ROBINSON NOBLE SALTBUSH INC. Established 1947
GROUNDWATER & ENVIRONMENTAL SCIENTISTS

August 31, 2005

Bob Mueller
UNAVCO
1440 Regatta Blvd.
Richmond, CA 94804

Dear Mr. Mueller,

Robinson, Noble & Saltbush recently accomplished slug testing and analysis for five of the UNAVCO PBO locations in Clallam County Washington. At each of these locations there is a partially cased borehole drilled into consolidated bedrock to varying depths. The deepest portion of each boring was completed using a diamond core drill. In all cases, the borings were placed into relatively fracture-free rock and yield very little water. The specific depths of drilling and coring varied at each location, details are presented in the following table.

Table 1: Site-specific Information

Site	Cased Depth	Drilled Depth	Cored Depth	Depth to Water
Golbeck	397	458	506.5	31.20
Clark West	503	575	575	41.26
Shore NE	396	501	522.5	187.4
Shore NW	397	501	542.5	119.69
Shore SW	295	419	471	109.58

Depths to water measured from top of 6" casing on June 21, 2005

Slug testing was accomplished by lowering an In-Situ MiniTroll 30 PSI electronic transducer/datalogger into each borehole to be tested and positioning the transducer approximately 40 feet below the static water level. The MiniTroll used to record water levels is barometrically compensated, with an atmospheric reference tube. A similar, non-vented MiniTroll 30-PSI datalogger was used as a barometer. Both instruments were equipped with fresh lithium batteries and were synchronized to each other prior to the start of the testing. Both instruments were set to record measurements at 1-second intervals during testing.

Once logging was started on both instruments and a baseline water level established at each borehole, a weighted slug or bailer, as appropriate for the location, was used to displace the water in the wells. In the deeper wells, the bailer was used as it has a slightly smaller diameter and was less likely to foul the datalogger cable as it was removed from the well.

Slug-in and slug-out responses were measured at each location. The time allowed for water level equilibration after each slug-in or slug-out event was at least fifteen minutes and ranged to more than an hour. Water level responses in all locations were extremely slow, as would be expected of a borehole in relatively fracture-free bedrock.

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Figures 1 through 5 present the raw water level data and barometric data on the same plot for each borehole. As is evident from the plots, no significant barometric fluctuations were observed during testing. Individual slug in or out events took place where the water level steps up or down, respectively. Two slug-out tests have brief intervals where the datalogger's cable fouled on the bailer, lifting the logger from the well with the bailer. As the cable was referenced when initially installed, the instrument was re-hung in the well once it was untangled. While this was not ideal, it functioned for the purpose of these tests. Figures 6 through 15 present the individual solutions for each of the tests completed.

The first site to be tested was the Golbeck location, located just south of Sequim, Washington. The Clark West location was tested next, and finally the three locations at the Shore site were tested. The Golbeck and Clark West locations were tested using a solid weighted slug to displace the water. Due to the depths involved, the three Shore locations were tested with a bailer that was slightly longer, but has a smaller outside diameter in an attempt to avoid fouling the datalogger cable.

Once the data was collected at each location, the datalogger was downloaded into a laptop computer then reprogrammed for the next location. Upon completion of the testing, the data was transferred from the laptop and imported into Excel for conversion to displacement-time data sets suitable for importing into the software used to analyze the slug tests. AquiferWin32, a product of Environmental Simulations, Inc., was used to calculate Bouwer & Rice unconfined solutions for each of the slug-in and slug-out tests. Each Bouwer & Rice analysis included the specific construction parameters for each location, results are presented in the following table. Data for the slug-in test at Shore SW was poor, the water level did not respond to the insertion of the slug. Analysis of the Shore SW slug-in test only included the data after 5 minutes. The rest of the tests yielded acceptable data.

Table 2: Test Parameters and Results

Site	Open Hole (Screen Length) (feet)	Aquifer Thickness (feet)	Hydraulic Conductivity Slug In (ft/day)/(m/s)		Hydraulic Conductivity Slug Out (ft/day)/(m/s)	
Golbeck	109.5	475.3	$1.451X10^{-2}$	$5.12X10^{-8}$	$4.327X10^{-3}$	$1.53X10^{-8}$
Clark West	72	533.74	$7.828X10^{-3}$	$2.76X10^{-8}$	$1.358X10^{-2}$	$4.79X10^{-8}$
Shore NE	126.5	402.81	$1.470X10^{-2}$	$3.08X10^{-8}$	$5.154X10^{-3}$	$6.06X10^{-8}$
Shore NW	145.5	355.1	$8.730X10^{-3}$	$5.19X10^{-8}$	$1.718X10^{-2}$	$1.82X10^{-8}$
Shore SW	176	361.46	$9.135X10^{-3}$	$3.22X10^{-8}$	$2.820X10^{-3}$	$9.95X10^{-8}$

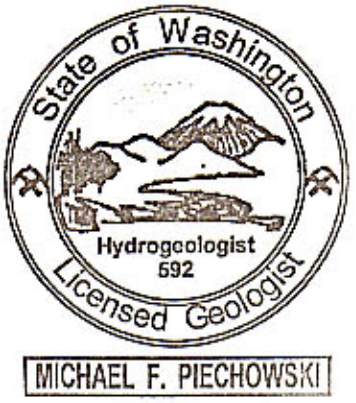
The average hydraulic conductivity of the locations tested is $1.233X10^{-2}$ ft/day ($4.35X10^{-8}$ m/s), with a maximum of $2.82X10^{-2}$ ft/day ($9.95X10^{-8}$ m/s) and a minimum of $4.327X10^{-3}$ ($1.53X10^{-8}$ m/s). These extremely low values of hydraulic conductivity indicate that the boreholes do not intersect appreciable fracture zones or other zones with significant permeability. These hydraulic conductivity values are consistent with the observed conditions, especially since fracture systems were avoided in the placement of these boreholes.

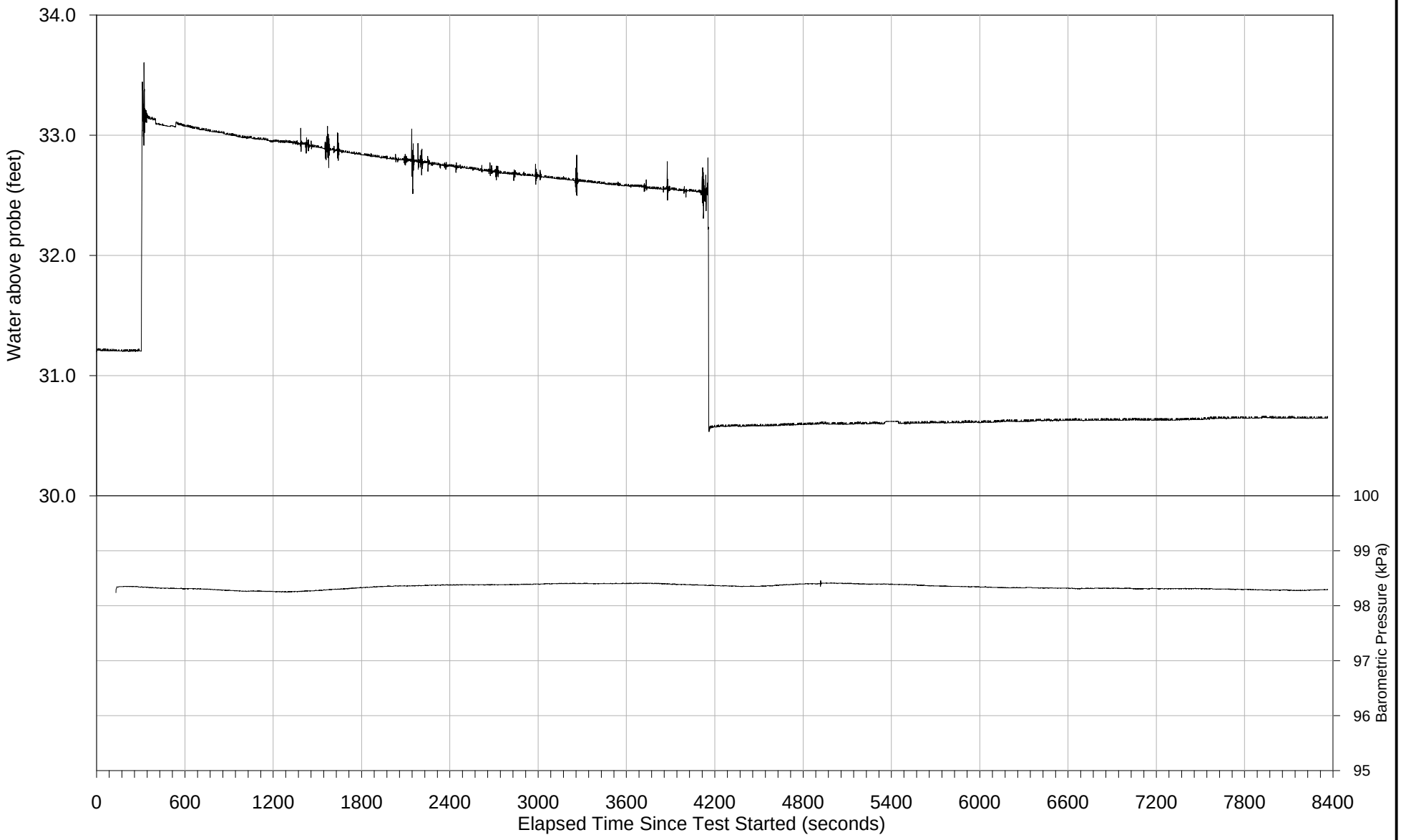
We appreciate this opportunity to complete this testing for UNAVCO. Should you have any questions or require further information, please do not hesitate to contact us.

Sincerely,
Robinson, Noble & Saltbush, Inc.

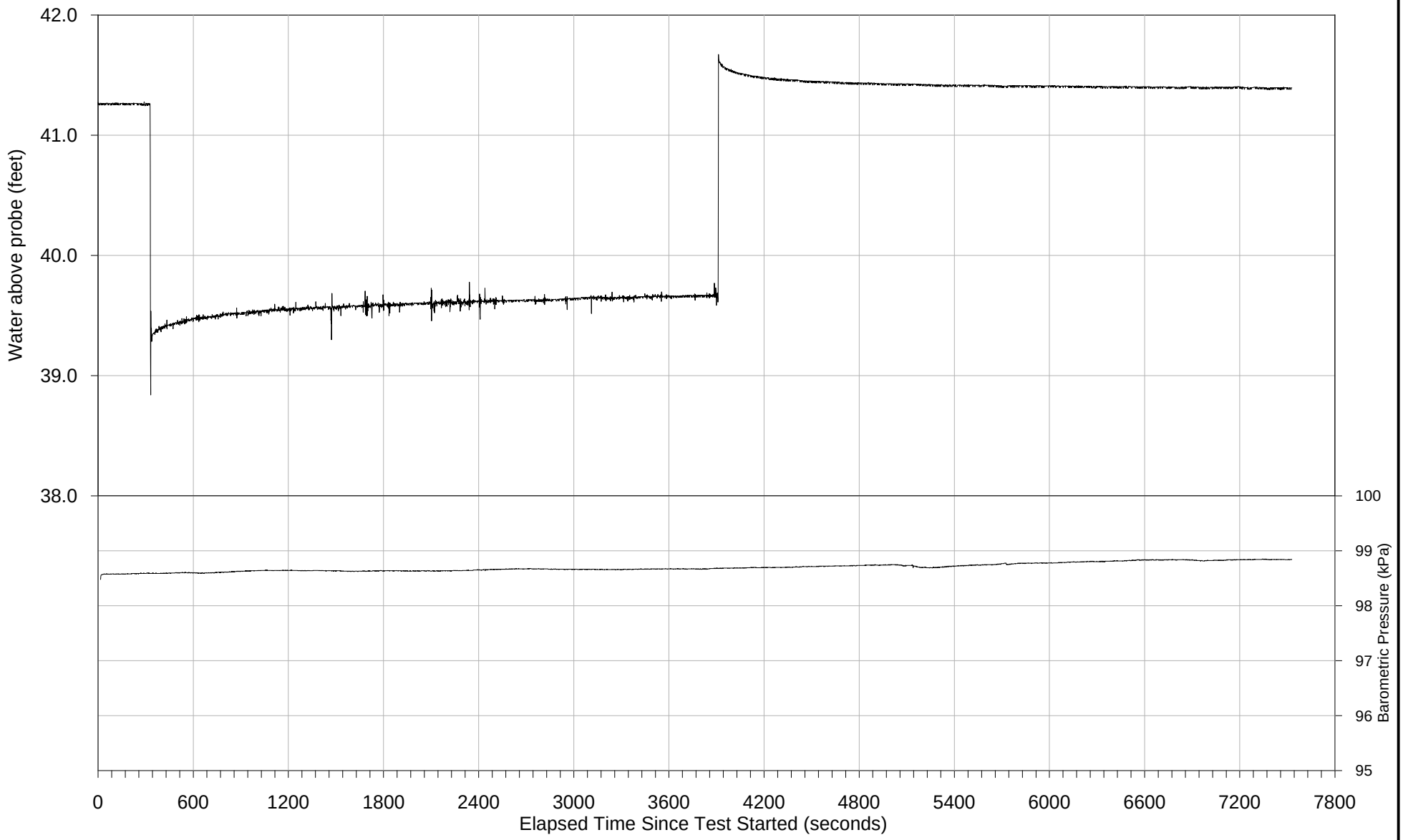
Michael F. Piechowski, L.HG
Senior Hydrogeologist

attachments

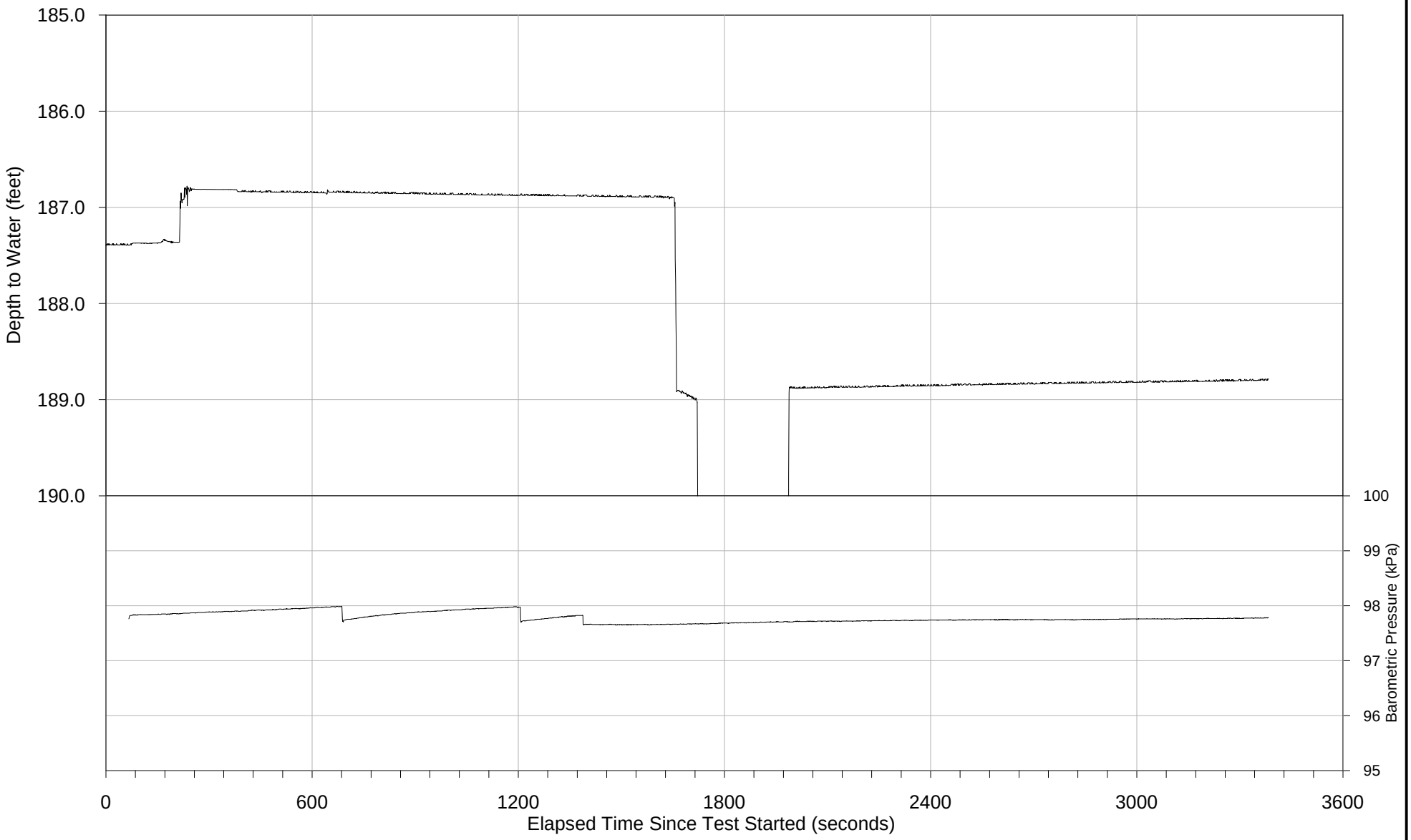




ROBINSON NOBLE SALTBUSH INC. Established 1947 GROUNDWATER & ENVIRONMENTAL SCIENTISTS	PM: JEB Date: 08/30/05	UNAVCO PBO Golbeck Site	Figure 1 Water Levels and Barometric Record UNAVCO PBO



ROBINSON NOBLE SALTBUSH INC. Established 1947 GROUNDWATER & ENVIRONMENTAL SCIENTISTS	PM: JEB Date: 08/30/05	UNAVCO PBO Clark West Site	Figure 2 Water Levels and Barometric Record UNAVCO PBO



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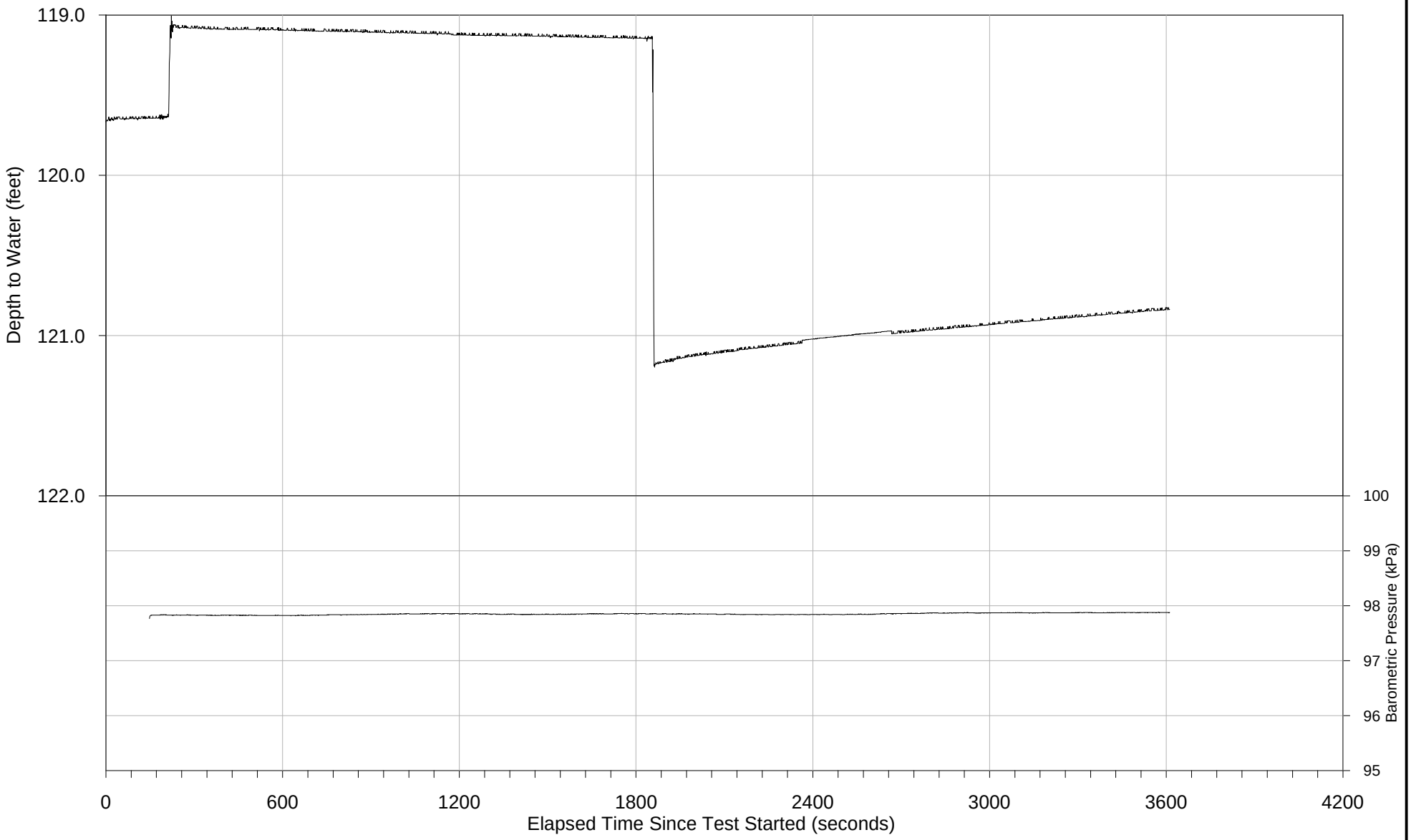
PM: JEB
Date: 08/30/05

UNAVCO PBO
Shore NE Site

Figure 3
Water Levels and Barometric Record
UNAVCO PBO



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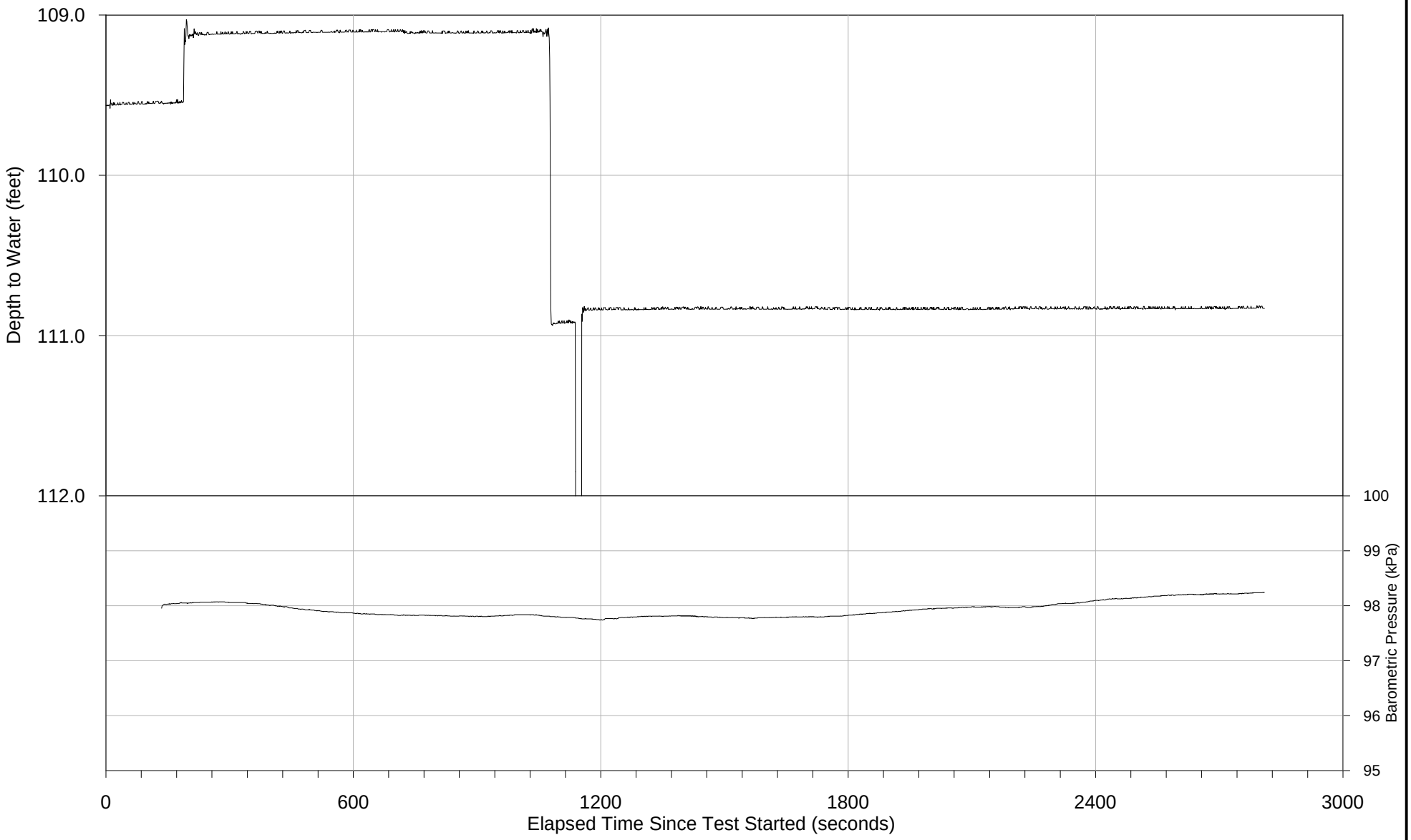
PM: JEB
Date: 08/30/05

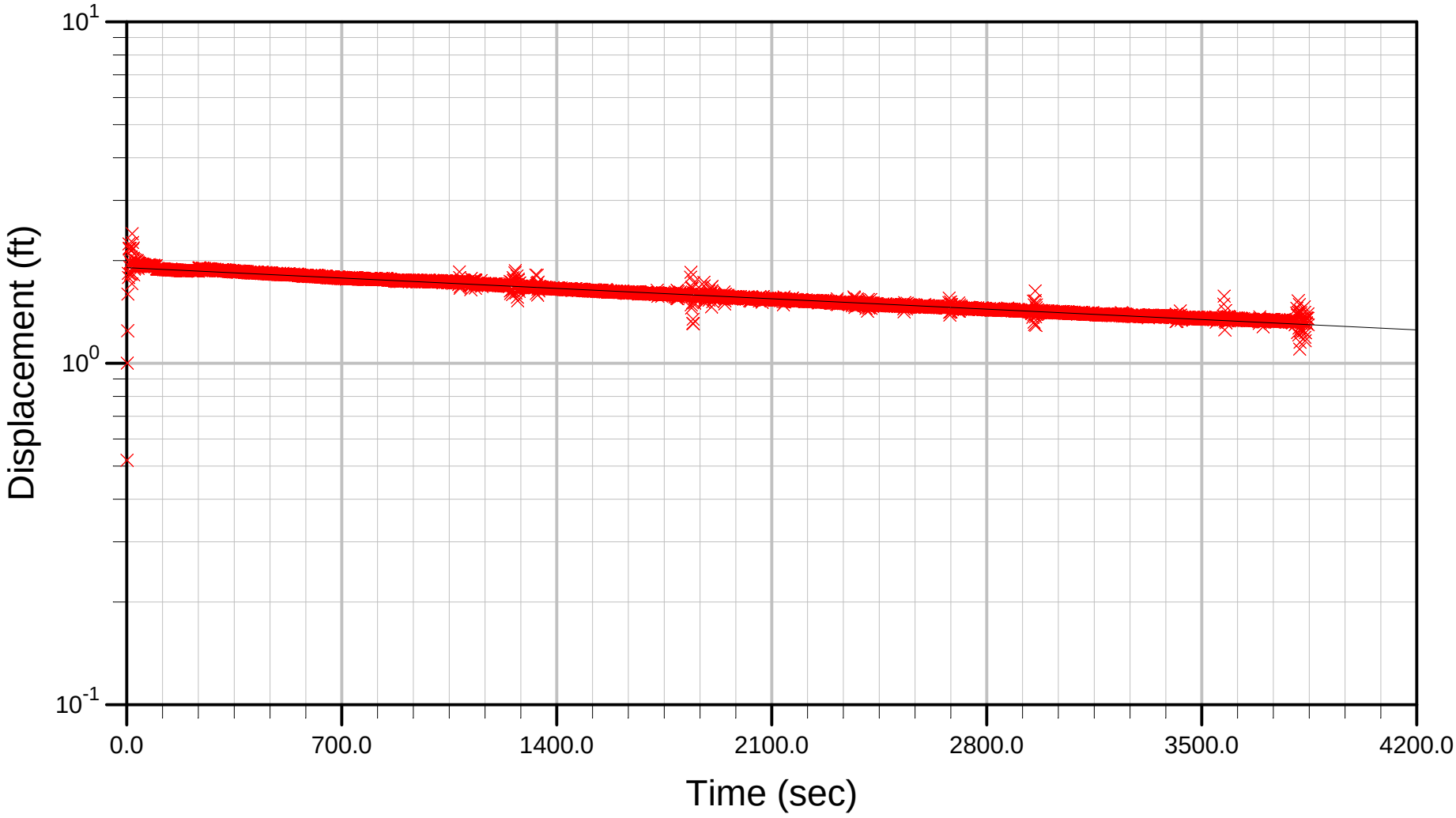
UNAVCO PBO
Shore NW Site

Figure 4
Water Levels and Barometric Record
UNAVCO PBO



ROBINSON NOBLE SALTBUSH INC. Established 1947 GROUNDWATER & ENVIRONMENTAL SCIENTISTS	PM: JEB Date: 08/30/05	UNAVCO PBO Shore SW Site	Figure 5 Water Levels and Barometric Record UNAVCO PBO

Bouwer & Rice Solution



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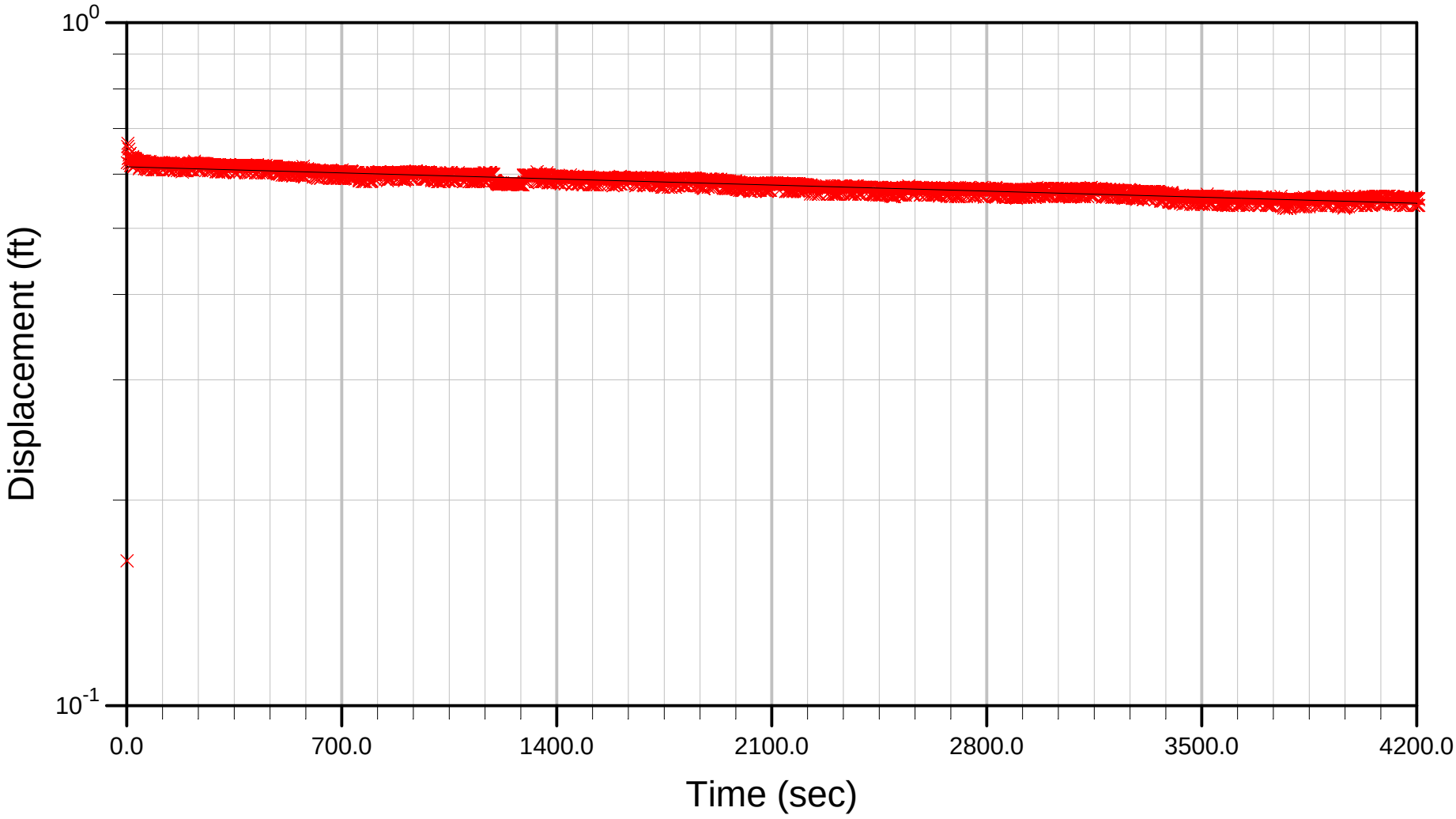
Analyst:	MFP	Hyd. Cond.:	1.451e-002 ft/d		Figure 6
Project Manager:	JEB	Date of Test:	June 21, 2005	Test Name:	Golbeck Slug In
Job Number:	2278-001A	Reference:	Bouwer & Rice, 1976	Client:	UNAVCO PBO

Bouwer & Rice Solution



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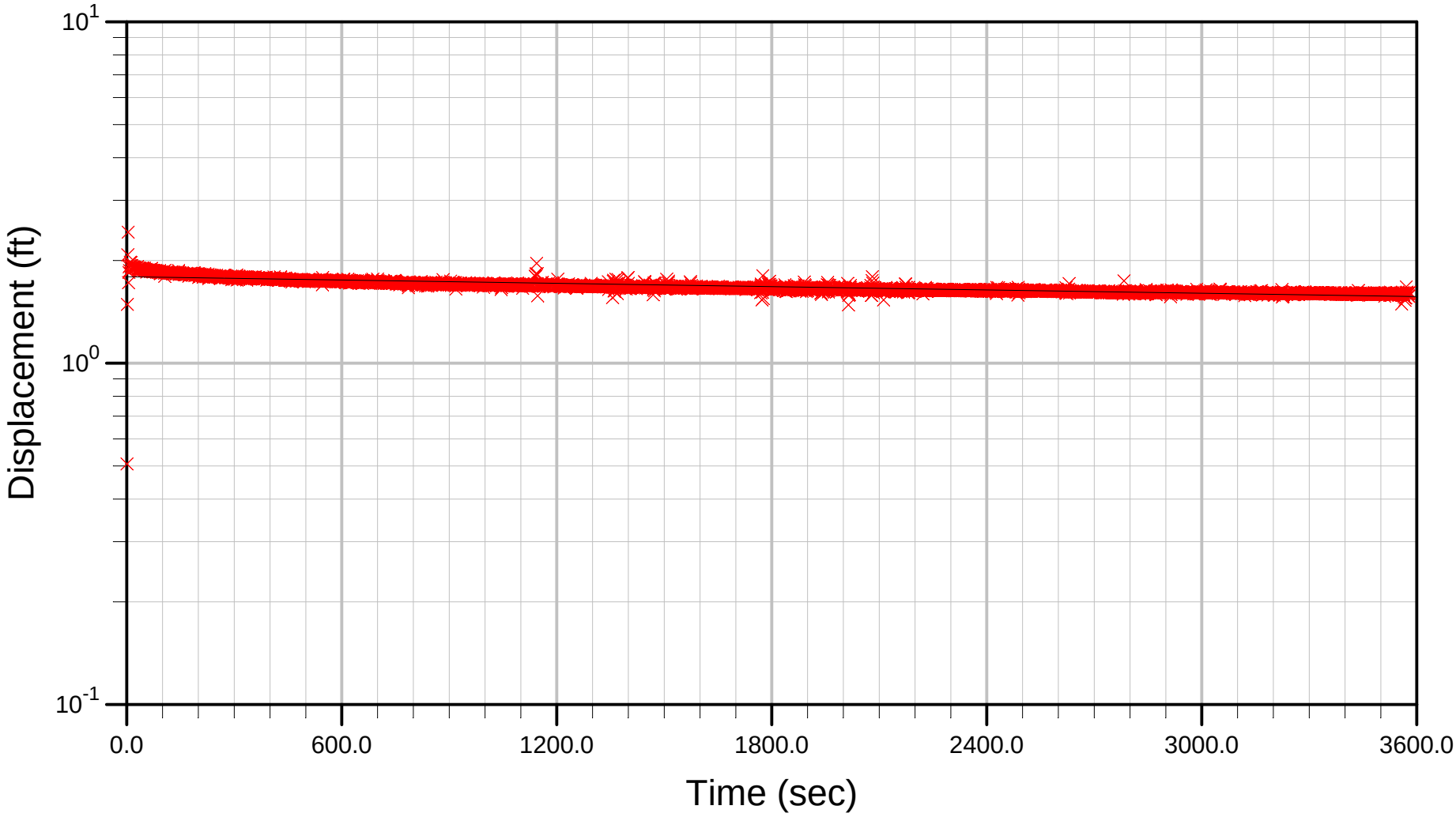
Analyst:	MFP	Hyd. Cond.:	4.327e-003 ft/d		Figure 7
Project Manager:	JEB	Date of Test:	June 21, 2005	Test Name:	Golbeck Slug Out
Job Number:	2278-001A	Reference:	Bouwer & Rice, 1976	Client:	UNAVCO PBO

Bouwer & Rice Solution



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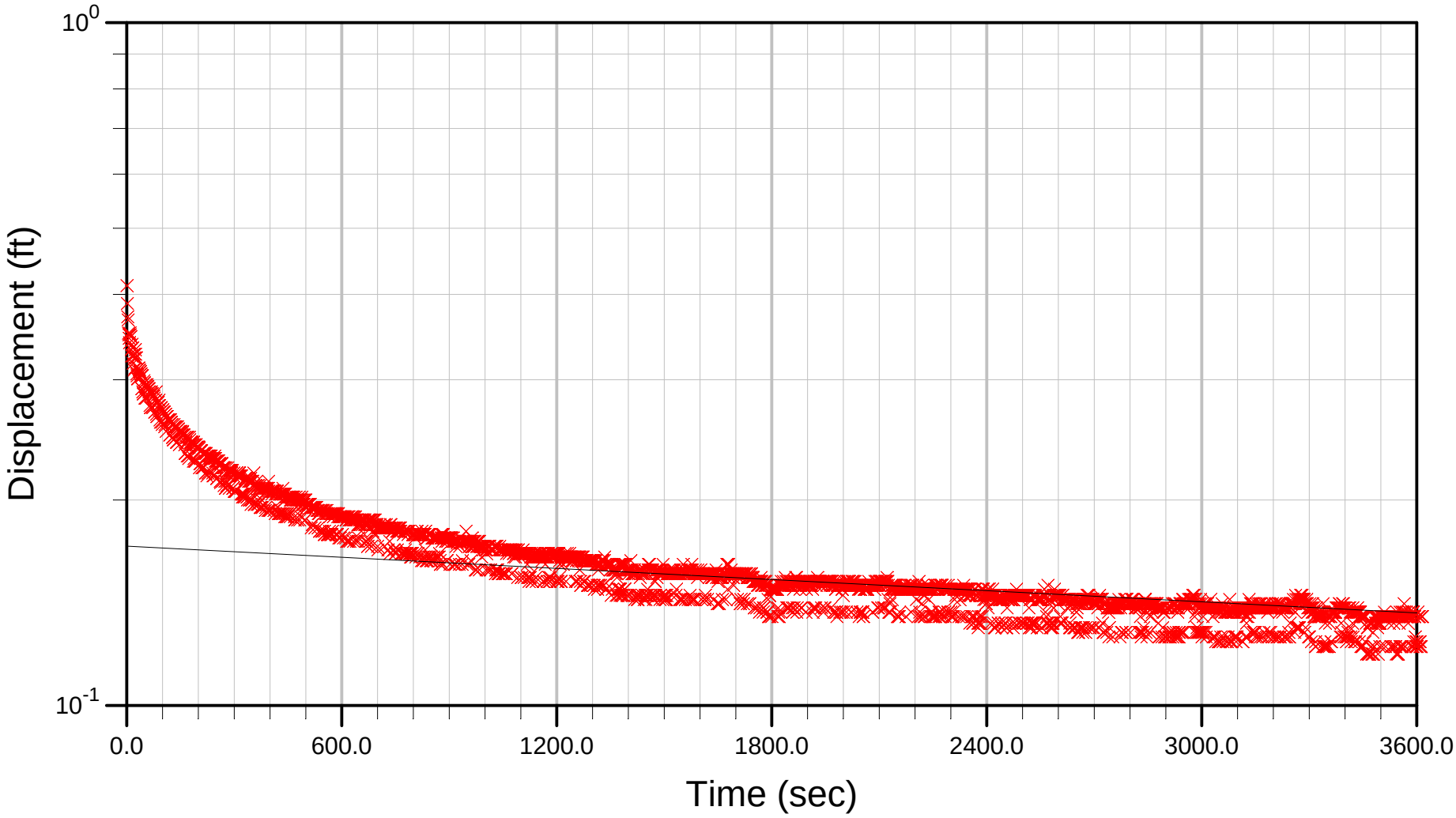
Analyst:	MFP	Hyd. Cond.:	7.828e-003 ft/d		Figure 8
Project Manager:	JEB	Date of Test:	June 21, 2005	Test Name:	Clark West Slug In
Job Number:	2278-001A	Reference:	Bouwer & Rice, 1976	Client:	UNAVCO PBO

Bouwer & Rice Solution



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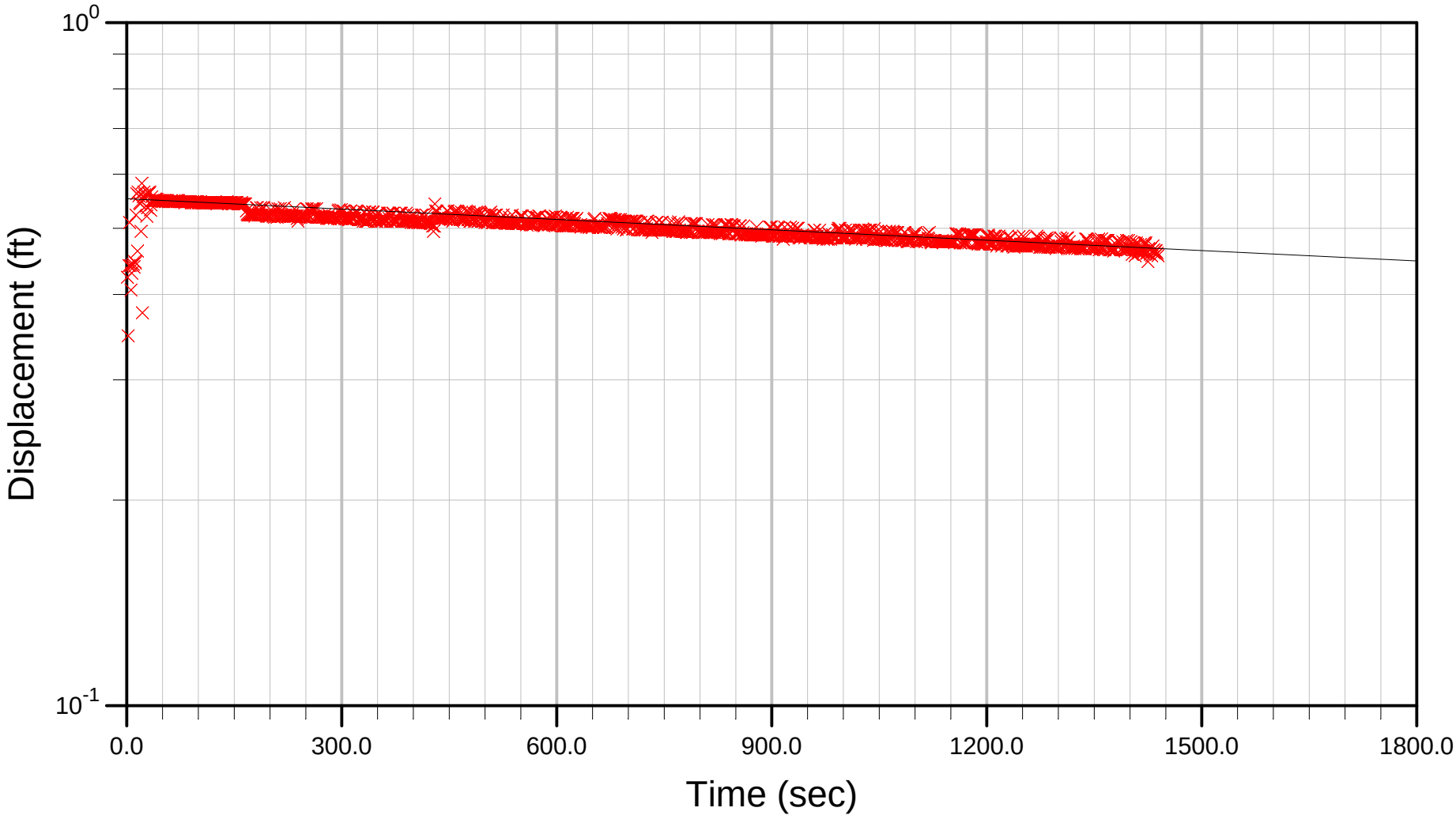
Analyst:	MFP	Hyd. Cond.:	1.358e-002 ft/d		Figure 9
Project Manager:	JEB	Date of Test:	June 21, 2005	Test Name:	Clark West Slug Out
Job Number:	2278-001A	Reference:	Bouwer & Rice, 1976	Client:	UNAVCO PBO

Bouwer & Rice Solution



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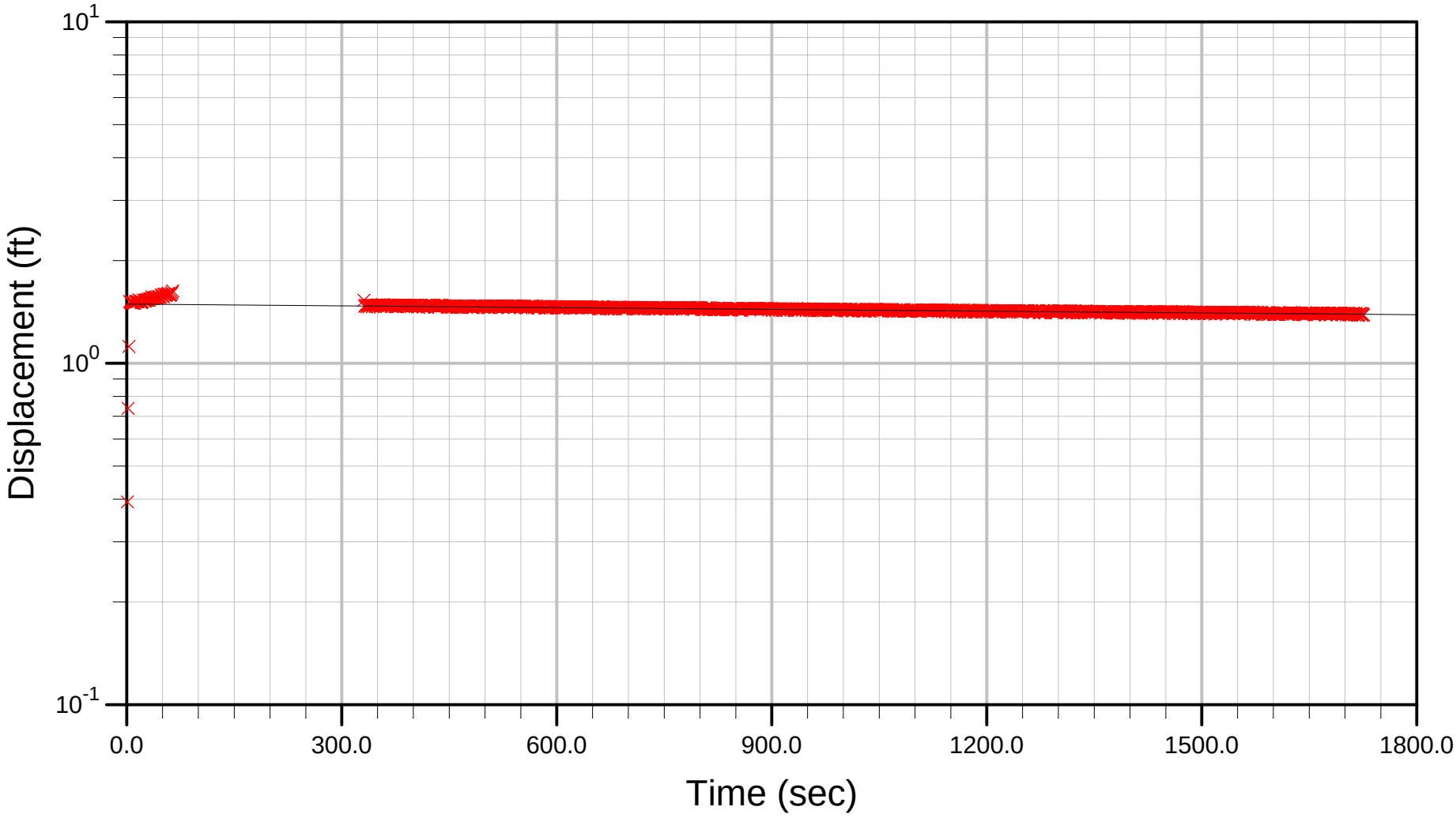
Analyst:	MFP	Hyd. Cond.:	1.470e-002 ft/d		Figure 10
Project Manager:	JEB	Date of Test:	June 21, 2005	Test Name:	Shore NE Slug In
Job Number:	2278-001A	Reference:	Bouwer & Rice, 1976	Client:	UNAVCO PBO

Bouwer & Rice Solution



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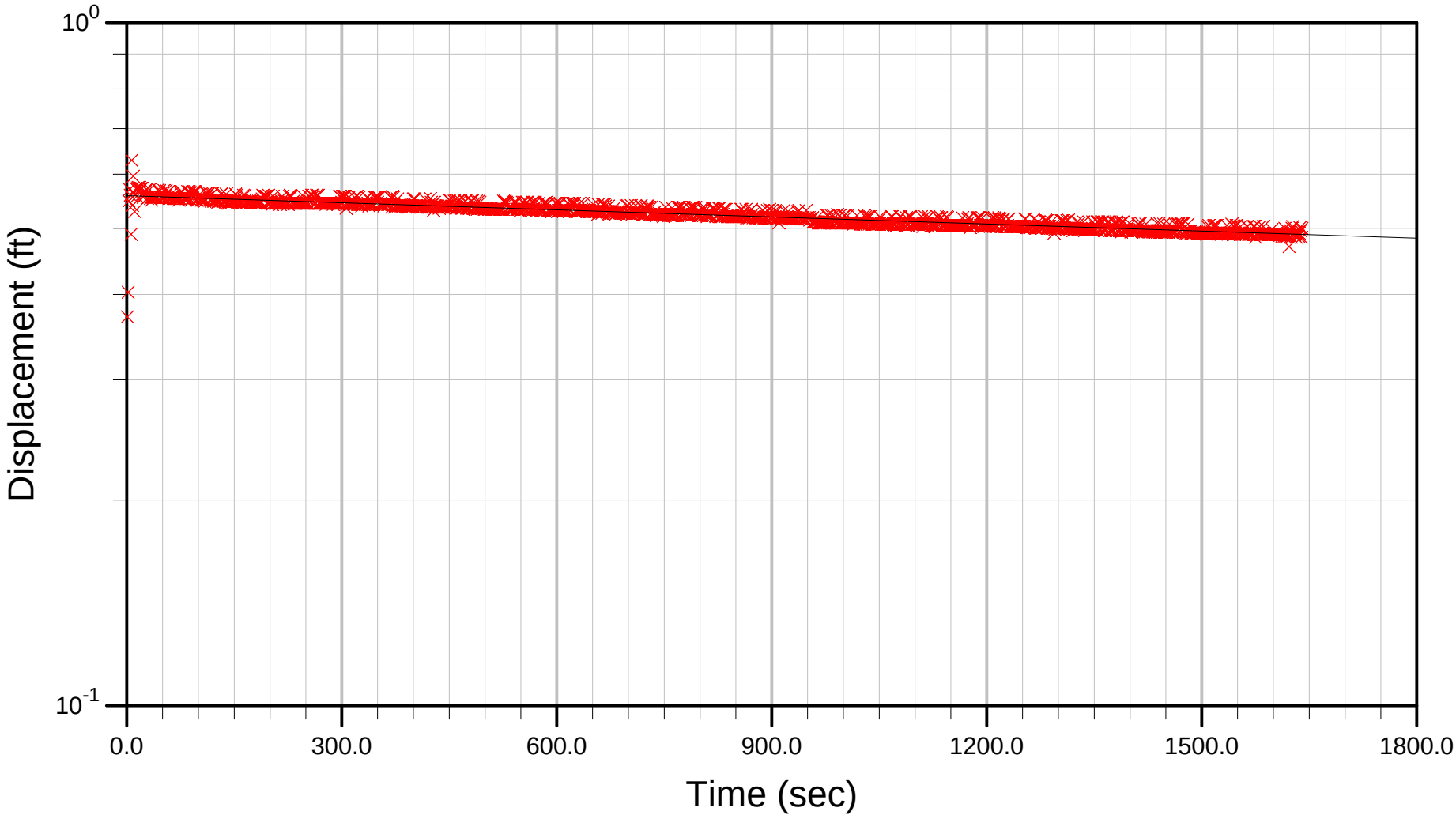
Analyst:	MFP	Hyd. Cond.:	5.154e-003 ft/d		Figure 11
Project Manager:	JEB	Date of Test:	June 21, 2005	Test Name:	Shore NE Slug Out
Job Number:	2278-001A	Reference:	Bouwer & Rice, 1976	Client:	UNAVCO PBO

Bouwer & Rice Solution



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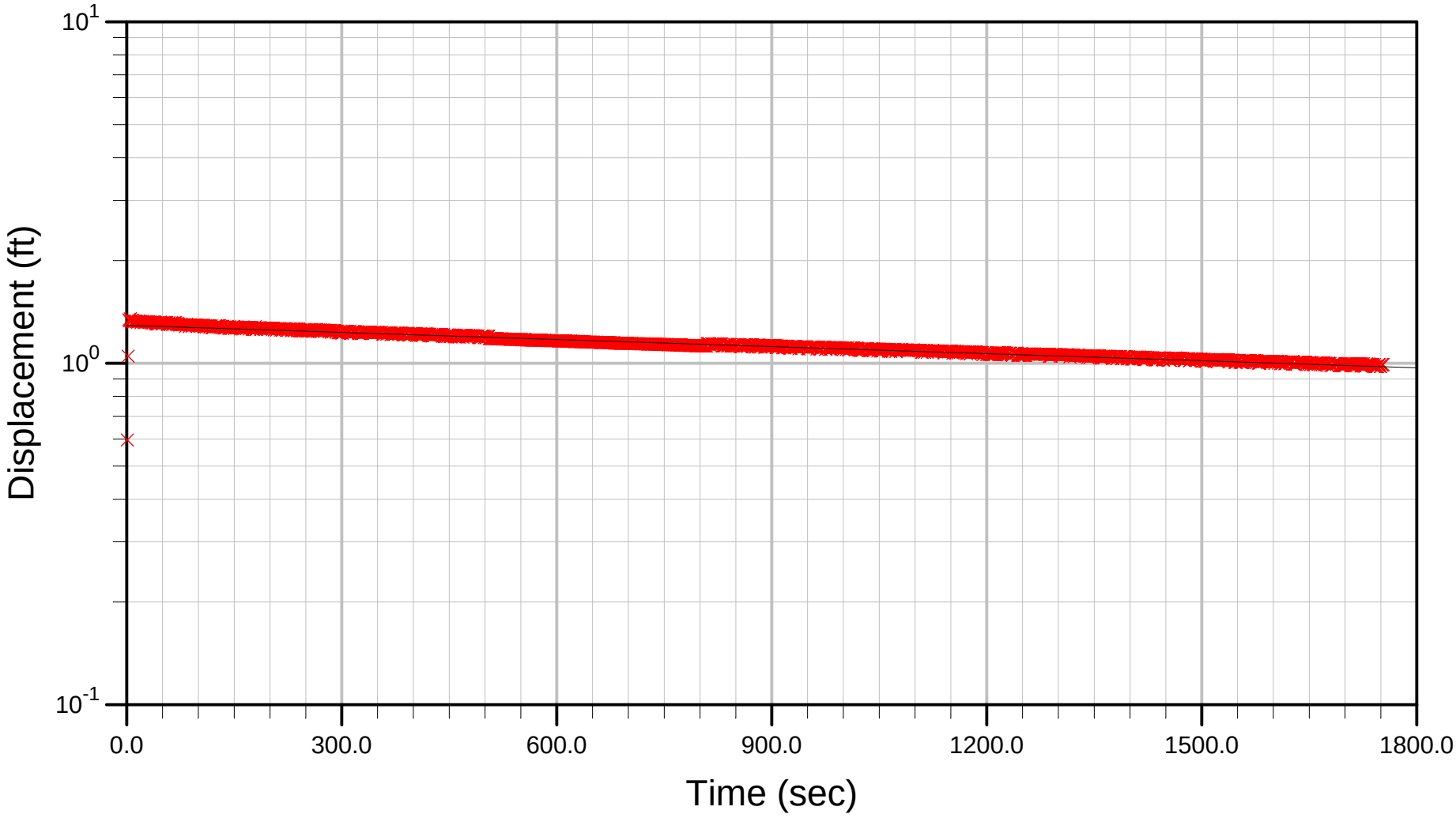
Analyst:	MFP	Hyd. Cond.:	8.730e-003 ft/d		Figure 12
Project Manager:	JEB	Date of Test:	June 21, 2005	Test Name:	Shore NW Slug In
Job Number:	2278-001A	Reference:	Bouwer & Rice, 1976	Client:	UNAVCO PBO

Bouwer & Rice Solution



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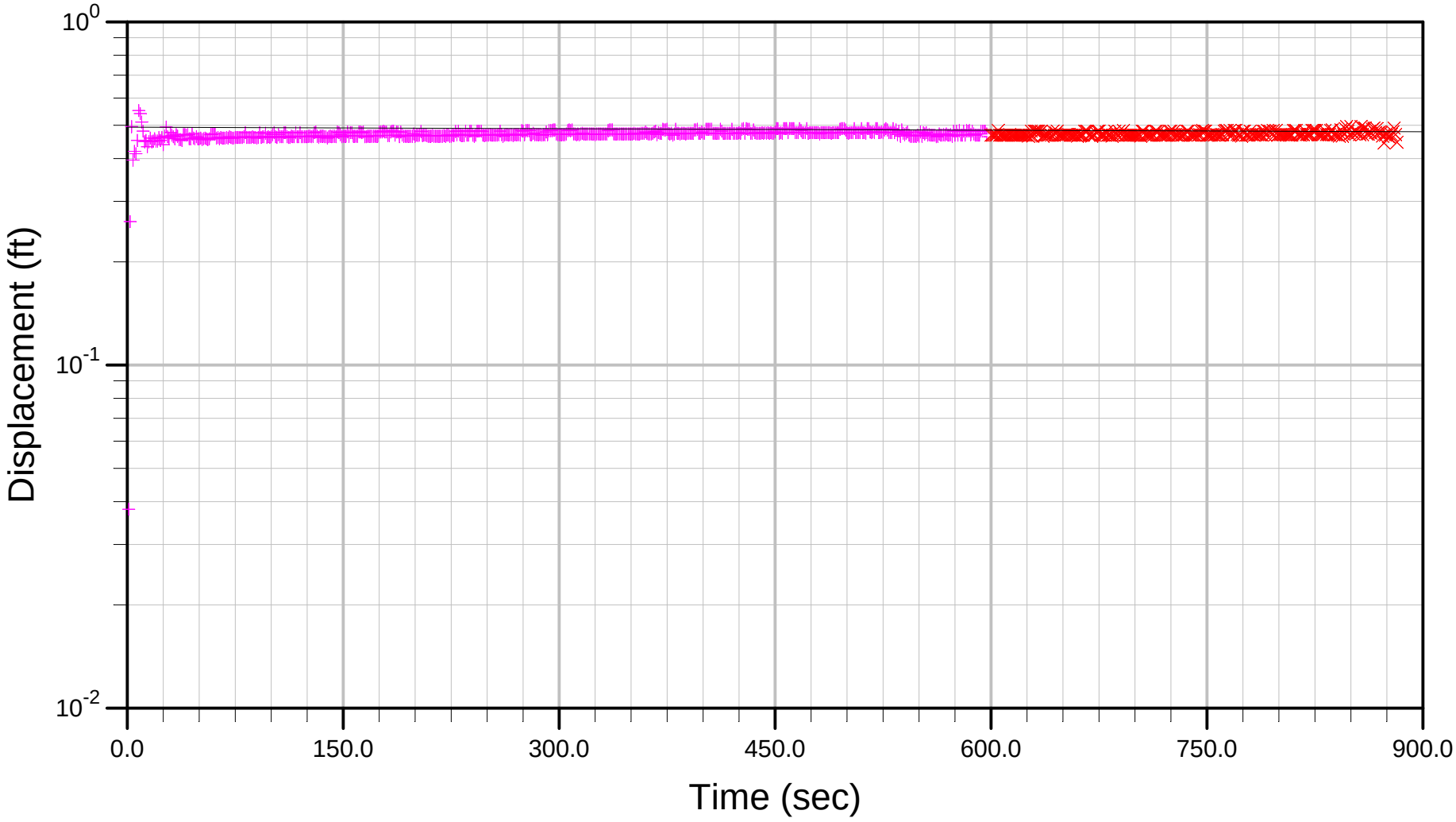
Analyst:	MFP	Hyd. Cond.:	1.718e-002 ft/d		Figure 13
Project Manager:	JEB	Date of Test:	June 21, 2005	Test Name:	Shore NW Slug Out
Job Number:	2278-001A	Reference:	Bouwer & Rice, 1976	Client:	UNAVCO PBO

Bouwer & Rice Solution



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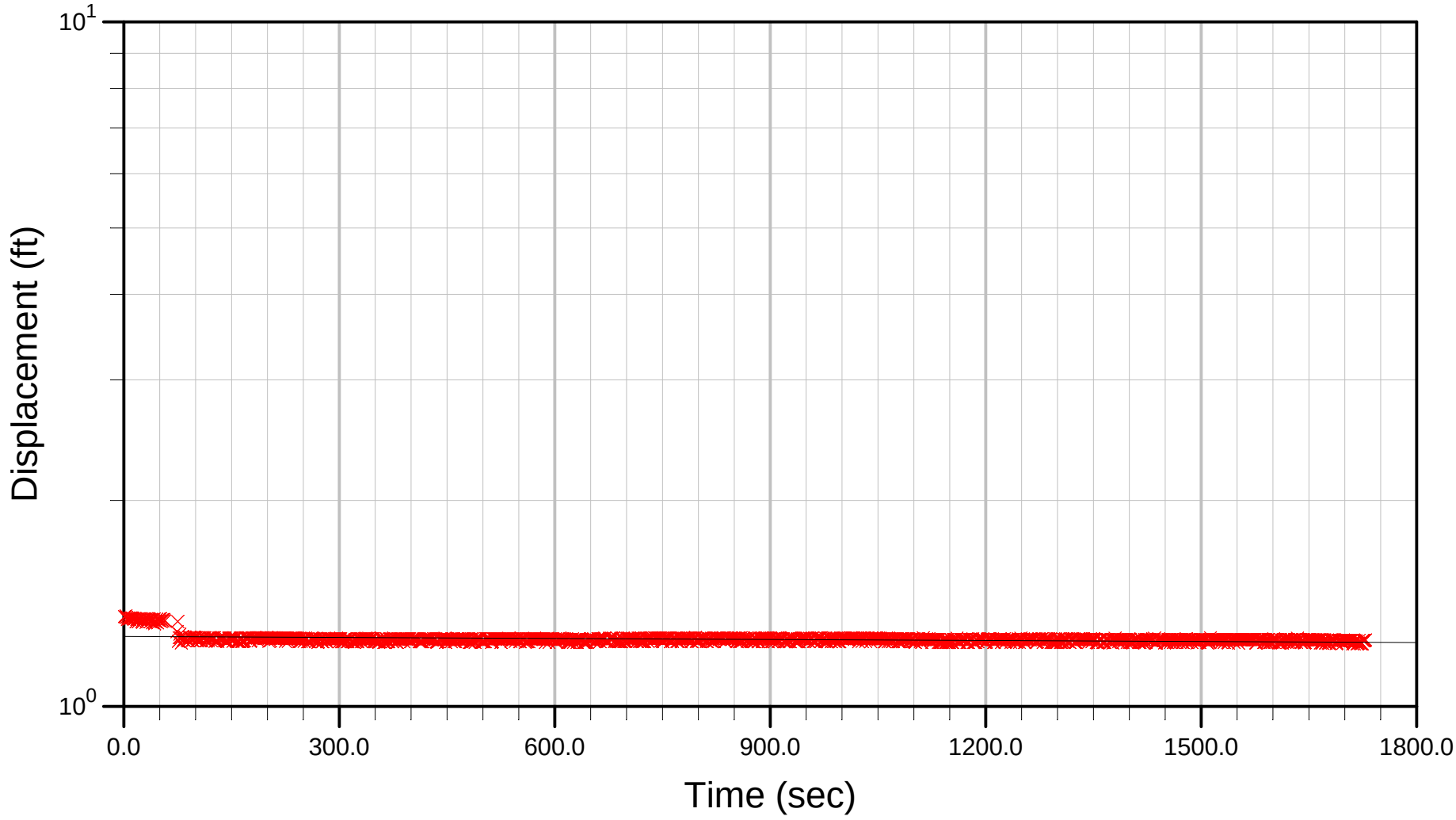
Analyst:	MFP	Hyd. Cond.:	9.135e-003 ft/d		Figure 14
Project Manager:	JEB	Date of Test:	June 21, 2005	Test Name:	Shore SW Slug In
Job Number:	2278-001A	Reference:	Bouwer & Rice, 1976	Client:	UNAVCO PBO

Bouwer & Rice Solution



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Analyst:	MFP	Hyd. Cond.:	2.820e-003 ft/d		Figure 15
Project Manager:	JEB	Date of Test:	June 21, 2005	Test Name:	Shore SW Slug Out
Job Number:	2278-001A	Reference:	Bouwer & Rice, 1976	Client:	UNAVCO PBO