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MHCDEP-14-0041
April 1, 2014

Mr. Joseph May, P.G.
Florida Department of Environmental Protection
400 N. Congress Ave, Suite 200
West Palm Beach, FL 33401

RE: Florida Power & Light Company Turkey Point Units 6 & 7 Class I Injection Well DIW-1 Short-Term Injection Test Technical Memorandum; Permit #293962-002-UC

Dear Mr. May:

The enclosed Technical Memorandum on the Short-Term Injection Testing of Deep Injection Well DIW-1 at the Florida Power and Light Company Turkey Point Units 6 & 7 is submitted pursuant to the Special Condition V. 2 of Permit #293962-002-UC listed below:

> 2. The permittee shall conduct operational testing of the injection well system to demonstrate that the well can absorb the design and peak daily flows that are expected, prior to granting approval for operational testing. [62-528.450(3)(a)]

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Should you have any questions regarding the attached Technical Memorandum or require any additional information, please contact me at (561) 891-0763 and thanks for your help.

Sincerely,

McNabb Hydrogeologic Consulting, Inc.

4/1/14

David McNabb, P.G.

cc: Joe Haberfeld/FDEP-Tallahassee
Emily Hopkins/SFWMD
David Holtz/Holtz Eng.
Randall LaBauve/FPL
Cindy Mulkey/FDEP
Ron Reese/USGS
Nancy Marsh/USEPA
Augustine Socarris/DERM
Mike Halpin/FDEP
Matthew Raffenberg/FPL

Technical Memorandum

Short-Term Injection Testing of Deep Injection Well DIW-1 at Florida Power & Light Company Turkey Point Units 6 & 7

Prepared for:

Florida Power & Light Company

Prepared by:

McNabb Hydrogeologic Consulting, Inc.

April 2014

Executive Summary

Short-term injection testing was performed on Class I deep injection well DIW-1 at Florida Power & Light Company's (FPL) proposed Turkey Point Units 6 & 7 site from February 17, 2014 through February 21, 2014. The purpose of the short-term injection testing was to demonstrate DIW-1 is capable of accepting the design wastewater flow rate, to demonstrate the trend of injection pressure on the long-term operating conditions of DIW-1, to obtain hydraulic information related to well performance, and demonstrate the absence of a hydraulic connection between the injection zone and the intervals monitored by dual-zone monitor well DZMW-1. Injection testing was performed in accordance with testing procedures and information submitted to the Florida Department of Environmental Protection (FDEP) on December 12, 2013 (as part of FPL's short-term injection test request), and January 8, 2014 conditions set forth in FDEP Permit #293962-002-UC, and in conformance with Rule 62-528, Florida Administrative Code (F.A.C.).

The injection test consisted of a background data collection phase, a pumping phase, and a recovery data collection phase. The pumping phase of the injection test began when the injection flow rate was greater than 7,000 gallons per minute (gpm). The pumping phase consisted of three test interval durations and flow rates: pumping interval 1 was performed with an average flow rate of 7,099 gpm, pumping interval 2 was performed with an average flow rate of 6,325 gpm, and pumping interval 3 was performed with an average flow rate of 7,142 gpm. The reduced flow rate associated with pumping interval 2 was due to one of the injection pumps running out of fuel. As a result of the reduced flow rate during pumping interval 2, pumping interval 3 was performed, after refueling and re-starting the injection pump, to ensure the equivalent injection volume of a minimum of eight hours of injecting into DIW-1 at an average flow rate in excess of 7,000 gpm. The injection wellhead pressure averaged 29.2 pounds per square inch gauge (psig) during the background phase, 55.2 psig during pumping interval 1, 51.2 psig during pumping interval 2, and 56.5 psig during pumping interval 3. The injection wellhead pressure averaged 31.3 psig during the recovery phase of the injection test. These results demonstrate Class I deep injection well DIW-1 and

the Boulder Zone in the injection area are capable of accepting up to 7,142 gpm at low wellhead pressures (56.5 psig).

As discussed further below, based on downhole pressure readings at the injection well, formation injection pressure increases during the injection phase were less than 4 psig. This formation pressure increase is significantly below the calculated formation fracture pressure of 1,910 psi.

Monitor well pressure data collected at the wellhead from the upper and lower monitor zones of DZMW-1 during injection testing demonstrates the absence of a direct hydraulic connection between the injection zone and monitoring intervals. Upper monitor zone pressure averaged 8.9 psig and ranged from 8.6 to 9.0 psig throughout the short-term injection test. Lower monitor zone pressure averaged 2.2 psig and ranged from 2.0 to 2.3 psig throughout the short-term injection test. The slight fluctuation in pressure in the monitoring zones was attributed to tidal influence.

Introduction

Class I deep injection well DIW-1 was constructed in accordance with conditions set forth in FDEP Permit #293962-002-UC and in conformance with Rule 62-528, F.A.C. The injection well was constructed with a 24-inch diameter final casing installed to a depth of 2,985 feet below land surface (bls) with a nominal 18-inch diameter fiberglass reinforced pipe (FRP) injection liner installed to a depth of 2,975 feet bls. The well was drilled to a total depth of 3,230 feet bls. Injection testing was performed in accordance with testing procedures and information submitted to the FDEP on December 12, 2013 as part of the short-term injection test request and January 8, 2014 , conditions set forth in FDEP Permit #293962-002-UC and in conformance with Rule 62-528, F.A.C. The short-term injection test procedure, information submitted on January 8, 2014, and the FDEP testing plan approval notification are provided in Attachment A. The short-term injection test was performed by Layne Christensen, Inc. following FDEP approval of the short-term injection test plan. FPL and McNabb Hydrogeologic Consulting, Inc. (MHC) personnel observed the injection test.

Short-Term Injection Test

Procedures

Prior to conducting the short-term injection test, an approximate one hour preliminary test was performed to fill the injection tubing of DIW-1 with test water (non-hazardous industrial wastewater from the FPL Turkey Point Unit 5 cooling tower basin, original source Upper Floridan Aquifer) and evaluate injection test pumping capacity. Laboratory analysis of a water sample collected from the Unit 5 cooling tower basin (results submitted to FDEP on January 8, 2014 – see Attachment A), showed the total dissolved solids concentration of the test water was 3,600 mg/L (fresh relative to the native injection zone water).

Prior to beginning the short-term injection test, each of the pressure transducers, memory gauges, and flowmeter calibration certificates were checked to verify each device was within calibration standards corresponding to the test equipment. Pressure transducer and flowmeter data were checked periodically during the short-term injection test to confirm data was being recorded and the flow rates achieved were at the test thresholds.

Short-term injection testing consisted of three data collection phases: background, pumping (i.e., injection), and recovery. The injection test consisted of a 52 hour and 58 minute background phase, a nine hour and 33 minute pumping phase, and a 36 hour recovery phase. The pumping phase consisted of three test interval durations and flow rates: pumping interval 1 was performed with an average flow rate of 7,099 gpm for a duration of six hours and 37 minutes, pumping interval 2 was performed with an average flow rate of 6,325 gpm for a duration of one hour and 23 minutes, and pumping interval 3 was performed with an average flow rate of 7,142 gpm for one hour and 33 minutes. The reduced flow rate associated with pumping interval 2 was associated with one of the injection pumps running out of fuel. The pump was re-started and ran for a period of approximately three minutes prior to stopping for a second time during pumping interval 2. As a result of the reduced flow rate during pumping interval 2, pumping interval 3 was performed, after refueling and re-starting the injection pump, to ensure the equivalent injection volume of a minimum of eight hours of injecting into DIW-1 at an average flow rate in excess of 7,000 gpm. A total volume of

approximately 3.94 million gallons of test water was injected into DIW-1 during the injection test.

Data collected during all phases of injection testing included: wellhead and downhole pressure in DIW-1, wellhead pressure in both DZMW-1 monitoring zones, and local barometric pressure. Redundant In-Situ Level TROLL 700 Data Loggers were used to measure and record DIW-1 wellhead and DZMW-1 monitoring zone pressures throughout injection testing. An In-Situ Baro TROLL 500 was used to measure and record barometric pressure for the duration of the short-term injection test. These devices are part of the Virtual HERMIT Aquifer Testing Kit. Redundant GRC Enduro NG-V 1.00 Piezoresistive Memory Recorders were installed to a depth of 2,970 feet bls inside the injection liner of DIW-1 to measure and record downhole pressure throughout the injection test. A Sonic-Pro® Ultrasonic Flow Meter Model #S3C1A2 was used to measure and record test water flow rates and volume during the pumping phase of the injection test. Injection wellhead pressure, monitor well upper and lower monitoring zone pressure, and flow rates were reviewed periodically by MHC staff during the pumping phase of the injection test to ensure the data was being recorded and within test parameters.

Observed tidal data for Virginia Key Station 8723214 for the period of injection testing were obtained from the National Oceanic and Atmospheric Administration (NOAA) website and graphed to confirm the influence of tidal water level [height in feet relative to North American Vertical Datum of 1988 (NAVD 88)] on the observed injection zone and monitoring zone pressure fluctuations. Virginia Key is the nearest primary NOAA tide monitoring station to the Turkey Point Units 6 & 7 site.

Calibration documentation for the flowmeter (calibrated by Blue – White Industries Ltd.), pressure transducer, and barometric pressure measuring and recording equipment is provided in Attachment B.

An outline of the as-performed testing procedure is provided below:

Background Data Collection Phase – For a period of 52 hours and 58 minutes (February 17, 2014 3:32 PM to February 19, 2014 8:30 PM), prior to beginning the pumping phase of the short-term injection test, DIW-1 wellhead and downhole pressure, pressure at both

monitor zones of DZMW-1, and barometric pressure were recorded to establish background (pre-pumping) phase conditions.

Pumping Phase – The pumping phase consisted of pumping test water originating at the FPL Turkey Point Unit 5 cooling tower basin through an approximately 11,000 foot long, 18-inch diameter high density polyethylene (HDPE) temporary pipeline terminating at the DIW-1 wellhead. The pumping phase of the injection test commenced after beginning to pump into DIW-1 and when the injection flow rate averaged greater than 7,000 gpm. This resulted in an 11 minute delay between the end of the background phase and the beginning of the pumping phase of the test. The pumping phase totaled nine hours and 33 minutes (February 19, 2014 8:41 PM to February 20, 2014 6:14 AM) and consisted of pumping into DIW-1 at an average flow rate of 7,099 gpm for six hours and 37 minutes, following by pumping at an average flow rate of 6,325 gpm for one hour and 23 minutes followed by pumping at an average flow rate of 7,142 gpm for one hour and 33 minutes. The period when the average flow rate was 6,325 gpm was due to one of the injection pumps running out of fuel. The pumping phase of the injection test was extended by one hour and 33 minutes beyond the planned eight hour duration after refueling the injection pump.

DIW-1 wellhead and downhole pressure, pressure at both monitor zones of DZMW-1, flow rate, and barometric pressure were electronically recorded throughout the injection phase.

Recovery Data Collection Phase – Upon completion of the pumping phase, the recovery data collection phase began. Recovery phase data were recorded for 36 hours (Febuary 20, 2014 6:14 AM to February 21, 2014 6:14 PM) and included DIW-1 wellhead and downhole pressure, pressure at both monitor zones of DZMW-1 and barometric pressure.

Results

The data collected during the injection test are presented in Figure 1. Table 1 provides a summary of DIW-1 average wellhead pressure, downhole pressure, flow rate, and upper and lower zone DZMW-1 pressure for each phase of the injection test and each flow rate of the pumping interval of the test. Review of Figure 1 shows that barometric pressure, which ranged from 30.0 to 30.3 inches of mercury and averaged 30.1 inches of mercury, did not impact DIW-1 wellhead pressure or the upper or lower monitor zones of DZMW-1.

Table 1. Average DIW-1 Pressure and Pumping Data and DZMW-1 Pressure Data Summary

Test Phase	Average Flow rate (gpm)	Average DIW-1 Wellhead Pressure (psig)	Average DIW-1 Downhole Pressure (psig)	Average DZMW-1 Upper Zone Pressure (psig)	Average DZMW-1 Lower Zone Pressure (psig)
Background	0	29.2	1,327.7*	8.9	2.3
Pumping Interval 1	7,099	55.2	1,330.9**	8.8	2.2
Pumping Interval 2	6,325	51.2	1,330.9	8.7	2.1
Pumping Interval 3	7,142	56.5	1,331.3	8.7	2.1
Recovery	0	31.3	1,328.9	8.9	2.2

*Downhole pressure averaged 1,327.5 psig during the last 24 hours of background data collection.
**At the end of pumping interval 1, downhole pressure was approximately 1,331.3 psig.

Figure 2 provides DIW-1 wellhead pressure and flow rate data for the entire injection test. Figure 3 provides the same information as Figure 2 with a focus on the pumping phase of the short-term injection test. The Figure 2 and Figure 3 data show that there were no large fluctuations in wellhead pressure for the background and recovery phases of the short-term injection test. These figures also show consistent flow rates for each of the pumping intervals with the exception of the second pumping interval, where a spike in flow rate corresponds to the approximately three minutes when one of the injection pumps was briefly re-started before running out of fuel again. The average wellhead pressure through the background phase and prior to injection was approximately 29.2 psig. Wellhead pressure then increased to approximately an average of 55.2 psig after approximately three minutes while pumping at an average rate of 7,099 gpm. The wellhead pressure then decreased to an average of 51.2 psig approximately one minute after the flow rate was temporarily decreased to an average of 6,325 gpm before increasing to an average of 56.5 psig approximately one minute after the flow rate was increased to an average of 7,142 gpm.

Test flow rate and wellhead pressure data were used to calculate a specific capacity of DIW-1. To determine the wellhead specific capacity of DIW-1, the ratio of the representative injection flow rate (gpm) to the observed coincident water level increase (in feet) is calculated. Wellhead pressure data, for the period while pumping at an average rate of 7,099 gpm, was used to calculate the wellhead specific capacity of DIW-1. The pressure data during the average flow rate of 7,099 gpm was selected as representative since the average flow rate of 7,099 gpm comprised the majority of the pumping phase of the short-term injection test. Specific capacity of DIW-1 at the wellhead was calculated in the following manner:

Wellhead specific capacity = 7,099 gpm ÷ [(55.2 psig – 29.2 psig) × 2.31 feet per psig] = 118 gpm/foot

As explained below, pipe friction losses account for nearly all of the wellhead pressure increase during the pumping phase of the short-term injection test. The Hazen-Williams equation is an empirical formula used to model the friction head loss of water flowing through pipe and is defined as follows:

$h_f = 0.002028 \times L \times (100 \div C)^{1.85} \times (Q^{1.85} \div d^{4.8655})$

where:

h_f = head loss due to friction in feet of water

L = length of pipe in feet

C = Hazen-Williams friction factor

Q = flow rate in gpm

d = inside pipe diameter in inches

Using a length of pipe of 2,970 feet (the depth of the downhole pressure gauges, a Hazen-Williams friction loss factor of 140, a flow rate of 7,099 gpm and an inside pipe diameter of 16.6 inches (the inside diameter of the FRP injection tubing) yields the following:

$h_f = 0.002028 \times 2{,}970 \text{ feet} \times (100 \div 140)^{1.85} \times (7{,}099^{1.85} \div 16.6^{4.8655})$

h_f = 49.9 feet of head loss due to friction

To convert h_f from feet to psig, a conversion factor of 2.31 feet per psig (appropriate for the relatively fresh water used in the test) is used to yield the following results:

h_f = 49.9 feet ÷ 2.31 feet per psig = 21.6 psig

Therefore, of the 26 psig pressure increase observed at the wellhead between background wellhead pressure (29.2 psig) and the average wellhead pressure while injecting at an average rate of 7,099 gpm (55.2 psig), 21.6 psig of the pressure increase is due to friction losses inside the injection tubing. Therefore, the 4.4 psi pressure difference between the observed wellhead pressure increase and the calculated pressure loss due to friction (26 psig – 21.6 psig = 4.4 psi) is a measure of the increased pressure in the injection zone.

Figure 4 presents DIW-1 downhole hydrostatic pressure and flow rate data for the short-term injection test. A trend of decreasing downhole hydrostatic pressure was observed during the first approximately 12 hours of the background phase of the test. This is attributed to dissipation of the relatively fresh (lower TDS concentration) water injected into the injection zone during the preliminary test. Downhole hydrostatic pressure stabilized during the 24 hours prior to the pumping phase of the test. Downhole hydrostatic pressure averaged 1,327.5 psig and ranged from 1,327.3 psig to 1,327.8 psig during the 24 hours prior to the pumping phase.

A similar trend of decreasing downhole hydrostatic pressure due to expansion and dissipation of the injected fresh water was observed during the recovery phase of the short-term injection test. Downhole hydrostatic pressure did not return to its background value at the end of the recovery phase. This observation is attributed to the large volume of relatively fresh water injected during the pumping phase having insufficient time to dissipate from the injection zone in the area of DIW-1.

Figure 5 presents the same data as Figure 4 but focused on the pumping phase of the short-term injection test. Review of Figures 4 and 5 shows that a downhole hydrostatic pressure difference of approximately 4 psi occurred between pre-pumping hydrostatic pressure and the pressure while pumping at an average rate of 7,099 gpm. The downhole pressure data shows that all but approximately 4 psi of the in wellhead operating pressure increase observed at the wellhead is due to pipe friction losses. This is consistent with the friction

loss calculation presented above when it is considered that the friction factor used in that calculation is a reasonable approximation of the friction factor of the installed FRP injection tubing. If the pipe friction losses are ignored and the downhole pressure increase is substituted for the wellhead pressure increase, the adjusted specific capacity is 768 gpm/foot [7,099 gpm ÷ (4 × 2.31 feet per psig) = 768 gpm/foot].

A calculated estimated transmissivity of the injection zone is provided below using the empirical relationship derived from the Jacob method where specific capacity is equal to transmissivity divided by 2000 (Driscoll, Groundwater and Wells 2nd Edition: Johnson Filtration Systems, St. Paul, Mn., 1089 p.). The equation is as follows:

Formation specific capacity = T ÷ 2000, where T = transmissivity in gallons per day per foot (gpd/foot)

Rearranging the equation to solve to transmissivity yields the follow:

T = specific capacity × 2000

T = 768 × 2000 = 1,536,000 gpd/foot.

Converting the transmissivity units from gpd/foot to feet²/day yields a transmissivity of approximately 205,000 feet²/day.

Pressure data in both monitoring zones, flow rate data and tidal data are presented in Figure 6. Figure 7 provides the same information as Figure 6 but focuses on the pumping phase of the short-term injection test. Review of the monitor zone pressure and flow rate data indicates there is no correlation between monitor zone pressure and pumping into deep injection well DIW-1. Pressure at the upper monitor zone remained between 8.6 and 9.0 psig throughout the entire testing period. Pressure at the lower monitor zone fluctuated between 2.0 and 2.3 psig throughout injection testing. Pressure in both monitor zones is slightly influenced by tidal water level, as indicated by the minor pressure fluctuations in both monitor zones. Tide level readings fluctuated between -1.9 and 0.6 feet NAVD88.

Formation Fracturing Calculation

As part of the evaluation of the injection test results, a comparison of the observed downhole pressure increase to the minimum fracture initiation pressure for the formation is conducted.

Potential damage to the injection zone and confining unit can occur when formation injection pressures surpass the mechanical strength of the formation. The equation developed by Hubbert and Willis (1972) to predict the minimum bottom hole pressure that could potentially propagate hydraulic fracturing of the formation is used for this calculation:

$$pi = \frac{Sz + 2Po}{3} \quad \text{where}$$

pi = hydraulic fracturing gradient in psi/foot

Sz = total lithostatic stress in psi/foot

Po = formation fluid pressure in psi/foot

Utilizing values of 1.0 and 0.46 psi/foot for Sz and Po (representing the theoretical vertical lithostatic and hydrostatic gradients derived from the respective densities of rock and water), a minimum fracture initiation gradient of 0.64 psi/foot is calculated (Hubbert and Willis, 1972). This representation conservatively assumes minimal lateral earth stress. At a depth of 2,985 feet bls (the base of the final casing) and the calculated fracture initiation gradient of 0.64 psi/foot, the calculated minimum bottom-hole pressure that may initiate hydraulic fracturing is:

$$pi = \frac{(1.0 \text{ psi/foot} + (2 \times 0.46 \text{ psi/foot}))}{3}$$

$$pi = 0.64 \text{ psi/foot}$$

Bottom-hole fracture initiation pressure = 0.64 psi/foot × 2,985 feet = 1,910 psig.

Subtracting the downhole hydrostatic pressure (1327.5 psig) from the calculated minimum fracture pressure shows the minimum differential injection pressure that could cause a fracture is 582.9 psig. The observed maximum differential pressure increase, 4psi, is considerably less than the calculated minimum fracture initiation pressure of 582.9 psig. Therefore, hydraulic fracturing initiated by anticipated injection operations is not considered a credible event.

Conclusion

During pumping interval 1 of the injection test, DIW-1was operated at an average flow rate of 7,099 gpm with an average wellhead operating pressure of 55.2 psig. The stabilized average wellhead operating pressure was 55.2 psig at the average flow rate of 7,099 gpm. Additionally, a low formation injection pressure average increase of approximately 4 psi results in a formation pressure increase significantly below the calculated formation minimum differential fracture pressure of 582.9 psi. These results demonstrate DIW-1 and the Boulder Zone in the injection area are capable of accepting an average flow rate of 7,099 gpm with a low operating well head pressure without resulting in fracturing of the formation. As required by Rule 62-528.405(3)(b) F.A.C., the stabilized wellhead pressure of 55.2 psig during the short-term injection test demonstrated the trend of the injection pressure on the long-term operating pressure of DIW-1. Data collected from the injection well and the dual zone monitoring well during the injection test demonstrated no measurable hydraulic connection between the DIW-1 injection zone and the monitoring intervals.

Figures

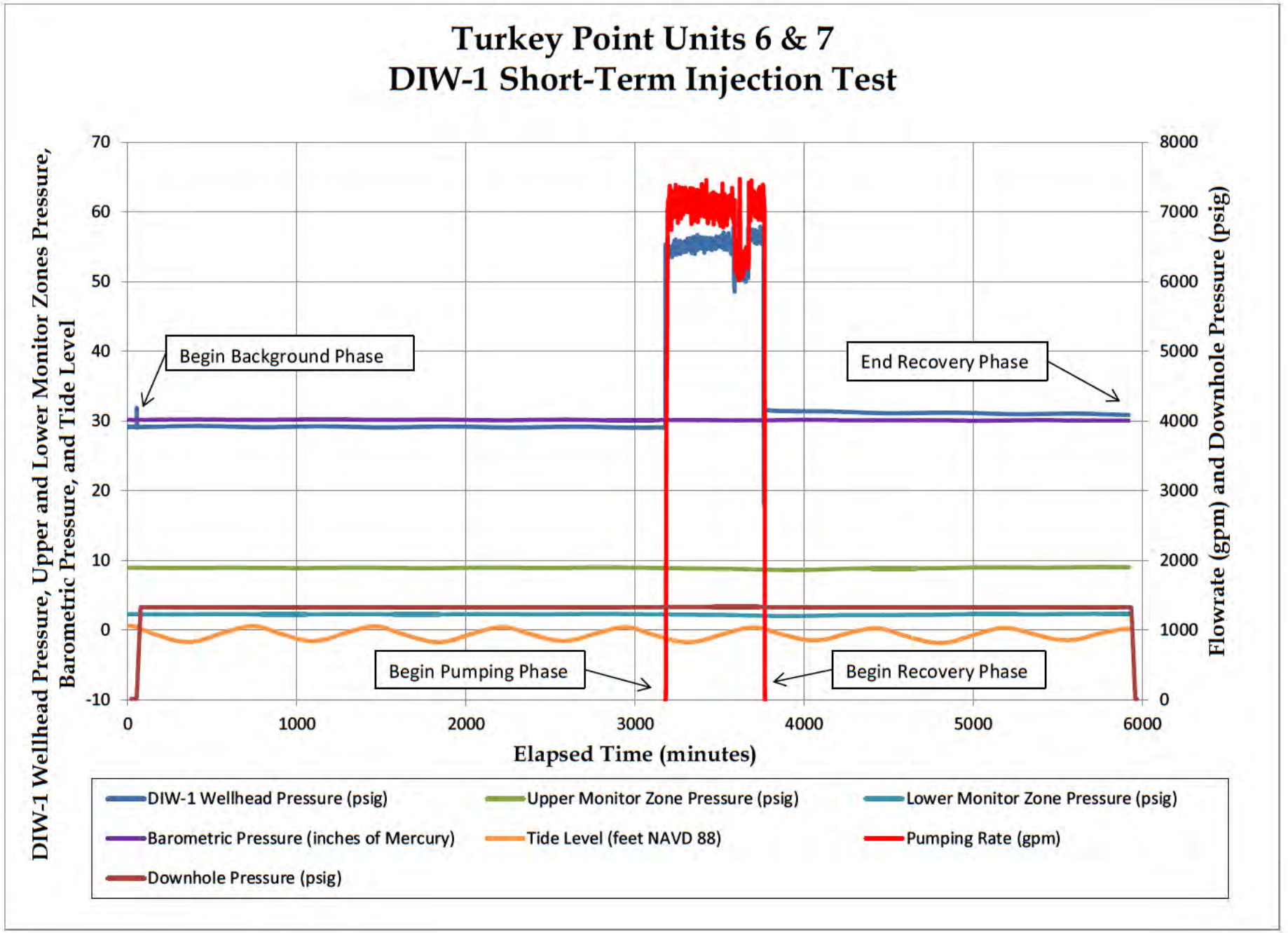

Figure 1. DIW-1 Injection Test Data

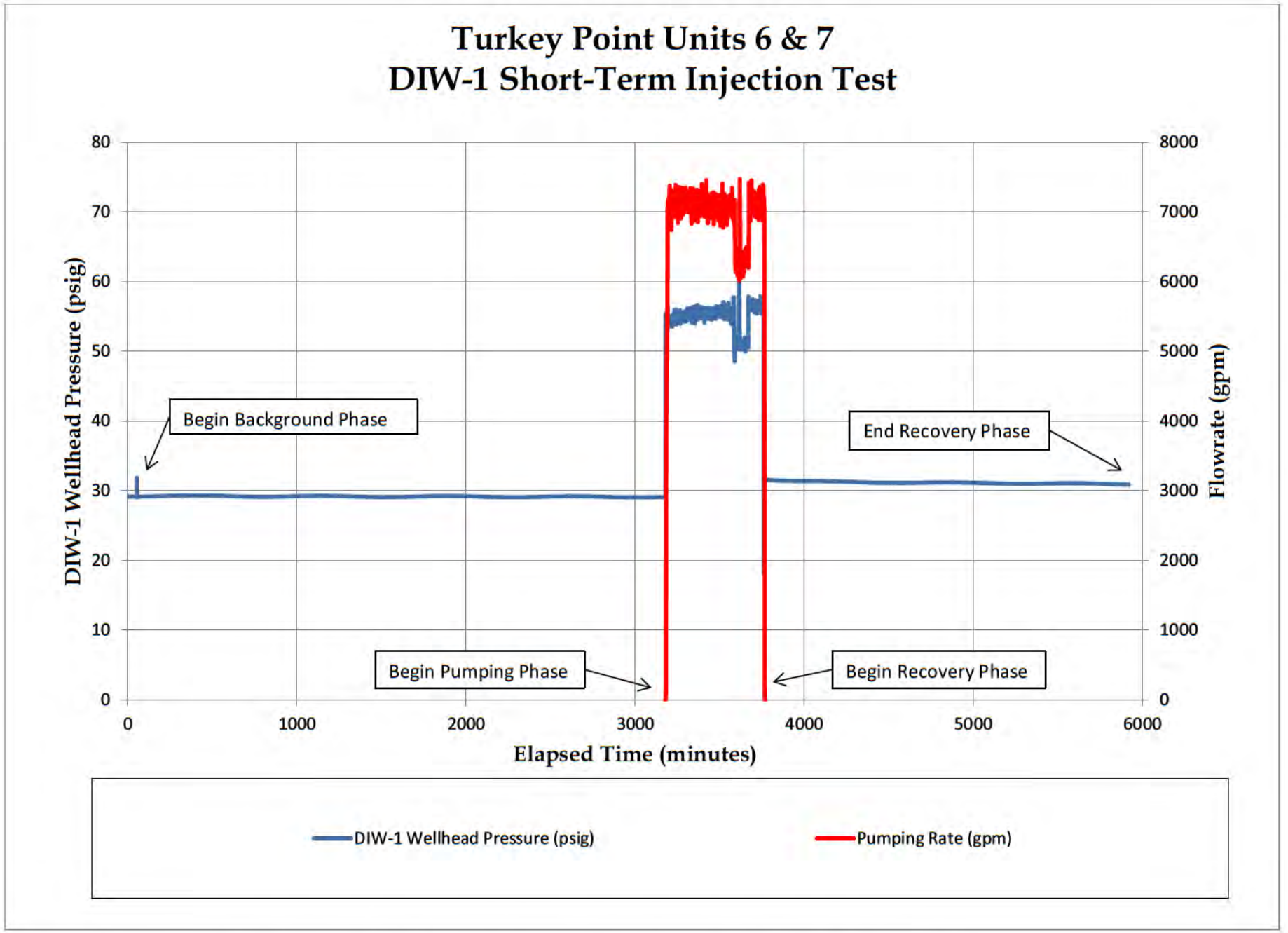

Figure 2. DIW-1 Injection Test Wellhead Pressure and Pumping Rate Data for the Entire Test

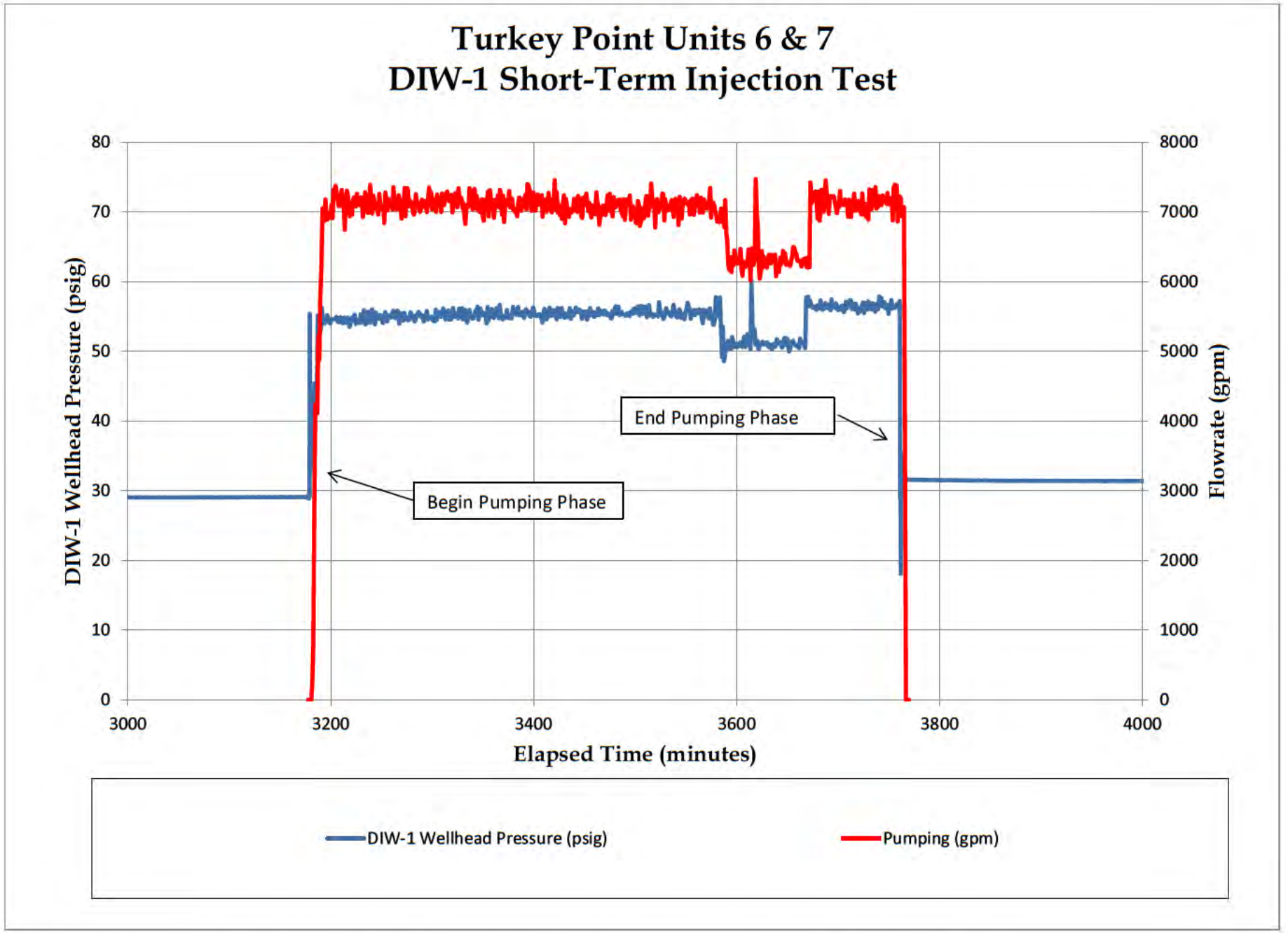

Figure 3. DIW-1 Injection Test Wellhead Pressure and Pumping Rate Data for the Pumping Phase

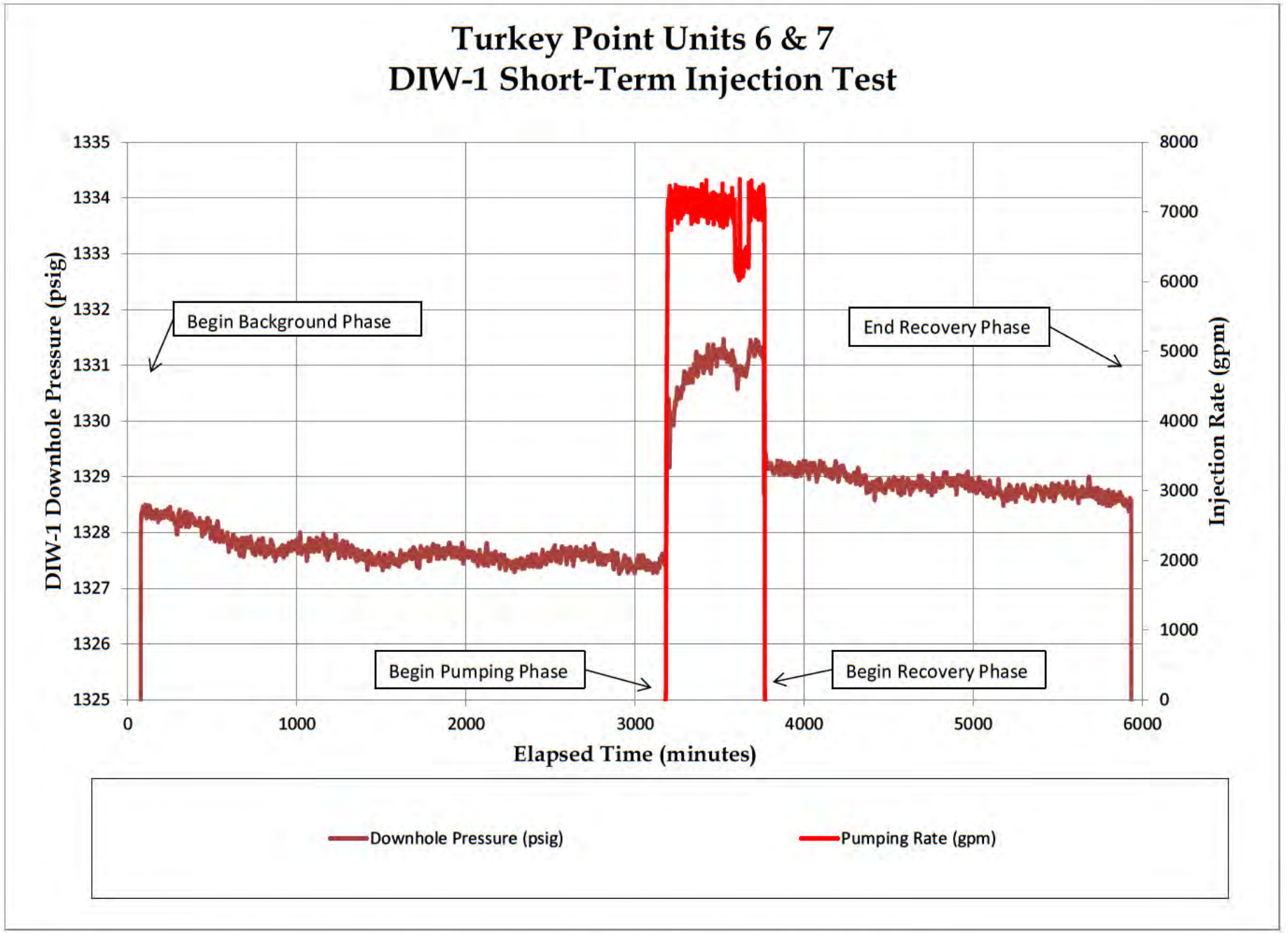

Figure 4. DIW-1 Injection Test Downhole Pressure and Pumping Rate Data for the Entire Test

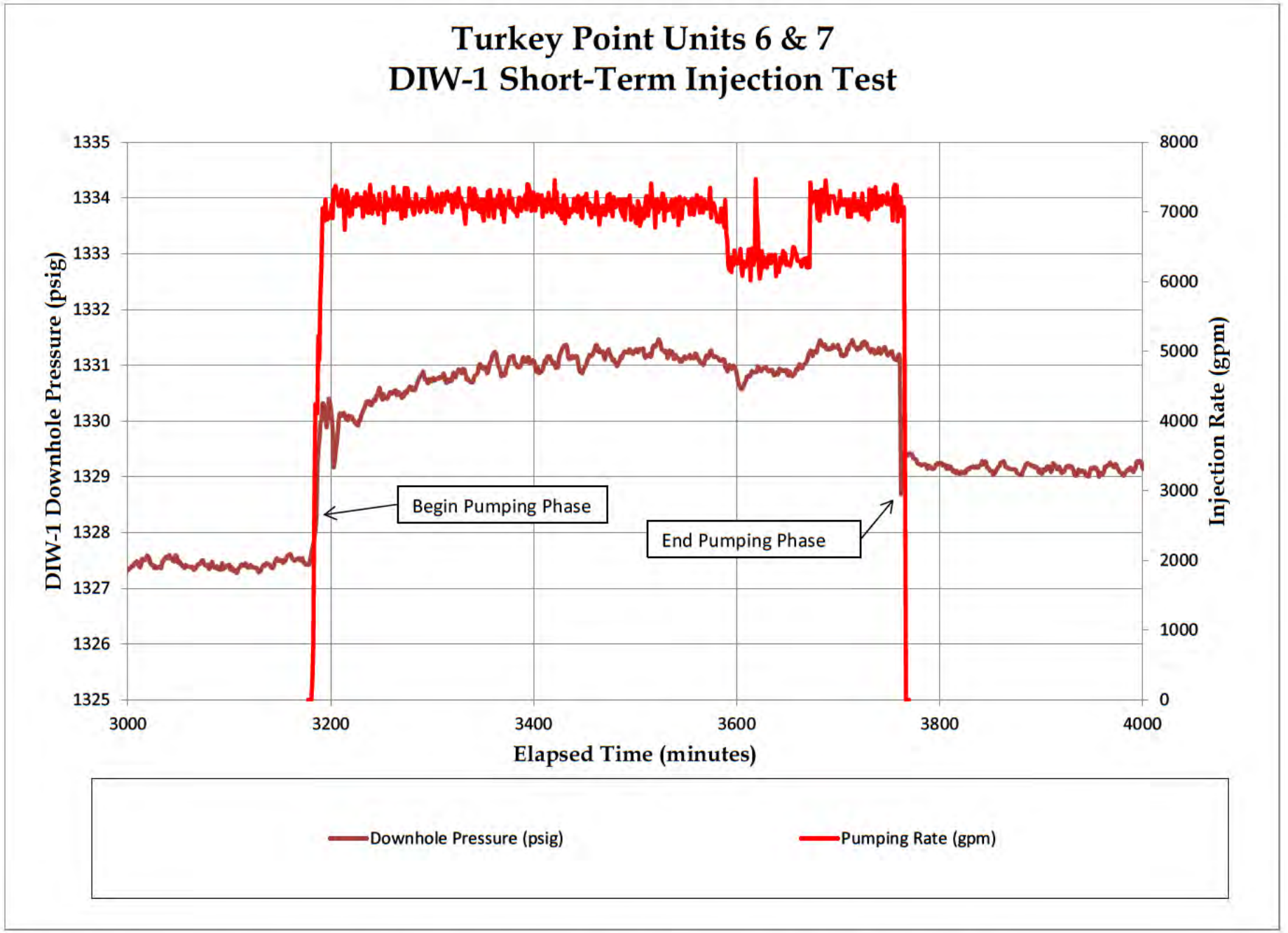

Figure 5. DIW-1 Injection Test Downhole Pressure and Pumping Rate Data for the Pumping Phase

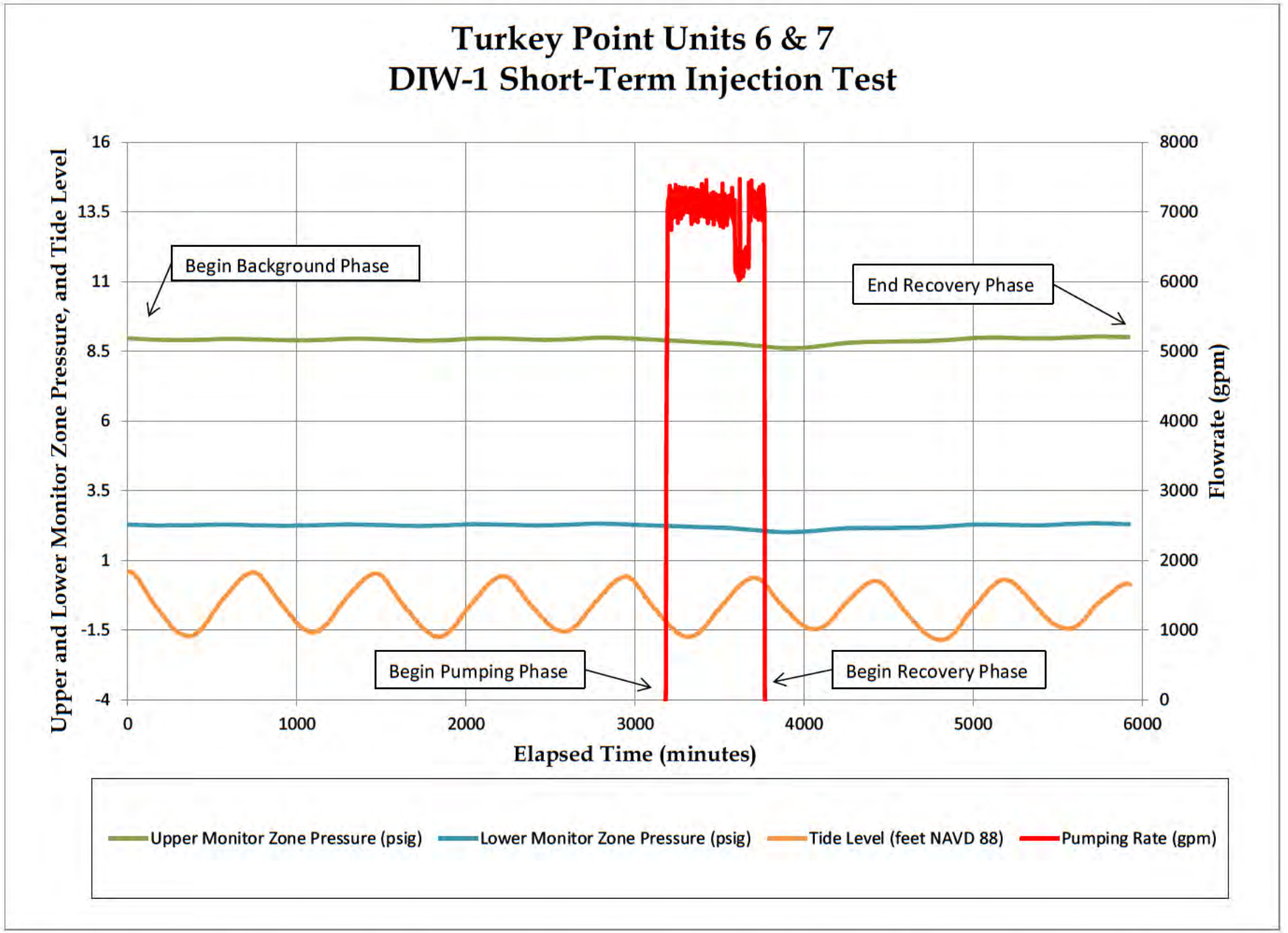

Figure 6. DIW-1 Injection Test Injection Rate, Upper and Lower Monitor Zones, and Tidal Data for the Entire Test

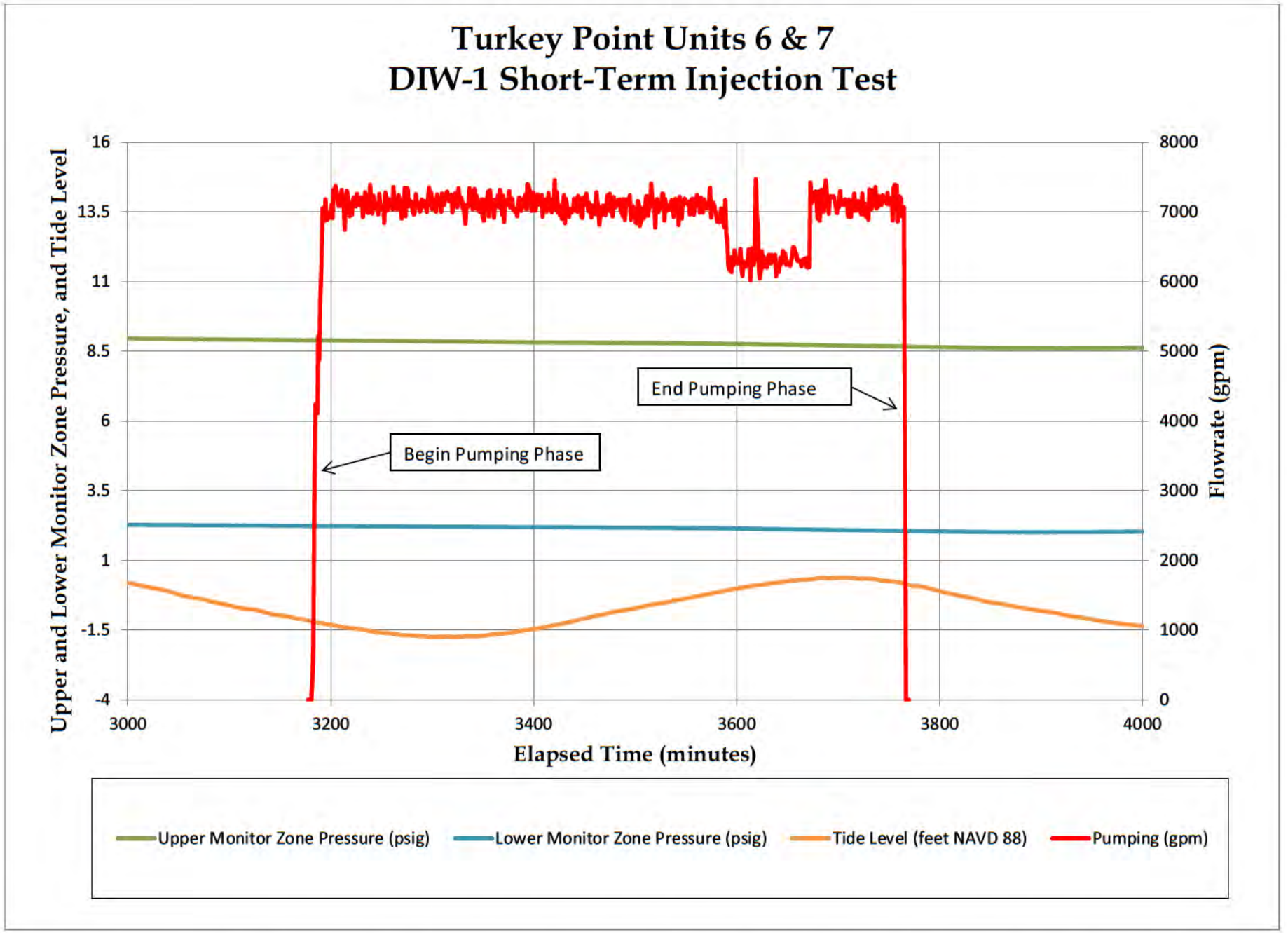

Figure 7. DIW-1 Injection Test Injection Rate, Upper and Lower Monitor Zones, and Tidal Data for the Pumping Phase

Attachment A

Short-Term Injection Testing Plan, Test Source-Water Quality Submittal and FDEP Testing Plan Approval

Short-Term Injection Testing Plan for Class I Injection Well DIW-1 at Florida Power & Light Company Turkey Point Units 6 & 7- Revised 12-11-13

Florida Power & Light Company (FPL), plans to conduct a short-term injection test on Turkey Point Units 6 & 7 Class I Injection Well DIW-1. The purposes of this injection test is to demonstrate the injection zone's capacity for receiving injected fluid and confirm the absence of a direct hydraulic connection of the injection zone to the monitoring zones. This plan sets forth the means for conducting this injection test and is a revision to the plan originally submitted with the application for permit no. 293962-002-UC.

Injection testing of DIW-1will be performed with a temporary wellhead in place and will consist of a 36-hour background data collection period, an 8-hour pumping period, and a 36-hour recovery data collection period.

Four potential water sources for the short-term injection are currently being considered as follows;

- Potable water from an on-site temporary reservoir
- Groundwater from Upper Floridan Aquifer production wells for Turkey Point Unit 5
- A combination of this potable water and Upper Floridan Aquifer groundwater
- Non-hazardous industrial wastewater from the Turkey Point Unit 5 cooling tower basin (estimated not to exceed 5000 mg/L)

When the water source or sources are selected, the Department will be so notified and be provided with the appropriate water quality sampling information required by Condition V.3.f. of permit no. 293962-002-UC for review and approval prior to initiating the injection test. If non-hazardous industrial wastewater is a source, the water quality sample will also include the eight Resource Conservation Recovery Act (RCRA) metals as per our discussion with Mr. Joe May on December 5, 2013.

Monitoring and Recording Equipment

The table below lists the monitoring and recording equipment that will be installed for the short-term injection test.

Equipment	Purpose
Upper Monitor Zone Level Transducer	Measure upper monitor zone pressure
Lower Monitor Zone Level Transducer	Monitor lower monitor zone pressure
Injection Wellhead Pressure Transducer	Monitor DIW-1 wellhead pressure
Formation Pressure Memory Gauge	Monitor DIW-1 formation pressure near the injection zone
Injection Well Flow meter	Monitor DIW-1 injection rate
Barometric Pressure Recorder	Monitor/Record barometric pressure
Data Recorder	Record upper and lower monitor zone pressure, DIW-1 wellhead pressure, and barometric pressure

DIW-1 Short-Term Injection Test Plan

The short-term injection test will consist of a background, pumping, and recovery phase, each of which are discussed below. Barometric pressure will be collected throughout each phase of the short-term injection test. Tidal data from Virginia Key for the testing period will be retrieved from the National Oceanic and Atmospheric Association (NOAA) and included with the test results. Virginia Key is the nearest NOAA tide monitoring station to the Turkey Point Units 6 & 7 site. A Hermit data recorder or similar data recording device will be used to collect the monitor well water level and injection wellhead pressure data throughout each phase of the short-term injection test. Additionally, a memory gauge and backup memory gauge will be installed to a depth of approximately 2,970 feet below pad level to measure pressure near the base of the injection tubing of DIW-1 throughout each phase of the short-term injection test.

Prior to beginning the short-term injection test, temporary piping, pumps and all data recording instrumentation will be installed.

Preliminary Test – A minimum of 6-hours prior to beginning the background data collection phase of the test, a preliminary test, using the selected water source, will be performed to ensure that recording equipment is working properly and the target pumping rate can be achieved. This will also allow the injection well casing to be filled with the water that will be used for the short-term injection test and background water level data collection.

Background Data Collection Phase – A minimum of 36-hours of background water level data will be collected. The well will not be disturbed during this phase of the test. During this time, pressure in both monitor zones, pressure at the injection wellhead and barometric pressure will be recorded using a Hermit data recorder or similar data recording device. Pressure near the base of the injection tubing will also be recorded by the memory gauges.

Pumping Phase – The pumping phase of the short-term injection test will take place following completion of background data collection and will last for 8 hours. The pumping phase will consist of injecting from the water source into the Injection Well at a rate of approximately 7,000 gpm for 8 hours. The total volume of water anticipated to be used during the test is approximately 3.36 million gallons. This volume of water injected over this period of time is sufficient to accurately demonstrate the trend of injection pressure on long-term operating conditions.

Pressure in both monitor zones and pressure at the injection wellhead and barometric pressure will be recorded using a Hermit data recorder or similar data recording device. Pressure near the base of the injection tubing will also be recorded by the memory gauges. Flowrate data will be collected and recorded at no greater than 5 minute intervals during the pumping portion of the short-term injection test.

Recovery Data Collection Phase – Upon completion of pumping into DIW-1, the recovery data collection phase will begin. Recovery phase pressure monitoring and recording will continue for a minimum of 36 hours for both monitor zones of DZMW-1 and at DIW-1. Both tidal and barometric data will also be collected during this period. A Hermit data recorder or similar data recording device will be used to collect injection wellhead pressure data during the recovery phase of the short-term injection test. Pressure near the base of the injection tubing will also be recorded by the memory gauges. The wells will not be disturbed during this phase of the test.

Data Interpretation - Upon completion of the recovery data collection phase, the test data, including tidal, barometric, monitor well pressure, injection wellhead pressure, pressure near the base of the injection tubing, and flowrate data will be compiled, interpreted, and submitted to the FDEP for review.

McNabb Hydrogeologic Consulting, Inc.
4600 Military Trail, Suite 116
Jupiter, Florida 33458
Phone: 561-891-0763

MHCDEP-14-0001
January 8, 2014

Mr. Joseph May, P.G.
Florida Department of Environmental Protection
400 N. Congress Ave, Suite 200
West Palm Beach, FL 33401

RE: Florida Power & Light Company Turkey Point Units 6 & 7 Class I Injection Well DIW-1 Short-Term Injection Tests Water Source Laboratory Report; Permit #293962-002-UC

Dear Mr. May:

The purpose of this letter is to provide the Florida Department of Environmental Protection (FDEP) with a copy of the laboratory analytical report for the water source to be used for the short term injection test to be conducted at the Turkey Point Units 6 & 7 DIW-1 deep injection well (attached). The water sample was collected on December 9, 2013 from the Florida Power & Light Company (FPL) Turkey Point Unit 5 cooling tower basin. This non-hazardous industrial wastewater is primarily Floridan Aquifer water with some chemicals added to maintain proper cooling tower chemistry. The water sample was analyzed for the parameters listed in Condition V.3.f. of permit no. 293962-002-UC and the eight Resource Conservation Recovery Act (RCRA) metals as per our discussion on December 5, 2013.

In conducting these samples and analysis, DEP Standard Operation Procedures (SOP's) were followed as required by condition IV no. 3 of the above referenced permit. In addition, the values for the RCRA metals are below the standards for being a hazardous waste. If the Short-Term Injection Test Plan submitted to your office on December 12, 2013 is approved, we plan to conduct the test in February 2014.

Should you have any questions regarding the attached laboratory report or require any additional information, please contact me at (561) 891-0763 and thanks for your help.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Sincerely,

McNabb Hydrogeologic Consulting, Inc.

David McNabb, P.G.

cc: Joe Haberfeld/FDEP-Tallahassee
Emily Hopkins/SFWMD
David Holtz/Holtz Eng.
Randall LaBauve/FPL
Cindy Mulkey/FDEP
Ron Reese/USGS
Nancy Marsh/USEPA
Augustine Socarris/DERM
Mike Halpin/FDEP
Matthew Raffenberg/FPL

LABORATORY RESULTS FOR WORK ORDER 13L0080

FPL Central Laboratory
6001A Village Blvd.
West Palm Beach, FL 33407
Phone: 561-640-2055

PTC - FPL Turkey Point Power Plant 5
9700 SW 344 Street
Homestead FL, 33035

Attn: Gary Andersen

State of Florida CompQAQ/QA Manual: 920041
NELAC Certification #: E56078

Reported:
01/08/2014 09:28

Field Data as Received

Sample Name	pH	Temperature (Deg. C)	Conductivity	Total Chlorine	Free Chlorine	LabNumber
NE Corner Cooling Tower Reduced Cycles and 4 cells off	7.93	28.10	7682			13L0080-01

Serial #: 01082014092910

FPL Central Lab

Tom Helton For Phoebe Brown, Central Lab Manager

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PTC - FPL Turkey Point Power Plant 5
9700 SW 344 Street
Homestead FL, 33035

Attn: Gary Andersen

State of Florida CompQAQ/QA Manual: 920041
NELAC Certification #: E56078

Reported:
01/08/2014 09:28

NE Corner Cooling Tower
Reduced Cycles and 4 cells off
Sampled: 12/9/2013 1:30:00PM Received: 12/9/2013 6:00:00PM
Lab Sample #: 13L0080-01 Sample Matrix: Water Sample Type: Water

Analyte	Result	Qualifier	MDL	PQL	Units	Dilution	Batch	Prepared	Analyst	Analyzed	Method	Certification
FPL Central Lab												
Wet Chemistry												
Ammonia as N	**0.0720**	I,J2	0.0160	0.100	mg/L	1	F13L107	12/11/2013 9:30	SSG	12/12/2013 9:50	EPA 350.1	NELAC
Bicarbonate Alkalinity	**150**		0.50	2.0	mg/L	1	F13L093	12/10/2013 13:48	SSG	12/10/2013 13:48	SM 2320 B	NELAC
Chloride	**2000**		9.6	40	mg/L	100	F13L089	12/10/2013 12:27	SSG	12/10/2013 12:27	EPA 300.0	NELAC
Nitrate as N	U		0.015	0.050	mg/L	1	F13L086	12/10/2013 10:07	SSG	12/10/2013 10:07	SM4500NO3-F	NELAC
Phosphorus-Total	U		0.020	0.040	mg/L	1	F13L106	12/11/2013 12:07	SSG	12/11/2013 12:07	SM4500-P F	NELAC
Specific conductance	**7400**		1.0	1.0	umhos/cm	1	F13L092	12/10/2013 15:47	SSG	12/10/2013 15:47	EPA 120.1	NELAC
Sulfate	**720**		29	100	mg/L	100	F13L089	12/10/2013 12:27	SSG	12/10/2013 12:27	EPA 300.0	NELAC
Total Dissolved Solids	**3600**		15	60	mg/L	4	F13L083	12/10/2013 8:30	SSG	12/10/2013 8:30	SM2540 C	NELAC
Total Suspended Solids	**6.0**	I	3.0	12	mg/L	1	F13L082	12/10/2013 8:32	SSG	12/10/2013 8:32	SM2540 D	NELAC
Turbidity	**0 33**	I	0.10	0.40	NTU	1	F13L094	12/10/2013 14:10	SSG	12/10/2013 14:10	EPA 180.1	NELAC
Metals (Total)												
Arsenic	U		24	95	ug/L	1	F13L084	12/10/2013 8:24	TP	12/10/2013 15:45	EPA 200.7	NELAC

Serial #: 01082014092910

FPL Central Lab

Tom Helton For Phoebe Brown, Central Lab Manager

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LABORATORY RESULTS FOR WORK ORDER 13L0080

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6001A Village Blvd.
West Palm Beach, FL 33407
Phone: 561-640-2055

PTC - FPL Turkey Point Power Plant 5
9700 SW 344 Street
Homestead FL, 33035

Attn: Gary Andersen

State of Florida CompQAQ/QA Manual: 920041
NELAC Certification #: E56078

Reported:
01/08/2014 09:28

NE Corner Cooling Tower
Reduced Cycles and 4 cells off
Sampled: 12/9/2013 1:30:00PM Received: 12/9/2013 6:00:00PM
Lab Sample #: 13L0080-01 Sample Matrix: Water Sample Type: Water

FPL Central Lab

Analyte	Result	Qualifier	MDL	PQL	Units	Dilution	Batch	Prepared	Analyst	Analyzed	Method	Certification
Metals (Total)												
Barium	U		22	88	ug/L	1	F13L084	12/10/2013 8:24	TP	12/10/2013 15:45	EPA 200.7	NELAC
Cadmium	U		2.8	11	ug/L	1	F13L084	12/10/2013 8:24	TP	12/10/2013 15:45	EPA 200.7	NELAC
Calcium	**150**		0.033	0.13	mg/L	1	F13L084	12/10/2013 8:24	TP	12/10/2013 15:45	EPA 200.7	NELAC
Chromium	U		6.0	24	ug/L	1	F13L084	12/10/2013 8:24	TP	12/10/2013 15:45	EPA 200.7	NELAC
Iron	**160**		6.1	24	ug/L	1	F13L084	12/10/2013 8:24	TP	12/10/2013 15:45	EPA 200.7	NELAC
Lead	U		18	70	ug/L	1	F13L084	12/10/2013 8:24	TP	12/10/2013 15:45	EPA 200.7	NELAC
Magnesium	**150**		0.0049	0.020	mg/L	1	F13L084	12/10/2013 8:24	TP	12/10/2013 15:45	EPA 200.7	NELAC
Mercury	U		0.077	0.27	ug/L	1	F13L097	12/10/2013 12:36	TP	12/11/2013 14:51	EPA 245.1	NELAC
Potassium	**100**	J2	0.10	0.41	mg/L	1	F13L084	12/10/2013 8:24	SSG	12/17/2013 13:01	EPA 200.7	NELAC
Selenium	U		45	180	ug/L	1	F13L084	12/10/2013 8:24	TP	12/10/2013 15:45	EPA 200.7	NELAC
Silver	**44**	J4	9.6	38	ug/L	1	F13L084	12/10/2013 8:24	TP	12/18/2013 14:52	EPA 200.7	NELAC
Sodium	**1700**	J2	0.069	0.28	mg/L	1	F13L084	12/10/2013 8:24	TP	12/10/2013 15:45	EPA 200.7	NELAC

Serial #: 01082014092910

FPL Central Lab

Tom Helton For Phoebe Brown, Central Lab Manager

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PTC - FPL Turkey Point Power Plant 5
9700 SW 344 Street
Homestead FL, 33035

Attn: Gary Andersen

State of Florida CompQAQ/QA Manual: 920041
NELAC Certification #: E56078

Reported:
01/08/2014 09:28

NE Corner Cooling Tower
Reduced Cycles and 4 cells off
Sampled: 12/9/2013 1:30:00PM Received: 12/9/2013 6:00:00PM
Lab Sample #: 13L0080-01 Sample Matrix: Water Sample Type: Water

Analyte	Result	Qualifier	MDL	PQL	Units	Dilution	Batch	Prepared	Analyst	Analyzed	Method	Certification
Pace Analytical - NELAC Certification #: E83079												
Wet Chemistry, Automated												
Nitrogen, Kjeldahl, Total	U		0.086	0.50	mg/L	1	156408	12/18/2013 11:50	CLS	12/22/2013 11:43	EPA 351.2	
Pace Analytical - NELAC Certification #: E86240												
Microbiology												
E.coli	Absent					1	154972	12/9/2013 19:00	KMR	12/10/2013 19:15	SM 9223B	
Enterococci	**58.0**		1.0	1.0	CFU/100 mL	1	155024	12/9/2013 18:30	KMR	12/10/2013 18:20	EPA 1600	
Fecal Coliforms	U		1.0	1.0	CFU/100 mL	1	154943	12/9/2013 18:25	KMR	12/10/2013 16:50	SM 9222D	
Total Coliforms	Present					1	154972	12/9/2013 19:00	KMR	12/10/2013 19:15	SM 9223B	

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Reported:
01/08/2014 09:28

NE Corner Cooling Tower
Reduced Cycles and 4 cells off
Sampled: 12/9/2013 1:30:00PM Received: 12/9/2013 6:00:00PM
Lab Sample #: 13L0080-01 Sample Matrix: Water Sample Type: Water

Analyte	Result	Qualifier	MDL	PQL	Units	Dilution	Batch	Prepared	Analyst	Analyzed	Method	Certification
Pace Analytical - NELAC Certification #: E87683												
Radiochemistry												
Gross Alpha	**21.6**		1.69		pCi/L	1	135986	12/13/2013 16:07	JMR	12/13/2013 16:07	SM 7110C	
Radium-226	**16.4**		0.623		pCi/L	1	135840	12/16/2013 16:03	SLA	12/16/2013 16:03	EPA 903.1	
Radium-228	U		0.804		pCi/L	1	135843	12/16/2013 15:07	MAW	12/16/2013 15:07	EPA 904.0	

Serial #: 01082014092910

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Reported:
01/08/2014 09:28

Notes and Definitions

Y	The laboratory analysis was from an improperly preserved sample. The data may not be accurate.
J4	The Laboratory Control Spike failed to meet the established quality control criteria for either precision or accuracy;. However the Matrix Spike and Matrix Spike Duplicate samples are within QA/QC limits.
J2	The MS/MSD or DUP failed to meet the established quality control criteria for either precision or accuracy;. However the Laboratory Control Spike is within QA/QC limits.
+	Not NELAC Certified
I	Analyte detected between the Laboratory MDL and PQL
U	Analyte analyzed for but Not Detected at or above the MDL
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
V	Analyte detected in the sample and the associated preparation blank

Serial #: 01082014092910

FPL Central Lab

Tom Helton For Phoebe Brown, Central Lab Manager

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CHAIN OF CUSTODY RECORD

Pace Analytical®
www.pacelabs.com

LAB W.O # 13L0080 Quote: _____ Page 1 of 1

Page 7 of 7

Company Name: FPL PO#
Address:
City: State: Zip:
Attn: Marcster Ruiz Fax#
email: Phone:
Project Name: Cooling tower samplins Turkey Point
Sampler Signature: JN
Circle One Event: Daily Weekly Monthly Quartely Semi-Annual Annual N/A

Container Type Codes

AV	Amber Vial	ES	Encore Sampler
CV	Clear Vial	PPV	Prepreserved vial
P	Plastic	PL C	Plastic container
AL	Amber Liter	PL J	Plastic Jar
CL	Clear Liter	Z	Ziploc bag
AP	Amber Plastic	TB	Tedlar bag
AG	Amber Glass	WP	Whirl pak
SJ	Soil Jar	G	Gallon Jug
Other		TC	Terra-core

PPV Prepreserved vial
Size(s): 2oz, 4oz, 8oz, 16oz, 32oz or 1L, other
40ml 500ml 250ml 125 ml
Example: 4ozP = 4oz Plastic, 8ozSJ= 8oz Soil Jar

Matrix Codes

SD	Solid Waste	OL	Oil
GW	Ground Water	SL	Sludge
EFF	Effluent	SO	Soil Sediment
AFW	Analyte Free H20	AQ	Aqueous
WW	Waste Water	NA	Nonaqueous
DW	Drinking Water	PE	Petroleum
SW	Surface Water	O	Other (Please specify)
ML	Misc. Liquid		

Preservative Type Codes

A. None	E. HCL	I. Ice
B. HNO_3	F. MeOH	J. MCAA
C. H_2SO_4	G. $Na_2S_2O_3$	K. Zn Acetate
D. NaOH	H. $NaHSO_4$	O. Other

LAB ANALYSIS

Sample #	Sample ID	Collect Date	Collect Time	Matrix Code*	Field Filtered	Integrity OK(Y/N)	Total # of containers	Parameters	Sample	TRC	pH	Pres Codes	Conductance Turbidity Bicarb/Alk	TDS, TSS, Cl, NO3, SO4	2 Metals Cr	2 Metals Fe	NH3	Phosphorus	RCRA 8 Metals		EXAMPLE Diss. Lead 6010
	NE Corner																				
1	Cooling tower	12/9/13	13:30	WW	2		5					A	A	B	C	B					
									# of Containers Size/Type				1 1L	1 1L	1 250ml	1 250ml	1 250ml				1 16ozP
2																					
3																					
4																					
5																					
6																					
7																					
8																					
9																					
10																					

REMARKS

7.93 pH
25.10 C temp
7,682 µs/cm cond.

To be analysed by FPL

Circle T.A.T. REQUEST (Rush Fees Approved)
Standard: Y N
RUSH: Today 1D 2D 3D 4D 5D

Short Hold: Y ✓ N

Circle QA/QC Report Level: 1 2 3 (4) CLP AFCEE QAPP Other

EDD (Fees May Apply): ADaPT SEDD ERPIMS TSV CSV Other

COC Condition: OK Incomplete

Required State Certification: FL GA SC NC NJ PA LA TX IL

Coolers #'s - Temp °C: 1 1.3 2 ___ 3 ___ 4 ___ 5 ___

Item	Relinquished by	Affiliation	Date	Time	Received by	Affiliation	Date	Time
1		FPL	12/9/13	16:00			12/9/13	1600
2		FPL	12/9/13	1800		FPL	12/9/13	1800
3								
4								

Lab Use Only	YES	NO	N/A
Non-Conformance Found?		✓	
Samples INTACT upon arrival?	✓		
Received on Wet Ice?	✓		
Proper Preservatives Indicated?	✓		
Received within holding time?	✓		
Custody seals Intact?	✓		
Volatiles rec'd without headspace?			✓
Proper Containers Used?	✓		

Pompano Lab 954-582-4300

Revision: F•ALL•C•007- Rev.00

C.O.C. Serial # 62516

ON ICE 2.3°C

Subject: FPL Turkey Point Class I short term injection test

From: May, Joseph (Joseph.May@dep.state.fl.us)

To: Marister.Ruiz@nexteraenergy.com;

Cc: david@mcnabbhydroconsult.com;

Date: Tuesday, January 21, 2014 2:03 PM

Marister,

You may start the test at any time, and please inform me at least 72-hours in advance of test-initiation so that I have the option to witness it.

Thanks,

Joe

Attachment B

Pressure Recording and Flowmeter Calibration Documentation

#1133302

Blue-White Industries, Ltd

CALIBRATION CERTIFICATE

5300 Business Drive
Huntington Beach, CA 92649
714-893-8529 fax 714-894-0149

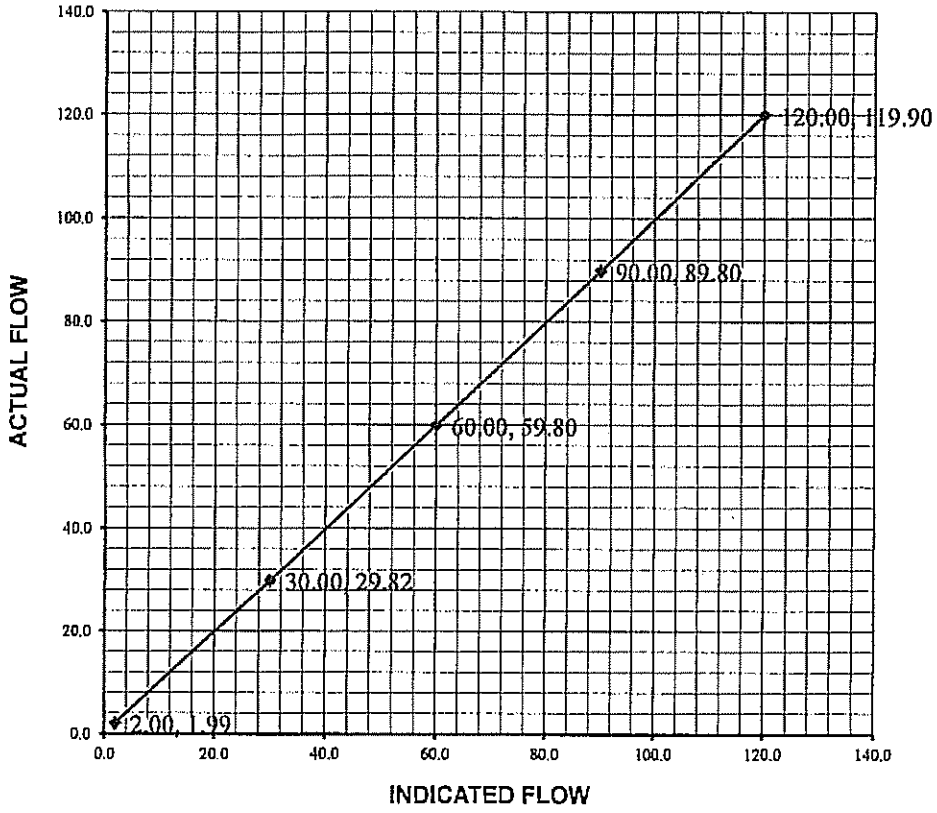
Customer Name:	ARGUS HAZCO	**CERT. No.:**	020514-01
Flowmeter Model No.:	S3C1A2	**Order Number:**	954216
Flowmeter Serial No.:	08302011-1200		
Flow Range:	0000		

Data condition	Calibration Date	Calibration Due	Calibration Technician
As found/ As left	2/5/2014	2/5/2015	J. WOOLARD

Rated Accuracy:	+/- 1.0% of Rate	**Ambient pressure:** 14.7 PSIA	**Test Fluid Type:** Water, S.G. = 1
Customer's Fluid Sp.Gr.:	1.000 (Liquid)	**Ambient Temp:** 72 DEG. F	**Test Fluid Temp:** 75 DEG. F

Indicated Flow cust. LIQUID (GPM)	Actual Flow test Water (GPM)	Calc. Actual Flow cust. LIQUID (GPM)	%Deviation of Rate	Data Condition Status
120.00	119.90	119.90	0.08%	In tolerance
90.00	89.80	89.80	0.22%	In tolerance
60.00	59.80	59.80	0.33%	In tolerance
30.00	29.82	29.82	0.60%	In tolerance
2.00	1.99	1.99	0.50%	In tolerance

Unit of flow = GPM of cust. LIQUID



Remarks: Calibrated on a 1 1/2" PVC pipe.

Blue-White Calibration Standard used in this calibration:

Equip ID	Equip. Cert. No.	Accuracy	Equip. Cal. Date	Equip. Cal. Due	Calibration Procedure
W3/1600	5-481-8	+/- 0.43%	8/13/2013	8/13/2014	ISA-RP16.6-1961

The indicated flow reading of customer's flowmeter was read directly and compared to the calibration standard.
The Blue-White calibration standards comply with MIL-STD 45662A and ANSI/NCSL Z540-1 and are traceable to the National Institute of Standards and Technology
The measurement uncertainty of the standard used in this calibration does not exceed 25% of the certified accuracy of the flowmeter under test.

Calibration Report

In-Situ Inc.
Report Number: 20140209204133-134218
221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 700**
Full Scale Pressure Range	**30 PSI vented**
Serial Number:	**134218**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2014-02-09 20:41:33 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification	+/- 0.1 C From -5 C to +50 C
Nominal Range of Applied Pressure:	0.0 PSI to 30.0 PSI
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0001	29.9977	-0.0079
Pressure	12.5996	12.5952	-0.0146
Pressure	0.0001	-0.0036	-0.0124
Temperature	24.9330	24.9165	-0.0165

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34980A SerialNo MY44014053
Manu Instrulab Model 4312A-15 SerialNo 41014
Manu Instrulab Model 832-151-01 SerialNo 12068
Manu Ruska Model 7215xi SerialNo 53143

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.

Performed By: FM

Calibration Report

In-Situ Inc.
Report Number: 20140205021014-172457
221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 700**
Full Scale Pressure Range	**30 PSI vented**
Serial Number:	**172457**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2014-02-05 02:10:14 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification	+/- 0.1 C From -5 C to +50 C
Nominal Range of Applied Pressure:	0.0 PSI to 30.0 PSI
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0000	29.9967	-0.0111
Pressure	12.6000	12.5983	-0.0057
Pressure	0.0004	-0.0033	-0.0121
Temperature	24.6920	24.6730	-0.0190

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34980A SerialNo MY44001931
Manu Instrulab Model 4312A-15 SerialNo 30117
Manu Instrulab Model 832-151-01 SerialNo 834
Manu Mensor Model PCS-400 SerialNo 180695
Manu Mensor Model PCS-400 SerialNo 180695
Manu Ruska Model 7215xi SerialNo 53144

Notes:

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3. A calibration interval of 12 to 18 months is recommended.

Performed By: FM

Calibration Report

In-Situ Inc.
Report Number: 2014020602334-136872
221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 700**
Full Scale Pressure Range	**30 PSI vented**
Serial Number:	**136872**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2014-02-06 02:3:34 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification	+/- 0.1 C From -5 C to +50 C
Nominal Range of Applied Pressure:	0.0 PSI to 30.0 PSI
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0005	29.9975	-0.0100
Pressure	12.5998	12.5982	-0.0052
Pressure	0.0001	-0.0024	-0.0082
Temperature	24.9280	24.9188	-0.0092

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34980A SerialNo MY44014053
Manu Instrulab Model 4312A-15 SerialNo 41014
Manu Instrulab Model 832-151-01 SerialNo 12068
Manu Ruska Model 7215xi SerialNo 53143

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.

Performed By: FM

Calibration Report

In-Situ Inc.
Report Number: 2014020602334-163262
221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 700**
Full Scale Pressure Range	**30 PSI vented**
Serial Number:	**163262**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2014-02-06 02:3:34 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification	+/- 0.1 C From -5 C to +50 C
Nominal Range of Applied Pressure:	0.0 PSI to 30.0 PSI
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	29.9997	30.0000	0.0008
Pressure	12.5994	12.5962	-0.0108
Pressure	0.0001	-0.0018	-0.0061
Temperature	24.9270	24.9158	-0.0112

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34980A SerialNo MY44014053
Manu Instrulab Model 4312A-15 SerialNo 41014
Manu Instrulab Model 832-151-01 SerialNo 12068
Manu Ruska Model 7215xi SerialNo 53143

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.

Performed By: FM

In-Situ Inc.

Calibration Report

Report Number: 20140206184029-321034

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 700**
Full Scale Pressure Range	**300 PSI vented**
Serial Number:	**321034**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2014-02-06 18:40:29 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From -5 C to +50 C
Nominal Range of Applied Pressure:	0.0 PSI to 300.0 PSI
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	300.0030	300.0623	0.0198
Pressure	126.0015	125.9903	-0.0037
Pressure	0.0000	-0.0141	-0.0047
Temperature	24.6910	24.6722	-0.0188

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34980A SerialNo MY44001931
Manu Instrulab Model 4312A-15 SerialNo 30117
Manu Instrulab Model 832-151-01 SerialNo 834
Manu Mensor Model PCS-400 SerialNo 180695
Manu Mensor Model PCS-400 SerialNo 180695
Manu Ruska Model 7215xi SerialNo 53144

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.

Performed By: FM

Report generated: 2014-02-07 8:59:24 UTC

Calibration Report

Report Number: 20140206184029-318771
221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Level TROLL 700**
Full Scale Pressure Range	**300 PSI vented**
Serial Number:	**318771**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2014-02-06 18:40:29 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From -5 C to +50 C
Nominal Range of Applied Pressure:	0.0 PSI to 300.0 PSI
Pressure Accuracy Specification:	+/- 0.1 %FS from -5 C to +50 C, +/- 0.05 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	300.0020	299.9853	-0.0056
Pressure	125.9995	125.9977	-0.0006
Pressure	0.0010	-0.0089	-0.0033
Temperature	24.6910	24.6718	-0.0192

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34980A SerialNo MY44001931
Manu Instrulab Model 4312A-15 SerialNo 30117
Manu Instrulab Model 832-151-01 SerialNo 834
Manu Mensor Model PCS-400 SerialNo 180695
Manu Mensor Model PCS-400 SerialNo 180695
Manu Ruska Model 7215xi SerialNo 53144

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.

Performed By: FM

In-Situ Inc.

Calibration Report

Report Number: 20131207014815-146501

221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Baro TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI)**
Serial Number:	**146501**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2013-12-07 01:48:15 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	48.3 KPa to 206.8 KPa (7.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.2 %FS from -5 C to +50 C, +/- 0.1 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0007	29.9980	-0.0090
Pressure	16.6601	16.6604	0.0010
Pressure	7.0001	6.9978	-0.0076
Temperature	24.9310	24.9200	-0.0110

Reported, applied, and deviation pressures are in PSI, PSI, and %FS; respectively. All temperatures are in C.

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34980A SerialNo MY44003951
Manu Instrulab Model 4312A-15 SerialNo 41014
Manu Instrulab Model 832-151-01 SerialNo 12068
Manu Ruska Model 7215xi SerialNo 53143

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. 1 PSI = 6.894757 KPa.

Performed By: FM

GRC
A SERCEL BRAND

Calibration Report

Calibration cell : Balance Desgrange et Huot 61962 S/N 10094 + stérilog 911
By : Metrolog Laboratory - Toulouse - France

Tool Type : Enduro-NG - V1.00
Serial Number : 3002
Calibration Date : 15/11/13

Sensor Range :
Pressure 1000 bar
Temperature 150 DegC

Pressure Sensor

Point	Applied Pressure bar	Applied Temperature DegC	Pressure Count	Temperature Count	Calculated Pressure bar	Pressure Difference bar
01,01	0.9346	19.747	1039369.35622	1353738.0343	0.9354	0.0008
01,02	100.9800	19.756	1134016.15833	1353831.2083	100.9775	-0.0025
01,03	200.9494	19.765	1228451.61905	1353887.2857	200.9513	0.0019
01,04	300.9173	19.778	1322727.87879	1353927.5000	300.9205	0.0032
01,05	400.8834	19.801	1416835.35849	1353955.0566	400.8829	-0.0005
01,06	500.8477	19.803	1510776.14925	1353981.9104	500.8462	-0.0015
01,07	600.8105	19.816	1604545.83099	1353982.5211	600.8104	-0.0001
01,08	700.7720	19.806	1698137.77381	1353981.9524	700.7758	0.0038
01,09	800.7320	19.805	1791540.32468	1353977.1299	800.7339	0.0019
01,10	900.6898	19.803	1884754.65079	1353967.5873	900.6885	-0.0013
01,11	1000.6465	19.799	1977786.01724	1353953.3621	1000.6502	0.0037
02,01	0.9368	45.871	1038966.07299	1480648.3285	0.9352	-0.0016
02,02	100.9831	45.893	1133598.14286	1480749.4592	100.9792	-0.0039
02,03	200.9535	45.935	1228023.69565	1480810.8696	200.9488	-0.0047
02,04	300.9225	45.935	1322300.58824	1480858.8235	300.9159	-0.0066
02,05	400.8894	45.932	1416423.39394	1480887.5000	400.8827	-0.0067
02,06	500.8546	45.938	1510381.27885	1480907.8846	500.8445	-0.0101
02,07	600.8183	45.947	1604178.45161	1480921.9839	600.8111	-0.0072
02,08	700.7807	45.938	1697804.43750	1480916.4625	700.7766	-0.0041
02,09	800.7417	45.950	1791246.63158	1480900.5658	800.7301	-0.0116
02,10	900.7005	45.941	1884520.20482	1480891.8795	900.6901	-0.0104
02,11	1000.6578	45.950	1977612.86022	1480878.6989	1000.6426	-0.0152
03,01	0.9374	71.933	1038455.54815	1606624.3259	0.9429	0.0055
03,02	100.9843	71.940	1133677.24000	1606712.7600	100.9820	-0.0023
03,03	200.9553	71.957	1228729.40625	1606769.3125	200.9701	0.0148
03,04	300.9246	71.977	1323632.08333	1606812.6786	300.9423	0.0177
03,05	400.8923	71.983	1418379.90805	1606837.0115	400.9024	0.0101
03,06	500.8581	71.985	1512978.92771	1606850.6506	500.8678	0.0097
03,07	600.8226	71.977	1607420.28814	1606840.7288	600.8366	0.0140
03,08	700.7857	71.977	1701696.59459	1606837.7838	700.8035	0.0178
03,09	800.7469	71.962	1795798.43038	1606848.3924	800.7627	0.0158
03,10	900.7063	71.959	1889739.02326	1606872.0116	900.7291	0.0228
03,11	1000.6645	71.968	1983506.83871	1606880.8871	1000.6902	0.0257
04,01	0.9385	98.076	1037838.37073	1731896.5707	0.9392	0.0007
04,02	100.9857	98.108	1134028.04167	1732000.8542	100.9698	-0.0159
04,03	200.9572	98.121	1230074.28571	1732086.1429	200.9468	-0.0104
04,04	300.9269	98.143	1325998.61017	1732129.8136	300.9159	-0.0110
04,05	400.8948	98.146	1421792.32692	1732152.3462	400.8869	-0.0079
04,06	500.8610	98.154	1517432.56757	1732184.5811	500.8479	-0.0131
04,07	600.8256	98.150	1612910.48571	1732176.5714	600.8028	-0.0228
04,08	700.7890	98.140	1708234.72973	1732164.5676	700.7649	-0.0241
04,09	800.7510	98.127	1803404.43590	1732138.4872	800.7373	-0.0137
04,10	900.7104	98.118	1898396.33696	1732140.6848	900.6902	-0.0202
04,11	1000.6683	98.117	1993227.94000	1732114.4400	1000.6408	-0.0275
05,01	0.9345	123.961	1037163.12977	1854606.7481	0.9397	0.0052
05,02	100.9814	123.972	1134509.79310	1854701.8851	100.9732	-0.0082
05,03	200.9523	124.001	1231780.70423	1854775.5070	200.9633	0.0110
05,04	300.9218	124.010	1328957.81818	1854819.1667	300.9338	0.0120

Point	Applied Pressure bar	Applied Temperature DegC	Pressure Count	Temperature Count	Calculated Pressure bar	Pressure Difference bar
05,05	400.8890	124.013	1426017.27941	1854847.0294	400.8954	0.0064
05,06	500.8548	124.004	1522942.12500	1854854.8500	500.8557	0.0009
05,07	600.8190	124.014	1619728.73171	1854875.8902	600.8262	0.0072
05,08	700.7818	123.986	1716347.17647	1854850.8676	700.7904	0.0086
05,09	800.7434	123.992	1812811.46575	1854849.4795	800.7569	0.0135
05,10	900.7024	123.989	1909114.07246	1854831.8986	900.7147	0.0123
05,11	1000.6609	124.004	2005283.28000	1854859.3600	1000.6700	0.0091
06,01	0.9339	150.023	1036446.55000	1977390.4633	0.9485	0.0146
06,02	100.9811	150.006	1134958.06557	1977488.9672	100.9441	-0.0370
06,03	200.9525	150.034	1233576.04286	1977555.0571	200.9568	0.0043
06,04	300.9224	150.058	1332176.08219	1977593.3699	300.9451	0.0227
06,05	400.8903	150.074	1430682.01587	1977641.4444	400.8981	0.0078
06,06	500.8567	150.097	1529073.39189	1977661.0405	500.8465	-0.0102
06,07	600.8213	150.115	1627329.08333	1977680.5972	600.8028	-0.0185
06,08	700.7850	150.083	1725442.61702	1977686.7234	700.7769	-0.0081
06,09	800.7471	150.079	1823390.80000	1977641.8333	800.7511	0.0040
06,10	900.7067	150.065	1921185.96341	1977616.2683	900.7172	0.0105
06,11	1000.6654	150.053	2018839.45313	1977617.3438	1000.6549	-0.0105

Temperature Sensor

Point	Applied Temperature DegC		Temperature Count		Calculated Temperature DegC	Temperature Difference DegC
01,01	19.747		1353738.0343		19.751	0.004
02,01	45.871		1480648.3285		45.886	0.015
03,01	71.933		1606624.3259		71.931	-0.002
04,01	98.076		1731896.5707		98.079	0.003
05,01	123.961		1854606.7481		123.955	-0.006
06,01	150.023		1977390.4633		150.018	-0.005
01,02	19.756		1353831.2083		19.770	0.014
02,02	45.893		1480749.4592		45.907	0.014
03,02	71.940		1606712.7600		71.949	0.009
04,02	98.108		1732000.8542		98.100	-0.008
05,02	123.972		1854701.8851		123.975	0.003
06,02	150.006		1977488.9672		150.039	0.033
01,03	19.765		1353887.2857		19.781	0.016
02,03	45.935		1480810.8696		45.919	-0.016
03,03	71.957		1606769.3125		71.961	0.004
04,03	98.121		1732086.1429		98.119	-0.002
05,03	124.001		1854775.5070		123.991	-0.010
06,03	150.034		1977555.0571		150.053	0.019
01,04	19.778		1353927.5000		19.790	0.012
02,04	45.935		1480858.8235		45.929	-0.006
03,04	71.977		1606812.6786		71.970	-0.007
04,04	98.143		1732129.8136		98.128	-0.015
05,04	124.010		1854819.1667		124.000	-0.010
06,04	150.058		1977593.3699		150.061	0.003
01,05	19.801		1353955.0566		19.795	-0.006
02,05	45.932		1480887.5000		45.935	0.003
03,05	71.983		1606837.0115		71.975	-0.008
04,05	98.146		1732152.3462		98.132	-0.014
05,05	124.013		1854847.0294		124.006	-0.007
06,05	150.074		1977641.4444		150.071	-0.003
01,06	19.803		1353981.9104		19.801	-0.002
02,06	45.938		1480907.8846		45.939	0.001
03,06	71.985		1606850.6506		71.978	-0.007
04,06	98.154		1732184.5811		98.139	-0.015
05,06	124.004		1854854.8500		124.007	0.003
06,06	150.097		1977661.0405		150.076	-0.021

Point	Applied Temperature DegC		Temperature Count		Calculated Temperature DegC	Temperature Difference DegC	
01,07	19.816		1353982.5211		19.801	-0.015	
02,07	45.947		1480921.9839		45.942	-0.005	
03,07	71.977		1606840.7288		71.976	-0.001	
04,07	98.150		1732176.5714		98.137	-0.013	
05,07	124.014		1854875.8902		124.012	-0.002	
06,07	150.115		1977680.5972		150.080	-0.035	
01,08	19.806		1353981.9524		19.801	-0.005	
02,08	45.938		1480916.4625		45.941	0.003	
03,08	71.977		1606837.7838		71.975	-0.002	
04,08	98.140		1732164.5676		98.135	-0.005	
05,08	123.986		1854850.8676		124.006	0.020	
06,08	150.083		1977686.7234		150.081	-0.002	
01,09	19.805		1353977.1299		19.800	-0.005	
02,09	45.950		1480900.5658		45.938	-0.012	
03,09	71.962		1606848.3924		71.978	0.016	
04,09	98.127		1732138.4872		98.129	0.002	
05,09	123.992		1854849.4795		124.006	0.014	
06,09	150.079		1977641.8333		150.071	-0.008	
01,10	19.803		1353967.5873		19.798	-0.005	
02,10	45.941		1480891.8795		45.936	-0.005	
03,10	71.959		1606872.0116		71.983	0.024	
04,10	98.118		1732140.6848		98.130	0.012	
05,10	123.989		1854831.8986		124.002	0.013	
06,10	150.065		1977616.2683		150.066	0.001	
01,11	19.799		1353953.3621		19.795	-0.004	
02,11	45.950		1480878.6989		45.933	-0.017	
03,11	71.968		1606880.8871		71.984	0.016	
04,11	98.117		1732114.4400		98.124	0.007	
05,11	124.004		1854859.3600		124.008	0.004	
06,11	150.053		1977617.3438		150.066	0.013	

GRC
A SERCEL BRAND

Calibration Report

Calibration cell : Balance Desgrange et Huot 61962 S/N 10094 + stérilog 911
By : Metrolog Laboratory - Toulouse - France

Tool Type : Enduro-NG - V1.00
Serial Number : 3002
Calibration Date : 15/11/13

Sensor Range :
Pressure 1000 bar
Temperature 150 DegC

Pressure Coefficients

M: 7.82167053e-007
F: 942224
MC: 1.05844248e-006
FC: 1230670

G0: -1.00912258e+002	J0: 1.33580480e+003	K0: 1.36688023e+001	L0: 6.77539290e-001
G1: -1.01133011e+001	J1: 1.52657278e+002	K1: -9.11641752e+000	L1: 4.34578041e+001
G2: 4.08534220e+001	J2: -4.70478635e+002	K2: -8.16038781e+000	L2: -1.45719828e+002
G3: -2.67082782e+001	J3: 3.18170093e+002	K3: 5.27704731e+001	L3: 1.88185386e+002
G4: 4.36813258e+000	J4: -4.59140118e+001	K4: -1.34426004e+002	L4: 2.05840039e+001

M0: 2.40344615e+000
M1: -4.09138837e+001
M2: 1.50118236e+002
M3: -2.25149687e+002
M4: 7.17530953e+001

Temperature Coefficients

M: 1.05844248e-006
F: 1230670

G0: -5.75501813e+000
J0: 1.97293644e+002
K0: -1.52997324e+001
L0: 3.18624272e+001
M0: -1.62315526e+001

GRC
A SERCEL BRAND

Calibration Report

Calibration cell :Balance Desgrange et Huot 61962 S/N 10094 + sterilog 904
By : Metrolog Laboratory - Toulouse - France

Tool Type : Enduro-NG - V1.00
Serial Number : 3012
Calibration Date : 25/11/13

Sensor Range :
Pressure 1000 bar
Temperature 150 DegC

Pressure Sensor

Point	Applied Pressure bar	Applied Temperature DegC	Pressure Count	Temperature Count	Calculated Pressure bar	Pressure Difference bar	
01,01	0.9041	19.691	1042256.40491	1356069.4233	0.9042	0.0001	
01,02	100.9517	19.694	1137568.64444	1356156.6000	100.9502	-0.0015	
01,03	200.9219	19.694	1232411.73333	1356212.8000	200.9222	0.0003	
01,04	300.8908	19.711	1326848.67500	1356271.5500	300.8907	-0.0001	
01,05	400.8577	19.721	1420878.08000	1356290.2000	400.8598	0.0021	
01,06	500.8229	19.732	1514483.83333	1356317.7667	500.8180	-0.0049	
01,07	600.7866	19.734	1607678.68571	1356313.9143	600.7886	0.0020	
01,08	700.7488	19.732	1700436.16129	1356326.8710	700.7529	0.0041	
01,09	800.7099	19.739	1792748.14286	1356307.5429	800.7095	-0.0004	
01,10	900.6686	19.762	1884610.16667	1356301.8333	900.6665	-0.0021	
01,11	1000.6265	19.743	1976016.70000	1356281.7333	1000.6278	0.0013	
02,01	0.9059	45.798	1042039.14835	1483616.4396	0.9032	-0.0027	
02,02	100.9537	45.790	1137111.66667	1483677.0476	100.9539	0.0002	
02,03	200.9243	45.789	1231738.12000	1483749.6400	200.9250	0.0007	
02,04	300.8934	45.799	1325983.86111	1483818.8889	300.8900	-0.0034	
02,05	400.8607	45.819	1419842.85714	1483862.2857	400.8522	-0.0085	
02,06	500.8262	45.830	1513318.72000	1483892.3200	500.8219	-0.0043	
02,07	600.7904	45.844	1606393.87500	1483912.3333	600.7870	-0.0034	
02,08	700.7530	45.841	1699059.65789	1483881.5789	700.7460	-0.0070	
02,09	800.7140	45.834	1791320.39583	1483845.3958	800.7093	-0.0047	
02,10	900.6728	45.833	1883166.65385	1483848.0769	900.6719	-0.0009	
02,11	1000.6305	45.831	1974582.77273	1483827.4545	1000.6240	-0.0065	
03,01	0.9068	71.878	1041709.96117	1610089.5437	0.9123	0.0055	
03,02	100.9550	71.888	1137162.22222	1610212.6111	100.9495	-0.0055	
03,03	200.9259	71.879	1232212.47059	1610304.7647	200.9252	-0.0007	
03,04	300.8955	71.886	1326911.44444	1610344.9259	300.9032	0.0077	
03,05	400.8632	71.918	1421240.85185	1610339.5185	400.8727	0.0095	
03,06	500.8289	71.920	1515199.00000	1610346.7600	500.8407	0.0118	
03,07	600.7932	71.913	1608773.75610	1610344.1220	600.7989	0.0057	
03,08	700.7564	71.930	1701972.47368	1610349.3684	700.7646	0.0082	
03,09	800.7178	71.913	1794774.06250	1610314.8438	800.7224	0.0046	
03,10	900.6767	71.913	1887187.61111	1610302.6389	900.6845	0.0078	
03,11	1000.6348	71.904	1979199.76316	1610326.9737	1000.6421	0.0073	
04,01	0.9084	97.997	1041307.04115	1735706.1399	0.9044	-0.0040	
04,02	100.9565	98.003	1137578.95000	1735805.7000	100.9546	-0.0019	
04,03	200.9273	98.008	1233461.76923	1735865.2308	200.9289	0.0016	
04,04	300.8965	98.021	1329002.54286	1735926.4286	300.8887	-0.0078	
04,05	400.8638	98.033	1424208.00000	1735948.6667	400.8547	-0.0091	
04,06	500.8294	98.040	1519061.31034	1735964.3103	500.8184	-0.0110	
04,07	600.7929	98.049	1613556.46154	1735967.6538	600.7838	-0.0091	
04,08	700.7554	98.044	1707679.80000	1735971.4000	700.7434	-0.0120	
04,09	800.7161	98.038	1801432.06897	1735949.4138	800.7071	-0.0090	
04,10	900.6748	98.039	1894814.50000	1735972.0417	900.6737	-0.0011	
04,11	1000.6325	98.044	1987799.75000	1735997.3864	1000.6213	-0.0112	
05,01	0.9071	123.818	1040946.57353	1858829.5441	0.9182	0.0111	
05,02	100.9544	123.825	1138163.84211	1858939.4211	100.9299	-0.0245	
05,03	200.9244	123.825	1235126.76000	1859026.7200	200.9291	0.0047	
05,04	300.8929	123.839	1331792.75000	1859065.2917	300.9101	0.0172	

Point	Applied Pressure bar	Applied Temperature DegC	Pressure Count	Temperature Count	Calculated Pressure bar	Pressure Difference bar
05,05	400.8594	123.867	1428127.13636	1859112.2727	400.8679	0.0085
05,06	500.8243	123.876	1524128.08571	1859119.0571	500.8245	0.0002
05,07	600.7875	123.883	1619783.00000	1859101.3200	600.7848	-0.0027
05,08	700.7496	123.878	1715082.93103	1859095.9310	700.7468	-0.0028
05,09	800.7100	123.880	1810030.27027	1859080.8649	800.7208	0.0108
05,10	900.6682	123.874	1904601.86111	1859064.6389	900.6768	0.0086
05,11	1000.6252	123.879	1998813.27778	1859066.2778	1000.6240	-0.0012
06,01	0.9055	149.848	1040667.62025	1981750.1013	0.9253	0.0198
06,02	100.9533	149.840	1138809.04545	1981907.5909	100.9079	-0.0454
06,03	200.9240	149.861	1236928.78947	1981975.0000	200.9229	-0.0011
06,04	300.8930	149.875	1334875.64000	1982029.5600	300.9250	0.0320
06,05	400.8602	149.895	1432528.55172	1982061.6897	400.8743	0.0141
06,06	500.8259	149.902	1529877.63333	1982088.5667	500.8227	-0.0032
06,07	600.7899	149.911	1626871.90909	1982074.3939	600.7603	-0.0296
06,08	700.7524	149.926	1723537.21875	1982086.9688	700.7313	-0.0211
06,09	800.7137	149.908	1819858.69388	1982038.5102	800.7241	0.0104
06,10	900.6723	149.908	1915828.60606	1982073.3030	900.7007	0.0284
06,11	1000.6301	149.899	2011427.11111	1982064.1944	1000.6128	-0.0173

Temperature Sensor

Point	Applied Temperature DegC		Temperature Count		Calculated Temperature DegC	Temperature Difference DegC
01,01	19.691		1356069.4233		19.684	-0.007
02,01	45.798		1483616.4396		45.779	-0.019
03,01	71.878		1610089.5437		71.861	-0.017
04,01	97.997		1735706.1399		97.985	-0.012
05,01	123.818		1858829.5441		123.813	-0.005
06,01	149.848		1981750.1013		149.832	-0.016
01,02	19.694		1356156.6000		19.702	0.008
02,02	45.790		1483677.0476		45.791	0.001
03,02	71.888		1610212.6111		71.886	-0.002
04,02	98.003		1735805.7000		98.005	0.002
05,02	123.825		1858939.4211		123.836	0.011
06,02	149.840		1981907.5909		149.866	0.026
01,03	19.694		1356212.8000		19.713	0.019
02,03	45.789		1483749.6400		45.806	0.017
03,03	71.879		1610304.7647		71.905	0.026
04,03	98.008		1735865.2308		98.018	0.010
05,03	123.825		1859026.7200		123.855	0.030
06,03	149.861		1981975.0000		149.880	0.019
01,04	19.711		1356271.5500		19.725	0.014
02,04	45.799		1483818.8889		45.820	0.021
03,04	71.886		1610344.9259		71.914	0.028
04,04	98.021		1735926.4286		98.031	0.010
05,04	123.839		1859065.2917		123.863	0.024
06,04	149.875		1982029.5600		149.892	0.017
01,05	19.721		1356290.2000		19.729	0.008
02,05	45.819		1483862.2857		45.829	0.010
03,05	71.918		1610339.5185		71.913	-0.005
04,05	98.033		1735948.6667		98.035	0.002
05,05	123.867		1859112.2727		123.873	0.006
06,05	149.895		1982061.6897		149.899	0.004
01,06	19.732		1356317.7667		19.735	0.003
02,06	45.830		1483892.3200		45.835	0.005
03,06	71.920		1610346.7600		71.914	-0.006
04,06	98.040		1735964.3103		98.038	-0.002
05,06	123.876		1859119.0571		123.874	-0.002
06,06	149.902		1982088.5667		149.904	0.002

Point	Applied Temperature DegC		Temperature Count		Calculated Temperature DegC	Temperature Difference DegC	
01,07	19.734		1356313.9143		19.734	0.000	
02,07	45.844		1483912.3333		45.839	-0.005	
03,07	71.913		1610344.1220		71.914	0.001	
04,07	98.049		1735967.6538		98.039	-0.010	
05,07	123.883		1859101.3200		123.870	-0.013	
06,07	149.911		1982074.3939		149.901	-0.010	
01,08	19.732		1356326.8710		19.737	0.005	
02,08	45.841		1483881.5789		45.833	-0.008	
03,08	71.930		1610349.3684		71.915	-0.015	
04,08	98.044		1735971.4000		98.040	-0.004	
05,08	123.878		1859095.9310		123.869	-0.009	
06,08	149.926		1982086.9688		149.904	-0.022	
01,09	19.739		1356307.5429		19.733	-0.006	
02,09	45.834		1483845.3958		45.826	-0.008	
03,09	71.913		1610314.8438		71.907	-0.006	
04,09	98.038		1735949.4138		98.035	-0.003	
05,09	123.880		1859080.8649		123.866	-0.014	
06,09	149.908		1982038.5102		149.894	-0.014	
01,10	19.762		1356301.8333		19.732	-0.030	
02,10	45.833		1483848.0769		45.826	-0.007	
03,10	71.913		1610302.6389		71.905	-0.008	
04,10	98.039		1735972.0417		98.040	0.001	
05,10	123.874		1859064.6389		123.863	-0.011	
06,10	149.908		1982073.3030		149.901	-0.007	
01,11	19.743		1356281.7333		19.727	-0.016	
02,11	45.831		1483827.4545		45.822	-0.009	
03,11	71.904		1610326.9737		71.910	0.006	
04,11	98.044		1735997.3864		98.045	0.001	
05,11	123.879		1859066.2778		123.863	-0.016	
06,11	149.899		1982064.1944		149.899	0.000	

GRC
A SERCEL BRAND

Calibration Report

Calibration cell :Balance Desgrange et Huot 61962 S/N 10094 + sterilog 904
By : Metrolog Laboratory - Toulouse - France

Tool Type : Enduro-NG - V1.00
Serial Number : 3012
Calibration Date : 25/11/13

Sensor Range :
Pressure 1000 bar
Temperature 150 DegC

Pressure Coefficients

M: 7.89572371e-007
F: 946061
MC: 1.05540113e-006
FC: 1232790

G0: -9.85452607e+001	J0: 1.30621712e+003	K0: 3.66291577e+001	L0: -1.02966805e+000
G1: -1.30081701e+001	J1: 1.60952436e+002	K1: 1.63963622e+001	L1: 2.08503697e+001
G2: 3.66635692e+001	J2: -3.65626841e+002	K2: -2.55929188e+002	L2: 1.05313185e+002
G3: -1.42788422e+001	J3: 7.82706200e+001	K3: 6.76024498e+002	L3: -5.48172382e+002
G4: -6.52879444e+000	J4: 1.24225000e+002	K4: -6.17694279e+002	L4: 6.30411361e+002

M0: 6.25840201e+000
M1: -4.03744869e+001
M2: 5.31301383e+001
M3: 1.03835305e+002
M4: -2.12207367e+002

Temperature Coefficients

M: 1.05540113e-006
F: 1232790

G0: -5.34922086e+000
J0: 1.91726800e+002
K0: 5.09188821e+000
L0: 8.87959825e-001
M0: 2.68140565e-002

Calibration Report

In-Situ Inc.
Report Number: 20131207014815-146501
221 East Lincoln Avenue, Fort Collins, CO 80524 USA
1-970-498-1500, 1-800-446-7488, FAX: 1-970-498-1598
Visit us at www.in-situ.com

Instrument Details:

Instrument Model:	**Baro TROLL 500**
Full Scale Pressure Range	**206.84 KPa (30 PSI)**
Serial Number:	**146501**

Calibration Details:

Calibration Result:	**PASS**
Calibration Date:	2013-12-07 01:48:15 (UTC)
Nominal Range of Applied Temperature:	-5 C to +50 C
Temperature Accuracy Specification:	+/- 0.1 C From 0 C to +50 C
Nominal Range of Applied Pressure:	48.3 KPa to 206.8 KPa (7.0 PSI to 30.0 PSI)
Pressure Accuracy Specification:	+/- 0.2 %FS from -5 C to +50 C, +/- 0.1 %FS at +15 C

Post-Calibration Check:

Parameter	Applied	Reported	Deviation
Pressure	30.0007	29.9980	-0.0090
Pressure	16.6601	16.6604	0.0010
Pressure	7.0001	6.9978	-0.0076
Temperature	24.9310	24.9200	-0.0110

Reported, applied, and deviation pressures are in PSI, PSI, and %FS; respectively. All temperatures are in C.

Calibration Procedures and Equipment Used:

Automated calibration procedures used.
Manu Agilent Model 34980A SerialNo MY44003951
Manu Instrulab Model 4312A-15 SerialNo 41014
Manu Instrulab Model 832-151-01 SerialNo 12068
Manu Ruska Model 7215xi SerialNo 53143

Notes:

1. Standards used in this calibration are traceable to the National Institute of Standards and Technology.
2. This calibration report shall not be reproduced, except in full, without the written approval of In-Situ, Inc.
3. A calibration interval of 12 to 18 months is recommended.
4. 1 PSI = 6.894757 KPa.

Performed By: FM

