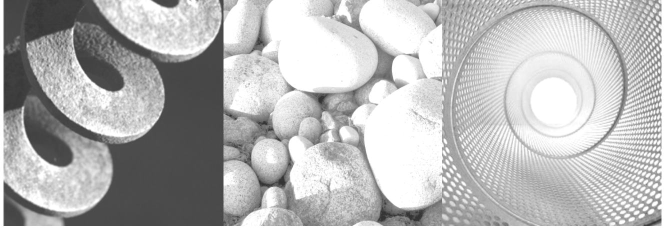

GEI Consultants

Consulting
Engineers and
Scientists

Well Evaluation Summary Report

Polychrome West Site

NYSDEC BCP Site No. C360099
City of Yonkers, New York

Submitted to:
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February 2024
Project 2201010

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Abbreviations and Acronyms

ANT	Apparent NAPL Thickness
ASTM	American Society for Testing and Materials
AVB	Avalon Yonkers Sun Sites, LLC
AWI	Air/Water Interface
BCP	Brownfield Cleanup Program
Con Edison	Consolidated Edison Company of New York, Inc.
DNAPL	Dense Non-Aqueous Phase Liquid
DvD	Drawdown versus Discharge
Ft^3/min	Cubic Feet per Minute
GEI	GEI Consultants, Inc., P.C.
GPD	Gallons per Day
LNAPL	Light Non-Aqueous Phase Liquid
MNIs	Mobile NAPL Intervals
NAPL	Non-Aqueous Phase Liquid
NWI	NAPL/Water Interface
NYSDEC	New York State Department of Environmental Conservation
Q_n	NAPL Discharge into the Well
S_n	NAPL Drawdown

1. Introduction

GEI Consultants, Inc. P.C. has prepared this report on behalf of Consolidated Edison Company of New York, Inc. (Con Edison) to summarize the results of a baildown and recovery test at the Polychrome West Site located at 137-145 Alexander Street, Yonkers, Westchester County, New York (the Site). GEI under contract with Con Edison on behalf of Avalon Yonkers Sun Sites, LLC (AVB) has been completing DNAPL recovery at a number of wells at the Site in accordance with the requirements of the New York State Department of Environmental Conservation (NYSDEC) approved Site Management Plan for the Polychrome West site [Brownfield Cleanup Program (BCP) Site No. C360099].

The baildown and recovery test was completed at two dense non-aqueous phase liquids (DNAPL) recovery wells at the Site in accordance with the Well Evaluation Work Plan dated November 15, 2022. The goal of the evaluation was to generate data to optimize DNAPL recovery at non-aqueous phase liquids (NAPL) recovery wells NW-5 and NW-6. This report presents a summary of the well evaluation results and recommendations for ongoing recovery.

2. DNAPL Recovery Well Evaluation

GEI performed and analyzed baildown tests at recovery wells NW-5 and NW-6 to evaluate potential alternatives to optimize ongoing DNAPL recovery (Fig. 1). The goal of the investigation was to identify:

- The sustainable recovery rate of DNAPL, assuming the DNAPL does not exceed the sump capacity.
- The depth of the mobile DNAPL intervals within screened interval of the well.

Mobile NAPL intervals (MNIs) represent the specific intervals within the formation where DNAPL is present and would flow into a well if present. Understanding the depth and thickness of each MNI within a formation can assist in developing more targeted approaches to DNAPL recovery at each recovery well location.

The evaluations were conducted using the procedures for calculating light non-aqueous phase liquid (LNAPL) transmissivity that are described in ASTM E2856-13(21), the Standard Guide for Estimation of LNAPL Transmissivity, as modified for wells containing DNAPL.

2.1 Field Testing

GEI collected a DNAPL sample from NW-5 and NW-6 on May 24, 2023, and submitted it to Triton Analytics Corp of Houston, Texas for analysis of its fluid properties (viscosity, density, and specific gravity) to support this evaluation. Understanding of the fluid properties of the DNAPL are required for calculating its transmissivity in accordance with the ASTM standard. The results are provided in the laboratory data report (Appendix A).

Periodic scheduled DNAPL recovery was suspended at the two well locations for two weeks prior to beginning the test to allow the DNAPL in the formation to reach equilibrium with the DNAPL in the well. The NAPL/water interface (NWI) was assumed to be in equilibrium at the start of the test. The baildown tests were initiated by purging DNAPL from the well screen interval and the sand filter pack to the extent feasible. Greater than the estimated equilibrium volume of DNAPL in the well and sand pack filter was removed to minimize filter pack recharge.

A portion of the DNAPL present in each of the wells became emulsified (i.e. suspended as separate globules of NAPL) in the water column as a result of agitation from the pumping at both wells. The suspended DNAPL was not removed during the baildown test. Following the completion of the baildown test, the suspended globules of DNAPL in the water column settle to the bottom of the well over time. The recovery of fluids was continuously monitored with pressure transducers (Solinst Leveloggers and Barologgers) and the data logged at 1-minute intervals.

The test was initiated at recovery well NW-6 on August 30, 2023. The test at recovery well NW-5 was initiated on September 27, 2023. Each test was suspended approximately two weeks later, at the next routine monitoring event when the apparent NAPL thickness (ANT) in the well had returned to pre-test equilibrium.

3. DNAPL Recoverability Evaluation

3.1 Fluid Level Data

The fluid pressure data recorded in the dataloggers from NW-5 and NW-6 were analyzed to calculate the air/water interface (AWI) and the NWI throughout the testing period. Fluid depths over time for NW-5 and NW-6 are shown in Figs. 2 and 3, respectively.

Based on the fluid level data, the following were calculated.

- The ANT.
- The apparent NAPL drawdown (difference between equilibrium and measured NWI).
- The NAPL discharge rate from the formation into the well.

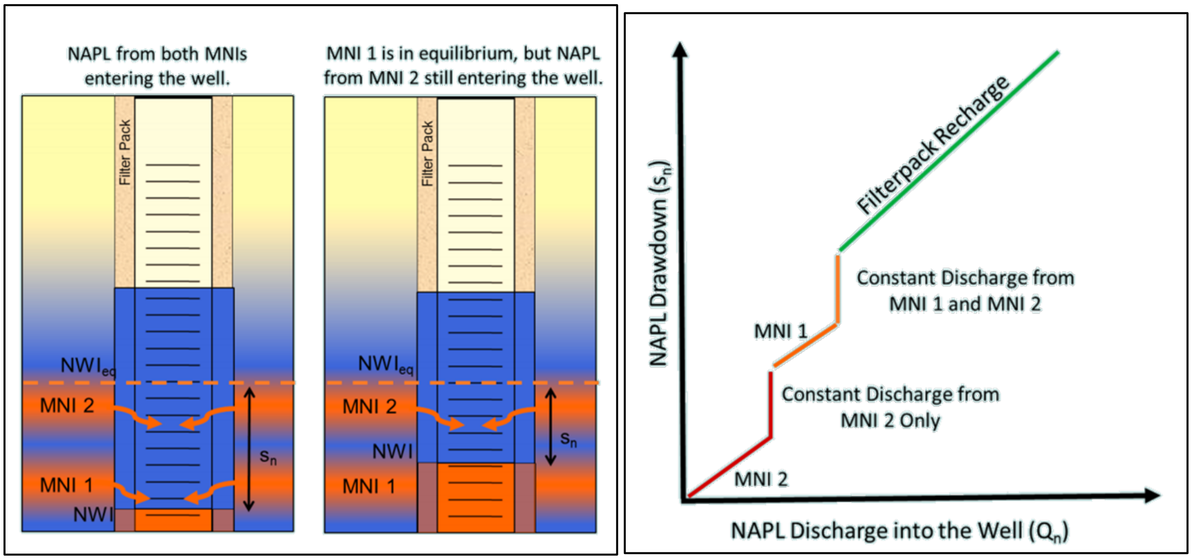
The ANT over time for NW-5 and NW-6 and shown in Figs. 4 and 5, respectively. The drawdown versus discharge (DvD) graphs are shown in Figs. 6 and 7, respectively.

3.2 Drawdown Versus Discharge Graph Interpretation

When a well is evacuated of DNAPL, the initial discharge of DNAPL into the well comes from the filter pack and all MNIs. Once the filter pack is recharged, the rate shifts to a constant rate of discharge into the well from all MNIs in the screen interval. When the NWI reaches the deepest MNI in the screen, then the discharge rate into the well changes until the NWI reaches the top of the MNI. If additional MNIs are present, then this effect is repeated until the well reached equilibrium. The intervals of constant discharge represent elevations withing the well screen between NMIs and are depicted as a constant discharge on the DvD graphs. At these elevations, the apparent DNAPL drawdown is changing while the DNAPL discharge rate into the well is constant.

Identification of the MNIs is critical to calculating the DNAPL drawdown in the DNAPL transmissivity calculations. Assuming that the entire ANT is the MNI will lead to an underestimate of DNAPL transmissivity.

The example graphic below depicts the flow of DNAPL into a well screen from multiple MNIs and the resulting DvD graph. It demonstrates that the DNAPL will fill the well to the top of the uppermost MNI (MNI-2). This condition typically results in an exaggeration of the DNAPL thickness present in the well relative to where the NAPL is actually present within the formation. As such, the thickness of DNAPL in the well may not reflect the true thickness of the impacted portion of the formation.



Example Drawdown vs Discharge Graph for Recovery Well with Two MNIs

3.2.1 Recovery Well NW-5

The ANT for NW-5 returned to within 1 foot of the pre-testing equilibrium thickness within a few hours and returned to equilibrium in approximately two weeks (See Fig. 4). The DvD graph for NW-5 initially shows a constant discharge rate of about 0.007 cubic feet per minute (ft^3/min) or 75 gallons per day (GPD) while the NWI is within the sump (See Fig. 6). However, then the discharge rate starts to decrease. This result indicates that the initial DNAPL discharge rate likely represents a combination of formation discharge into the well and emulsified DNAPL present as globules temporarily suspended in the water column following DNAPL removal settling within the well. Once, the NWI is within the screened interval, the DvD trend is a straight line until the thickness of DNAPL in the well reaches an apparent drawdown of about one foot. This result indicates the potential for a 3-foot MNI beginning at the bottom of the screen and extending to 3 ft above the bottom of the screen. However, due to the potential for emulsified DNAPL settling within the well, the lower elevation of the MNI cannot be definitively identified. Although the specific depth and thickness of the MNI is estimated for this well, it does not exceed the lower 3 ft of screen interval as the DNAPL reaches equilibrium with the formation at approximately 3 ft above the top of the sump.

3.2.2 Recovery Well NW-6

The ANT for NW-6 initially returned to equilibrium within a few hours. The well was disturbed for manual gauging after which the ANT showed an apparent reduction, returning to equilibrium within about two weeks (See Fig. 5). The DvD graph for NW-6 is based on the initial recovery to equilibrium. It shows a constant discharge rate of about 0.02 ft^3/min (215 GPD) (See Fig. 7). This rate is the combined rate of recovery for all mobile NAPL intervals. It may also include a component from emulsified DNAPL settling within the well.

3.3 Recovery Rate Evaluation

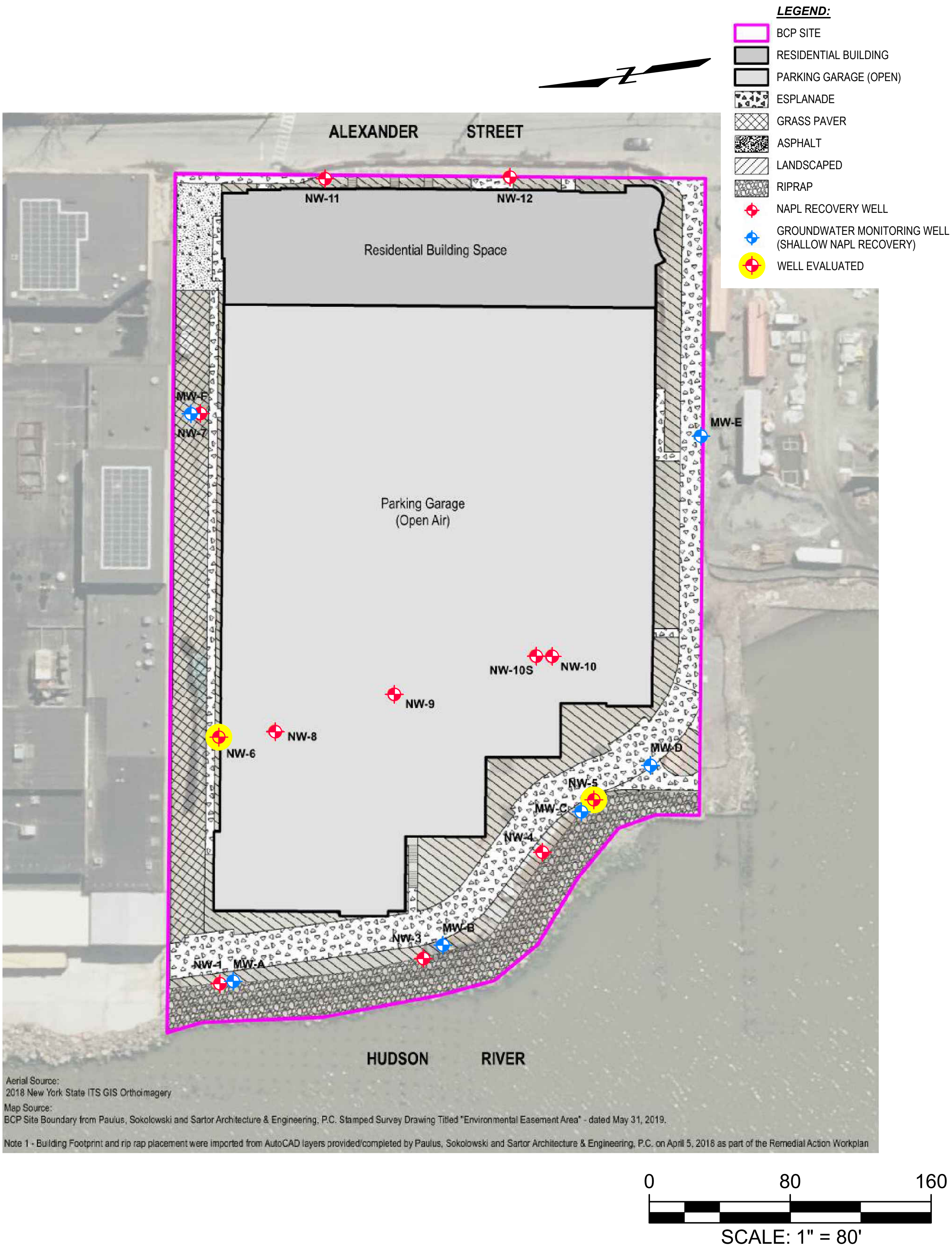
Figs. 4 and 5 present the ANT over time for wells NW-5 and NW-6, respectively. These results demonstrate that the DNAPL returns to near its equilibrium ANT within hours of purging the NAPL. Any remaining ANT recovered over a period of about two weeks.

The sustainable recovery rate, if the DNAPL were maintained in the sump below the bottom of the screen, was conservatively estimated from the maximum recovery rate on the DvD graphs when the NWI is within the screened interval. The estimated rates for NW-5 and NW-6 are 75 GPD and 215 GPD, respectively.

4. Conclusions and Recommendations

During the evaluation, the DNAPL returned to near the equilibrium ANT within 10 to 24 hours of purging the DNAPL from the two recovery wells. This indicates that the wells are effectively collecting DNAPL at these locations and elevations therefore, changing the well screen interval would not increase the rate of DNAPL recovery at these locations. As such, installing replacement wells for NW-5 or NW-6 is not recommended at this time.

Figures



Well Evaluation Report Polychrome West Site (PCW) City of Yonkers, New York	GEI Consultants	WELLS EVALUATED
Consolidated Edison	Project 2201010	February 2024 Fig. 1

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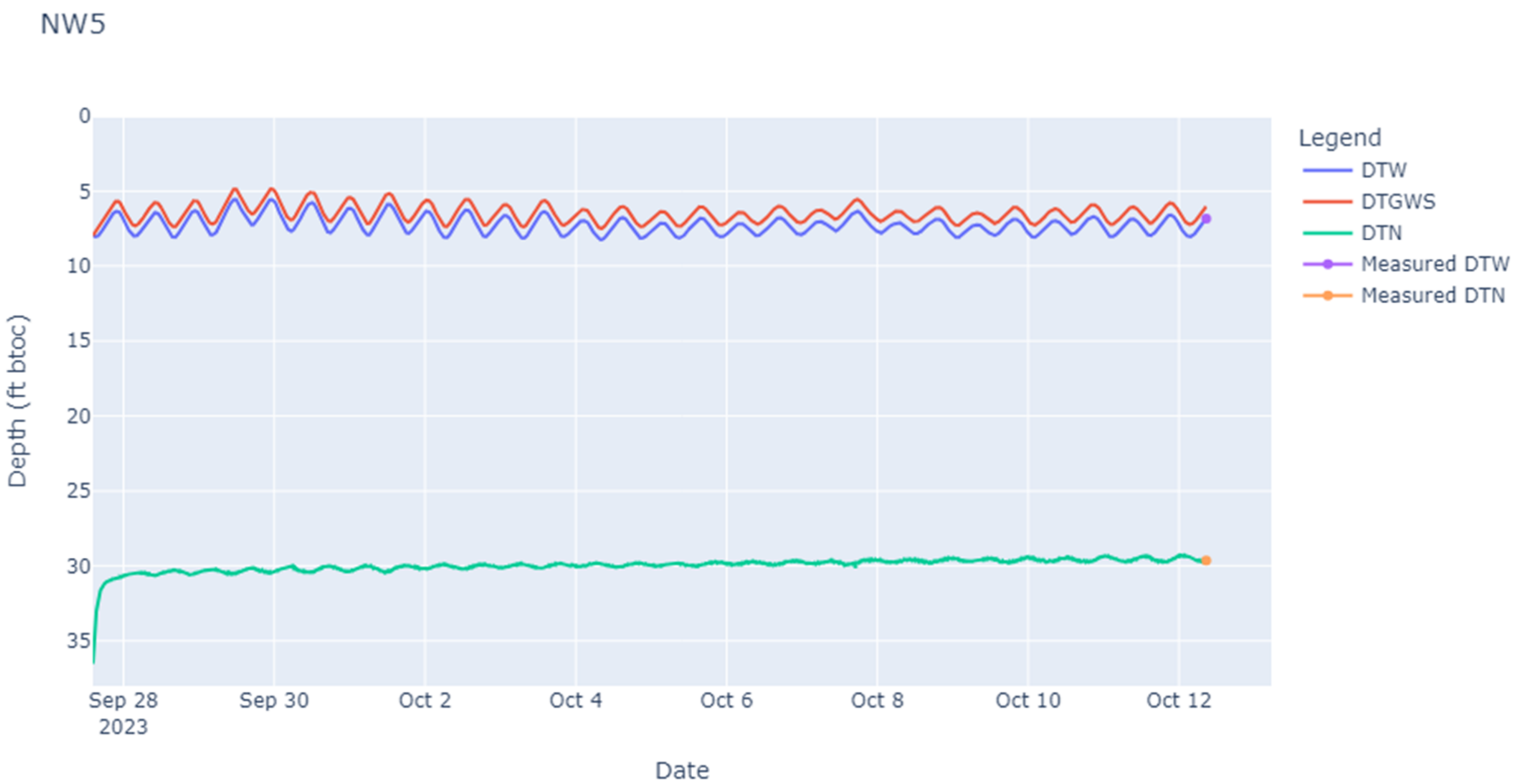
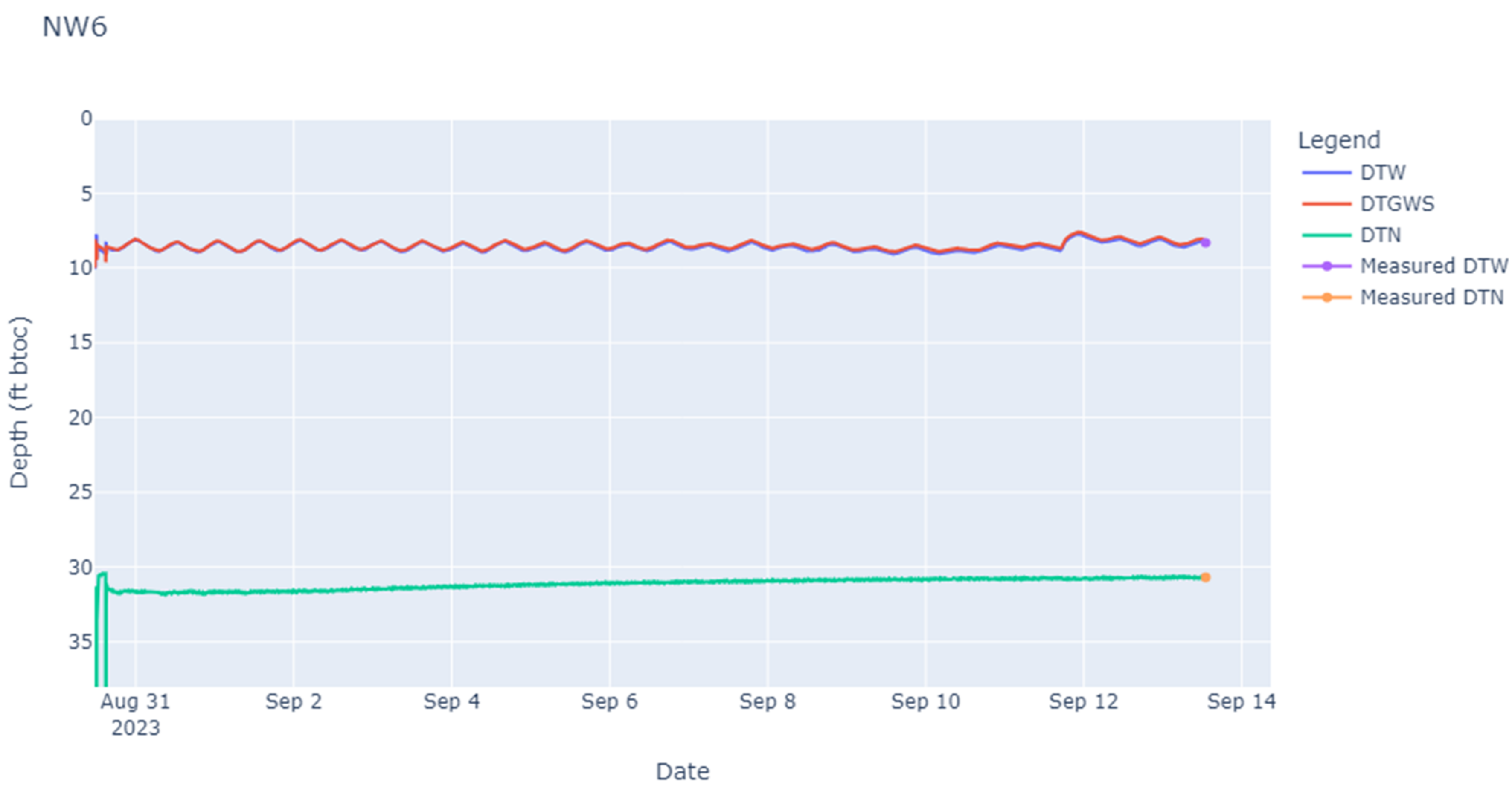


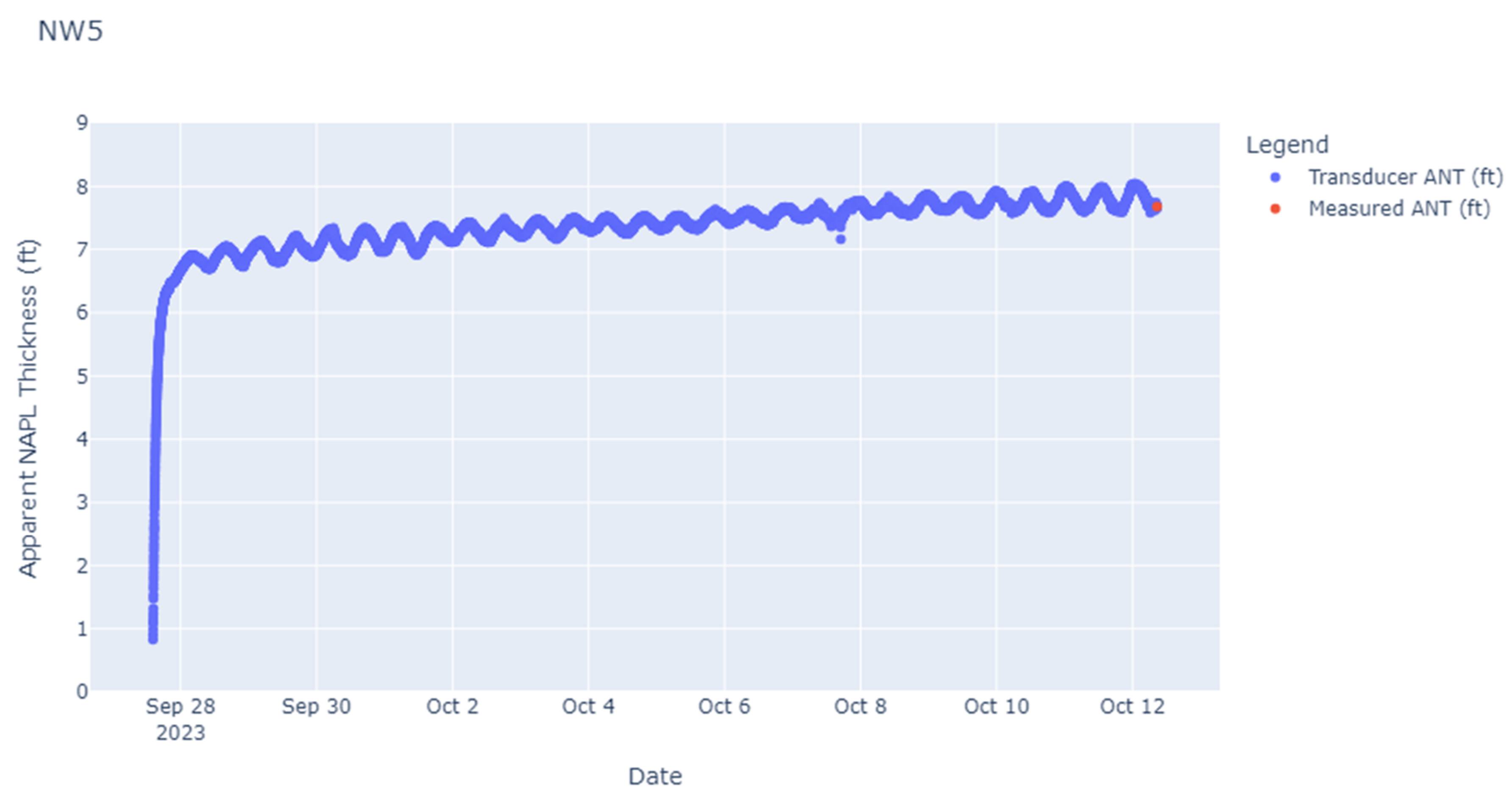
NOTES:
DTW – Depth to Water
DTN – Depth to NAPL

Well Evaluation Report Polychrome West Site (PCW) City of Yonkers, New York	GEI Consultants	**Fluid Depths Well NW-5**	
Consolidated Edison	Project 2201010	February 2024	Fig. 2



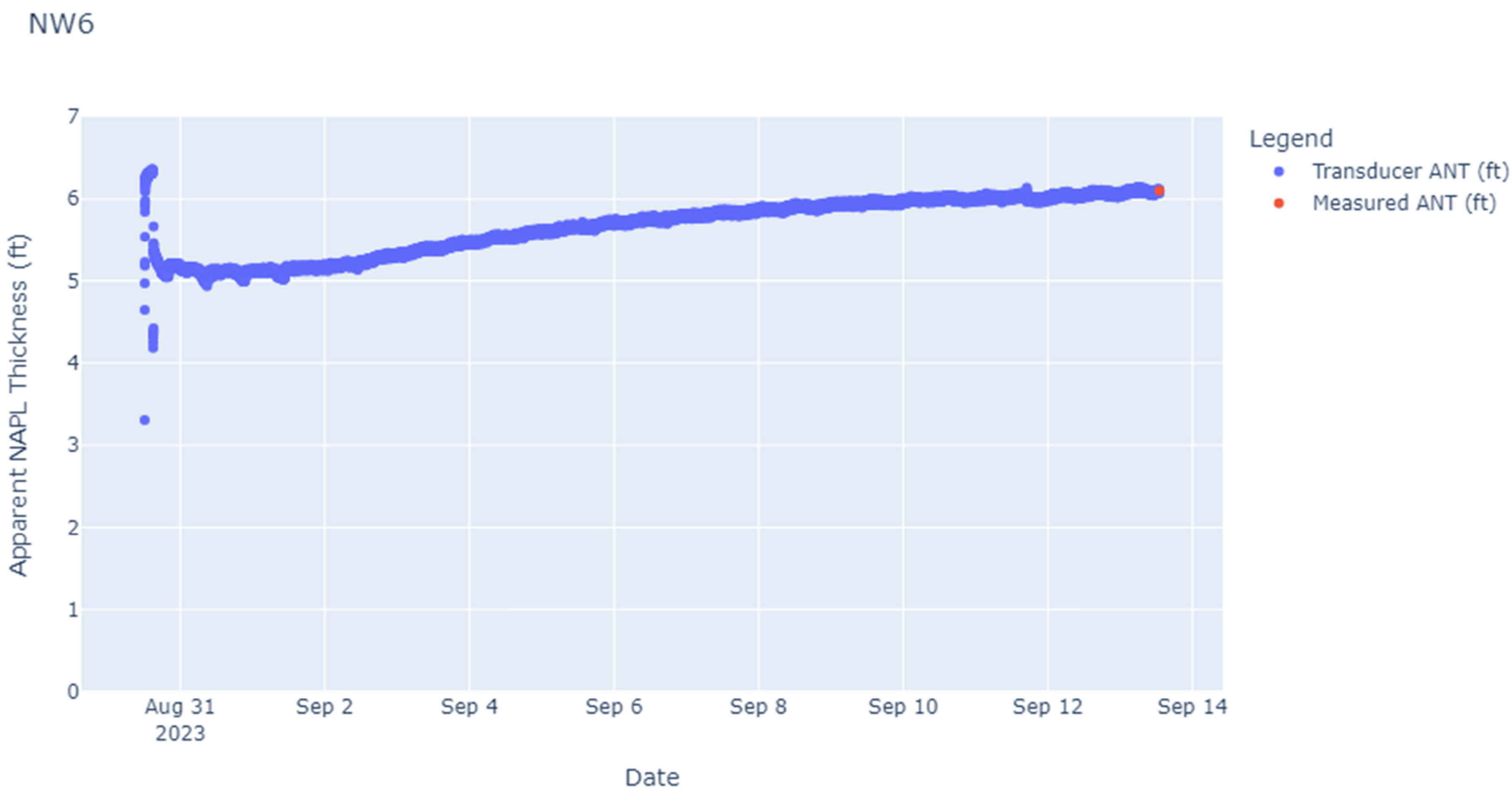
NOTES:
DTW – Depth to Water
DTN – Depth to NAPL

Well Evaluation Report Polychrome West Site (PCW) City of Yonkers, New York	GEI Consultants	**Fluid Depths** **Well NW-6**
Consolidated Edison	Project 2201010	February 2024 Fig. 3



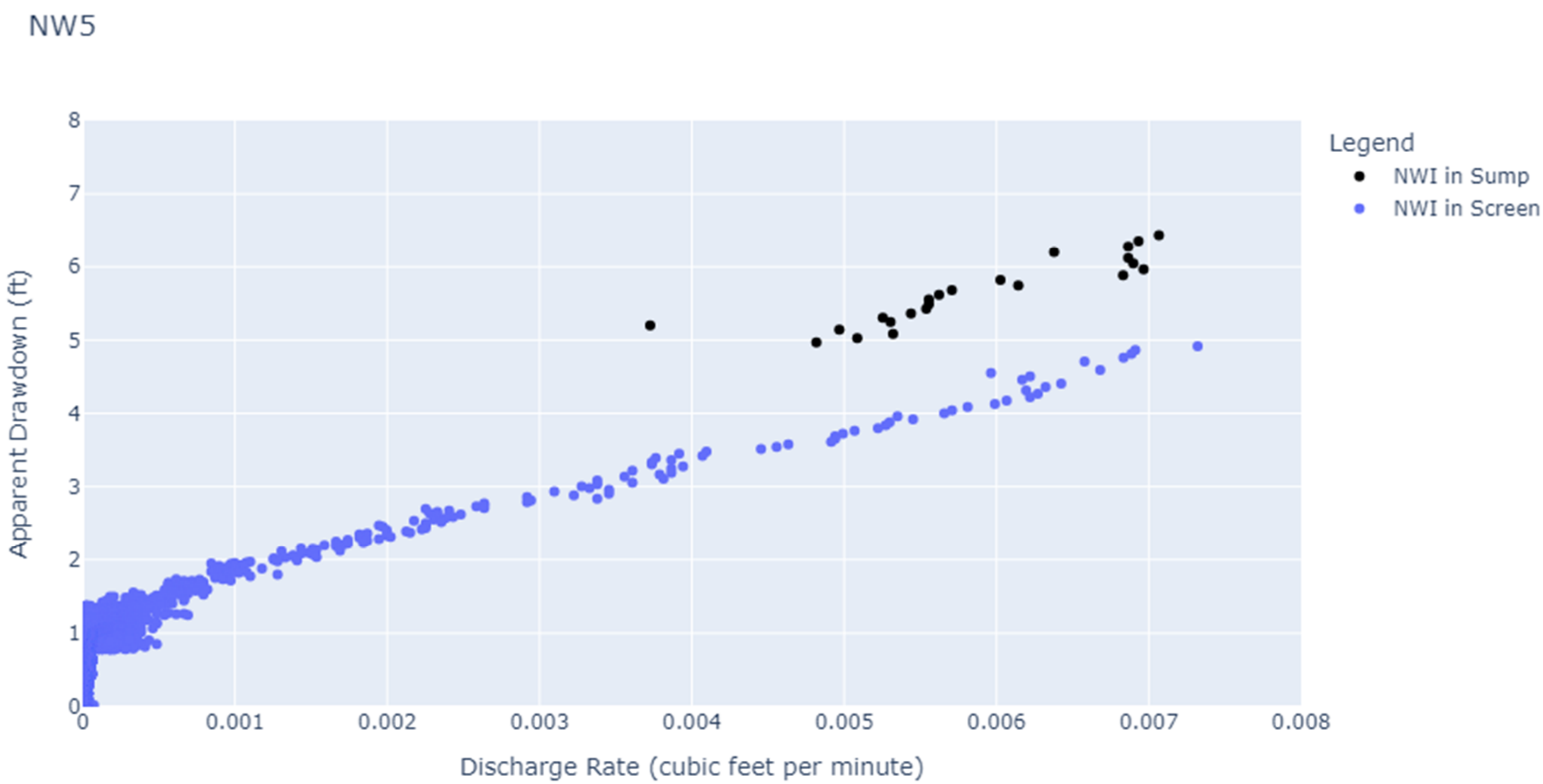
NOTES:
ANT – Apparent NAPL Thickness

Well Evaluation Report Polychrome West Site (PCW) City of Yonkers, New York	GEI Consultants	**Apparent NAPL Thickness Well NW-5**
Consolidated Edison	Project 2201010	February 2024 Fig. 4



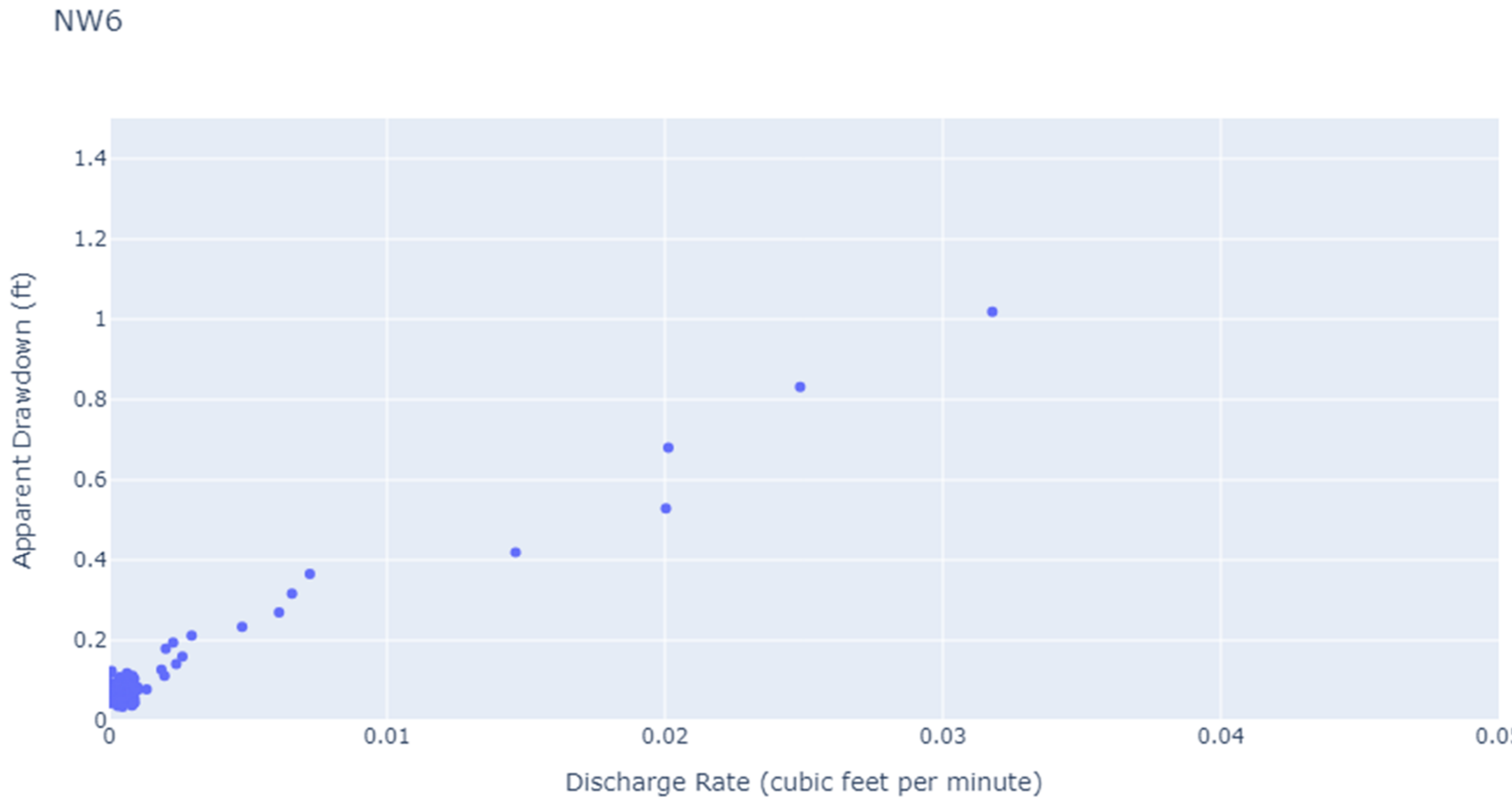
NOTES:
ANT – Apparent NAPL Thickness

Well Evaluation Report Polychrome West Site (PCW) City of Yonkers, New York	GEI Consultants	**Apparent NAPL Thickness Well NW-6**
Consolidated Edison	Project 2201010	February 2024 Fig. 5



NOTES:
NWI – NAPL-Water Interface

Well Evaluation Report Polychrome West Site (PCW) City of Yonkers, New York	GEI Consultants	**Drawdown versus Discharge Well NW-5**	
Consolidated Edison	Project 2201010	February 2024	Fig. 6



NOTES:
NWI – NAPL-Water Interface

Well Evaluation Report Polychrome West Site (PCW) City of Yonkers, New York	GEI Consultants	**Drawdown versus Discharge Well NW-6**
Consolidated Edison	Project 2201010	February 2024 Fig. 7

Appendix A

Triton Analytics Corp Laboratory Report

Triton Analytics Corp
16840 Barker Springs Rd. #302
Houston, TX 77084

(281) 578-2289

Certificate of Analysis

Job ID: TAC 12139

Submitted By: M. Felter / GEI Consultants

Date Received: 25-May-23

Date Reported: 26-May-23

	Submitted Sample: NW - 5	
Method	Test	Result
ASTM D4052	Density @ 60F, (g/cm3)	1.1185
	API Gravity @ 60 F	-5.1
	Specific Gravity @ 60F	1.1196
ASTM D7042	Dynamic Viscosity @ 55 F, m-Pa's	4765.4
	Kinematic Viscosity @ 55 F, mm2/s	4257.2
	Density @ 55 F, g/cm3	1.1194

	Submitted Sample: NW - 6	
Method	Test	Result
ASTM D4052	Density @ 60F, (g/cm3)	1.1067
	API Gravity @ 60 F	-3.8
	Specific Gravity @ 60F	1.1078
ASTM D7042	Dynamic Viscosity @ 55 F, m-Pa's	934.7
	Kinematic Viscosity @ 55F, mm2/s	843.5
	Density @ 55 F, g/cm3	1.1081

Dan C. Villalanti

Dan Villalanti, President