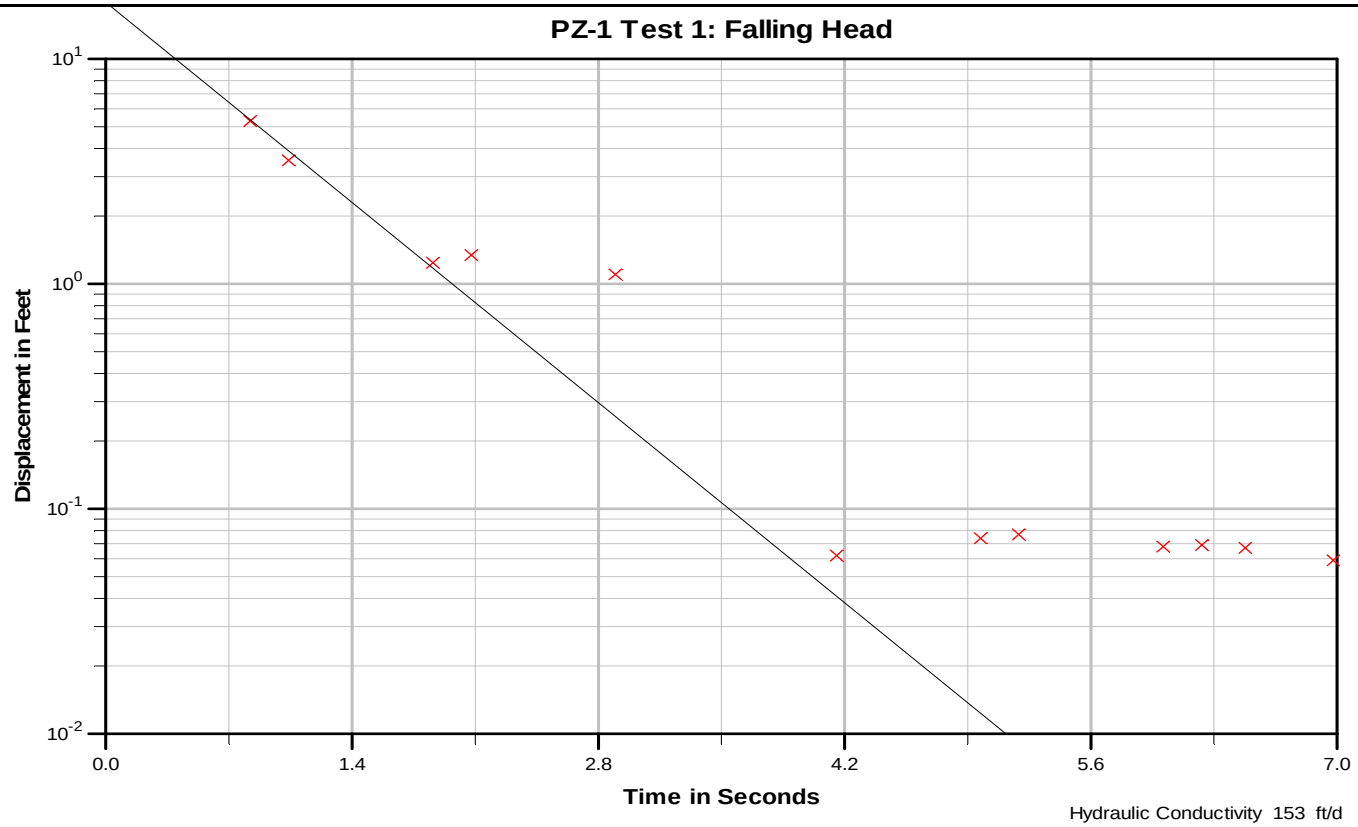
17843-16 5/13

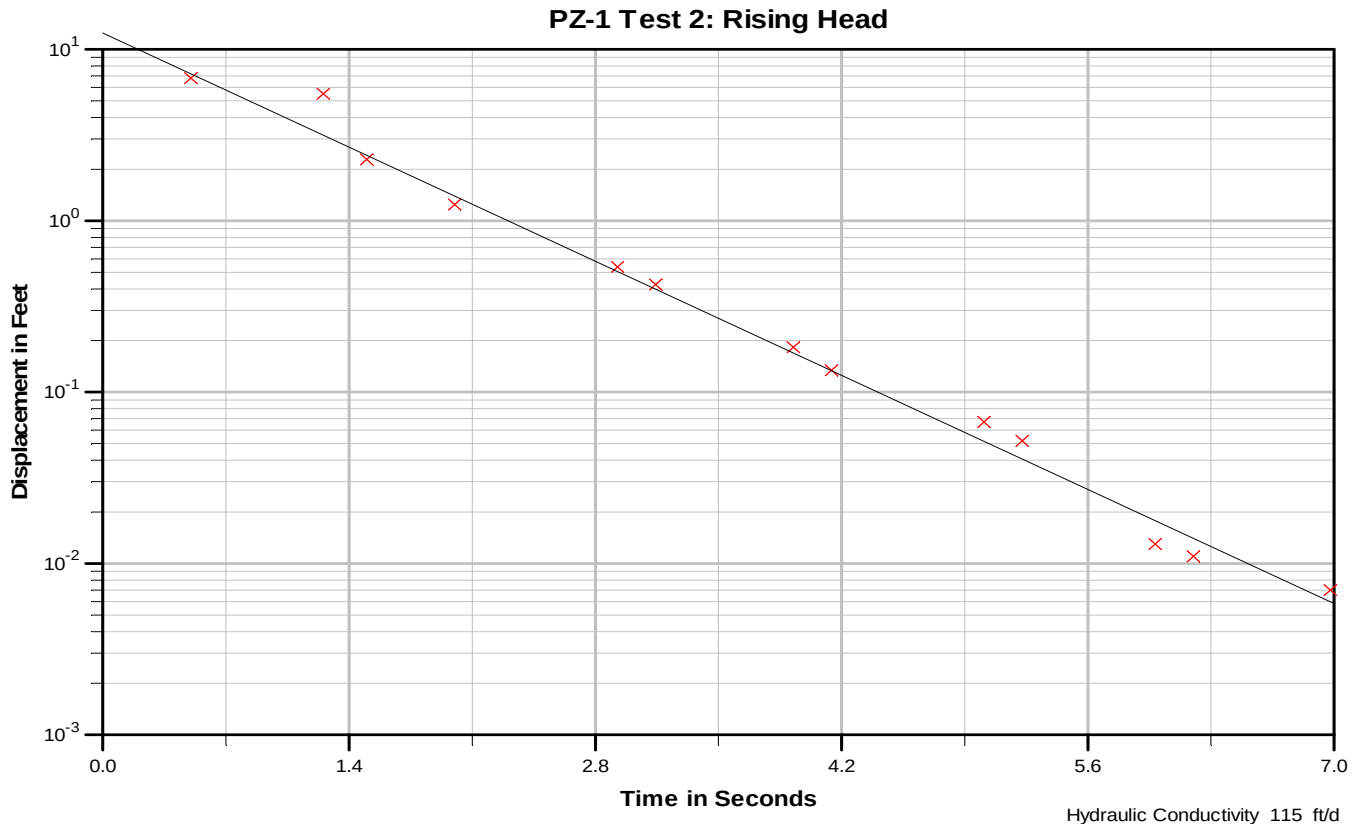
HARTCROWSER

Figure

C-3

AJG 05/14/13 L:\Project Notebook\1784316 Diablo Lake\Slug Tests & GW Samp/ Slug Test .xls





Diablo Wastewater Facility
Diablo, Washington

PZ-1 Slug Tests 1 and 2

17843-16 5/13

HARTCROWSER

Figure

C-4

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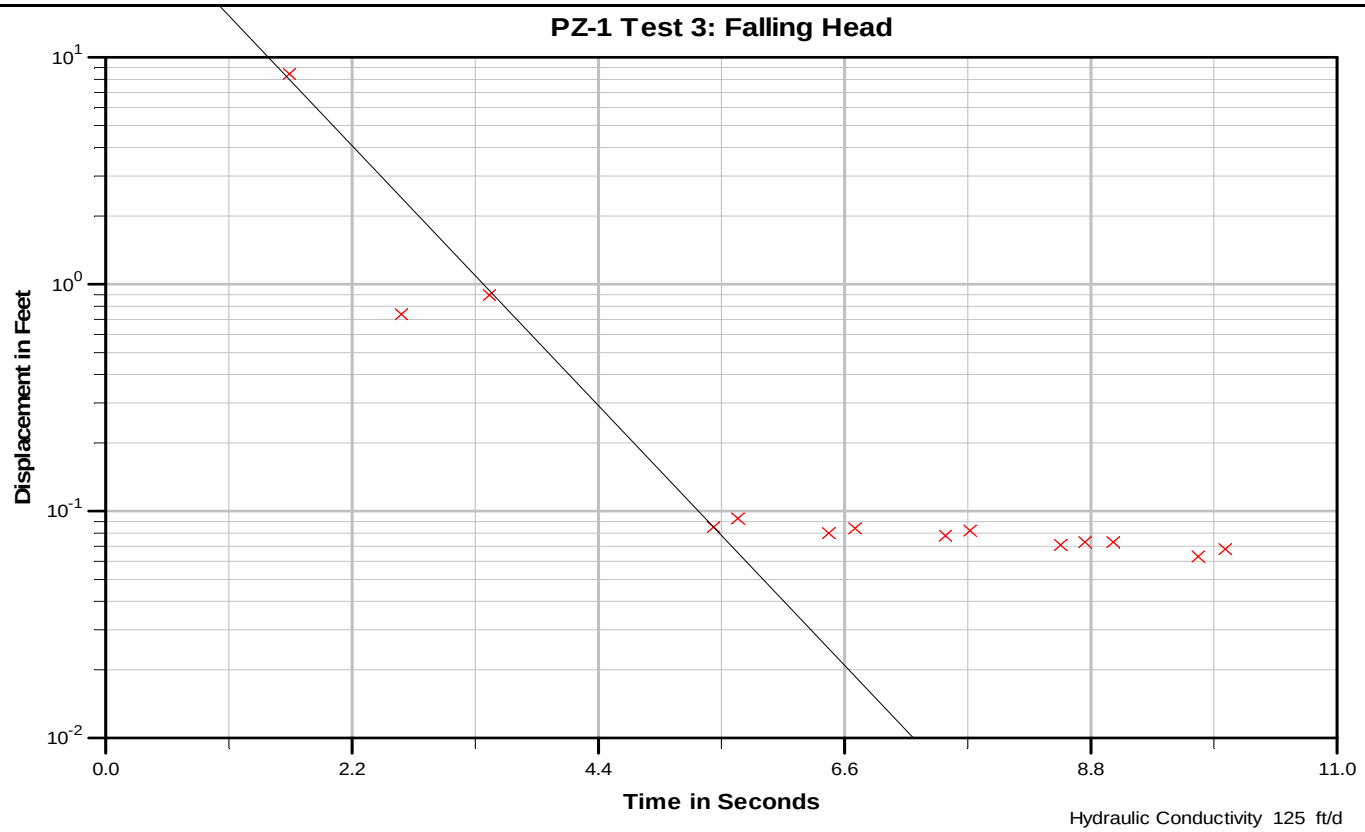

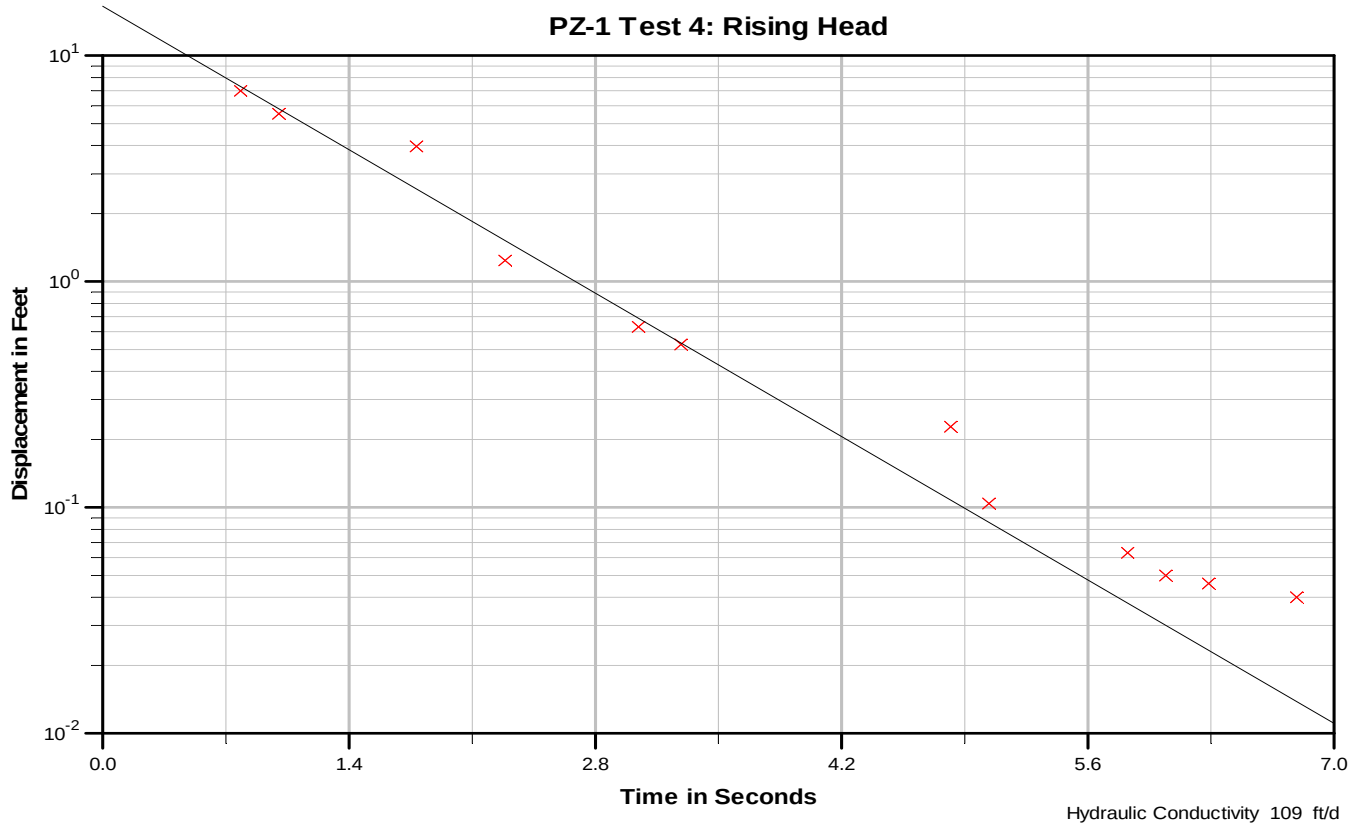

Diablo Wastewater Facility
Diablo, Washington

PZ-1 Slug Tests 3 and 4

17843-16 5/13

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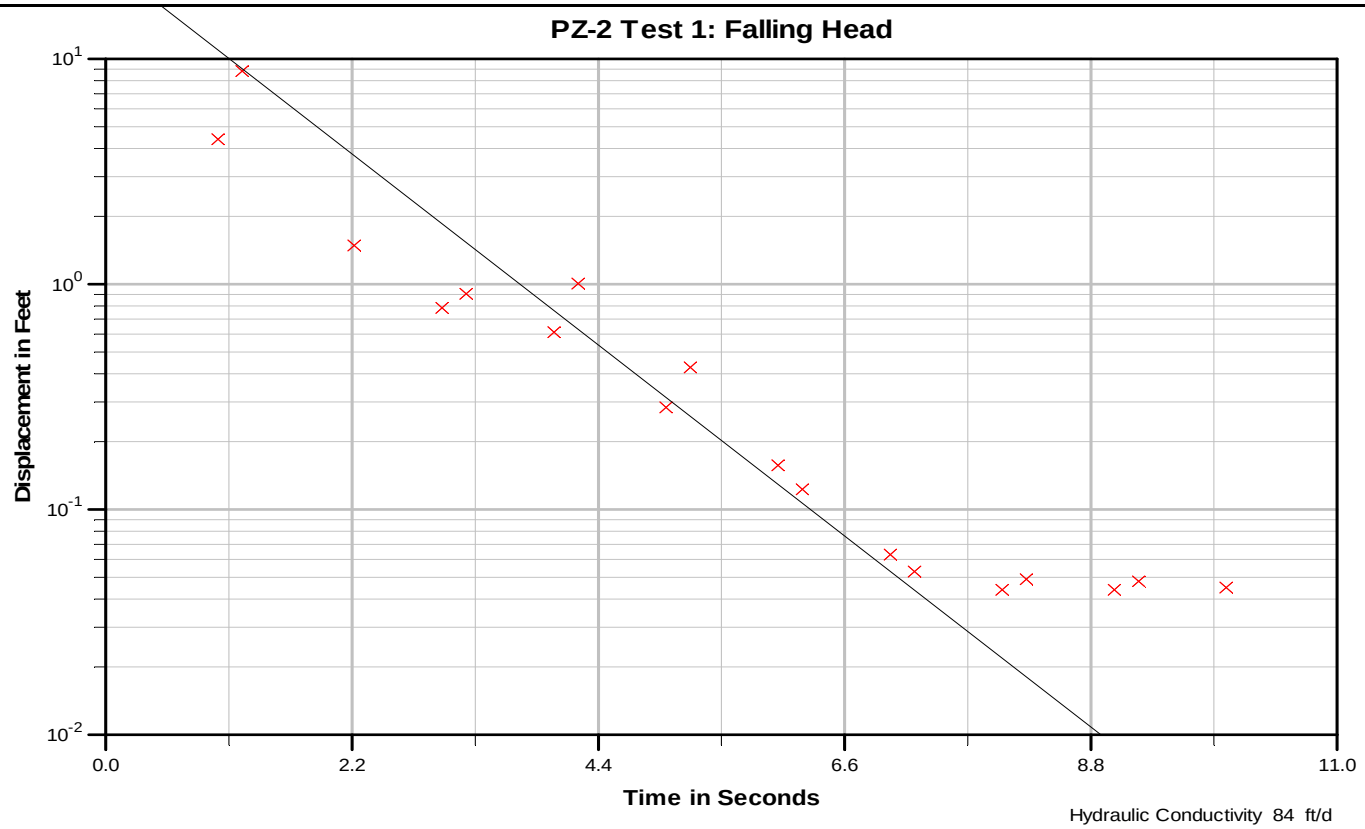
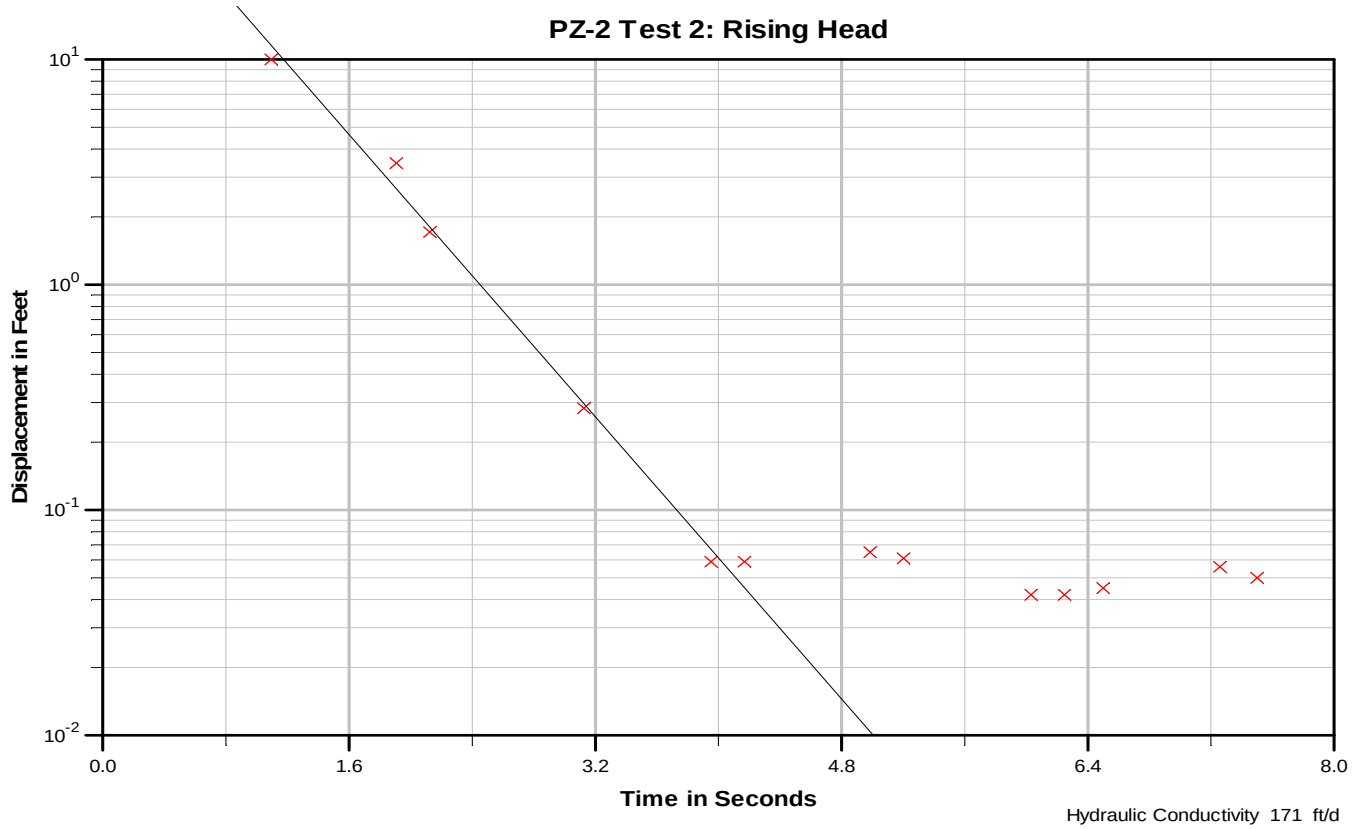
Figure
C-5

AJG 05/14/13 L:\Project Notebook\1784316 Diablo Lake\Slug Tests & GW Samp/ Slug Test .xls





Diablo Wastewater Facility
Diablo, Washington

PZ-2 Slug Tests 1 and 2

17843-16 5/13

HARTCROWSER

Figure
C-6

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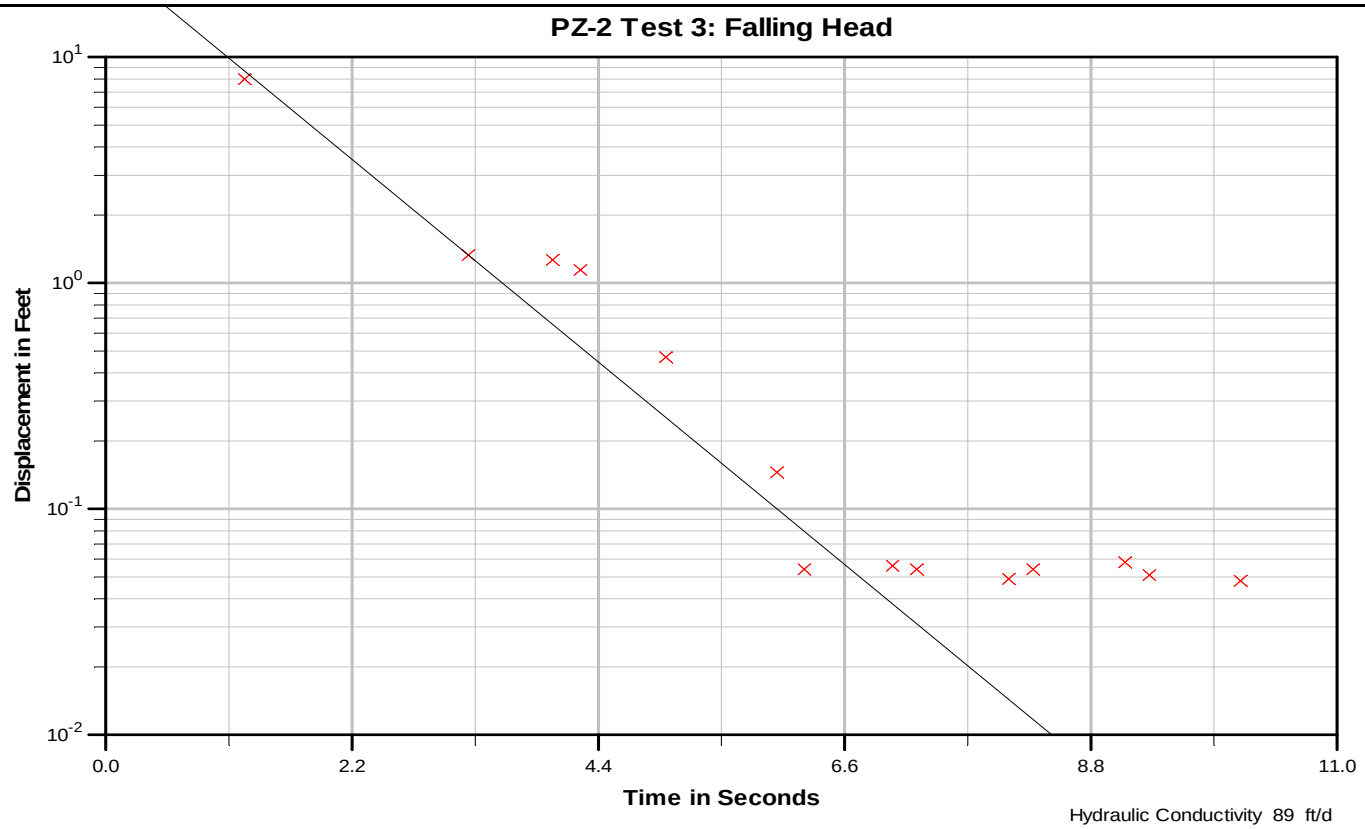

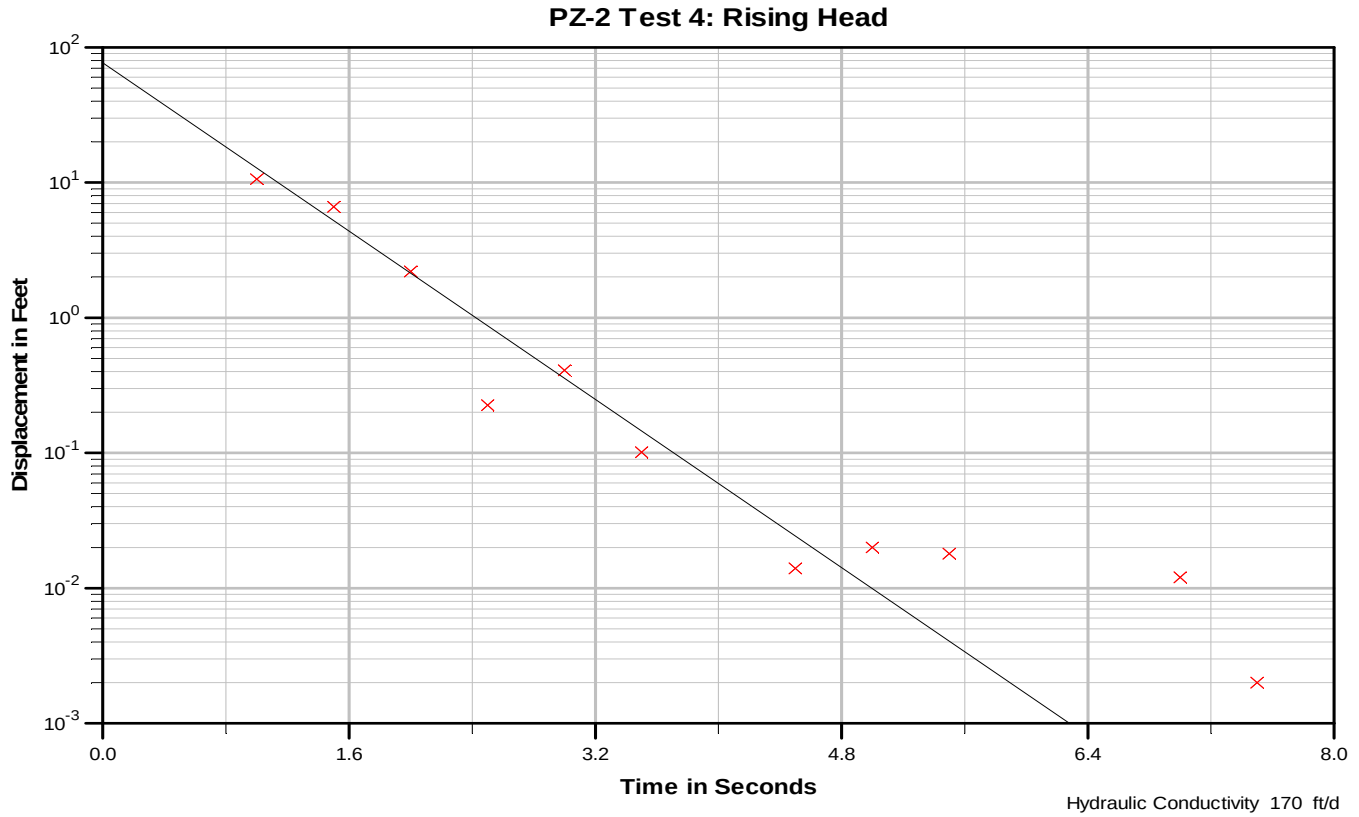

Diablo Wastewater Facility
Diablo, Washington

PZ-2 Slug Tests 3 and 4

17843-16 5/13

HARTCROWSER

Figure
C-7

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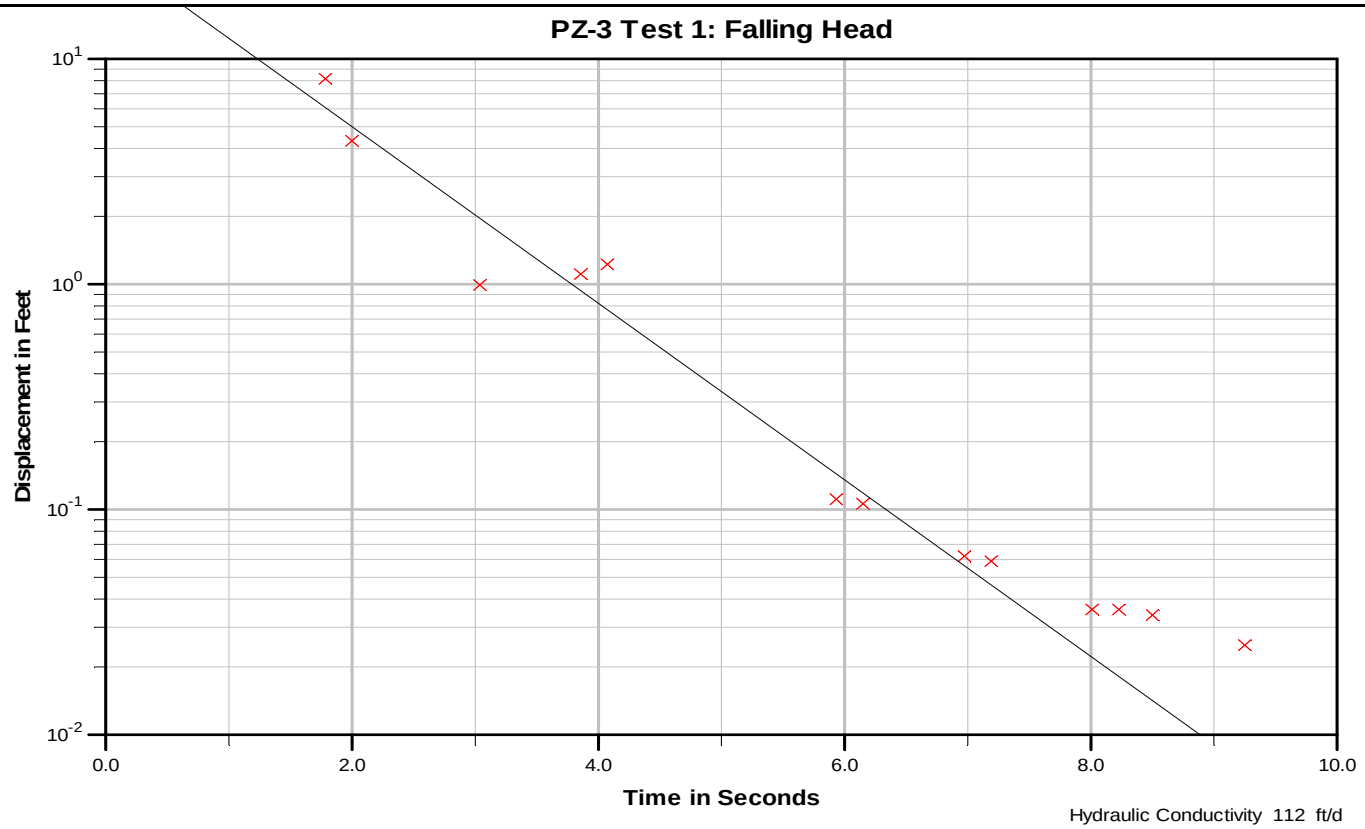

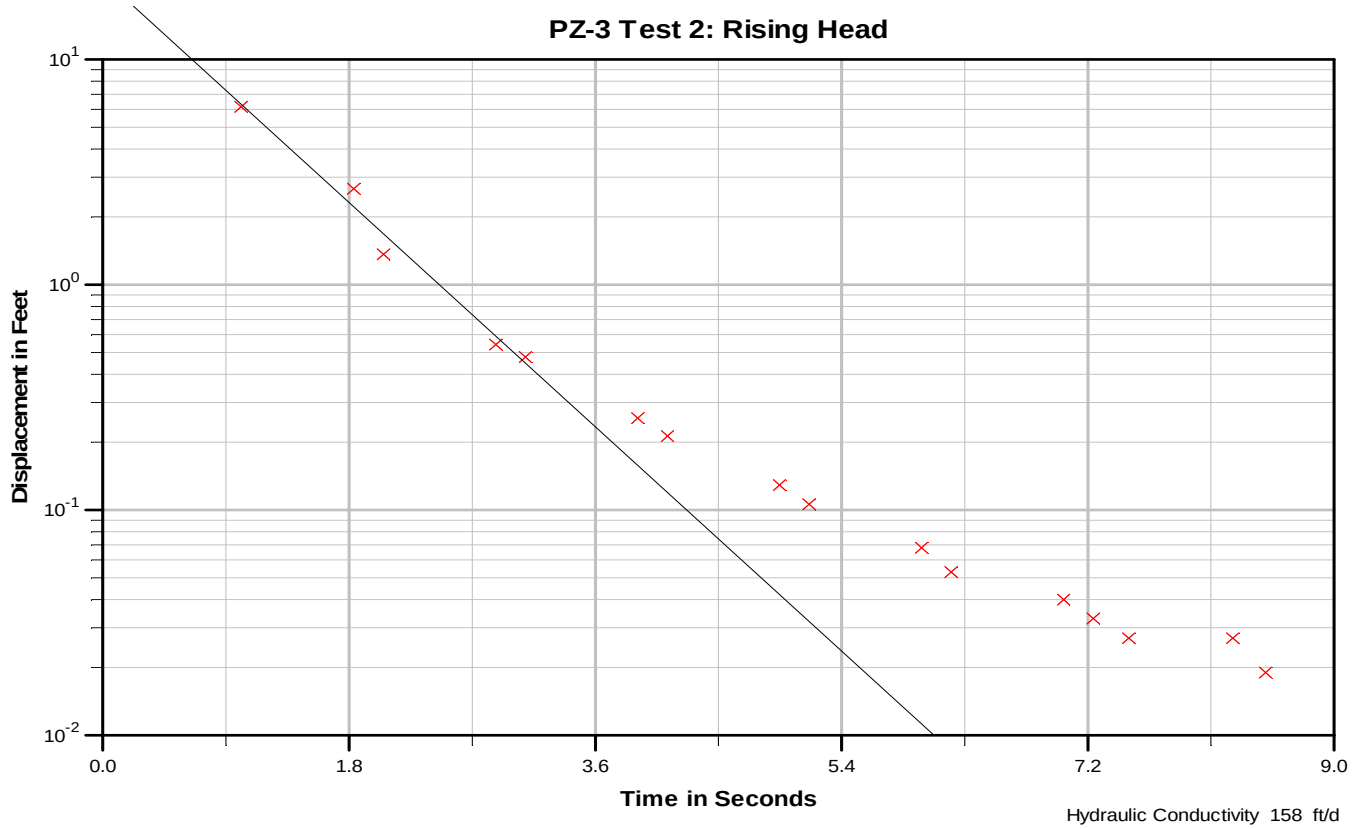

Diablo Wastewater Facility
Diablo, Washington

PZ-3 Slug Tests 1 and 2

17843-16 5/13

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Figure

C-8

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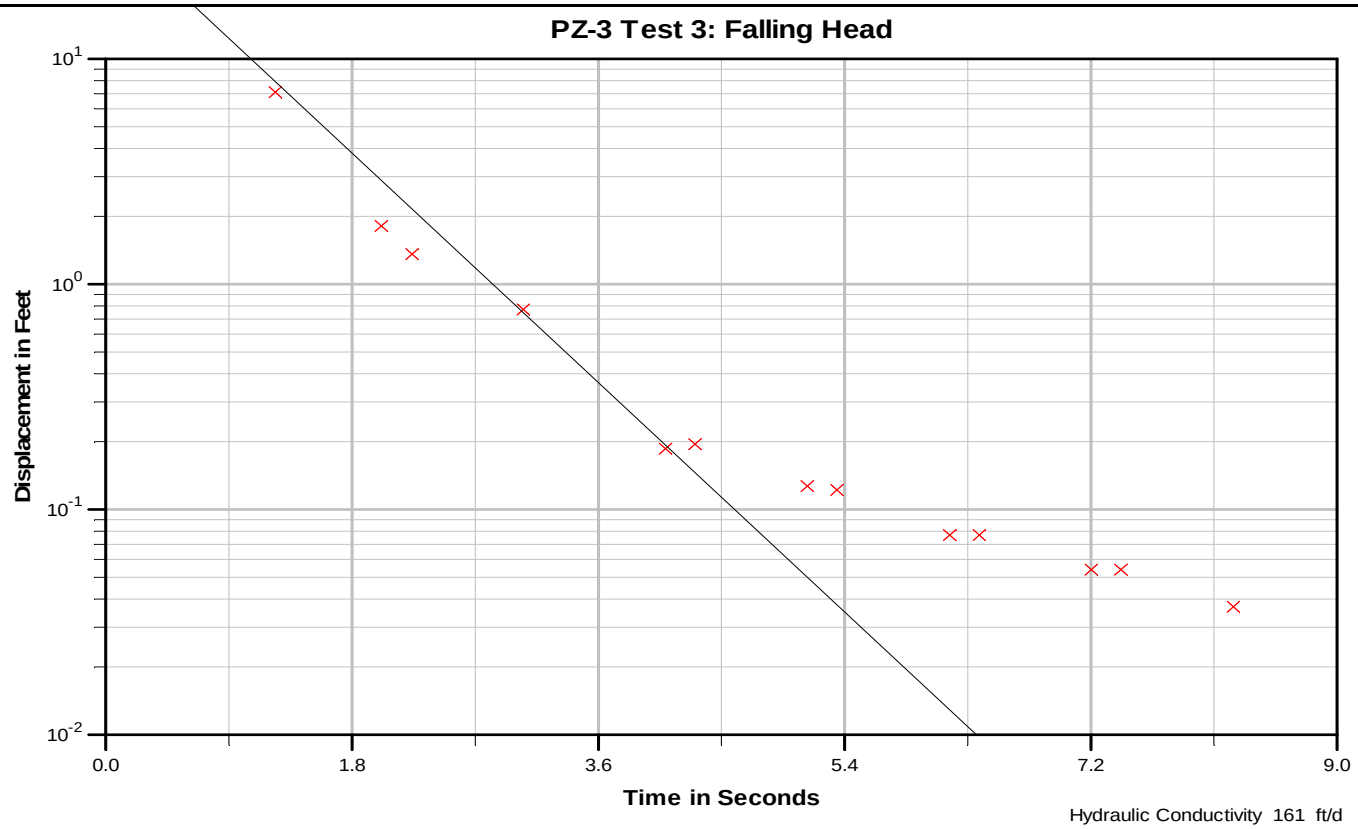
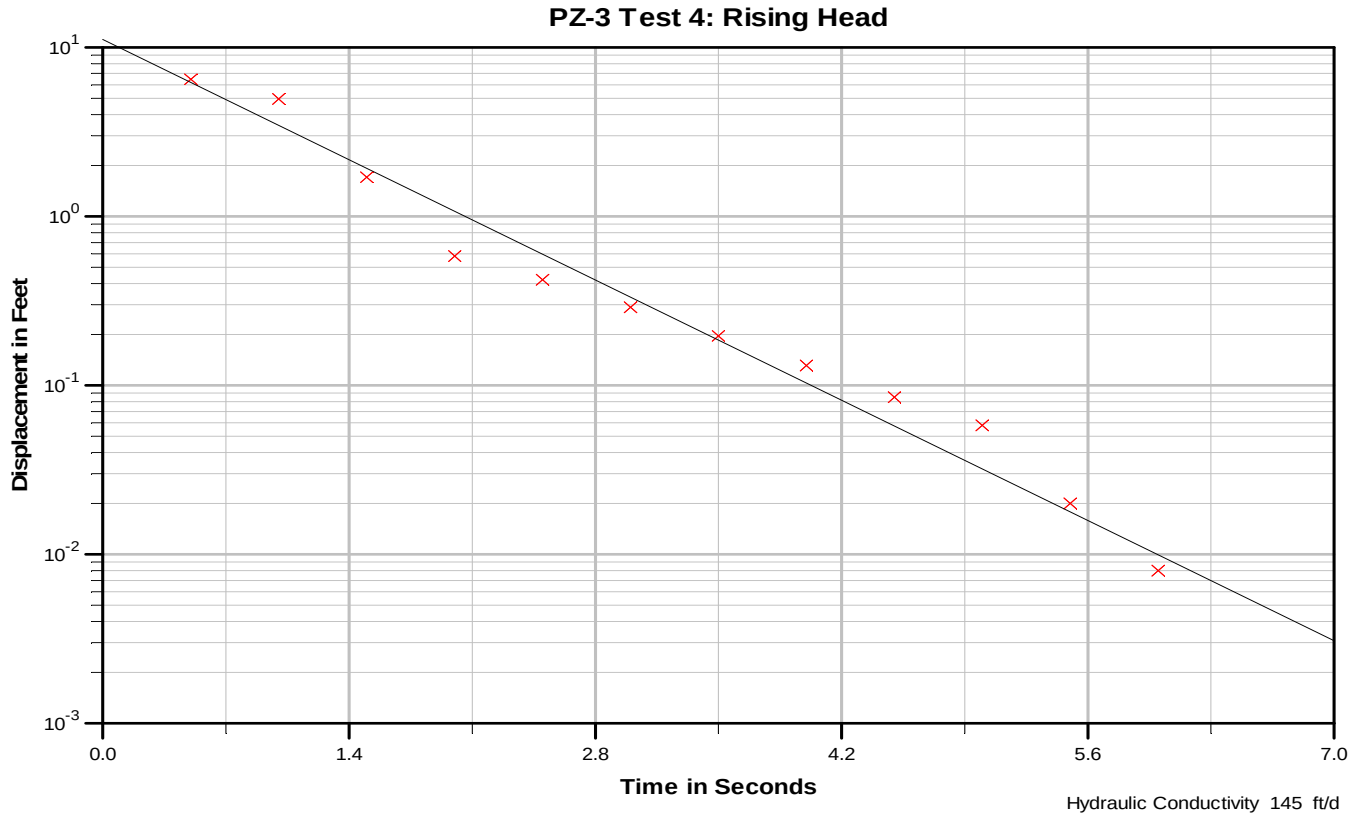




Diablo Wastewater Facility
Diablo, Washington

PZ-3 Slug Tests 3 and 4

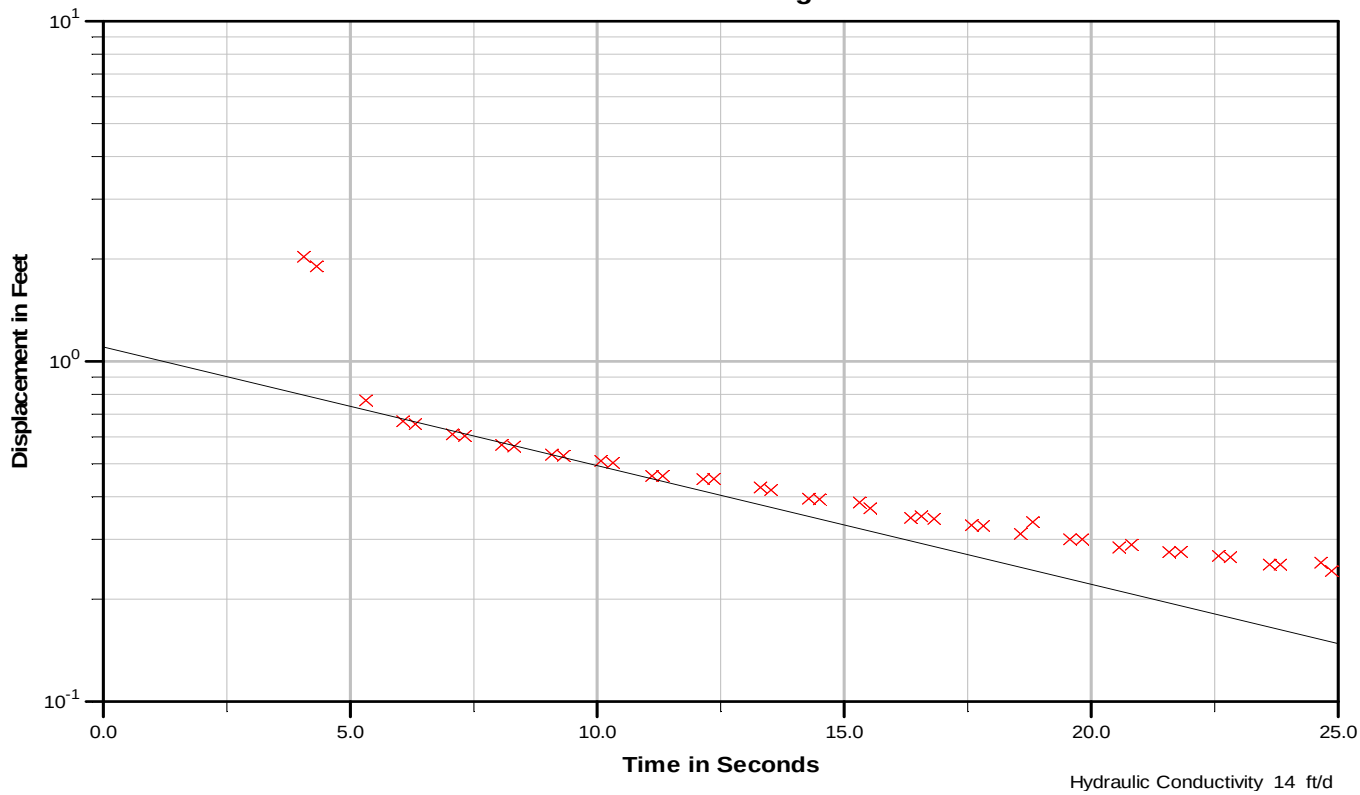
17843-16 5/13

HARTCROWSER

Figure
C-9

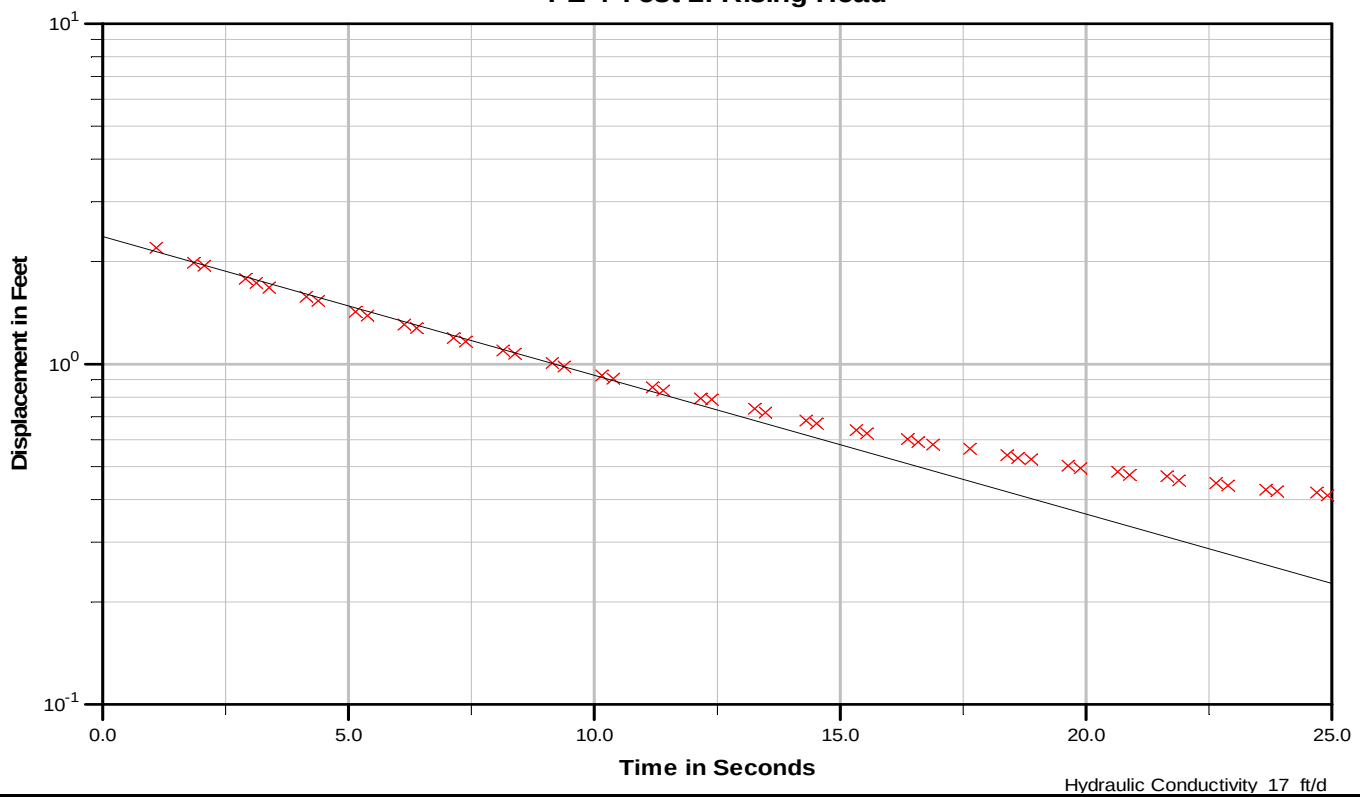
AJG 05/14/13 L:\Project Notebook\1784316 Diablo Lake\Slug Tests & GW Samp/ Slug Test .xls

PZ-4 Test 1: Falling Head



Hydraulic Conductivity 14 ft/d

PZ-4 Test 2: Rising Head



Hydraulic Conductivity 17 ft/d

Diablo Wastewater Facility
Diablo, Washington

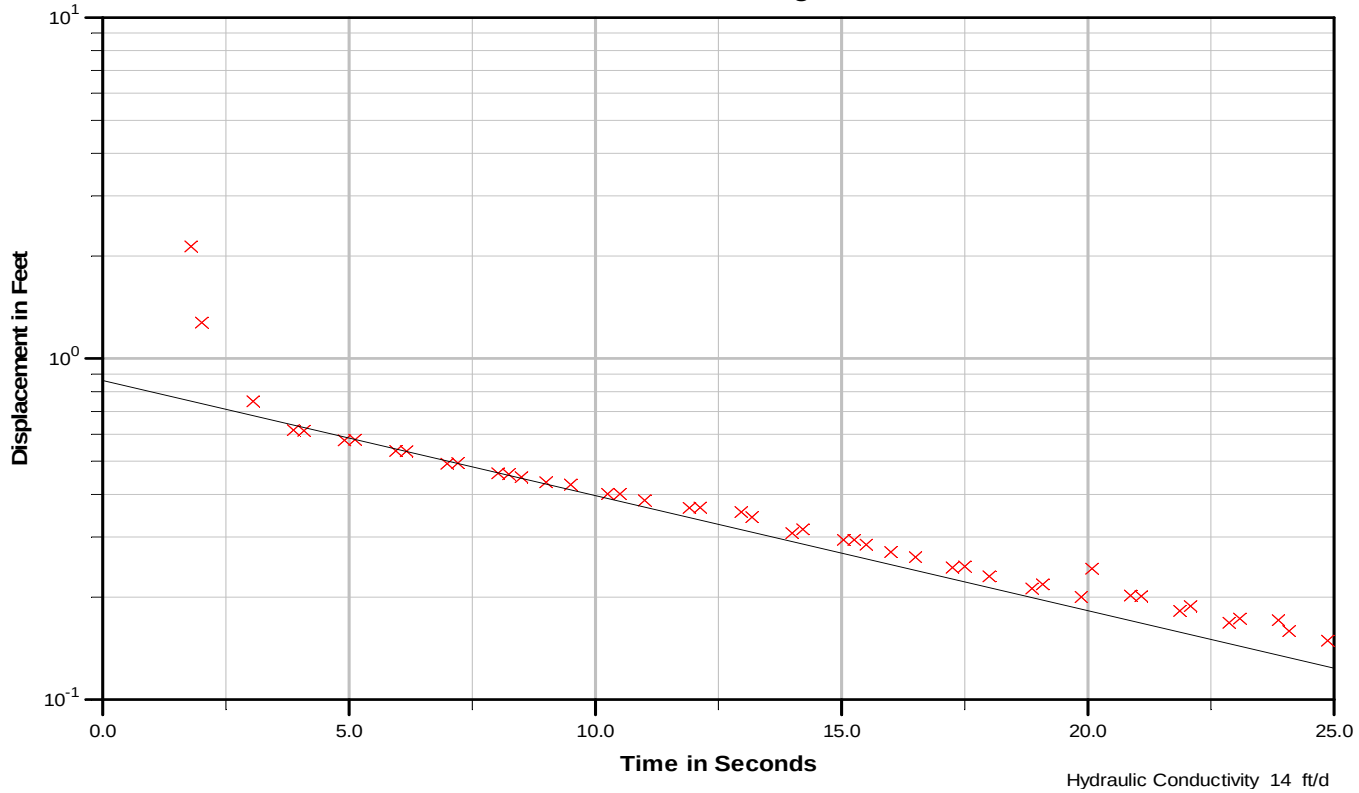
PZ-4 Slug Tests 1 and 2

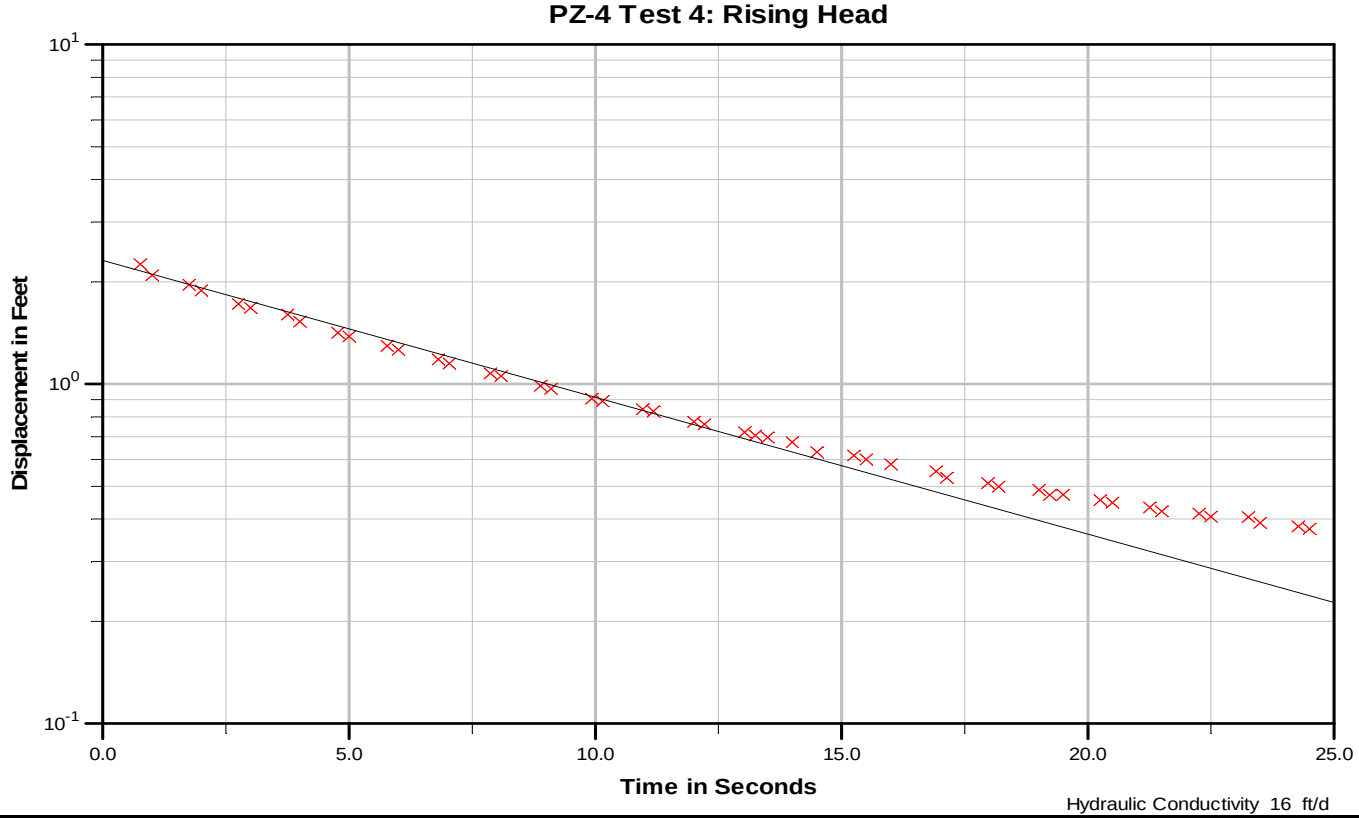
17843-16 5/13

HARTCROWSER

Figure
C-10

AJG 05/14/13 L:\Project Notebook\1784316 Diablo Lake\Slug Tests & GW Samp/ Slug Test .xls





Diablo Wastewater Facility
Diablo, Washington

PZ-4 Slug Tests 3 and 4

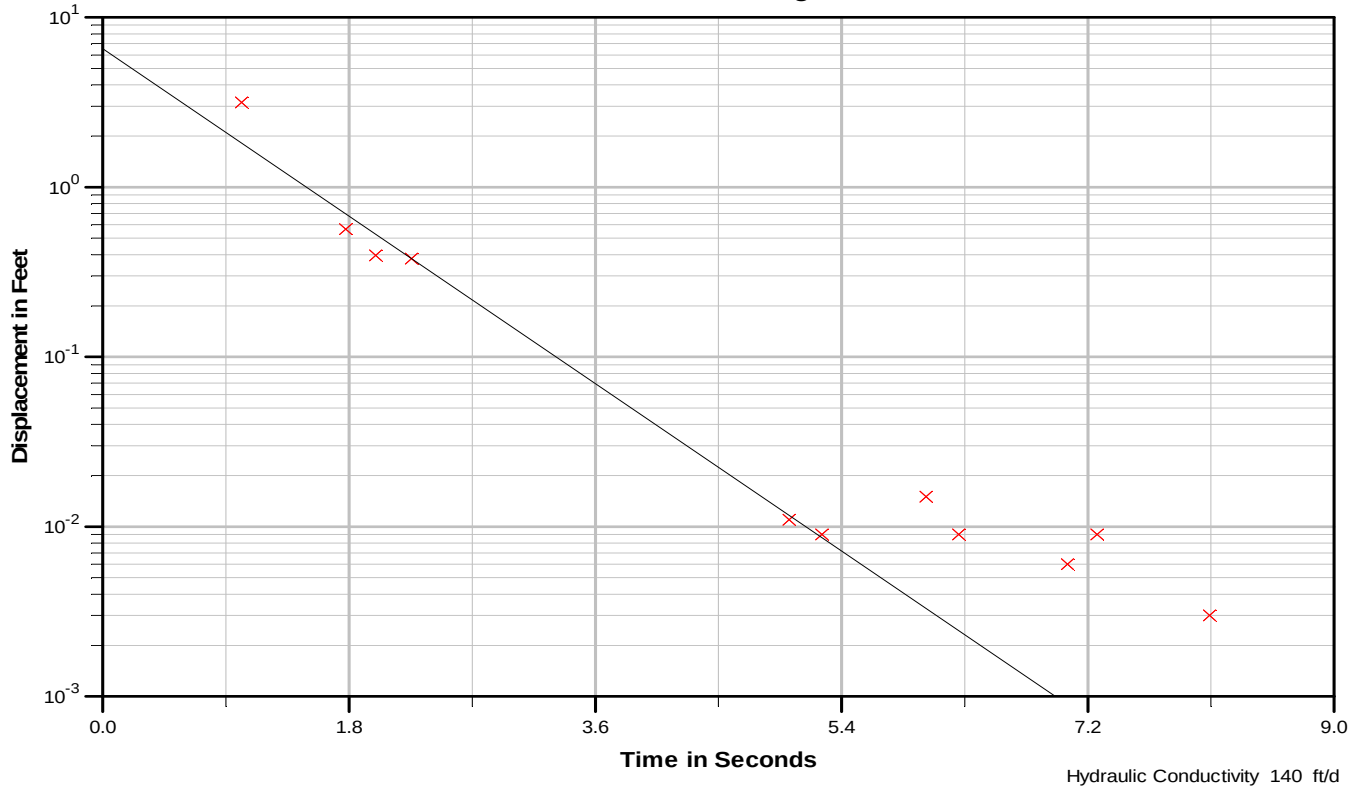
17843-16 5/13

HARTCROWSER

Figure
C-11

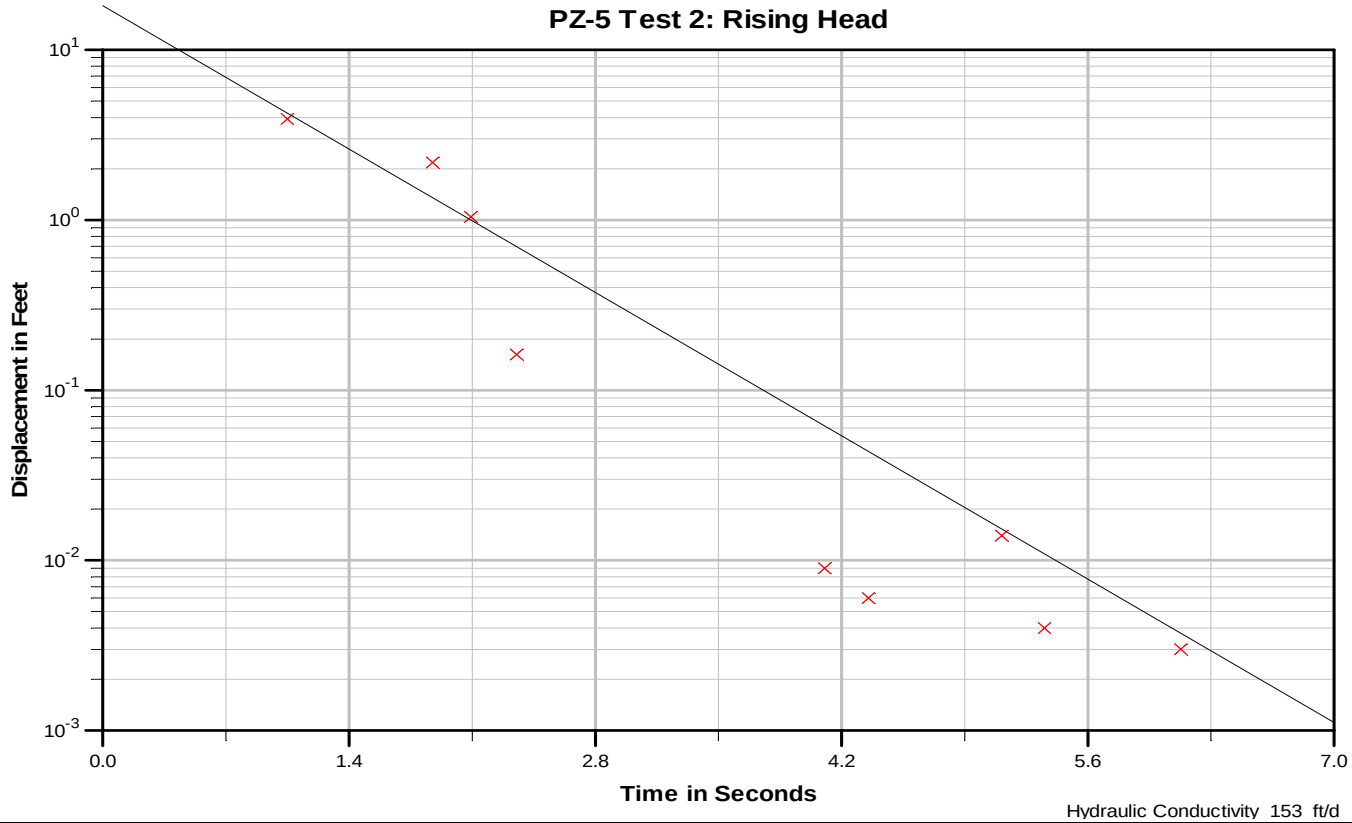
AJG 05/14/13 L:\Project Notebook\1784316 Diablo Lake\Slug Tests & GW Samp/ Slug Test .xls

PZ-5 Test 1: Falling Head



Hydraulic Conductivity 140 ft/d

PZ-5 Test 2: Rising Head



Hydraulic Conductivity 153 ft/d

Diablo Wastewater Facility
Diablo, Washington

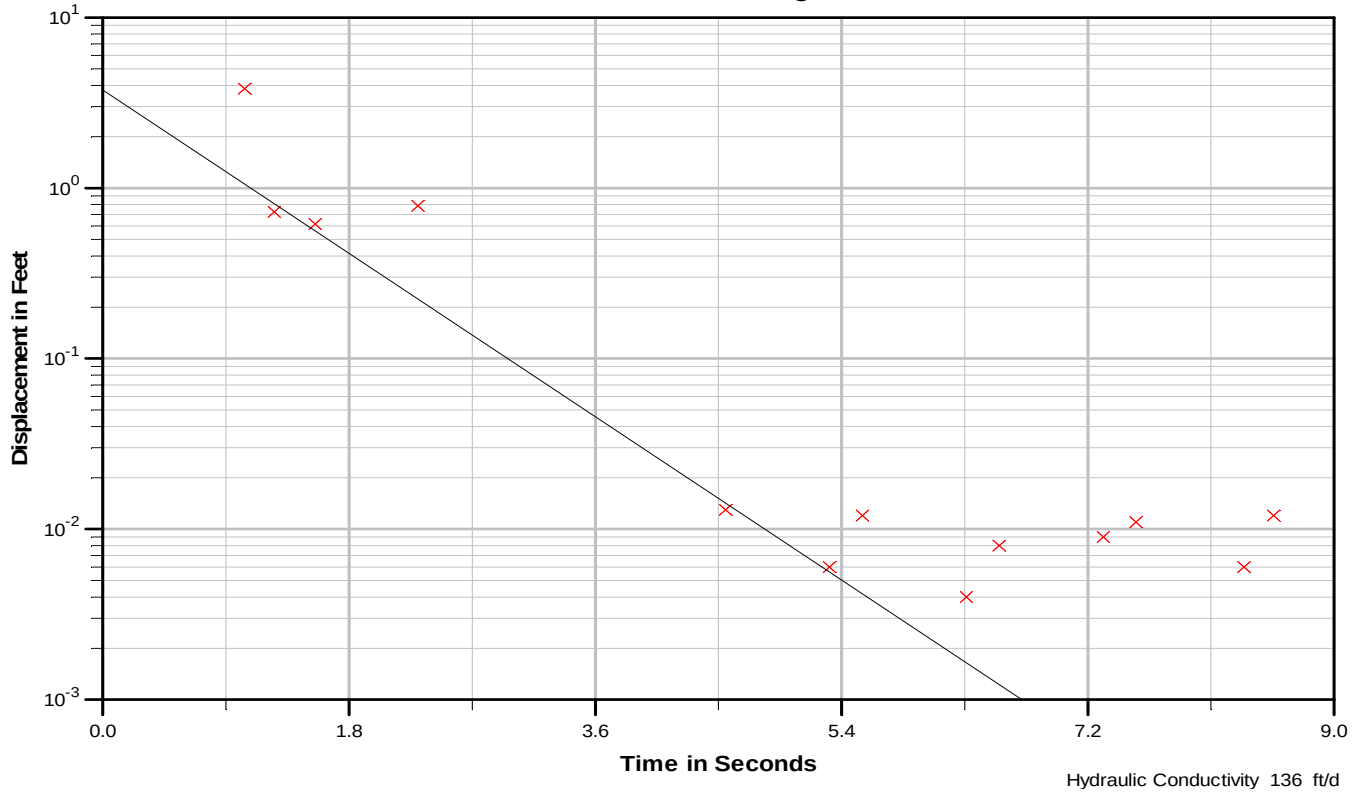
PZ-5 Slug Tests 1 and 2

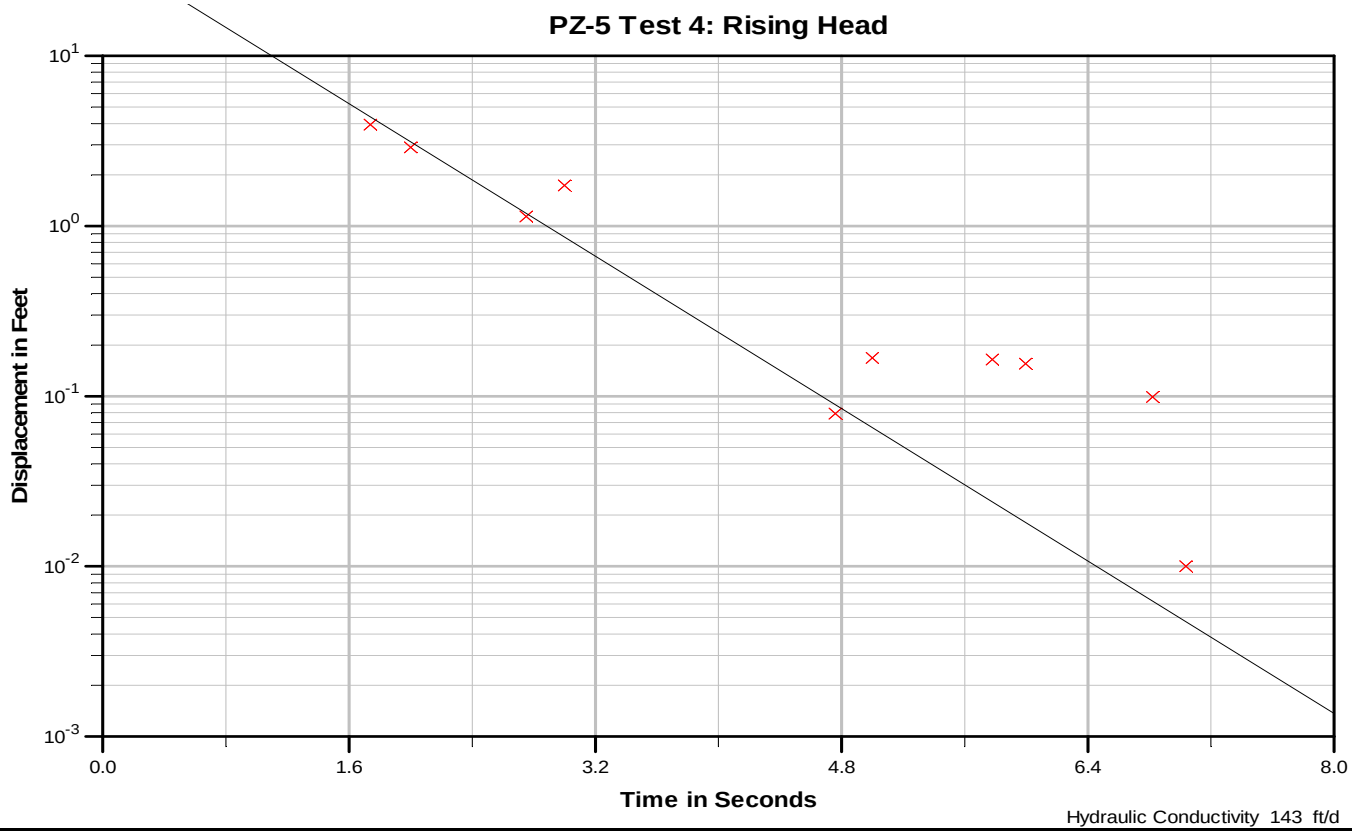
17843-16 5/13

HARTCROWSER

Figure
C-12

AJG 05/14/13 L:\Project Notebook\1784316 Diablo Lake\Slug Tests & GW Samp/ Slug Test .xls





Diablo Wastewater Facility
Diablo, Washington

PZ-5 Slug Tests 3 and 4

17843-16 5/13

HARTCROWSER

Figure
C-13

AJG 05/14/13 L:\Project Notebook\1784316 Diablo Lake\Slug Tests & GW Samp/ Slug Test .xls