# FINAL POST-TERMINATION MONITORING REPORT

for

OLD BETHPAGE LANDFILL
RECOVERY WELLS RW-1 AND RW-2
(Site No. 130001)

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Prepared for:

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Submitted to:

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# 1.0 INTRODUCTION

The Town of Oyster Bay (Town) installed and formerly operated the groundwater remediation system for the Old Bethpage Landfill (Site) located at the Old Bethpage Solid Waste Disposal Complex (Figure 1). The system was installed under a Consent Order to remediate the off-site volatile organic compound (VOC) plume from the landfill. It consists of five off-site recovery wells (Recovery Wells RW-1 through RW-5) located offsite downgradient in Bethpage State Park, an on-site air stripper, two recharge basins to recharge the treated water, associated piping, and 32 landfill plume monitoring wells (Figure 2). The treated water is used seasonally for golf course irrigation in Bethpage State Park.

In addition to capturing the landfill's VOC plume, three of the system's recovery wells (Recovery Wells RW-3, RW-4 and RW-5) capture a significant portion of the off-site VOC plume from the nearby Claremont Polychemical Site. On October 1, 2016, following remediation of the off-site VOC plume from the landfill, the Town transferred ownership of the system to the New York State Department of Environmental Conservation (NYSDEC) for the continued remediation of the Claremont Polychemical Site's off-site VOC plume. The NYSDEC turned off Recovery Wells RW-1 and RW-2, and required the Town to enter post-termination monitoring for these two recovery wells as per the Consent Decree Remedial Action Plan (RAP).

Post-termination monitoring for Recovery Wells RW-1 and RW-2 entailed sampling 13 monitoring wells located in their vicinity and selected by the NYSDEC for RAP parameters and reporting, semiannually for three years. The six rounds of post-termination monitoring were performed during the period from June 2017 through August 2019, and a report was submitted for each round. The NYSDEC also required that this final report be submitted at the end of the three-year post-termination monitoring period to assess the impacts, if any, of turning off Recovery Wells RW-1 and RW-2 on groundwater quality, and ascertain if these two recovery wells can remain inactive.

The post-termination monitoring results have already been submitted to the NYSDEC in the semiannual reports, and indicate that most of the RAP parameters analyzed for were not detected. Moreover, the nature and extent of the landfill plume is well defined by 24 years of quarterly operational monitoring and RAP reports, and seven periodic review reports (PRRs). Therefore, this final report focuses on the key parameters and site-specific factors that influence the results. Specifically, this final report focuses on the VOC results because they were the reason for the landfill plume remediation. However, it also evaluates the results for the metals and leachate indicator parameters that are landfill-related and were detected at concentrations exceeding state or federal groundwater-quality standards. This final report also evaluates the influences of the monitoring well screen zones, temporal variations in recharge, the partial operation of Recovery Wells RW-1 and RW-2 during the monitoring period, and the presence of residual VOC contamination from other nearby sites on the post-termination monitoring results.

# FIGURE 1 – LOCATION OF OLD BETHPAGE LANDFILL


NORTH

## LEGEND:

- TOWN OF OYSTER BAY RECOVERY WELL (RW-1 THROUGH RW-5).
- TOWN OF OYSTER BAY MONITORING WELL OR WELL CLUSTER (AS INDICATED).
- NASSAU COUNTY RECOVERY WELL (RW-1 THROUGH RW-3, OR ORW-1 THROUGH ORW-7).
- NASSAU COUNTY INJECTION WELL (IW-1 THROUGH IW-3).
- NASSAU COUNTY MONITORING WELL OR WELL CLUSTER (AS INDICATED).
- CLAREMONT POLYCHEMICAL SITE DIFFUSION WELL (DW 00).
- CLAREMONT POLYCHEMICAL SITE MONITORING WELL OR WELL CLUSTER (AS INDICATED).
- VILLAGE OF FARMINGDALE SUPPLY WELL (WELLS 1-3, 2-2 AND 3-3).

## NOTES:

1. TOWN WELLS LOCATED BY LKB.
2. COUNTY WELLS LOCATED BY NCDPW (ON-SITE FTC MONITORING WELLS NOT SHOWN).
3. CLAREMONT WELLS LOCATED BY USEPA AS PROVIDED ON PLATE 1, CONTAMINANTS DETECTED IN GROUNDWATER AND PROPOSED MONITORING WELL LOCATIONS, EBASCO SERVICES, INC. 1/6/93.
4. AERIAL PHOTOGRAPH DATE: 2004

| REV. | DATE | REMARKS | BY |
|---|---|---|---|
| | | | |

CLIENT

DEPARTMENT OF PUBLIC WORKS
TOWN OF OYSTER BAY
NASSAU COUNTY, N.Y.

LKB CONSULTING ENGINEERS
ENGINEERING EXCELLENCE SINCE 1889

PROJECT TITLE
OLD BETHPAGE SOLID WASTE DISPOSAL COMPLEX
OLD BETHPAGE LANDFILL GROUNDWATER REMEDIATION

DRAWING TITLE
WELL LOCATION MAP

| | |
|---|---|
| DESIGN BY: | J.G. |
| DRAWN BY: | E.J.Z. |
| CHECKED BY: | J.G. |
| DATE: | DECEMBER 2019 |
| SCALE: | APPROX. 1"=400' |

PROJECT NO. 2018-1030

# 2.0 BACKGROUND INFORMATION

Sections 2.1 and 2.2 below provide more detailed information on the Site's setting and remedial history, as well as other known sources of contamination in its vicinity for readers who may not be as familiar with the Site and/or its history and surroundings.

## 2.1 Site Description and Remediation History

The Site is located in Old Bethpage, New York. It lies between Bethpage-Sweet Hollow Road to the north and Round Swamp Road to the south, Claremont Road to the west and Winding Road to the east. The Site is located at the 134-acre OBSWDC, and occupies approximately 65 acres of that area. The Town began landfilling operations at the Site in 1958. Municipal solid waste was burned in two on-site incinerators. The ash, as well as compacted and baled downtime waste, were disposed in the landfill. In 1986, landfilling and incineration activities ceased. Since then, waste has been recycled or shipped offsite for disposal.

The Site's groundwater treatment system was installed under the Final Consent Decree to remediate the off-site VOC plume from the landfill. The Town completed construction of the system in March 1992, and operated it through September 2016. Effective October 1, 2016, the Town transferred ownership of it to the NYSDEC. As noted in Section 1.0, the system consists of five off-site recovery wells (RW-1 through RW-5) which are located downgradient of the Site in Bethpage State Park, an on-site air stripper to treat recovered groundwater and a network of 32 landfill monitoring wells to monitor groundwater quality. Treated groundwater is discharged to two recharge basins (Nos. 1 and 33). The water discharged to Basin No. 33 is used seasonally for golf course irrigation at Bethpage State Park. Accordingly, this basin is mainly used during the May – October irrigation season.

## 2.2 Non-Landfill Sources of Groundwater Contamination

The Site is located in a partly commercial/industrial area, and at least three other known sources of groundwater contamination are located nearby to the south and east. As a result, groundwater in the vicinity of the Site contains a number of source-specific VOCs. Specifically, as shown on Figure 2, the Claremont Polychemical Site, which has a documented history of VOC contamination is located very near the Town's Site. It is a NYSDEC inactive hazardous waste disposal site that manufactured pigments for plastics and other materials from 1966 to 1980, and illegally discharged VOC-contaminated wastewater in on-site diffusion wells. In addition, as documented in the USEPA Site Profile, soil and groundwater contamination from leaking drums and storage tanks, primarily tetrachloroethene (PCE) and trichloroethene (TCE), have also been documented at this facility. In 2013, the building was demolished leaving the concrete floor intact and undisturbed as an institutional control. The NYSDEC is currently further investigating the downgradient groundwater quality at this site.

Adjacent to the Claremont Polychemical Site is another similar source of VOC contamination known as the Former Aluminum Louvre Corporation Site, which is comprised to two separate parcels. From 1986-1993, the common industrial chlorinated solvents PCE, TCE and 1,1,1-trichloroethane (1,1,1-TCA) were used to degrease metal parts, and solvent-contaminated waste was illegally disposed on-site resulting in releases to soil and groundwater. The on-site contamination has reportedly been addressed. However, the NYSDEC is currently planning to conduct remediation of its offsite VOC plume, which extends approximately 2,000 feet downgradient.

Additionally, as shown on Figure 2, the Nassau County Fire Service Academy (Fireman's Training Center) Site is located adjacent to, and south of, the Site. The Fireman's Training Center has been used since 1960 for firefighting training exercises conducted in open burn areas and building mock-ups. Between 1970 and 1980 waste solvents, in addition to fuel oil and gasoline, were accepted at the site for use in training. Since 1980, training has been conducted using only fuel oil and gasoline. Groundwater contamination at the Fireman's Training Center consisted of various VOCs. Additionally, a significant amount of separate-phase petroleum was remediated at this site. A VOC plume emanated from the site in a southeasterly direction along the natural flow of groundwater, principally containing benzene, cis-1,2-dichloroethene, PCE and TCE. This site also had a groundwater treatment system, but it is no longer in operation.

## 3.0 SUMMARY OF WORK PERFORMED

The six post-termination monitoring rounds were completed as detailed in Table 1 below:

Table 1. Summary of Post-Termination Monitoring Rounds Performed

| Year | Quarter | Month | Wells Sampled |
|---|---|---|---|
| 2017 | Second | June | 12 |
| | Third | September | 12 |
| 2018 | Second | June | 12 |
| | Fourth | December | 12 |
| 2019 | Second | May | 13 |
| | Third | August | 13 |

Note that during the first four post-termination monitoring rounds Well MW-6A, which is screened at the water-table, could not be sampled because it was dry as a result of the near-record low water-table elevation following a prolonged period of below-normal recharge from precipitation. Otherwise, post-termination monitoring was performed for all of the wells requested by the NYSDEC. The missing results for Well MW-6A are not a significant data gap because although this well is located downgradient of the landfill, it is too shallow to intersect the off-site landfill plume at its location.

During each post-termination monitoring round, groundwater samples were collected using a variable-speed electric submersible pump and either LDPE or HDPE tubing. The pump was lowered to approximately five feet below the water level in each well, and approximately two to three casing volumes were purged prior to sampling. Field readings of water-chemistry parameters were obtained using a calibrated multiparameter meter equipped with a flow-through cell, and a portable turbidity meter. Samples were collected at a low flow rate directly from the pump discharge in new pre-preserved sample bottles.

The pump apparatus was decontaminated between wells. QA/QC-related samples, specifically an anonymous duplicate, a field blank and daily trip blanks, were also collected. The samples were kept in coolers with ice, and hand-delivered to the Town's contract laboratory (Pace Analytical, Inc. of Melville, NY) under chain-of-custody protocol. The samples were analyzed for the same RAP parameters monitored during operation.

The objective of the post-termination monitoring was to assess the impacts of turning off Recovery Wells RW-1 and RW-2 on Site-related groundwater quality. Therefore, the results were evaluated based on the Termination Criteria in III.A of the RAP, which state that groundwater must either 1) meet applicable standards or guidance values, or 2) be remediated to the extent feasible based on a zero-slope condition, residual contamination attributable to another source, cannot be remediated further with existing technology, and will not cause future exceedances of applicable standards or guidance values beyond the current plume boundary.

Accordingly, the post-termination monitoring VOC results were first compared to applicable standards and guidance values. For wells that did not meet applicable standards or guidance values, the total VOC (TVOC) results were evaluated for a zero-slope condition. For wells that did not meet a zero-slope condition, the results were evaluated to determine if the VOCs are residual contamination attributable to other sources in the area and will not cause future exceedances of applicable standards or guidance values beyond the current plume boundary. The results for the landfill-related inorganic parameters that were detected at concentrations exceeding applicable standards or guidance values were also evaluated. The evaluation included the available results from the six post-termination monitoring rounds and the last round of operational monitoring, which was performed in August 2016. The influences of the site-specific factors discussed in Section 4.0 below were also taken into account in interpreting the post-termination monitoring results.

## 4.0 SITE-SPECIFIC FACTORS INFLUENCING THE MONITORING RESULTS

During the post-termination monitoring and reporting period four site-specific factors were identified that influence the results, specifically:

- The screen zones of the monitoring wells.
- Temporal variations in aquifer recharge.
- The partial operation of Recovery Wells RW-1 and RW-2.
- The presence of residual VOC contamination from other nearby sites.

The influence of each of these site-specific factors on the results is evaluated below.

### 4.1 Monitoring Well Screen Zones

In the vicinity of the Site, the surficial Pleistocene-age Upper Glacial Formation is typically situated above the water table. Consequently, the saturated portion of the underlying Magothy Formation, known as the Magothy Aquifer, comprises the uppermost aquifer for monitoring purposes.

The 13 post-termination monitoring wells selected by the NYSDEC are generally screened in either the water-table zone, shallow potentiometric zone, or deep potentiometric zone of the Magothy Aquifer, as detailed in Table 2 below:

Table 2. List of Post-Termination Monitoring Wells

| Well No. | Magothy Aquifer Screen Zone |
|---|---|
| MW-5B | Shallow Potentiometric |
| MW-6A | Water-Table |
| MW-6B | Shallow Potentiometric |
| MW-6C | Shallow Potentiometric |
| MW-6E | Deep Potentiometric |
| MW-6F | Below Deep Potentiometric |
| MW-8A | Water Table |
| MW-8B | Shallow Potentiometric |
| MW-9B | Shallow Potentiometric |
| MW-9C | Deep Potentiometric |
| OBS-1 | Deep Potentiometric |
| LF-1 | Shallow Potentiometric |
| LF-2 | Shallow Potentiometric |

As indicated in Table 2 above, most (10 out of 13) of the post-termination monitoring wells are screened in either the shallow or deep potentiometric zones of the Magothy Aquifer as these are the aquifer zones that intersect the main portion of the landfill plume at their

locations. Well MW-6F is screened below the deep potentiometric zone of the Magothy Aquifer, and is therefore too deep to intersect the main portion of the landfill plume at its location. Wells MW-6A and MW-8A are screened in the water-table zone of the Magothy Aquifer, and are therefore too shallow to intersect the landfill plume at their locations.

The horizontal groundwater flow direction in the vicinity of the landfill is generally from northwest to southeast, with localized radial flow occurring in the vicinity of the operating recovery wells. As shown previously in Figure 2, 11 of the 13 monitoring wells are located offsite, downgradient of the landfill in Bethpage State Park. Wells LF-1 and LF-2 are located onsite, directly downgradient of the landfill. Well LF-1 is located downgradient of the newer, partially-lined portion of the landfill, whereas Well LF-2 is located downgradient of the older, unlined portion of the landfill.

The locations and screen zones of the wells, relative to the known position of the landfill plume, were taken into account during evaluation of the post-termination monitoring results. Also, during the post-termination monitoring period, three site-specific factors that could influence the results were identified, specifically: 1) temporal variations in aquifer recharge, 2) the partial operation of Recovery Wells RW-1 and RW-2; and 3) the presence of residual VOC contamination from other nearby sites. Each of these site-specific factors is discussed below.

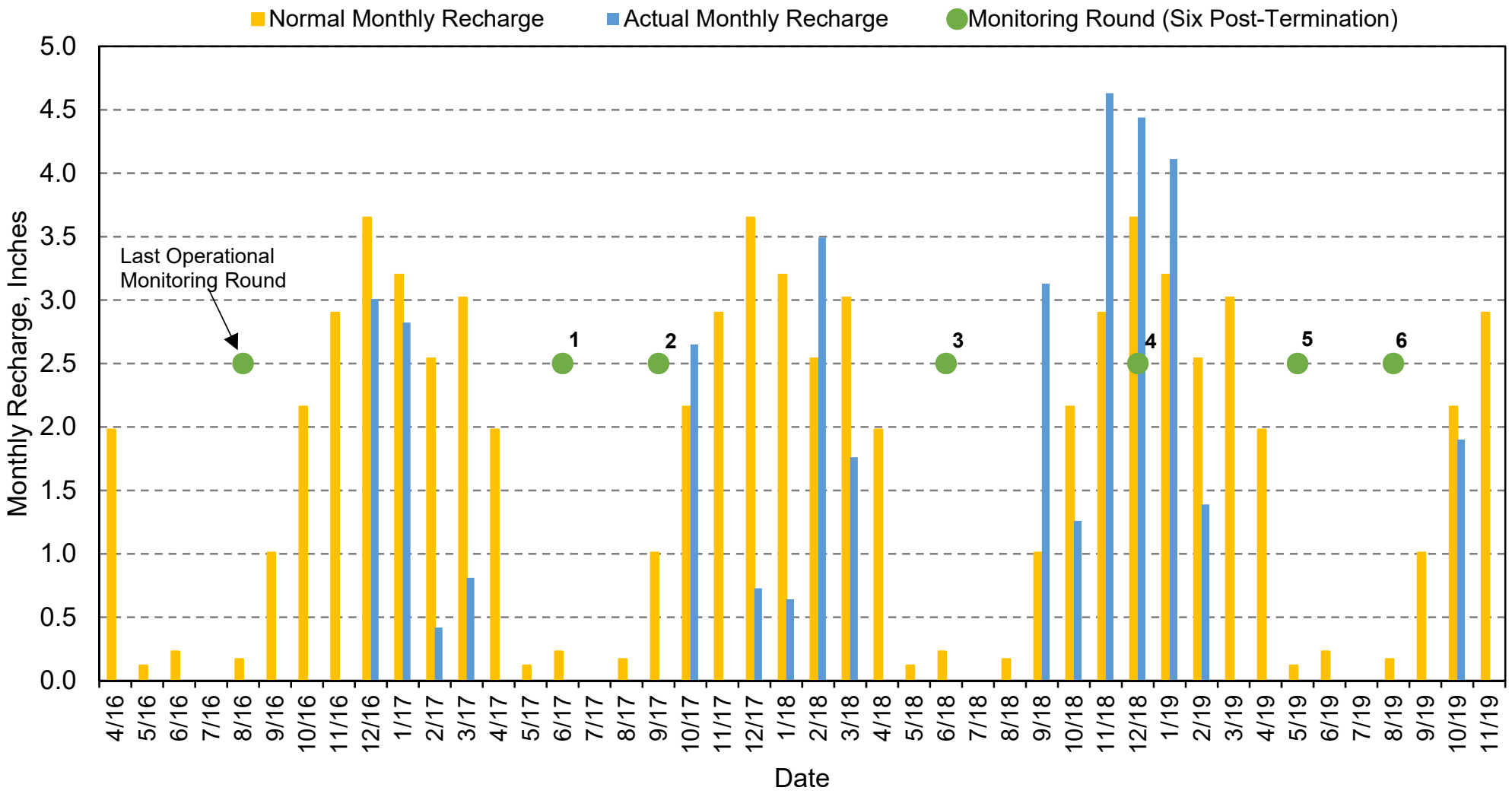
### 4.2 Temporal Variations in Aquifer Recharge

Based on available water-level data, the water-table was already at a near-record low elevation at the start of the post-termination monitoring period in 2017 following a prolonged period of below-normal recharge from precipitation. It remained at a near-record low elevation until late 2018, and then rose rapidly to a near-normal elevation by the end of the post-termination monitoring period in late 2019. Such extreme/abrupt fluctuations in the water-table elevation can noticeably influence groundwater-monitoring results, and were therefore evaluated in this final report.

The distributions of normal versus actual monthly recharge from precipitation during the post-termination monitoring period are illustrated in Figure 3 on the following page. They were calculated by subtracting the monthly evapotranspiration by turf grass (the dominant land cover in Bethpage State Park) published by Cornell University's Northeast Regional Climate Center from the normal monthly precipitation for Long Island published by the U.S. Geological Survey and the actual monthly precipitation recorded at nearby Republic Airport, respectively. The dates of the last operational monitoring round and six post-termination monitoring rounds are also shown in Figure 3. References for the data used in Figure 3 are provided in Section 7.0 of this final report.

As indicated by the orange columns in Figure 3, normal monthly recharge exhibits a regular, seasonal saw-tooth pattern, occurring mainly from September through April and peaking in December and January. During the other, growing-season, months of the year from May through August, nearly all of the precipitation is utilized by plants, resulting in

# Figure 3. Recharge During Post-Termination Monitoring Period



little or no recharge to the aquifer. As indicated by the blue columns in Figure 3, actual monthly recharge remained generally below normal through August 2018, but was then well above-normal in September 2018 and from November 2018 through January 2019.

As indicated by the green circles in Figure 3, the last operational monitoring round and first three post-termination monitoring rounds were performed during the period of below-normal recharge and near-record low water-table elevation. The fourth post-termination monitoring round was performed in December 2018, during the period of above-normal recharge but before the water table could respond to the additional recharge. The fifth and sixth post-closure monitoring rounds were performed after the late 2018 through early 2019 period of above-normal recharge, while the water-table elevation was rising due to the additional recharge. Correspondingly, it was during these two monitoring rounds that Well MW-6A was no longer dry and was able to be sampled.

### 4.3 Partial Operation of Recovery Wells RW-1 and RW-2

Recovery Wells RW-1 and RW-2 were officially turned off on October 1, 2016, marking the start of the post-termination monitoring period. However, in mid to late June 2018 they were turned back on by the NYSDEC at the request of the New York State Department of Parks, Recreation and Historic Preservation to provide additional water for golf course irrigation. Specifically, it is LKB's understanding that they operated workdays during the day shift through mid-September. The fourth post-closure monitoring round was not performed until December 2018 to give the aquifer as much time as possible to re-equilibrate beforehand. Nevertheless, the partial operation of Recovery Wells RW-1 and RW-2 could have influenced the post-termination monitoring results. For example, monitoring wells located between the landfill and the recovery wells (e.g., Well Cluster MW-6) could experience temporal increases in contaminant concentrations due to additional migration of plume water downgradient towards the recovery wells. Conversely, monitoring wells located downgradient of the recovery wells (e.g., Well OBS-1) could experience temporal decreases in contaminant concentrations due to additional migration of clean groundwater within the radius of influence upgradient towards the recovery wells.

It is also our understanding that Recovery Wells RW-1 and RW-2 were operated periodically in December 2018 and January 2019 in conjunction with a pumping test conducted by the NYSDEC. This partial operation could have influenced the results of the fourth post-termination monitoring round, conducted in December 2018. The potential influences of the pumping test operation on the monitoring results would be similar to those noted above for the irrigation water operation.

In addition to their partial operation from June through September 2018, and in December 2018 and January 2019, Recovery Wells RW-1 and RW-2 were typically operated 5 to 10 minutes per month throughout the post-termination period to exercise their submersible pumps. However, this brief monthly operation is presumed to have been too minor to noticeably influence the post-termination monitoring results.

### 4.4 Presence of VOC Contamination from Other Nearby Sites

As noted previously in Section 2.2, the presence of VOC contamination downgradient of the landfill but originating from other nearby sites is known to the NYSDEC, and has been well documented in the Town's RAP and PRR reports. The sites include: 1) the Claremont Polychemical Site, 2) the Former Aluminum Louvre Site, and 3) the Nassau County Fireman's Training Center Site.

Although these other sites have been at least partially remediated, the post-termination monitoring results indicate that residual VOC contamination from one or more of them is still present downgradient of the landfill. For example, the presence of chlorinated solvents in Well MW-8A, which is screened in the water-table zone of the Magothy Aquifer and located directly downgradient of the Claremont Polychemical Site, has historically been attributed to the off-site plume from that site. Although this well is also located downgradient of the landfill, it is too shallow to intersect the main landfill plume at its location, as evidenced by the lack of landfill-related inorganic contaminants in this well.

The Former Aluminum Louvre Site is also a source of chlorinated solvent releases to groundwater, and the Nassau County Fireman's Training Center Site was a source of both chlorinated solvent and aromatic hydrocarbon releases to groundwater. Accordingly, the presence of residual VOC contamination from these sites was taken account during evaluation of the post-termination monitoring results.

# 5.0 ASSESSMENT OF POST-TERMINATION MONITORING RESULTS

As noted previously in Section 1.0, this final report focuses on evaluating the results for VOCs because they were the reason for the landfill plume remediation. However, it also evaluates the results for the small number of metals and leachate indicator parameters that are landfill-related and were detected at concentrations exceeding the NYSDEC Class GA standards and guidance values or other applicable limits. The site-specific factors identified in Section 4.0 were also taken into account in this assessment.

## 5.1 Volatile Organic Compounds

In addition to standards and guidance values for individual VOCs, Consent Decree Table 2 specifies a 50-ug/L limit for TVOC. Accordingly, as a first step in evaluating the VOC results, the TVOC concentration results for all 13 wells are summarized in Table 3 on the following page. Based on Table 3, all TVOC concentrations are much lower than the 50-ug/L Consent Decree limit, and therefore meet this termination criterion.

Consistent with the low TVOC concentrations, most of the individual VOCs analyzed for during post-termination monitoring were not detected, and only six VOCs were detected at concentrations exceeding their NYSDEC Class GA standard. The results for these six VOCs are summarized in Table 4, which follows Table 3. As indicated in Table 4, landfill-related VOC exceedances were limited to sporadic, low-magnitude exceedances for up to aromatic hydrocarbons in Wells LF-2, MW-6B, MW-6C and MW-6E, and are not increasing in frequency and/or magnitude over time. Moreover, no exceedances for individual VOCs occurred in Well OBS-1. The sporadic, low-magnitude exceedances for two chlorinated solvent VOCs in Well MW-8A are attributed to residual VOC contamination from the Claremont Polychemical Site.

In the other seven wells, VOCs were either not detected, were only detected sporadically, at low concentrations and/or are limited to chlorinated solvents attributed to another nearby site. The specific VOC results for these seven wells are summarized below.

Well MW-5B was non-detectable for VOCs until the sixth post-termination monitoring round in August 2019, when a low (1.8-ug/L) concentration of trichloroethene (TCE) was detected, as indicated in Table 3. This low-level detection is attributed to residual contamination from the Claremont Polychemical Site and plume movement associated with the rise in the water-table elevation during 2019, and is not landfill-related.

Well MW-6A was dry during the 2017 and 2018 post-termination rounds due to the near-record low water-table elevation, but following several months of well above-normal recharge from late 2018 through early 2019 and the associated significant rise in the water-table elevation, it was able to be sampled during both 2019 post-termination monitoring rounds. The low (1.2-ug/L) concentrations of TCE detected during these two rounds, as indicated in Table 3, are attributed to residual contamination from the Claremont Polychemical Site, and are not landfill-related.

# Table 3. Summary of Post-Termination Monitoring [TVOC] Results

| Wells Sampled | Sample Month/Year and [TVOC] in ug/L | | | | | | | Remarks |
|---|---|---|---|---|---|---|---|---|
| | 8/16* | 6/17 | 9/17 | 6/18 | 12/18 | 5/19 | 8/19 | |
| LF-1 | ND | ND | ND | ND | ND | ND | ND | |
| LF-2 | NS | ND | 24.2 | 10.9 | 5.6 | 10.1 | 6.5 | Only Aromatic Hydrocarbons Detected |
| MW-5B | ND | ND | ND | ND | ND | ND | 1.8 | Only TCE Detected |
| MW-6A | Dry | Dry | Dry | Dry | Dry | 1.2 | 1.2 | Only TCE Detected |
| MW-6B | 11.2 | 6.0 | 21.6 | 15.5 | 8.8 | 12.6 | 12.2 | Only Aromatic Hydrocarbons Detected |
| MW-6C | ND | ND | ND | ND | 6.6 | 5.9 | 9.8 | Only Aromatic Hydrocarbons Detected |
| MW-6E | ND | 1.3 | 5.6 | 20.4 | 7.0 | 2.2 | 3.2 | Only Aromatic Hydrocarbons Detected |
| MW-6F | ND | ND | ND | ND | ND | ND | ND | |
| MW-8A | 4.1 | 11.1 | 14.7 | 11.8 | 3.9 | 14.1 | 21.5 | Only Chlorinated Solvents Detected |
| MW-8B | ND | ND | ND | 1.2 | ND | ND | ND | Only TCE Detected |
| MW-9B | ND | ND | ND | ND | 2.1 | 1.1 | 2.9 | Only TCE Detected |
| MW-9C | ND | ND | 1.3 | 2.8 | 2.4 | 3.2 | 2.1 | Only TCE Detected |
| OBS-1 | ND | 1.1 | 3.0 | 3.0 | 0.96 J | ND | ND | Only Aromatic Hydrocarbons Detected |

Notes:

[TVOC] = Total Volatile Ogranic Compound Concentration.
ug/L = Micrograms per Liter.
* = Last operational monitoring round.
ND = Not Detected.
NS = Not Sampled.
J = Estimated Result.

# Table 4. Summary of VOC Exceedances of NYSDEC Class GA Standards

| Sample Date | Well Number and Result in ug/L | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LF-1 | LF-2 | MW-5B | MW-6A | MW-6B | MW-6C | MW-6E | MW-6F | MW-8A | MW-8B | MW-9B | MW-9C | OBS-1 |
| Benzene Exceedances (Class GA Standard = 1 ug/L) | | | | | | | | | | | | | |
| 8/16* | -- | NS | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 6/17 | -- | -- | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 9/17 | -- | 3.4 | -- | NS | 1.9 | -- | -- | -- | -- | -- | -- | -- | -- |
| 6/18 | -- | 1.7 | -- | NS | 2.0 | -- | 3.1 | -- | -- | -- | -- | -- | -- |
| 12/18 | -- | 1.2 | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/19 | -- | 2.3 | -- | -- | 2.1 | -- | -- | -- | -- | -- | -- | -- | -- |
| 8/19 | -- | 2.8 J | -- | -- | 1.7 | 1.5 | -- | -- | -- | -- | -- | -- | -- |
| Chlorobenzene Exceedances (Class GA Standard = 5 ug/L) | | | | | | | | | | | | | |
| 8/16* | -- | NS | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 6/17 | -- | -- | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 9/17 | -- | -- | -- | NS | 7.7 | -- | -- | -- | -- | -- | -- | -- | -- |
| 6/18 | -- | -- | -- | NS | 6.0 | -- | 9.4 | -- | -- | -- | -- | -- | -- |
| 12/18 | -- | -- | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/19 | -- | -- | -- | -- | 5.4 | -- | -- | -- | -- | -- | -- | -- | -- |
| 8/19 | -- | -- | -- | -- | 5.7 | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,4-Dichlorobenzene Exceedances (Class GA Standard = 3 ug/L) | | | | | | | | | | | | | |
| 8/16* | -- | NS | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 6/17 | -- | -- | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 9/17 | -- | 3.3 | -- | NS | 3.8 | -- | -- | -- | -- | -- | -- | -- | -- |
| 6/18 | -- | -- | -- | NS | 3.2 | -- | 3.9 | -- | -- | -- | -- | -- | -- |
| 12/18 | -- | -- | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/19 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 8/19 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Isopropylbenzene Exceedances (Class GA Standard = 5 ug/L) | | | | | | | | | | | | | |
| 8/16* | -- | NS | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 6/17 | -- | -- | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 9/17 | -- | 9.7 | -- | NS | 6.0 | -- | -- | -- | -- | -- | -- | -- | -- |
| 6/18 | -- | -- | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 12/18 | -- | -- | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/19 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 8/19 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Tetrachloroethene Exceedances (Class GA Standard = 5 ug/L) | | | | | | | | | | | | | |
| 8/16* | -- | NS | -- | NS | -- | -- | -- | -- | 5.6 | -- | -- | -- | -- |
| 6/17 | -- | -- | -- | NS | -- | -- | -- | -- | 5.6 | -- | -- | -- | -- |
| 9/17 | -- | -- | -- | NS | -- | -- | -- | -- | 5.5 | -- | -- | -- | -- |
| 6/18 | -- | -- | -- | NS | -- | -- | -- | -- | 8.6 | -- | -- | -- | -- |
| 12/18 | -- | -- | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/19 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 8/19 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| cis-1,2-Dichloroethene Exceedances (Class GA Standard = 5 ug/L) | | | | | | | | | | | | | |
| 8/16* | -- | NS | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 6/17 | -- | -- | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 9/17 | -- | -- | -- | NS | -- | -- | -- | -- | 6.4 | -- | -- | -- | -- |
| 6/18 | -- | -- | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 12/18 | -- | -- | -- | NS | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 5/19 | -- | -- | -- | -- | -- | -- | -- | -- | 10.0 | -- | -- | -- | -- |
| 8/19 | -- | -- | -- | -- | -- | -- | -- | -- | 15.5 | -- | -- | -- | -- |

Notes:

ug/L = Micrograms per Liter.
* = Last operational monitoring round.
-- = Result did not exceed Class GA standard (includes non-detectable results).
J = Estimated result.
NS = Not sampled.

Well MW-6F, which is screened below the deep potentiometric zone well at the MW-6 cluster, was non-detectable for VOCs during all six post-termination monitoring rounds. The consistently non-detectable results for this well, as indicated in Table 3, confirm that the vertical extent of the landfill VOC plume does not extend below the deep potentiometric zone of the Magothy Aquifer at this location directly downgradient of the older, unlined portion of the landfill.

Well MW-8A, which is screened at the water table directly downgradient of the Claremont Polychemical Site, contained relatively low concentrations of up to three VOCs historically associated with the off-site plume from that site (TCE, tetrachloroethene (PCE) and/or 1,2-dichloroethene (1,2-DCE)) during all six post-termination monitoring rounds, as indicated in Tables 3 and 4. Overall, the total VOC concentration in this well has remained relatively stable, although it decreased during the fourth post-termination monitoring round in December 2018 and increased during the sixth post-termination monitoring round in August 2019. These two variations are attributed to recharge-related fluctuations in the water-table elevation and vertical position of the shallow off-site plume from the Claremont Polychemical Site.

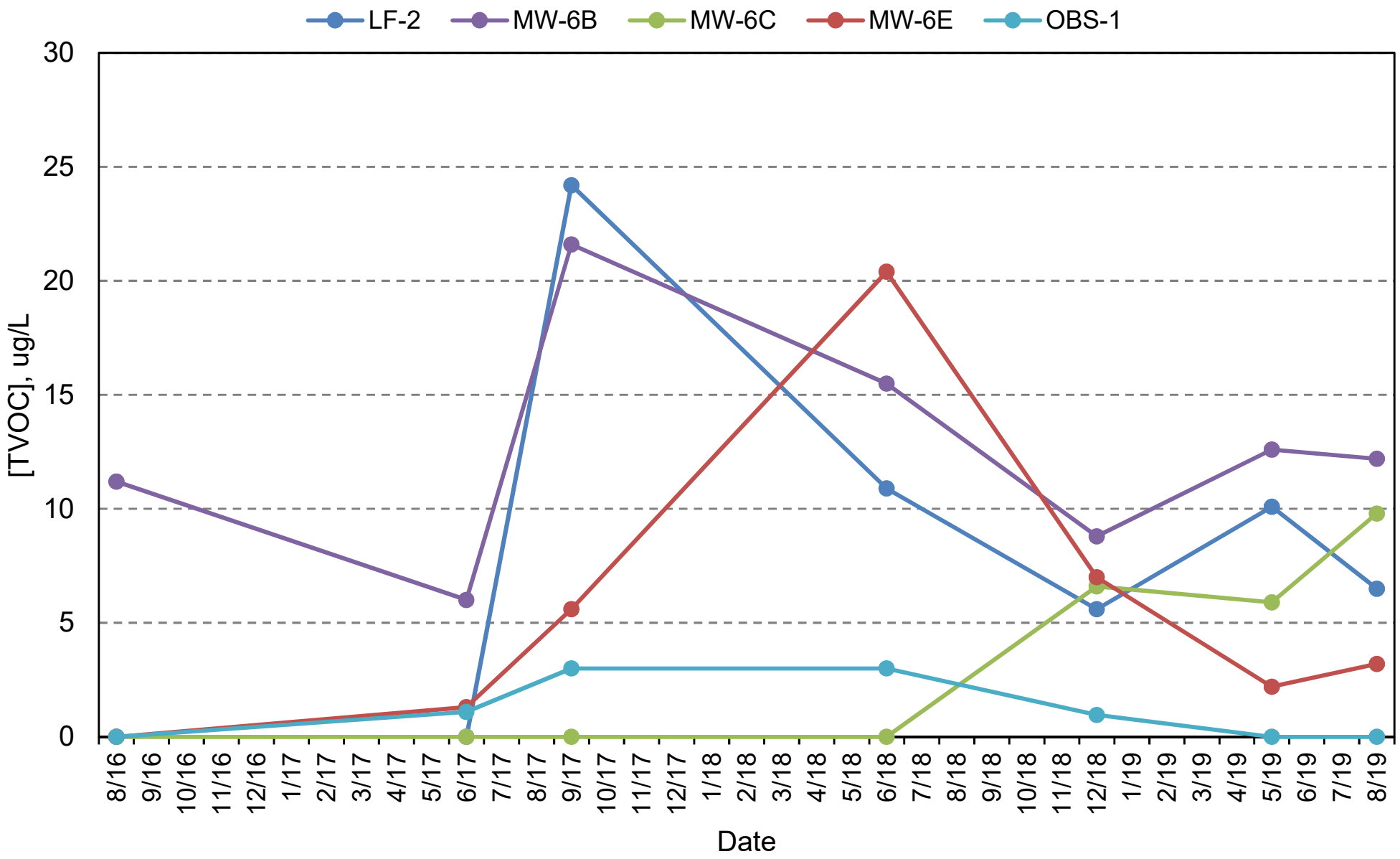
Well MW-8B, which is screened in the shallow potentiometric zone of the Magothy Aquifer, was non-detectable for VOCs during post-termination monitoring except for a low (1.2-ug/L) concentration of TCE during the third post-termination monitoring round in June 2018, as indicated in Table 3. This VOC detection is attributed to residual contamination from the Claremont Polychemical Site and the lower water table, and is not landfill-related.

Well MW-9B, which is screened in the shallow potentiometric zone of the Magothy Aquifer, was non-detectable for VOCs during the first three post-termination monitoring rounds, and contained only low (1.1-ug/L to 2.9-ug/L) concentrations of TCE during the last three post-termination monitoring rounds, as shown in Table 3. These detections are attributed to residual contamination from the Claremont Polychemical Site. Their occurrence mid-way through the post-termination monitoring period is attributed to a shift in the position of the residual VOC plume from that site caused by the partial operation of Recovery Wells RW-1 and RW-2 from mid 2018 through early 2019.

Well MW-9C, which is screened in the deep potentiometric zone of the Magothy Aquifer, was non-detectable for VOCs during the first post-termination monitoring round, and contained only low (1.3-ug/L to 3.3-ug/L) concentrations of TCE during the subsequent five post-termination monitoring rounds, as shown in Table 3. These TCE detections are attributed to residual contamination from the Claremont Polychemical Site and appear to exhibit a flat trend.

TVOC trend graphs for Wells LF-2, MW-6B, MW-6C, MW-6E and OBS-1, which are the only wells in which landfill-related VOCs were detected, are provided in Figure 4, which follows Table 4. Based on the TVOC results in Table 3 and TVOC trends in Figure 4, the concentrations of landfill-related VOCs in groundwater have not increased significantly

# Figure 4. Trends in Landfill-Related [TVOC]



since Recovery Wells RW-1 and RW-2 were turned off, and are unlikely to increase significantly in the future. Specifically, the landfill-related VOCs detected in these five wells were limited to relatively low concentrations of several aromatic hydrocarbons, and the concentrations in on-site Well LF-2 are similar to those in off-site Wells MW-6B, MW-6C and MW-6E. These four wells are located directly downgradient of the older, unlined portion of the landfill, and their VOC results indicate that it is now only a relatively minor source of VOC releases to groundwater. Moreover, VOCs were not detected in on-site Well LF-1, and landfill-related VOCs in off-site Well OBS-1 were limited to sporadic, very low concentrations of several aromatic hydrocarbons. These two wells are located downgradient of the newer, partially-lined portion of the landfill, and their VOC results indicate that it is not a significant source of VOC releases to groundwater.

TVOC concentrations in on-site Well LF-2, and off-site Wells MW-6B and MW-6E increased temporarily after Recovery Wells RW-1 and RW-2 were turned off, but now exhibit basically flat trends. Well MW-6C was non-detectable for VOCs during the first three post-termination monitoring rounds, but contained similar, low concentrations of aromatic hydrocarbons during the last three post-termination monitoring rounds. The detection of aromatic hydrocarbons in Well MW-6C midway through the post-termination monitoring period is attributed to a shift in the landfill plume caused by the partial operation of Recovery Wells RW-1 and RW-2 from mid 2018 through early 2019.

Per the Consent Decree termination criteria, for the wells in which a VOC exceedance occurred, specifically Wells LF-2, MW-6B, MW-6C, MW-6E and MW-8A, TVOC results were evaluated for a zero-slope condition. The results of this evaluation are provided in Appendix A, and indicate that TVOC concentrations in Wells MW-6B, MW-6E and MW-8A exhibit normal distributions and zero-slope conditions. TVOC concentrations in Well LF-2 do not do not meet these criteria, but this is only because of the temporary increase in TVOC concentration during the second monitoring round due to one-time exceedances for 1,4-dichlorobenzene and isopropylbenzene. As shown in Table 4, the magnitudes of the exceedances for benzene, which is the only consistently exceeding VOC detected in Well LF-2, were in fact stable during the post-termination monitoring period. Moreover, as shown in Figure 4, TVOC concentrations in Well LF-2 have exhibited an overall downward trend since the second monitoring round. TVOC concentrations in Well MW-6C also do not meet these criteria because of the detections during the second half of the monitoring period. However, as noted above, these detections are attributed to a shift in the landfill plume caused by partial operation of Recovery Wells RW-1 and RW-2 by the NYSDEC. Moreover, as shown in Table 4, the only VOC exceedance in Well MW-6C was a single, minor exceedance for benzene during the last monitoring round (1.5 ug/L vs. 1-ug/L Class GA standard). Consequently, VOC concentrations in Well MW-6C are not a concern.

In summary, landfill-related VOCs in groundwater are currently limited to similar, relatively low concentrations of several aromatic hydrocarbons in Well LF-2, which is located onsite, directly downgradient of the older, unlined portion of the landfill; and in Wells MW-6B,

MW-6C and MW-6E, which are located offsite, but still downgradient of the older, unlined portion of the landfill and are screened at depths that intersect the off-site landfill plume. Very low concentrations of landfill-related aromatic hydrocarbons were initially detected in Well OBS-1 also, but this well was non-detectable for VOCs during the last two post-termination monitoring rounds, performed in 2019.

Landfill-related VOC concentrations in groundwater easily meet the 50-ug/L TVOC limit. Exceedances for individual VOCs are limited to low-magnitude exceedances for up to four aromatic hydrocarbons in Wells LF-2, MW-6B, MW-6C and MW-6E. However, TVOC concentrations in Wells MW-6B and MW-6E show a zero-slope condition, TVOC concentrations in Well LF-2 exhibit an overall downward trend since the second monitoring round, and the detection of VOCs in Well MW-6C during the second half of the monitoring period is attributed to partial operation of Recovery Wells RW-1 and RW-2 from June 2018 through January 2019.

The VOC detections in certain other post-termination monitoring wells are attributed to residual contamination from the Claremont Polychemical Site, and are limited to relatively low concentrations of up to three chlorinated solvents historically associated with that site in Well MW-8A (TCE, PCE and 1,2-DCE), and sporadic, low concentrations of TCE in Wells MW-5B, MW-6A in 2019, MW-8B, MW-9B and MW-9C. Wells MW-6F and LF-1 were non-detectable for VOCs during the entire post-termination monitoring period.

### 5.2 Metals

As noted in the previously submitted semiannual reports, most of the metals, including the most toxic ones (e.g., chromium, copper, lead, mercury, nickel and zinc) were only detected sporadically and/or at low concentrations during post-termination monitoring. Whereas certain other metals, specifically calcium, iron, magnesium, potassium and sodium, were detected at higher concentrations that generally correlate with each well's proximity to the landfill plume. Accordingly, assessment of the post-termination monitoring metals results focused on the only three metals that are landfill-related and were detected at concentrations exceeding NYSDEC Class GA standards, specifically: iron, manganese and sodium. The total concentration results for these three metals are summarized in Table 5 on the following page. Note that one exceedance for total lead occurred in the June 2017 unfiltered sample from Well LF-2, but is attributed to sample turbidity because lead was not detected in the June 2017 filtered sample from this well, and was not detected in any of the subsequent total or filtered metals samples from this well.

Review of Table 5 indicates that, overall, the concentrations of iron, manganese and sodium in every well were stable or decreasing during the post-termination monitoring period. Exceedances of the NYSDEC Class GA standards are also highlighted by bold font in Table 5. Note that exceedances for iron were concentrated in on-site Wells LF-1 and LF-2, and off-site Wells MW-6B, MW-6C and MW-6E; and that exceedances for manganese occurred only in on-site Well LF-1, and off-site Wells MW-5B, MW-6E, MW-

## Table 5. Results for Landfill-Related Metals Exceeding NYSDEC Class GA Standards

| Sample Date | Well Number and Result in ug/L | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LF-1 | LF-2 | MW-5B | MW-6A | MW-6B | MW-6C | MW-6E | MW-6F | MW-8A | MW-8B | MW-9B | MW-9C | OBS-1 |
| Total Iron Results (Class GA Standard = 300 ug/L) | | | | | | | | | | | | | |
| 8/16* | NS | NS | 270 | NS | **9,900** | **19,000** | **7,100** | **600** | 200 | 220 | 140 | **410** | 38 |
| 6/17 | **57,400** | **1,080** | 112 | NS | **21,800** | **26,600** | **29,300** | **756** | **328** | **352** | **752** | **875** | **1,390** |
| 9/17 | **22,400** | **8,220** | <200 | NS | **12,300** | **3,970** | **21,000** | <63.2 | <64 | <19.6 | <200 | <20.5 | <53.5 |
| 6/18 | **8,360** | **6,730** | 55.9 | NS | **10,600** | **5,730** | **54,600** | **693** | 19.0 J | 56.2 | 39.6 | 93.1 | 104 |
| 12/18 | **13,000** | **6,490** | 14.5 J | NS | **10,300** | **3,140** | **27,600** | **500** | <100 | 23.1 J | <100 | 21.0 J | 74.6 J |
| 5/19 | **9,520** | **7,280** | <24.5 | <29.4 | **10,800** | **6,700** | **16,200** | 137 | <48.6 | <32.6 | <38.2 | <35.7 | <65.5 |
| 8/19 | **11,000** | **7,400** | <100 | <151 | **10,500** | **3,490** | **17,800** | <100 | <100 | <100 | <100 | <100 | <100 |
| Total Manganese Results (Class GA Standard = 300 ug/L) | | | | | | | | | | | | | |
| 8/16* | NS | NS | **11,000** | NS | 50 | 67 | **510** | 110 | 130 | **1,300** | **2,500** | 110 | **2,000** |
| 6/17 | **11,200** | 120 J | **5,760 J** | NS | 153 J | 134 J | **665 J** | 141 J | 162 | **647** | **2,510 J** | 77.8 J | **3,190 J** |
| 9/17 | **4,340** | 193 | **5,030** | NS | 68.5 | 93.4 | **706** | 116 | 143 | **1,110** | **3,380** | 187 | **2,780** |
| 6/18 | **1,600** | 157 | **3,620** | NS | 45.1 | 78.4 | **545** | 105 | 159 | **331** | **2,520** | 144 | **2,350** |
| 12/18 | **2,590** | 138 | **3,860** | NS | 50.0 | 55.4 | **445** | 118 | 65.1 | **1,150** | **2,430** | 174 | **2,550** |
| 5/19 | **1,930** | 162 | **3,690** | 21.4 | 53.3 | 131 | **479** | 119 | 75.1 | **1,120** | **2,630** | 156 | **2,430** |
| 8/19 | **2,120** | 157 | **3,410** | 22.8 | 46.6 | 51.7 | **438** | 122 | 82.8 | **1,050** | **3,340** | 181 | **2,620** |
| Total Sodium Results (Class GA Standard = 20,000 ug/L) | | | | | | | | | | | | | |
| 8/16* | NS | NS | **83,000** | NS | **260,000** | **220,000** | **140,000** | **110,000** | **48,000** | **160,000** | **67,000** | **46,000** | **61,000** |
| 6/17 | **61,100** | **450,000** | **64,000** | NS | **250,000** | **203,000** | **184,000** | **111,000** | **29,900** | **125,000** | **63,400** | 12,900 | **68,400** |
| 9/17 | **83,400** | **536,000** | **60,700** | NS | **258,000** | **179,000** | **183,000** | **132,000** | **35,800** | **151,000** | **57,700** | **63,700** | **72,300** |
| 6/18 | **61,900** | **400,000** | **57,600** | NS | **205,000** | **163,000** | **198,000** | **96,300** | 11,900 | **107,000** | **51,500** | **45,000** | **50,700** |
| 12/18 | **66,100** | **450,000** | **63,600** | NS | **250,000** | **243,000** | **203,000** | **121,000** | 10,800 | **160,000** | **59,000** | **65,000** | **69,100** |
| 5/19 | **59,700** | **420,000** | **62,900** | 17,600 | **217,000** | **429,000** | **168,000** | **127,000** | **41,700** | **150,000** | **52,700** | **65,100** | **62,100** |
| 8/19 | **53,900** | **424,000** | **61,000** | 12,500 | **201,000** | **233,000** | **163,000** | **125,000** | **33,800** | **148,000** | **54,100** | **62,600** | **58,000** |

Notes:

ug/L = Micrograms per Liter.
* = Last operational monitoring round.
Bold Font = Result exceeded Class GA standard.
J = Estimated result.
NS = Not sampled.

8B, MW-9B and OBS-1. Exceedances for sodium were more widespread and occurred in every well except Well MW-6A, which, as stated previously, was dry during the first four post-termination monitoring rounds and is too shallow to intercept the landfill plume at its location. The highest-magnitude sodium exceedances occurred in on-site Well LF-2, and off-site Wells MW-6B, MW-6C, MW-6E, MW-6F and MW-8B, all of which are located downgradient of the older, unlined portion of the landfill. As expected, sodium concentrations in wells located downgradient of the newer, partially-lined portion of the landfill (e.g., Wells LF-1 and OBS-1) are considerably lower.

The magnitudes of the iron and manganese exceedances in the on-site well(s) were similar to, or lower than, those in the downgradient wells. Therefore, the magnitudes of the exceedances for these two metals in groundwater downgradient of the landfill are not expected to increase in the future. The magnitudes of the sodium exceedances in on-site Well LF-2 are approximately twice as high as those in the off-site wells, however due to diffusion and the fact that the entire landfill was capped in the 1990s, the magnitudes of the sodium exceedances on the off-site wells are also not expected to increase significantly in the future. Moreover, it should be noted that the NYSDEC Class GA standards for iron and manganese are aesthetics-based rather than health-based, and that sodium is not considered to be particularly hazardous. Therefore, the continued presence of these three metals in downgradient groundwater is not a significant threat to public health.

### 5.3 Leachate Indicator Parameters

The occurrence and distribution of leachate indicator parameter concentrations in groundwater was discussed in detail in the semiannual reports, and generally indicate a direct correlation with each well's proximity to the landfill plume. Therefore, this final report focuses on the only three leachate indicator parameters that were detected at concentrations exceeding their NYSDEC Class GA standard during post-termination monitoring, specifically: ammonia, chloride and phenols. The results for total dissolved solids (TDS) are also evaluated because although there it has no NYSDEC Class GA standard or guidance value, TDS concentrations in certain wells during post-termination monitoring exceeded the federal Secondary Maximum Contaminant Level (SMCL).

The results for these four leachate indicator parameters are summarized in Table 6 on the following page. As indicated in Table 6, with the possible exceptions of ammonia in on-site Well LF-1, and ammonia and TDS in off-site Well MW-6C, concentrations appear to be stable or decreasing in all 13 post-termination monitoring wells. Well MW-6C is bracketed above and below by Wells MW-6B and MW-6E, respectively, which do not show increasing trends for ammonia and TDS. Therefore, the possible increasing trends for ammonia and TDS in Well MW-6C are attributed to the partial operation of Recovery Wells RW-1 and RW-2 during the period from June 2018 through January 2019.

Table 6. Results for Landfill-Related Leachate Indicators Exceeding NYSDEC Class GA Standards

| Sample Date | Well Number and Result in mg/L | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | LF-1 | LF-2 | MW-5B | MW-6A | MW-6B | MW-6C | MW-6E | MW-6F | MW-8A | MW-8B | MW-9B | MW-9C | OBS-1 |
| Ammonia Results (Class GA Standard = 2 mg/L) | | | | | | | | | | | | | |
| 8/16* | 0.43 | NS | 0.15 | NS | **178** | **66.2** | **34.5** | 0.3 | 0.16 | 0.29 | 0.7 | **3.3** | **17.7** |
| 6/17 | <0.026 | 0.68 J | <0.03 | NS | **116** | **16.2** | **31.9** | 0.42 | <0.021 | 0.43 | <0.19 | 0.59 J | **8.4 J** |
| 9/17 | 0.83 | **192** | <0.22 | NS | **137 J** | **18.4** | **44.5** | <0.14 | <0.018 | 0.68 J | <0.23 | 1.3 | **20.4** |
| 6/18 | 0.87 | **117** | 0.16 | NS | **97.1** | **18.0** | **101** | 0.49 | 0.25 | 0.069 J | 0.64 | **2.1** | **7.8** |
| 12/18 | **10.0** | **12.3** | 0.024 | NS | **117** | **97.3** | **6.6** | 0.2 | 0.14 | 0.17 | 0.42 | **3.7** | **40.4** |
| 5/19 | **11.7** | **145** | <0.10 | 1.1 | **96.5** | **66.5** | **36.0** | **3.3** | 0.72 | <0.32 | 1.7 | **2.2** | **19.7** |
| 8/19 | **11.9** | **147** | <0.1 | 0.55 | **119** | **111** | **33.4** | <0.16 | <0.1 | <0.1 | 0.45 | 1.4 | **16.9** |
| Chloride Results (Class GA Standard = 250 mg/L) | | | | | | | | | | | | | |
| 8/16* | 155 | NS | 188 | NS | **321** | **254** | **308** | **277** | 92.7 | **355** | 100 | 68.3 | 94.6 |
| 6/17 | 75.8 | **488** | 97.2 | NS | **306** | 206 | **346** | 248 | 65.4 | 249 | 88.7 | 39 | 96.3 |
| 9/17 | 138 | **633** | 125 | NS | **344** | 238 | **380** | **388** | 81.1 | **360** | 117 | 126 | 123 |
| 6/18 | 78.2 | **476** | 126 | NS | 241 | 214 | 248 | **295** | 38.0 | 232 | 115 | 96.5 | 103 |
| 12/18 | 118 | **461** | 137 | NS | **296** | **288** | **404** | **376** | 37.6 | 130 | 126 | 128 | 124 |
| 5/19 | 76.2 | **383** | 94.8 | 20.5 | 231 | 228 | **325** | **374** | 47.4 | **294** | 76.9 | 102 | 77.3 |
| 8/19 | 59.1 | **403** | 89.7 | 18.5 | 225 | **291** | **339** | **315** | 58.6 | **280** | 88.8 | 92.8 | 82.4 |
| Total Phenols Results (Class GA Standard = 0.001 mg/L) | | | | | | | | | | | | | |
| 8/16* | <0.005 | NS | **0.0062** | NS | **0.0148** | **0.0315** | **0.0114** | <0.005 | **0.0076** | <0.005 | <0.005 | **0.0051** | **0.0117** |
| 6/17 | <0.0011 | <0.0021 | <0.0016 | NS | <0.017 | <0.0135 | <0.0049 | <0.0034 | <0.0011 | <0.0029 | <0.0025 | <0.003 | <0.0094 |
| 9/17 | <0.0038 | **0.0318** | <0.005 | NS | **0.0405** | **0.0146** | <0.0065 | <0.0016 | <0.0011 | <0.0034 | <0.005 | <0.0016 | <0.0087 |
| 6/18 | <0.005 | **0.0372** | **0.0033 J** | NS | **0.0392** | **0.0141** | **0.0305** | **0.0018 J** | <0.005 | <0.005 | <0.005 | **0.0048 J** | **0.0059** |
| 12/18 | **0.0079** | **0.0213** | **0.0018 J** | NS | **0.0295** | **0.0346** | **0.0161** | <0.005 | <0.005 | <0.005 | <0.005 | **0.0048 J** | **0.0069** |
| 5/19 | <0.010 | <0.010 | <0.010 | **0.011** | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 | <0.010 |
| 8/19 | <0.005 | <0.005 | <0.005 | **0.0167** | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 | <0.005 |
| Total Dissolved Solids Results (Federal SMCL = 500 mg/L) | | | | | | | | | | | | | |
| 8/16* | 405 | NS | 401 | NS | **914** | **690** | **599** | **594** | 252 | **655** | 216 | 142 | 286 |
| 6/17 | 325 | **1,420** | 264 | NS | **1,040** | **670** | **680** | **544** | 159 | **508** | 228 | 72 | 279 |
| 9/17 | 348 | **1,900** | 241 | NS | **882** | **608** | **682** | **628** | 178 | **560** | 213 | 210 | 323 |
| 6/18 | 307 | **1,590** | 231 | NS | **862** | **595** | **856** | 397 | 94 | 409 | 269 | 236 | 337 |
| 12/18 | 282 | **1,540** | 267 | NS | **848** | **812** | **732** | **568** | 73 | **538** | 240 | 240 | 312 |
| 5/19 | 400 J | **1,690 J** | 362 J | 224 J | **996 J** | **896 J** | **1,100 J** | **666 J** | 179 J | **718 J** | 308 J | 310 J | 498 J |
| 8/19 | 250 | **1,600** | 232 | 62.0 J | **786 J** | **910 J** | **678 J** | **614 J** | 160 | **520** | 206 | 240 | 292 |

Notes:

mg/L = Milligrams per Liter.
* = Last operational monitoring round.
Bold Font = Result exceeded Class GA standard or Federal SMCL.
J = Estimated result.
NS = Not sampled.

Exceedances of the NYSDEC Class GA standards for ammonia, chloride and phenols, and the federal SMCL for TDS, are indicated by bold-face type in Table 6. Review of the patterns of these exceedances indicates that exceedances for ammonia are concentrated in on-site Well LF-2, and off-site Wells MW-6B, MW-6C and MW-6E, and that lower-magnitude ammonia exceedances are present in on-site Well LF-1 and off-site Well OBS-1. Exceedances for chloride are fewer in number and concentrated in on-site Well LF-2 and off-site Wells MW-6E and MW-6F, with more sporadic, lower-magnitude chloride exceedances in off-site Wells MW-6B, MW-6C and MW-8B. Exceedances for phenols were concentrated in on-site Well LF-2, and in off-site Wells MW-6B, MW-6C and MW-6E, with sporadic, lower-magnitude phenols exceedances in on-site Well LF-1 and off-site Wells MW-5B, MW-6A, MW-6F, MW-9C and OBS-1. No exceedances for phenols occurred during the first round of post-termination monitoring in June 2017. During the last two post-termination monitoring rounds in 2019 exceedances for phenols occurred only in off-site Well MW-6A, which is too shallow to intercept the off-site landfill plume at its location. Based on the distribution of phenol exceedances, the sporadic, lower-magnitude ones are not landfill-related. Exceedances for TDS occurred only in on-site Well LF-2 and off-site Wells MW-6B, MW-6C, MW-6E, MW-6F and MW-8B.

Based on the occurrence and distribution of ammonia, chloride, phenols and TDS in groundwater, landfill-related impacts for leachate parameters are concentrated in on-site Well LF-2, and off-site Wells MW-6B, MW-6C and MW-6E, which are located downgradient of the older, unlined portion of the landfill, and lesser impacts are present in off-site Wells MW-6F, MW-8B and OBS-1. As noted previously in Section 3.0 (Site-Specific Factors Influencing the Monitoring Results) Well MW-6F is screened below the deep potentiometric zone of the Magothy Aquifer, and is therefore too deep to intercept the main portion of the off-site landfill plume at its location. The exceedances for certain leachate indicator parameters in this well (mainly chloride and TDS) are therefore attributed to the greater density of the landfill plume relative to the aquifer groundwater due to the presence of these dissolved constituents in the plume.

## 6.0 CONCLUSIONS AND RECOMMENDATIONS

The overall conclusion of this final report is that based on results of the post-termination monitoring, leaving Recovery Wells RW-1 and RW-2 turned off will not result in significant changes in landfill-related groundwater quality. The specific findings supporting this overall conclusion are summarized below:

1. Groundwater TVOC concentrations were much lower than 50-ug/L Consent Decree limit in all 13 wells monitored during all six post-closure monitoring period, and are not increasing over time.

2. Landfill-related VOCs in groundwater are limited to low concentrations of several aromatic hydrocarbons in five wells located downgradient of the older, unlined portion of the landfill, specifically on-site Well LF-2 and off-site Wells MW-6B, MW-6C, MW-6E and OBS-1. VOC detections in certain other wells are attributed to residual contamination from other sites in the vicinity.

3. Although four aromatic hydrocarbons were detected in Wells LF-2, MW-6B, MW-6C and MW-6E at concentrations exceeding NYSDEC Class GA standards, these exceedances were sporadic and low in magnitude, and are not increasing in frequency and/or magnitude over time. No VOC exceedances occurred in Well OBS-1, and this well was non-detectable for VOCs in 2019.

4. TVOC concentrations in on-site Well LF-2 are similar to those in off-site Wells MW-6B, MW-6C and MW-6E, indicating that the older, unlined portion of the landfill is now only a relatively minor source of VOC releases to groundwater, and that the concentrations of landfill-related VOCs in groundwater are unlikely to increase significantly in the future. This is supported by the fact that TVOC concentrations in Wells MW-6B and MW-6E show a zero-slope condition.

5. The consistently non-detectable TVOC results for on-site Well LF-1 during the post-termination monitoring period indicate that the newer, partially-lined portion of the landfill is now not a source of VOC releases to groundwater.

6. With respect to landfill-related metals concentrations in groundwater, only three metals, specifically: iron, manganese and sodium, were detected at total concentrations exceeding NYSDEC Class GA standards. The exceedances are mainly concentrated in certain wells downgradient of the older, unlined portion of the landfill, and do not appear to be increasing in frequency and/or magnitude. Moreover, since the Class GA standards for iron and manganese are aesthetics-based and sodium is not particularly hazardous, the presence of these metals in groundwater is not a significant concern for public health.

7. With respect to landfill-related leachate indicator parameter concentrations in groundwater, only three parameters, specifically: ammonia, chloride and phenols, were detected at concentrations exceeding NYSDEC Class GA standards. One

other parameter, TDS, does not have a State limit but was detected at concentrations exceeding the federal SMCL. These exceedances were also mainly concentrated in certain wells downgradient of the older, unlined portion of the landfill, and except for ammonia and TDS in Well MW-6C, also do not appear to be increasing in frequency and/or magnitude. The results for Well MW-6C are believed to have been influenced by the partial operation of Recovery Wells RW-1 and RW-2 by the NYSDEC during the post-termination monitoring period.

Based on the above overall conclusion and summary of supporting findings, it is recommended that Recovery Wells RW-1 and RW-2 remain turned off, and that no further post-termination monitoring for them be performed.

## 7.0 REFERENCES FOR FIGURE 3 DATA

Source of monthly potential evapotranspiration (PET) rates for turf grass:

Potential Evapotranspiration for Selected Locations. New York (LaGuardia), NY Station Averages for 1981-2010. Northeast Regional Climate Center, 1123 Bradfield Hall, Cornell University, Ithaca, NY 14853. Web: http://www.nrcc.cornell.edu/wxstation/pet/pet.html

Source of normal monthly precipitation values:

Figure 18. Monthly Climate Normals for Precipitation and Temperature (1981-2010) Near Islip Area, NY. United States Geological Survey, New York Water Science Center, Long Island Precipitation. Web: https://www.usgs.gov/centers/ny-water/science/long-island-precipitation?qt-science_center_objects=0#qt-science_center_objects

Source of actual monthly precipitation values:

Weather Underground, Farmingdale, NY Weather History. Republic Airport Station. Web: https://www.wunderground.com/history/monthly/us/ny/farmingdale/KFRG

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Source of normal monthly precipitation values:

Figure 18. Monthly Climate Normals for Precipitation and Temperature (1981-2010) Near Islip Area, NY. United States Geological Survey, New York Water Science Center, Long Island Precipitation. Web: https://www.usgs.gov/centers/ny-water/science/long-island-precipitation?qt-science_center_objects=0#qt-science_center_objects

Source of actual monthly precipitation values:

Weather Underground, Farmingdale, NY Weather History. Republic Airport Station. Web: https://www.wunderground.com/history/monthly/us/ny/farmingdale/KFRG

# APPENDIX A
# Tabular Summary of Data Analysis
## (Prepared by D&B)

| Well ID | No. of Sampling Events | Exceedances of Groundwater Cleanup Objectives in Last 3 Years of Sampling | | | | Normally Distributed Data [1] | Zero-Slope Condition [2] | Observations |
|---|---|---|---|---|---|---|---|---|
| | | Contaminant ID | Concentration Range | RAP Table 2 - Termination Criteria | NYSDEC Class GA Standard or Guidance Values | | | |
| ***RAP Termination Monitoring Wells*** | | | | | | | | |
| **LF-1** | 6 | Iron (ug/l) | 8360 - 57400 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | No VOCs were detected above RAP SGV cleanup objectives and/or NYSDEC Class GA Standard or Guidance Values. |
| | | Manganese (ug/l) | 1600 - 11200 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | |
| | | Sodium (ug/l) | 53900 - 83400 (ug/l) | NS | 20000 (ug/l) | -- | -- | |
| | | Nitrogen, Ammonia (mg/l) | 10 - 11.9 (mg/l) | NS | 2 (mg/l) | -- | -- | |
| | | Phenolics, Total (mg/l) | BDL - 0.0079 (mg/l) | 0.001 (mg/l) | 0.001 (mg/l) | -- | -- | |
| **LF-2** | 6 | 1,4-Dichlorobenzene (ug/l) | BDL - 3.3 (ug/l) | 4.7 (ug/l) | 3 (ug/l) | No, $R^2$ = 89% | Yes, slope = -1.6 ug/l/per year | 1,4-dichlorobenzene, benzene and isopropylbenzene were detected slightly above their respective RAP SGV cleanup objectives and/or NYSDEC Class GA Standard or Guidance Values. |
| | | Benzene (ug/l) | BDL - 3.4 (ug/l) | Non-Detect | 1 (ug/l) | | | |
| | | Isopropylbenzene (ug/l) | BDL - 9.7 (ug/l) | NS | 5 (ug/l) | | | |
| | | Iron (ug/l) | 1080 - 8220 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | |
| | | Lead (ug/l) | BDL - 370 (ug/l) | 25 (ug/l) | 25 (ug/l) | -- | -- | |
| | | Sodium (ug/l) | 40000 - 536000 (ug/l) | NS | 20000 (ug/l) | -- | -- | |
| | | Chloride (mg/l) | 383 - 633 (mg/l) | 250 (mg/l) | 250 (mg/l) | -- | -- | |
| | | Nitrogen, Ammonia (mg/l) | 0.68 - 192 (mg/l) | NS | 2 (mg/l) | -- | -- | |
| | | Phenolics, Total (mg/l) | BDL - 0.0372 (mg/l) | 0.001 (mg/l) | 0.001 (mg/l) | -- | -- | |
| | | Total Dissolved Solids (mg/l) | 1420 - 1900 (mg/l) | 500 (mg/l) | NS | -- | -- | |
| **MW-5B** | 6 | Manganese (ug/l) | 3410 - 5760 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | No VOCs were detected above RAP SGV cleanup objectives and/or NYSDEC Class GA Standard or Guidance Values. |
| | | Sodium (ug/l) | 57600 - 64000 (ug/l) | NS | 20000 (ug/l) | -- | -- | |
| | | Phenolics, Total (mg/l) | BDL - 3.3 (mg/l) | 0.001 (mg/l) | 0.001 (mg/l) | -- | -- | |
| **MW-6A** | 2 | Phenolics, Total (mg/l) | 11 - 16.7 (mg/l) | 0.001 (mg/l) | 0.001 (mg/l) | -- | -- | No VOCs were detected above RAP SGV cleanup objectives and/or NYSDEC Class GA Standard or Guidance Values. |
| **MW-6B** | 6 | 1,4-Dichlorobenzene (ug/l) | 1.1 - 3.8 (ug/l) | 4.7 (ug/l) | 3 (ug/l) | Yes, $R^2$= 92% | Yes, slope = -0.6 ug/l/per year | 1,4-dichlorobenzene, benzene, chlorobenzene and isopropylbenzene were detected slightly above their respective RAP SGV cleanup objectives and/or NYSDEC Class GA Standard or Guidance Values.. |
| | | Benzene (ug/l) | 0.71 - 2.1 (ug/l) | Non-Detect | 1 (ug/l) | | | |
| | | Chlorobenzene (ug/l) | 1.9- 7.7 (ug/l) | 20 (ug/l) | 5 (ug/l) | | | |
| | | Isopropylbenzene (ug/l) | 1.2 - 6.0 (ug/l) | NS | 5 (ug/l) | | | |
| | | Iron (ug/l) | 10300 - 21800 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | |
| | | Sodium (ug/l) | 201000 - 258000 (ug/l) | NS | 20000 (ug/l) | -- | -- | |
| | | Chloride (mg/l) | BDL - 344 (mg/l) | 250 (mg/l) | 250 (mg/l) | -- | -- | |
| | | Nitrogen, Ammonia (mg/l) | 96.5 - 137 (mg/l) | NS | 2 (mg/l) | -- | -- | |
| | | Phenolics, Total (mg/l) | BDL - 0.0405 (mg/l) | 0.001 (mg/l) | 0.001 (mg/l) | -- | -- | |
| | | Total Dissolved Solids (mg/l) | 786 - 1040 (mg/l) | 500 (mg/l) | NS | -- | -- | |
| **MW-6C** | 6 | Benzene (ug/l) | BDL - 1.5 (ug/l) | Non-Detect | 1 (ug/l) | No, $R^2$ = 82% | Yes, slope = 4.4 ug/l/per year | Benzene was detected slightly above the RAP SGV cleanup objective and/or NYSDEC Class GA Standard or Guidance Value. |
| | | Iron (ug/l) | 3140 - 26600 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | |
| | | Sodium (ug/l) | 163000 - 429000 (ug/l) | NS | 20000 (ug/l) | -- | -- | |
| | | Chloride (mg/l) | 206 - 291 (mg/l) | 250 (mg/l) | 250 (mg/l) | -- | -- | |
| | | Nitrogen, Ammonia (mg/l) | 16.2 - 111 (mg/l) | NS | 2 (mg/l) | -- | -- | |
| | | Phenolics, Total (mg/l) | BDL - 0.0346 (mg/l) | 0.001 (mg/l) | 0.001 (mg/l) | -- | -- | |
| | | Total Dissolved Solids (mg/l) | 595 - 910 (mg/l) | 500 (mg/l) | NS | -- | -- | |
| **MW-6E** | 6 | 1,4-Dichlorobenzene (ug/l) | BDL - 3.9 (ug/l) | 4.7 (ug/l) | 3 (ug/l) | Yes, $R^2$= 90% | Yes, slope = -0.5 ug/l/per year | 1,4-dichlorobenzene, benzene and chlorobenzene were detected slightly above their respective RAP SGV cleanup objectives and/or NYSDEC Class GA Standard or Guidance Values. |
| | | Benzene (ug/l) | BDL - 3.1 (ug/l) | Non-Detect | 1 (ug/l) | | | |
| | | Chlorobenzene (ug/l) | 1.3 - 9.4 | 20 (ug/l) | 5 (ug/l) | | | |
| | | Iron (ug/l) | 16200 - 54600 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | |
| | | Manganese (ug/l) | 438 - 706 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | |
| | | Sodium (ug/l) | 163000 - 203000 (ug/l) | NS | 20000 (ug/l) | -- | -- | |
| | | Chloride (mg/l) | 248 - 404 (mg/l) | 250 (mg/l) | 250 (mg/l) | -- | -- | |
| | | Nitrogen, Ammonia (mg/l) | 6.6 - 101 (mg/l) | NS | 2* (mg/l) | -- | -- | |
| | | Phenolics, Total (mg/l) | BDL - 0.0305 (mg/l) | 0.001 (mg/l) | 0.001 (mg/l) | -- | -- | |
| | | Total Dissolved Solids (mg/l) | 678 - 1100 (mg/l) | 500 (mg/l) | NS | -- | -- | |
| **MW-6F** | 6 | Iron (ug/l) | BDL - 756 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | No VOCs were detected above RAP SGV cleanup objectives and/or NYSDEC Class GA Standard or Guidance Values. |
| | | Mercury (ug/l) | BDL - 0.32 (ug/l) | 0.2 (ug/l) | 0.07 (ug/l) | -- | -- | |
| | | Sodium (ug/l) | 96300 - 132000 (ug/l) | NS | 20000* (ug/l) | -- | -- | |
| | | Chloride (mg/l) | 248 - 388 (mg/l) | 250 (mg/l) | 250 (mg/l) | -- | -- | |
| | | Phenolics, Total (mg/l) | BDL - 0.0018 (mg/l) | 0.001 (mg/l) | 0.001 (mg/l) | -- | -- | |
| | | Total Dissolved Solids (mg/l) | 397 - 666 (mg/l) | 500 (mg/l) | NS | -- | -- | |
| **MW-8A** | 6 | Cis-1,2-Dichloroethylene (ug/l) | 1.1 - 15.5 (ug/l) | 50 (ug/l) | 5 (ug/l) | Yes, $R^2$= 91% | Yes, slope = 1.9 ug/l/per year | Cis-1,2-dichlroethylene and PCE were detected above their respective RAP SGV cleanup objectives and/or NYSDEC Class GA Standard or Guidance Values. MW-8A is located immediately downgradient of the former Claremont Polychemical Site where chlorinated solvents were historically a contaminant of concern. |
| | | Tetrachloroethylene (PCE) (ug/l | BDL - 8.6 (ug/l) | 0.7 (ug/l) | 5 (ug/l) | | | |
| | | Iron (ug/l) | BDL - 328 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | |
| | | Sodium (ug/l) | 10800 - 41700 (ug/l) | NS | 20000 (ug/l) | -- | -- | |
| **MW-8B** | 6 | Iron (ug/l) | BDL - 352 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | No VOCs were detected above RAP SGV cleanup objectives and/or NYSDEC Class GA Standard or Guidance Values. |
| | | Manganese (ug/l) | 331 - 1150 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | |
| | | Sodium (ug/l) | 107000 - 160000 (ug/l) | NS | 20000* (ug/l) | -- | -- | |
| | | Chloride (mg/l) | 130 - 360 (mg/l) | 250 (mg/l) | 250 (mg/l) | -- | -- | |
| | | Total Dissolved Solids (mg/l) | 409 - 718 (mg/l) | 500 (mg/l) | NS | -- | -- | |
| **MW-9B** | 6 | Iron (ug/l) | BDL - 752 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | No VOCs were detected above RAP SGV cleanup objectives and/or NYSDEC Class GA Standard or Guidance Values. |
| | | Manganese (ug/l) | 2430 - 3380 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | |
| | | Sodium (ug/l) | 51500 - 63400 (ug/l) | 20000 (ug/l) | 20000 (ug/l) | -- | -- | |
| **MW-9C** | 6 | Iron (ug/l) | BDL - 875 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | No VOCs were detected above RAP SGV cleanup objectives and/or NYSDEC Class GA Standard or Guidance Values. |
| | | Mercury (ug/l) | BDL - 0.28 (ug/l) | 0.2 (ug/l) | 0.7 (ug/l) | -- | -- | |
| | | Sodium (ug/l) | 12900 - 65100 (ug/l) | NS | 20000 (ug/l) | -- | -- | |
| | | Nitrogen, Ammonia (mg/l) | 0.59 - 3.7 (mg/l) | NS | 2 (mg/l) | -- | -- | |
| | | Phenolics, Total (mg/l) | BDL - 0.0048 (mg/l) | 0.001 (mg/l) | 0.001 (mg/l) | -- | -- | |
| **OBS-1** | 6 | Iron (ug/l) | BDL - 1390 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | No VOCs were detected above RAP SGV cleanup objectives and/or NYSDEC Class GA Standard or Guidance Values. |
| | | Manganese (ug/l) | 2350 - 3190 (ug/l) | 300 (ug/l) | 300 (ug/l) | -- | -- | |
| | | Sodium (ug/l) | 50700 - 72300 (ug/l) | NS | 20000 (ug/l) | -- | -- | |
| | | Nitrogen, Ammonia (mg/l) | 8.4 - 40.4 (mg/l) | NS | 2 (mg/l) | -- | -- | |
| | | Phenolics, Total (mg/l) | BDL - 0.0069 (mg/l) | 0.001 (mg/l) | 0.001 (mg/l) | -- | -- | |

**Notes:**

[1] An $R^2$ value of 90% or greater was determined to be normally distributed data.
[2] In general, a slope of +/- 5 ug/l/year total VOCs was determined to be zero slope.
---: Further statistical analysis was not performed as per the requirements of the RAP.
: Monitoring Well Meets VOC Termination Criteria
NS: No Standard identified in RAP Table 2 - Termination Criteria

**Abbreviations:**
BDL: Below Detection Limit

# APPENDIX B

Statistical Analyses for Wells LF-2, MW-6B, MW-6C, MW-6E and MW-8A
(Prepared by D&B)

# Statistical Analysis Procedures

In accordance with Section III, Attachment 3 of the RAP, a zero slope condition analysis was performed for the five post-termination monitoring wells that did not meet the VOC groundwater quality standards/guideline values. The objective of the analysis was to ascertain if groundwater total VOC concentrations have leveled off and are no longer significantly increasing or decreasing.

The initial step was to plot total VOCs for each monitoring well over the three-year post-termination monitoring period for the six sampling semiannual sampling rounds. If total VOC concentrations leveled off in a given monitoring well during this period, then it was assumed that the statistical analysis was working with data that modeled more of a linear equation, otherwise logarithmic equation was used. Probability charts were then prepared to determine if the total VOC concentration data for each monitoring well were normally distributed. A normal distribution of the total VOC concentration data over time with a strong correlation ($R^2 > 0.9$) would indicate that the data more closely modeled a linear equation as opposed to power or logarithmic equation. For those monitoring wells with a lower correlation ($R^2 < 0.9$), probability charts were prepared using the log of the total VOC concentrations to determine if the data more closely modeled a logarithmic equation. Monitoring wells with total VOC concentrations that modeled a logarithmic equation or without a clear correlation to time were excluded from further consideration of the zero slope condition.

The next step was to test for normality (i.e. that the data was normally distributed). Under the assumption that the data primarily fit a linear equation, a simple statistical test was used to determine if any individual data points fell outside a normal (95%) range of data. To determine this, the mean and standard deviation were calculated and any data points that fell outside the normal range of the mean plus 1.96 times the standard deviation were considered to be outliers. It was found that only one data point was determined to be an outlier based off this method, but do to the limited data points available for the comparison, this point was included in the statistical analysis.

Finally, a best fit line was applied to the plotted total VOC concentration data for each monitoring well, and the slope of the line calculated in ug/L per year. A slope within the range of -5 to +5 ug/l/year was determined to be a zero slope. This range was selected due to the fact that a slope of ±5 ug/l/year is equivalent to ±25 ug/l after 5 years (or half the total VOC cleanup objective of 50 ug/l). A slope exceeding ±5 ug/l/year indicates that total VOC concentrations could be expected to eventually increase above (or decrease below) the cleanup objective. Monitoring wells with normally distributed data and a slope in this range were determined to have a zero slope condition and have therefore achieved termination criteria.

**TOWN OF OYSTER BAY**
**OLD BETHPAGE LANDFILL**
**OLD BETHPAGE, NEW YORK**
**DETAILS OF STATISTICAL ANALYSIS**
**WELL LF-2**

*Total VOCs Over Past 6 Sampling Events*

| Date | Total VOCs (ug/l) |
|---|---|
| 6/20/17 | 0 |
| 9/21/17 | 24.2 |
| 6/25/18 | 9.9 |
| 12/17/18 | 5.58 |
| 5/23/19 | 10.1 |
| 8/28/19 | 6.5 |

*Basic Statistical Calculations*

| | |
|---|---|
| Average (ug/l); | 9.38 |
| Median (ug/l): | 8.2 |
| Standard Deviation (ug/l): | 8.138058737 |
| Upper Limit (ug/l): | 33.79417621 |
| Lower Limit (ug/l): | -6.570595124 |
| Slope (ug/l/yr): | -1.597501265 |

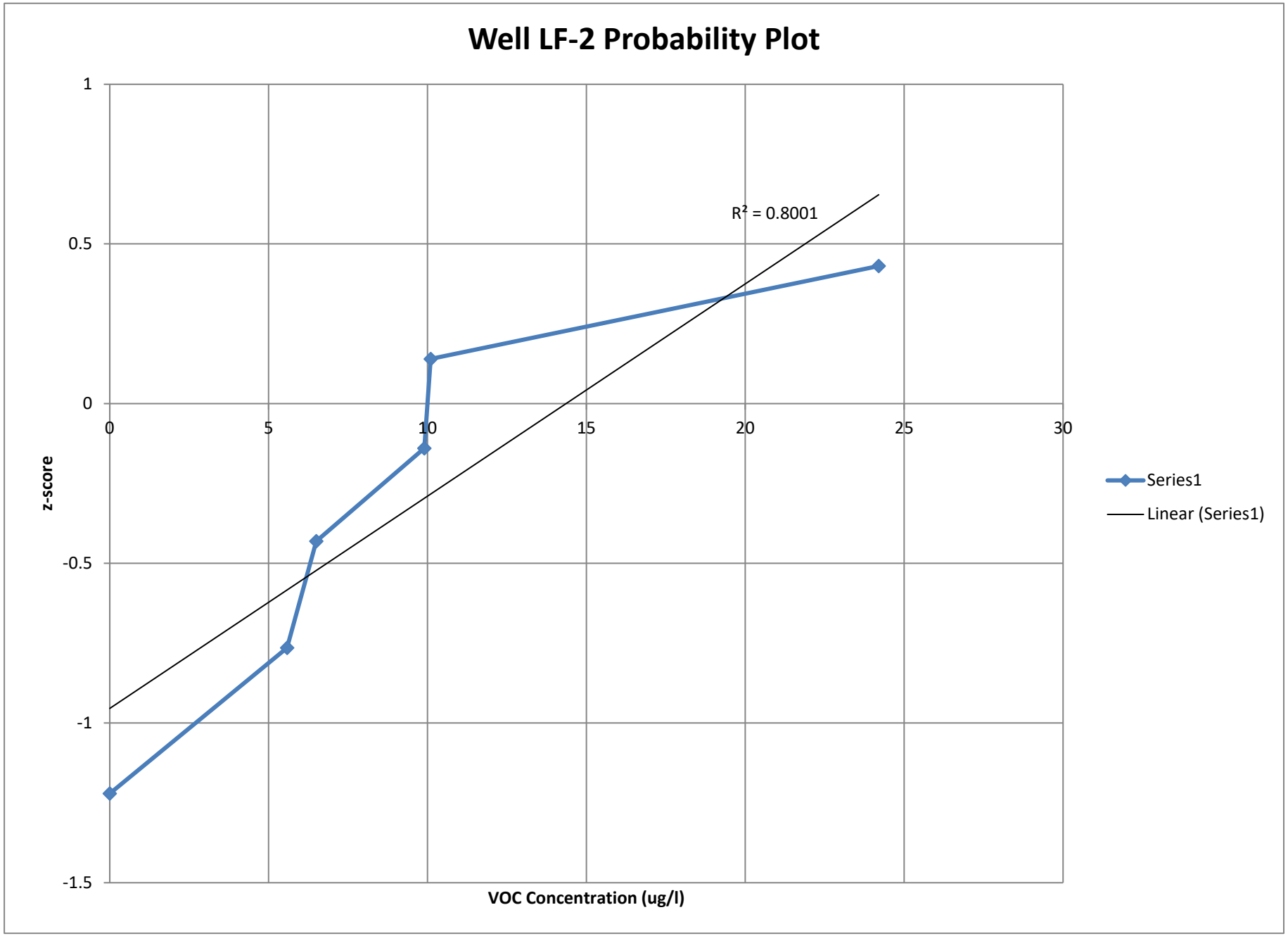
*Probability Plot Statistical Calculations*

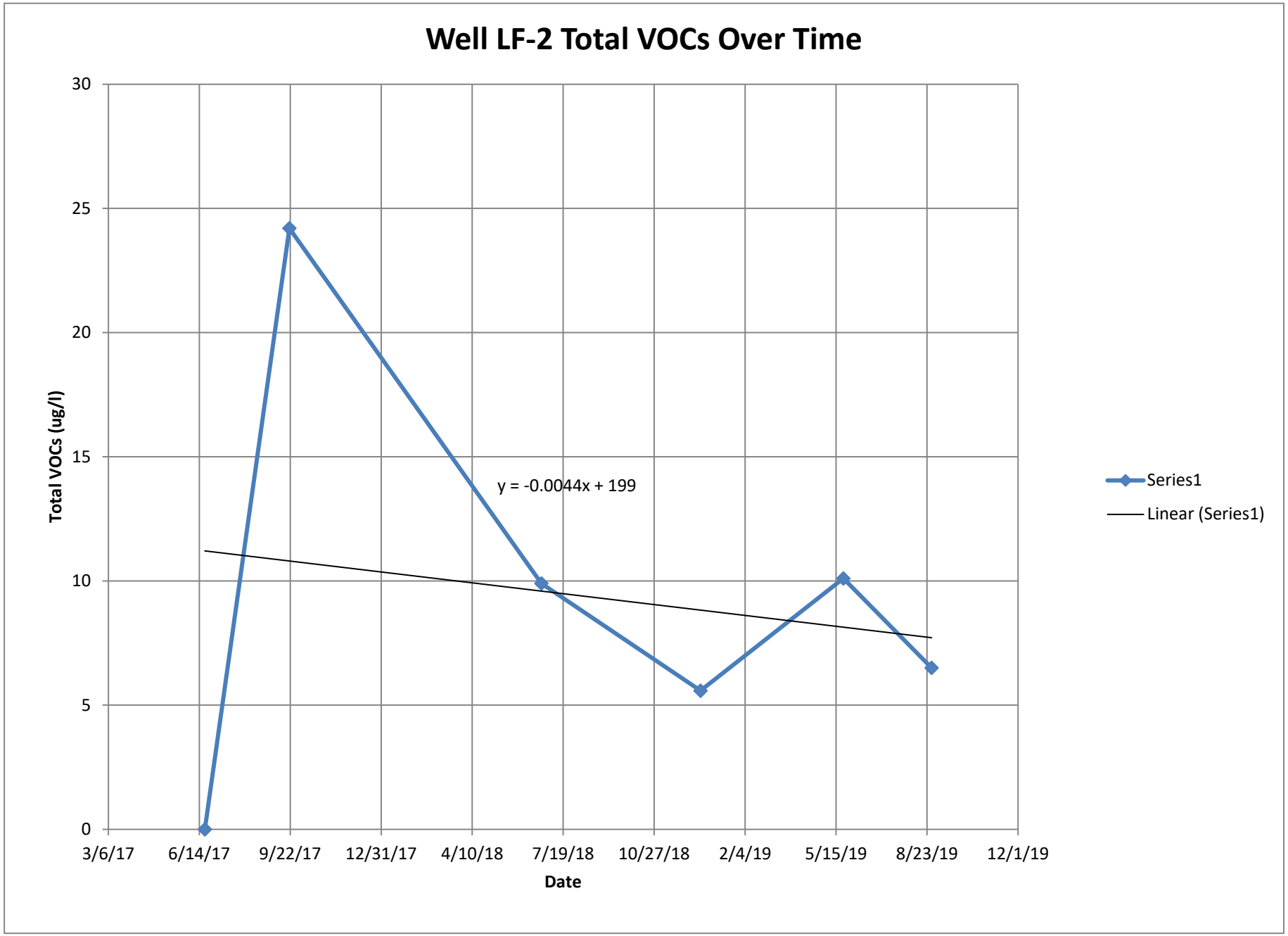
| position | Date | Total VOCs (ug/l) | Cumulative Probability | z-score |
|---|---|---|---|---|
| 1 | 6/20/17 | 0 | 0.111111111 | -1.220640349 |
| 2 | 12/17/18 | 5.58 | 0.222222222 | -0.764709674 |
| 3 | 8/28/19 | 6.5 | 0.333333333 | -0.430727299 |
| 4 | 6/25/18 | 9.9 | 0.444444444 | -0.139710299 |
| 5 | 5/23/19 | 10.1 | 0.555555556 | 0.139710299 |
| 6 | 9/21/17 | 24.2 | 0.666666667 | 0.430727299 |

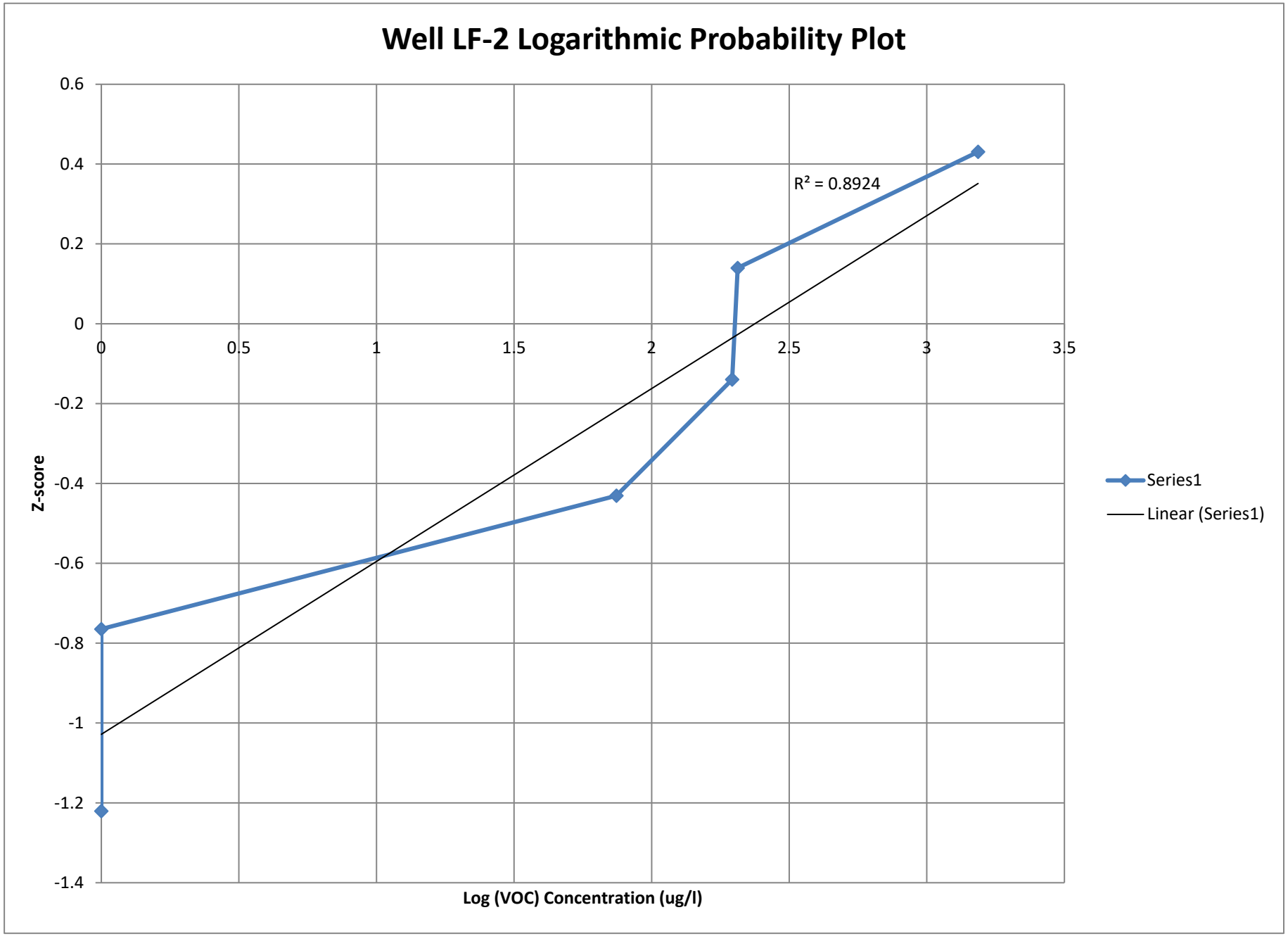
*Logarithmic Probability Plot Statistical Calculations*

| position | Date | Total VOCs (ug/l) | Log of Concentration | Cumulative Probability | z-score |
|---|---|---|---|---|---|
| 1 | 6/20/17 | 0 | 0 | 0.111111111 | -1.22064 |
| 2 | 12/17/18 | 5.58 | 0 | 0.222222222 | -0.76471 |
| 3 | 8/28/19 | 6.5 | 1.871802177 | 0.333333333 | -0.43073 |
| 4 | 6/25/18 | 9.9 | 2.292534757 | 0.444444444 | -0.13971 |
| 5 | 5/23/19 | 10.1 | 2.312535424 | 0.555555556 | 0.13971 |
| 6 | 9/21/17 | 24.2 | 3.186352633 | 0.666666667 | 0.430727 |

Notes:


Well LF-2 Probability Plot
1
0.5
0
-0.5
-1
-1.5
0
5
10
15
20
25
30
z-score
VOC Concentration (ug/l)
R² = 0.8001
Series1
Linear (Series1)


Well LF-2 Total VOCs Over Time
30
25
20
15
10
5
0
Total VOCs (ug/l)
y = -0.0044x + 199
3/6/17
6/14/17
9/22/17
12/31/17
4/10/18
7/19/18
10/27/18
2/4/19
5/15/19
8/23/19
12/1/19
Date
Series1
Linear (Series1)


Well LF-2 Logarithmic Probability Plot
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
0
0.5
1
1.5
2
2.5
3
3.5
R² = 0.8924
Z-score
Log (VOC) Concentration (ug/l)
Series1
Linear (Series1)

**TOWN OF OYSTER BAY**
**OLD BETHPAGE LANDFILL**
**OLD BETHPAGE, NEW YORK**
**DETAILS OF STATISTICAL ANALYSIS**
**WELL MW-6B**

*Total VOCs Over Past 6 Sampling Events*

| Date | Total VOCs (ug/l) |
|---|---|
| 6/21/17 | 6.01 |
| 9/22/17 | 21.6 |
| 6/25/18 | 15.5 |
| 12/17/18 | 8.8 |
| 5/23/19 | 12.6 |
| 8/27/19 | 12.2 |

*Basic Statistical Calculations*

| | |
|---|---|
| Average (ug/l); | 12.785 |
| Median (ug/l): | 12.4 |
| Standard Deviation (ug/l): | 5.426467543 |
| Upper Limit (ug/l): | 29.06440263 |
| Lower Limit (ug/l): | 2.149123615 |
| Slope (ug/l/yr): | -0.65833044 |

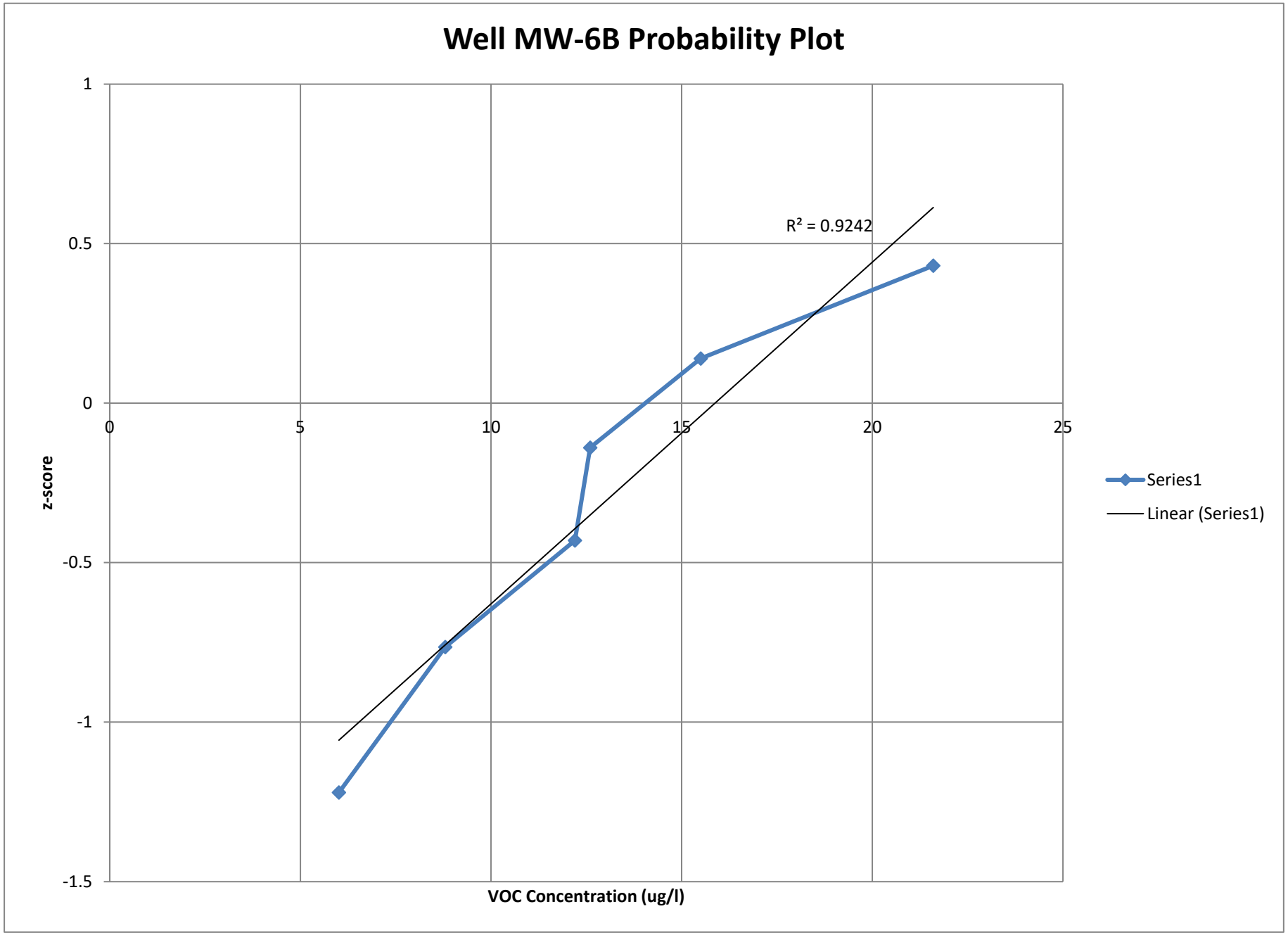
*Probability Plot Statistical Calculations*

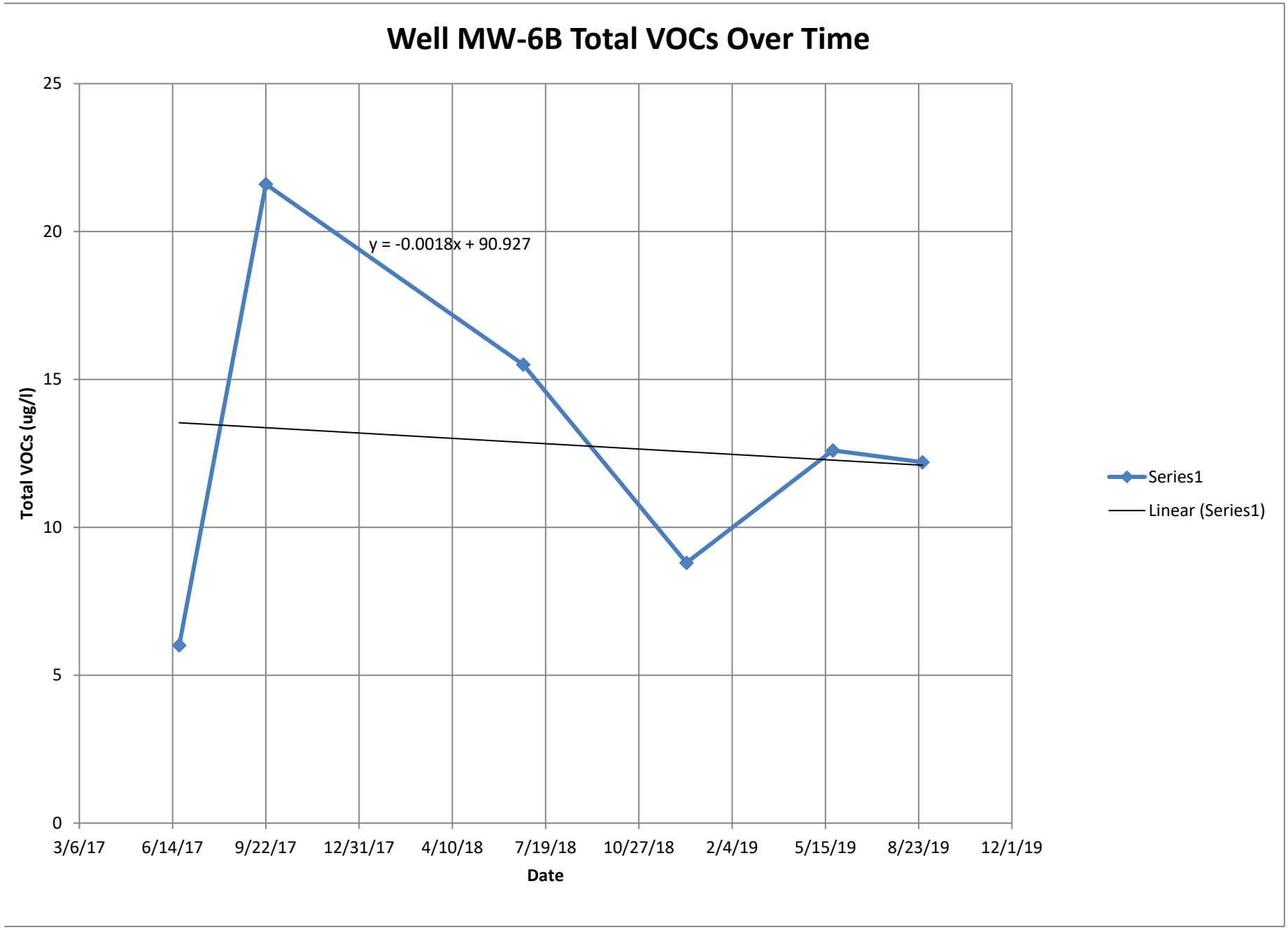
| position | Date | Total VOCs (ug/l) | Cumulative Probability | z-score |
|---|---|---|---|---|
| 1 | 6/21/17 | 6.01 | 0.111111111 | -1.220640349 |
| 2 | 12/17/18 | 8.8 | 0.222222222 | -0.764709674 |
| 3 | 8/27/19 | 12.2 | 0.333333333 | -0.430727299 |
| 4 | 5/23/19 | 12.6 | 0.444444444 | -0.139710299 |
| 5 | 6/25/18 | 15.5 | 0.555555556 | 0.139710299 |
| 6 | 9/22/17 | 21.6 | 0.666666667 | 0.430727299 |

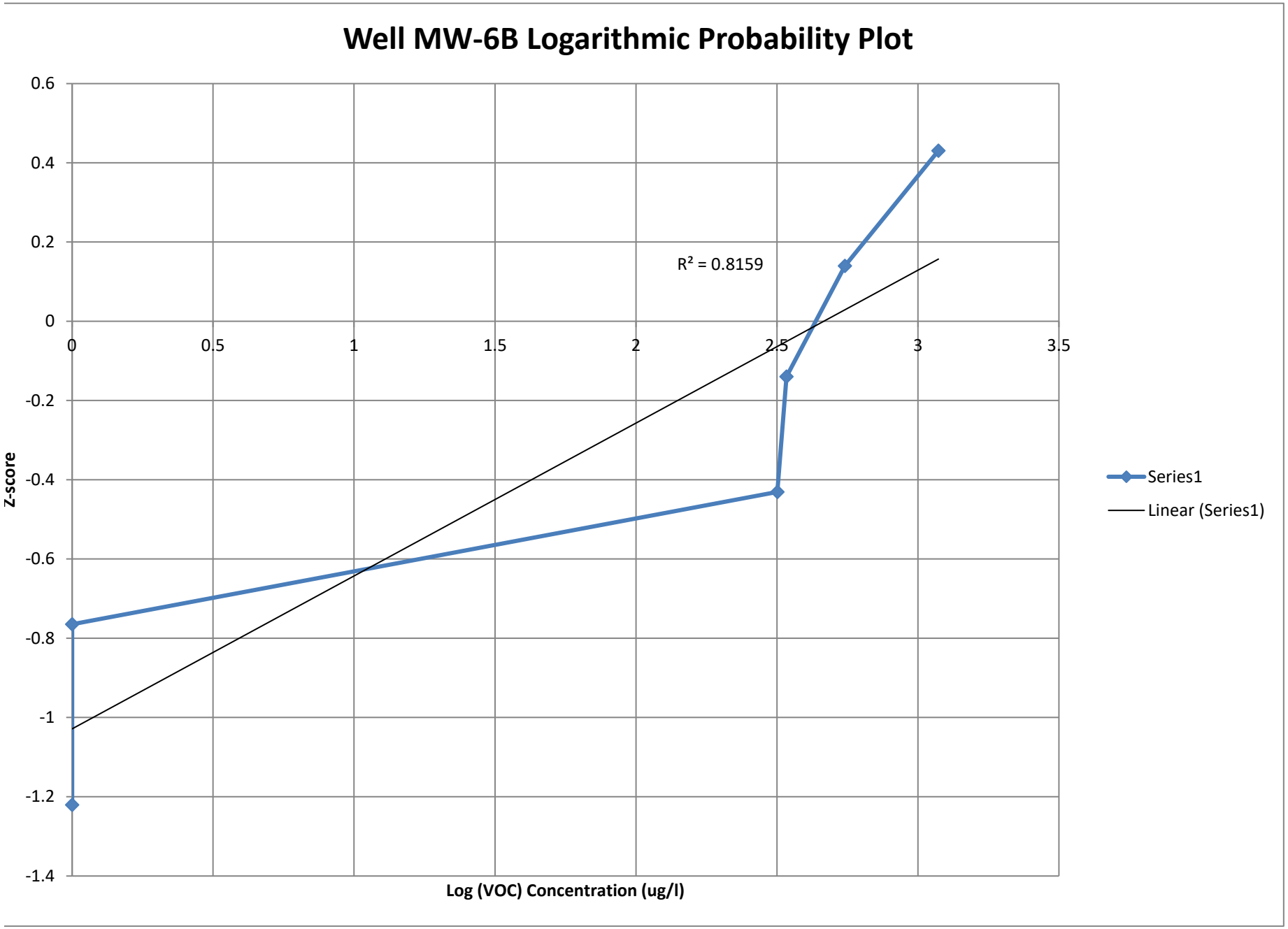
*Logarithmic Probability Plot Statistical Calculations*

| position | Date | Total VOCs (ug/l) | Log of Concentration | Cumulative Probability | z-score |
|---|---|---|---|---|---|
| 1 | 6/21/17 | 6.01 | 0 | 0.111111111 | -1.22064 |
| 2 | 12/17/18 | 8.8 | 0 | 0.222222222 | -0.76471 |
| 3 | 8/27/19 | 12.2 | 2.501435952 | 0.333333333 | -0.43073 |
| 4 | 5/23/19 | 12.6 | 2.533696814 | 0.444444444 | -0.13971 |
| 5 | 6/25/18 | 15.5 | 2.740840024 | 0.555555556 | 0.13971 |
| 6 | 9/22/17 | 21.6 | 3.072693315 | 0.666666667 | 0.430727 |

Notes:


Well MW-6B Probability Plot
1
0.5
0
-0.5
-1
-1.5
0
5
10
15
20
25
z-score
VOC Concentration (ug/l)
R² = 0.9242
Series1
Linear (Series1)


Well MW-6B Total VOCs Over Time
Total VOCs (ug/l)
25
20
15
10
5
0
y = -0.0018x + 90.927
3/6/17
6/14/17
9/22/17
12/31/17
4/10/18
7/19/18
10/27/18
2/4/19
5/15/19
8/23/19
12/1/19
Date
Series1
Linear (Series1)


Well MW-6B Logarithmic Probability Plot
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
0
0.5
1
1.5
2
2.5
3
3.5
R² = 0.8159
Z-score
Log (VOC) Concentration (ug/l)
Series1
Linear (Series1)

**TOWN OF OYSTER BAY**
**OLD BETHPAGE LANDFILL**
**OLD BETHPAGE, NEW YORK**
**DETAILS OF STATISTICAL ANALYSIS**
**WELL MW-6C**

*Total VOCs Over Past 6 Sampling Events*

| Date | Total VOCs (ug/l) |
|---|---|
| 6/21/17 | 0 |
| 9/22/17 | 0 |
| 6/25/18 | 0 |
| 12/17/18 | 6.64 |
| 5/23/19 | 5.92 |
| 8/27/19 | 9.8 |

*Basic Statistical Calculations*

| | |
|---|---|
| Average (ug/l); | 3.726666667 |
| Median (ug/l): | 2.96 |
| Standard Deviation (ug/l): | 4.285970913 |
| Upper Limit (ug/l): | 16.58457941 |
| Lower Limit (ug/l): | -4.673836323 |
| Slope (ug/l/yr): | 4.361040292 |

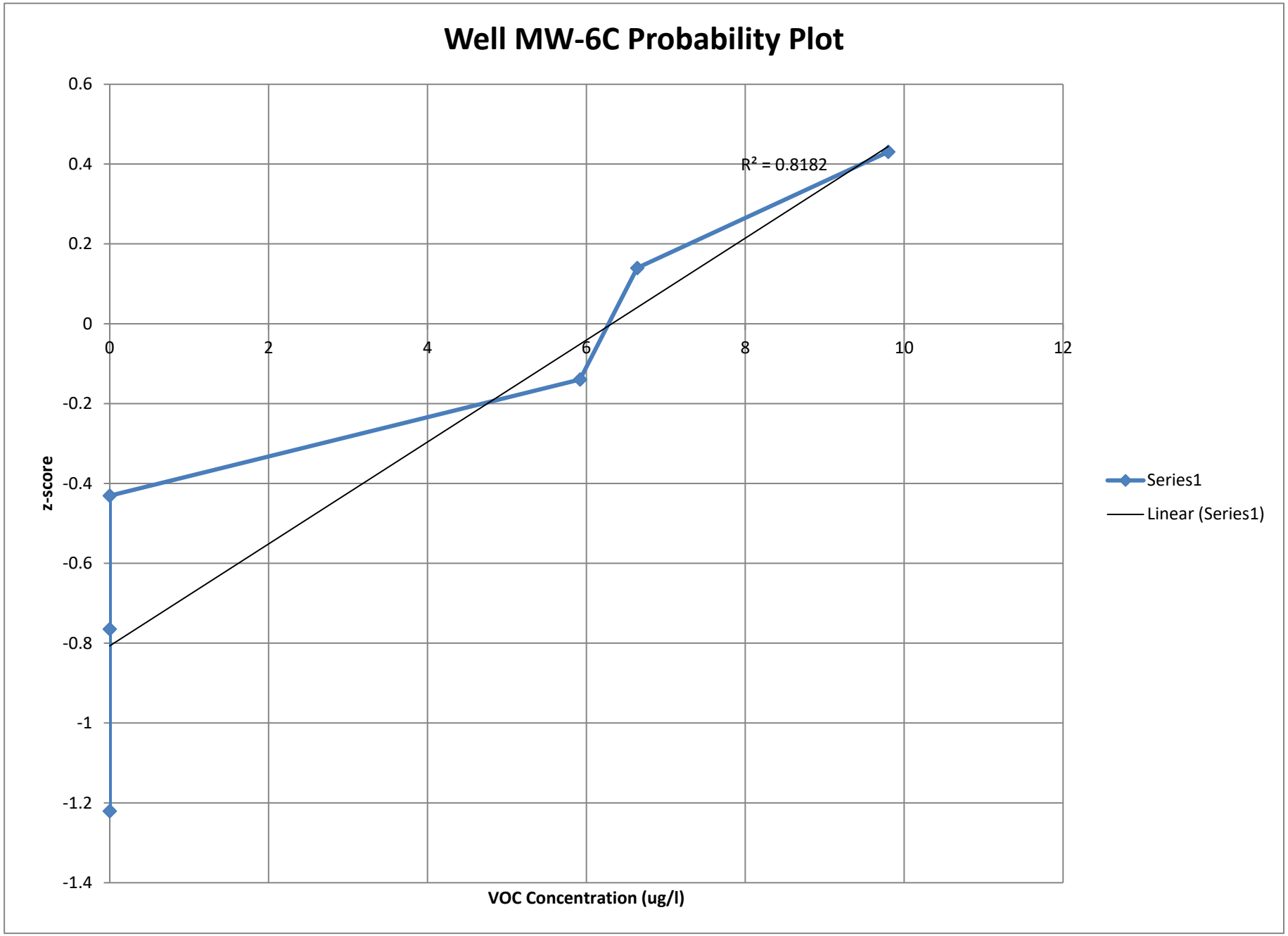
*Probability Plot Statistical Calculations*

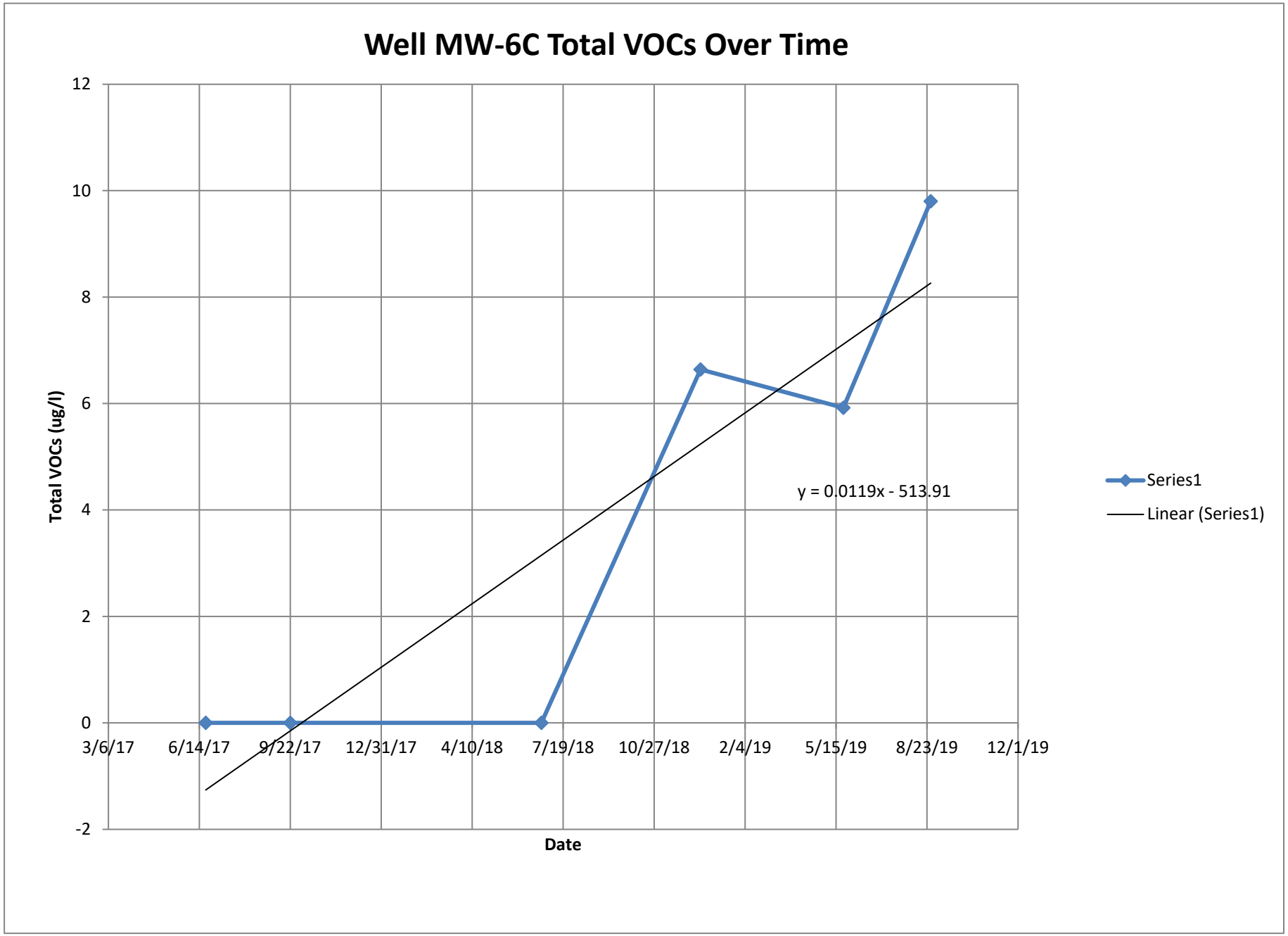
| position | Date | Total VOCs (ug/l) | Cumulative Probability | z-score |
|---|---|---|---|---|
| 1 | 6/21/17 | 0 | 0.111111111 | -1.220640349 |
| 2 | 9/22/17 | 0 | 0.222222222 | -0.764709674 |
| 3 | 6/25/18 | 0 | 0.333333333 | -0.430727299 |
| 4 | 5/23/19 | 5.92 | 0.444444444 | -0.139710299 |
| 5 | 12/17/18 | 6.64 | 0.555555556 | 0.139710299 |
| 6 | 8/27/19 | 9.8 | 0.666666667 | 0.430727299 |

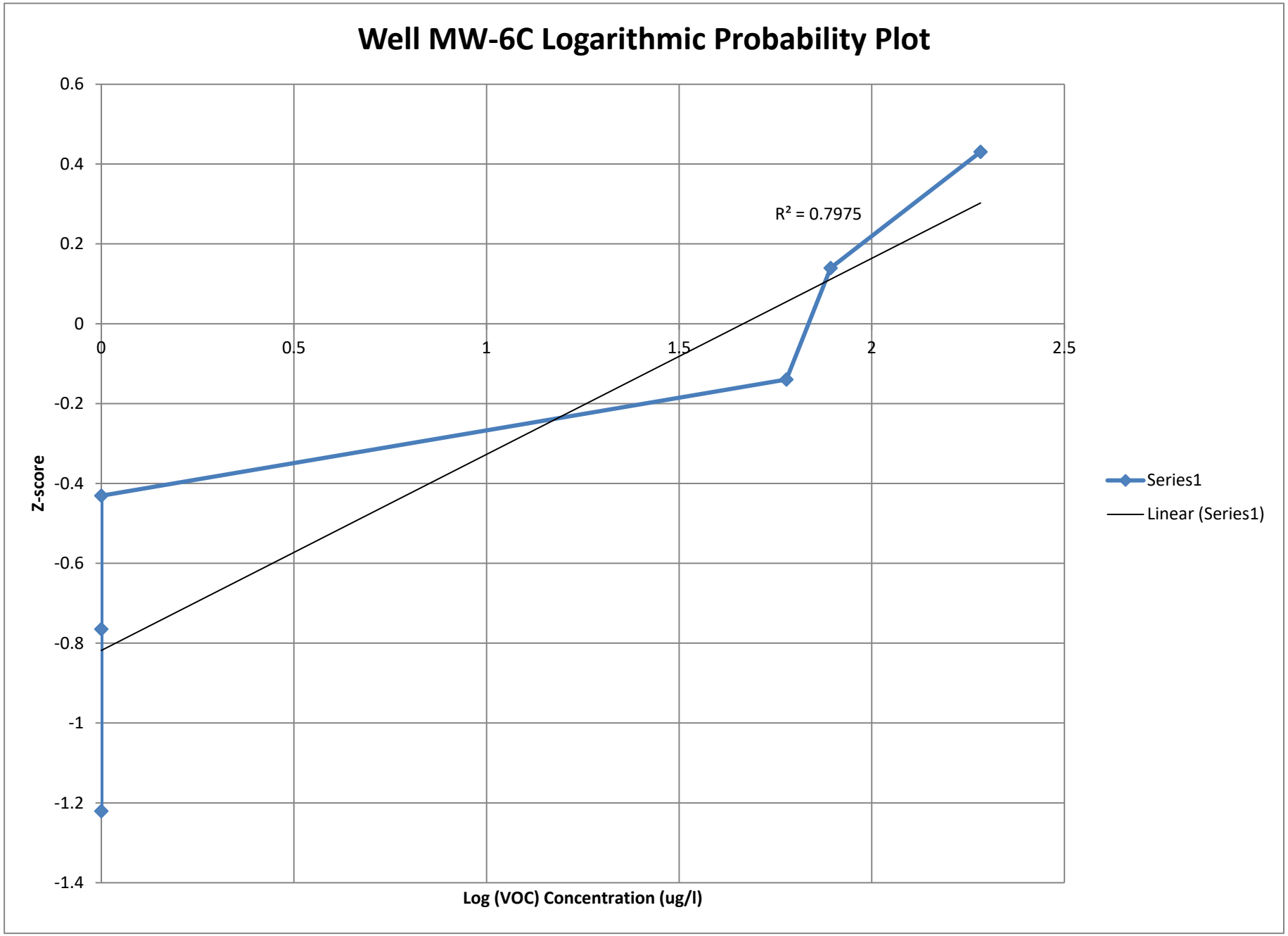
*Logarithmic Probability Plot Statistical Calculations*

| position | Date | Total VOCs (ug/l) | Log of Concentration | Cumulative Probability | z-score |
|---|---|---|---|---|---|
| 1 | 6/21/17 | 0 | 0 | 0.111111111 | -1.22064 |
| 2 | 9/22/17 | 0 | 0 | 0.222222222 | -0.76471 |
| 3 | 6/25/18 | 0 | 0 | 0.333333333 | -0.43073 |
| 4 | 5/23/19 | 5.92 | 1.778336449 | 0.444444444 | -0.13971 |
| 5 | 12/17/18 | 6.64 | 1.893111963 | 0.555555556 | 0.13971 |
| 6 | 8/27/19 | 9.8 | 2.282382386 | 0.666666667 | 0.430727 |

Notes:


Well MW-6C Probability Plot
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
0
2
4
6
8
10
12
z-score
VOC Concentration (ug/l)
R² = 0.8182
Series1
Linear (Series1)


Well MW-6C Total VOCs Over Time
Total VOCs (ug/l)
12
10
8
6
4
2
0
-2
3/6/17
6/14/17
9/22/17
12/31/17
4/10/18
7/19/18
10/27/18
2/4/19
5/15/19
8/23/19
12/1/19
Date
y = 0.0119x - 513.91
Series1
Linear (Series1)


Well MW-6C Logarithmic Probability Plot
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
0
0.5
1
1.5
2
2.5
R² = 0.7975
Z-score
Log (VOC) Concentration (ug/l)
Series1
Linear (Series1)

**TOWN OF OYSTER BAY**
**OLD BETHPAGE LANDFILL**
**OLD BETHPAGE, NEW YORK**
**DETAILS OF STATISTICAL ANALYSIS**
**WELL MW-6E**

*Total VOCs Over Past 6 Sampling Events*

| Date | Total VOCs (ug/l) |
|---|---|
| 6/21/17 | 1.3 |
| 9/22/17 | 5.6 |
| 6/25/18 | 20.5 |
| 12/17/18 | 5.7 |
| 5/23/19 | 2.2 |
| 8/27/19 | 3.2 |

*Basic Statistical Calculations*

| | |
|---|---|
| Average (ug/l); | 6.416666667 |
| Median (ug/l): | 4.4 |
| Standard Deviation (ug/l): | 7.125002924 |
| Upper Limit (ug/l): | 27.79167544 |
| Lower Limit (ug/l): | -7.548339064 |
| Slope (ug/l/yr): | -0.551066009 |

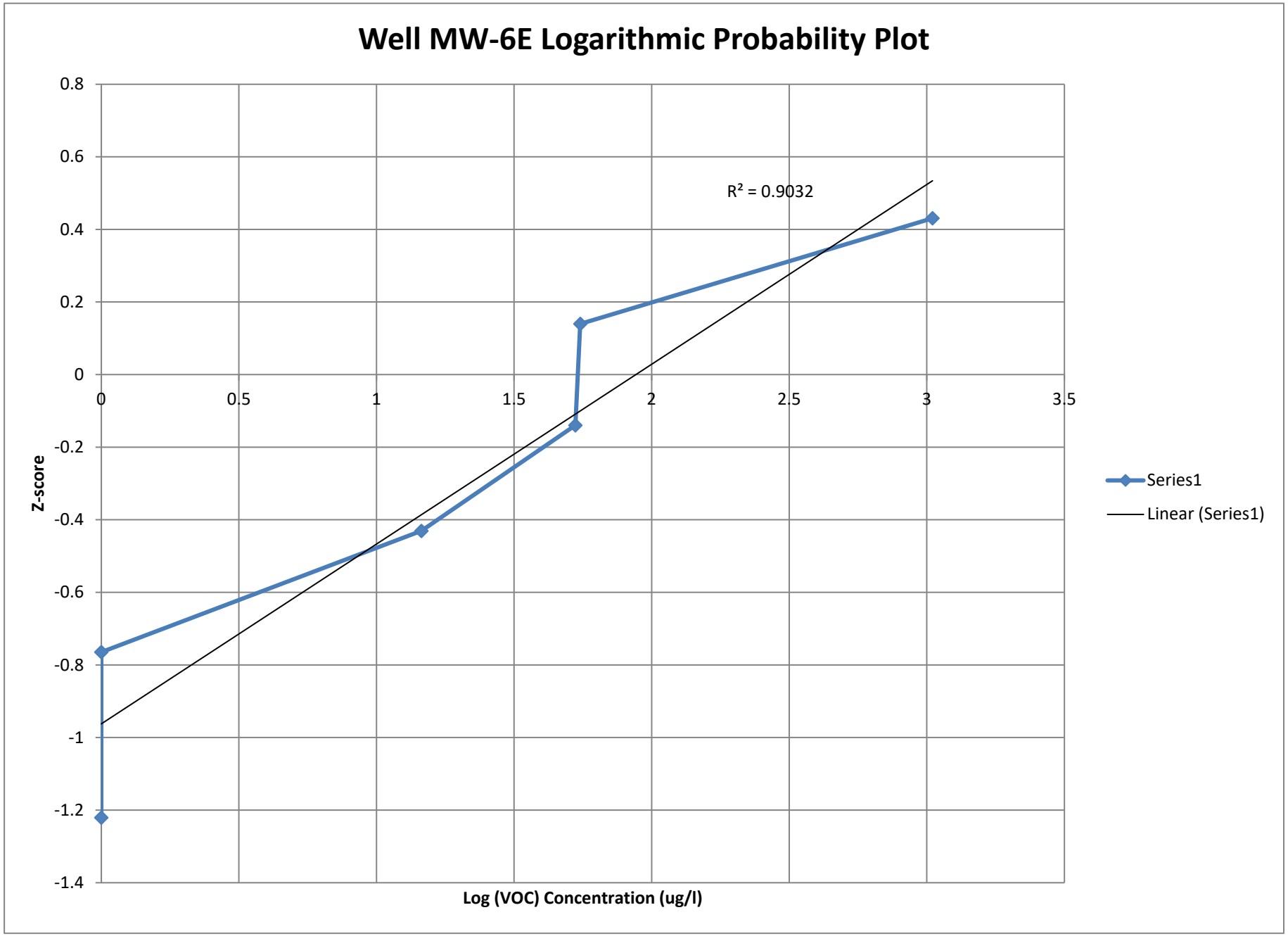
*Probability Plot Statistical Calculations*

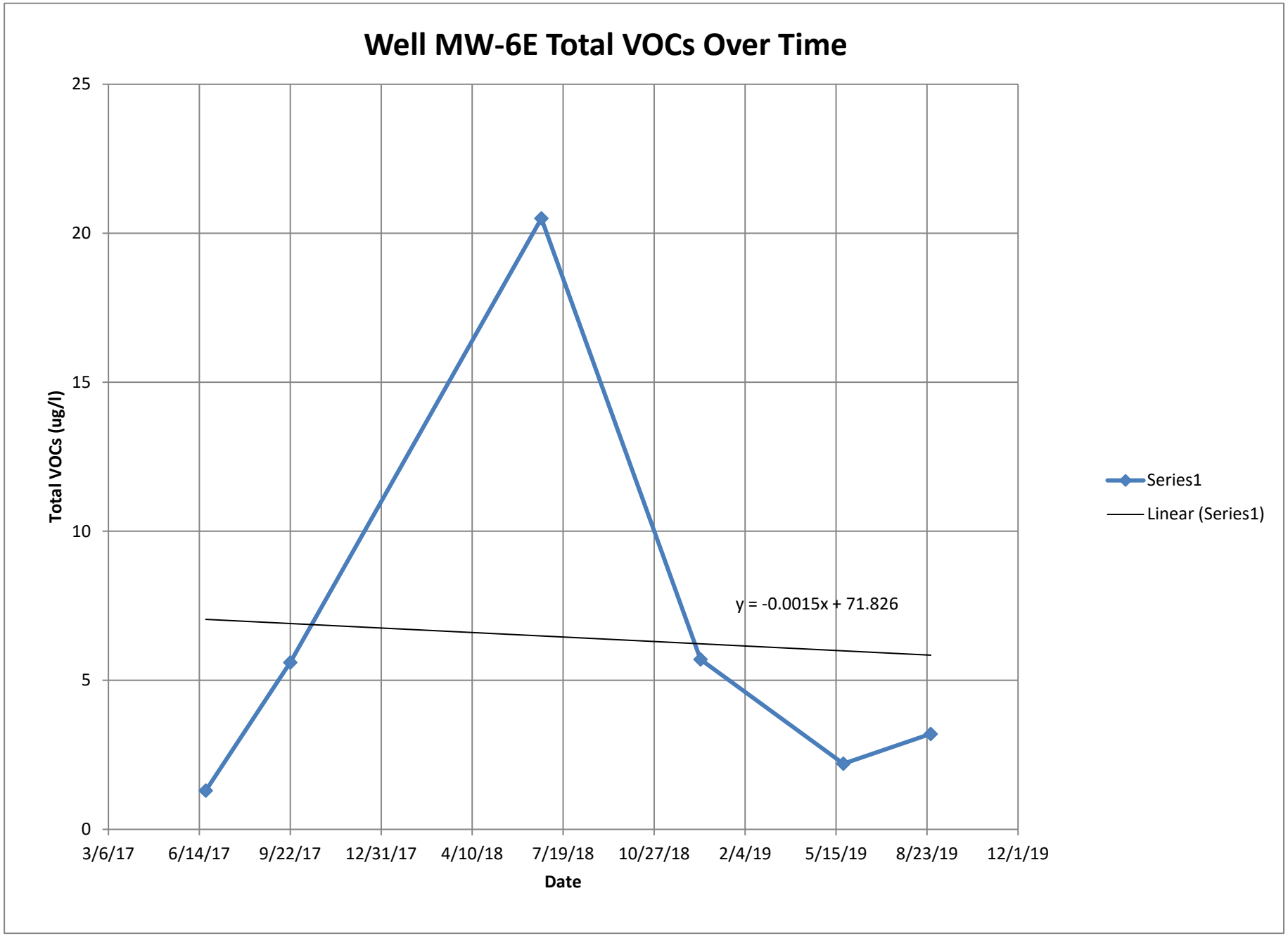
| position | Date | Total VOCs (ug/l) | Cumulative Probability | z-score |
|---|---|---|---|---|
| 1 | 6/21/17 | 1.3 | 0.111111111 | -1.220640349 |
| 2 | 5/23/19 | 2.2 | 0.222222222 | -0.764709674 |
| 3 | 8/27/19 | 3.2 | 0.333333333 | -0.430727299 |
| 4 | 9/22/17 | 5.6 | 0.444444444 | -0.139710299 |
| 5 | 12/17/18 | 5.7 | 0.555555556 | 0.139710299 |
| 6 | 6/25/18 | 20.5 | 0.666666667 | 0.430727299 |

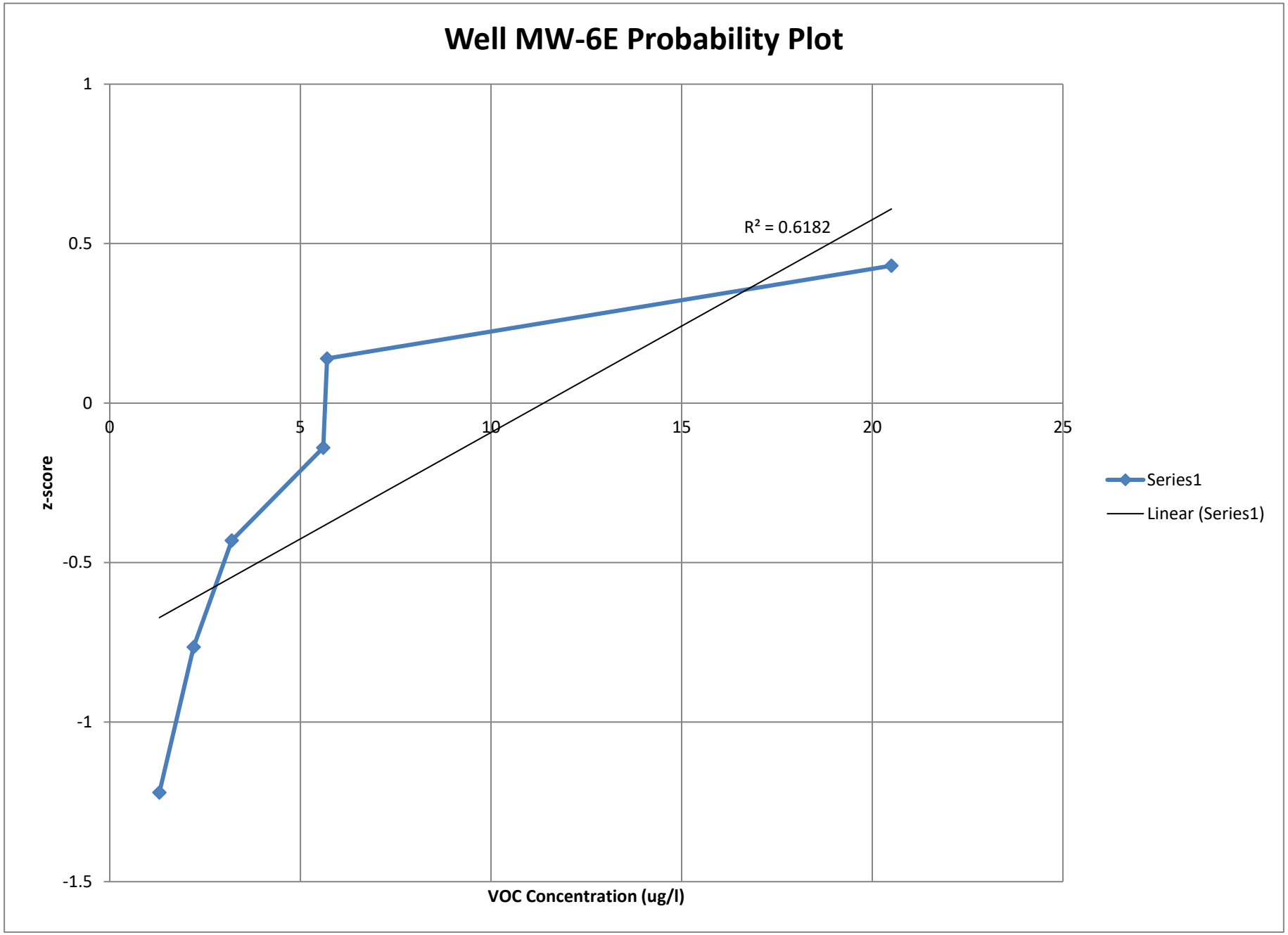
*Logarithmic Probability Plot Statistical Calculations*

| position | Date | Total VOCs (ug/l) | Log of Concentration | Cumulative Probability | z-score |
|---|---|---|---|---|---|
| 1 | 6/21/17 | 1.3 | 0 | 0.111111111 | -1.22064 |
| 2 | 5/23/19 | 2.2 | 0 | 0.222222222 | -0.76471 |
| 3 | 8/27/19 | 3.2 | 1.16315081 | 0.333333333 | -0.43073 |
| 4 | 9/22/17 | 5.6 | 1.722766598 | 0.444444444 | -0.13971 |
| 5 | 12/17/18 | 5.7 | 1.740466175 | 0.555555556 | 0.13971 |
| 6 | 6/25/18 | 20.5 | 3.020424886 | 0.666666667 | 0.430727 |

Notes:


Well MW-6E Logarithmic Probability Plot
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
0
0.5
1
1.5
2
2.5
3
3.5
R² = 0.9032
Z-score
Log (VOC) Concentration (ug/l)
Series1
Linear (Series1)


Well MW-6E Total VOCs Over Time
Total VOCs (ug/l)
25
20
15
10
5
0
3/6/17
6/14/17
9/22/17
12/31/17
4/10/18
7/19/18
10/27/18
2/4/19
5/15/19
8/23/19
12/1/19
Date
y = -0.0015x + 71.826
Series1
Linear (Series1)


Well MW-6E Probability Plot
1
0.5
0
-0.5
-1
-1.5
0
5
10
15
20
25
z-score
VOC Concentration (ug/l)
R² = 0.6182
Series1
Linear (Series1)

**TOWN OF OYSTER BAY**
**OLD BETHPAGE LANDFILL**
**OLD BETHPAGE, NEW YORK**
**DETAILS OF STATISTICAL ANALYSIS**
**WELL MW-8A**

*Total VOCs Over Past 6 Sampling Events*

| Date | Total VOCs (ug/l) |
|---|---|
| 6/22/17 | 11.1 |
| 9/22/17 | 14.7 |
| 6/25/18 | 11.9 |
| 12/14/18 | 3.9 |
| 5/22/19 | 14.1 |
| 8/26/19 | 21.5 |

*Basic Statistical Calculations*

| | |
|---|---|
| Average (ug/l); | 12.86666667 |
| Median (ug/l): | 13 |
| Standard Deviation (ug/l): | 5.724916302 |
| Upper Limit (ug/l): | 30.04141557 |
| Lower Limit (ug/l): | 1.645830714 |
| Slope (ug/l/yr): | 1.894794664 |

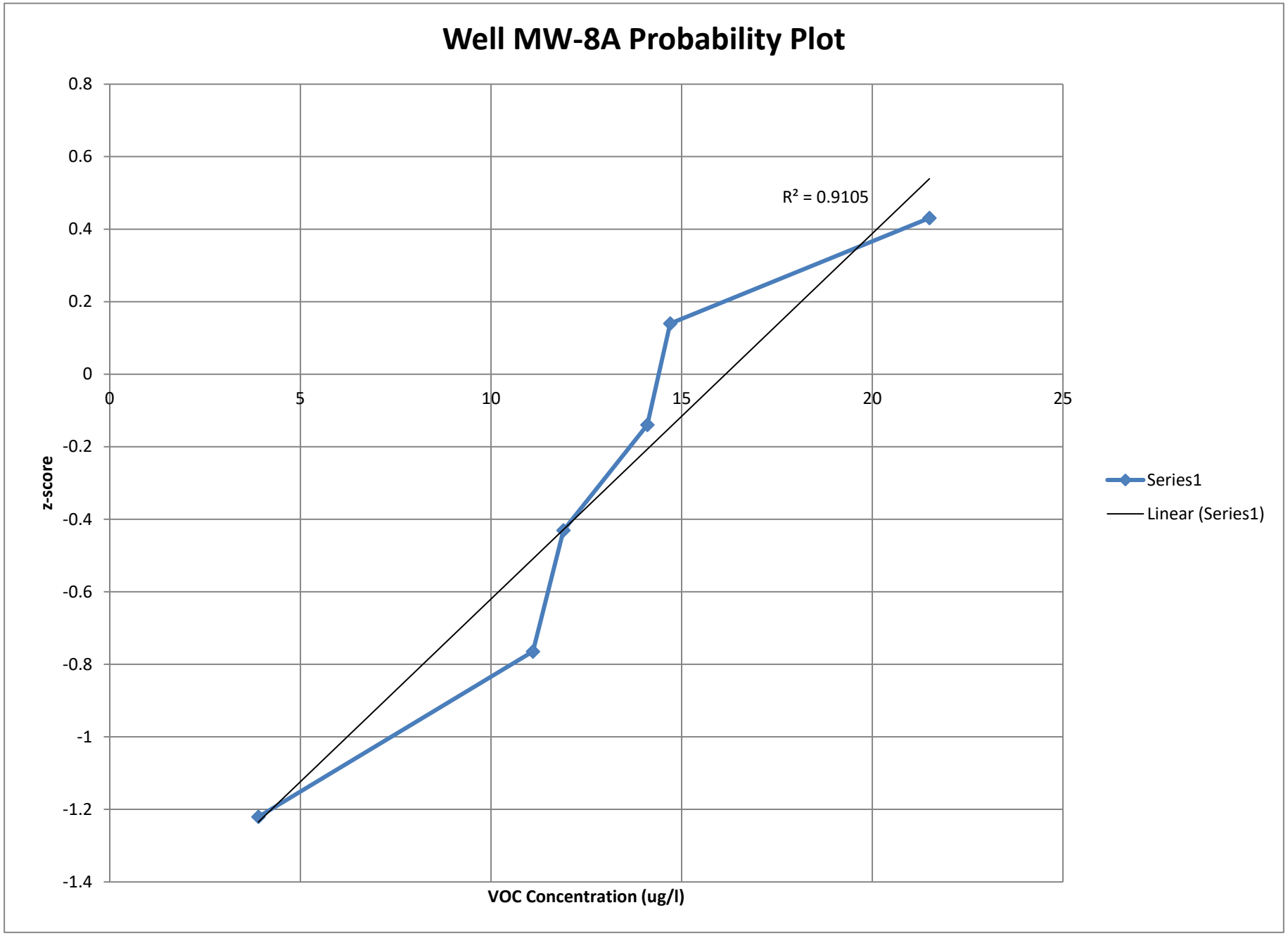
*Probability Plot Statistical Calculations*

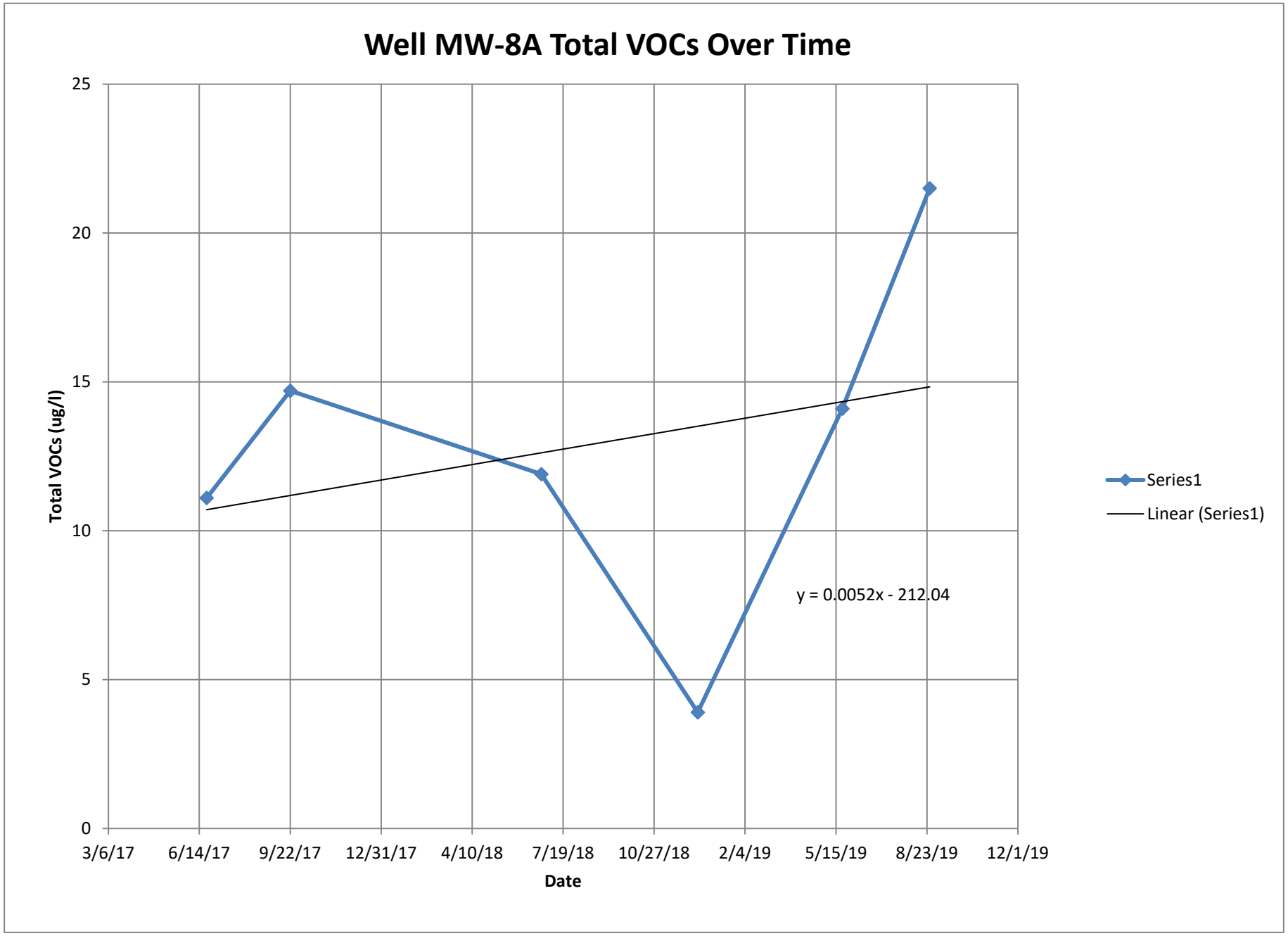
| position | Date | Total VOCs (ug/l) | Cumulative Probability | z-score |
|---|---|---|---|---|
| 1 | 12/14/18 | 3.9 | 0.111111111 | -1.220640349 |
| 2 | 6/22/17 | 11.1 | 0.222222222 | -0.764709674 |
| 3 | 6/25/18 | 11.9 | 0.333333333 | -0.430727299 |
| 4 | 5/22/19 | 14.1 | 0.444444444 | -0.139710299 |
| 5 | 9/22/17 | 14.7 | 0.555555556 | 0.139710299 |
| 6 | 8/26/19 | 21.5 | 0.666666667 | 0.430727299 |

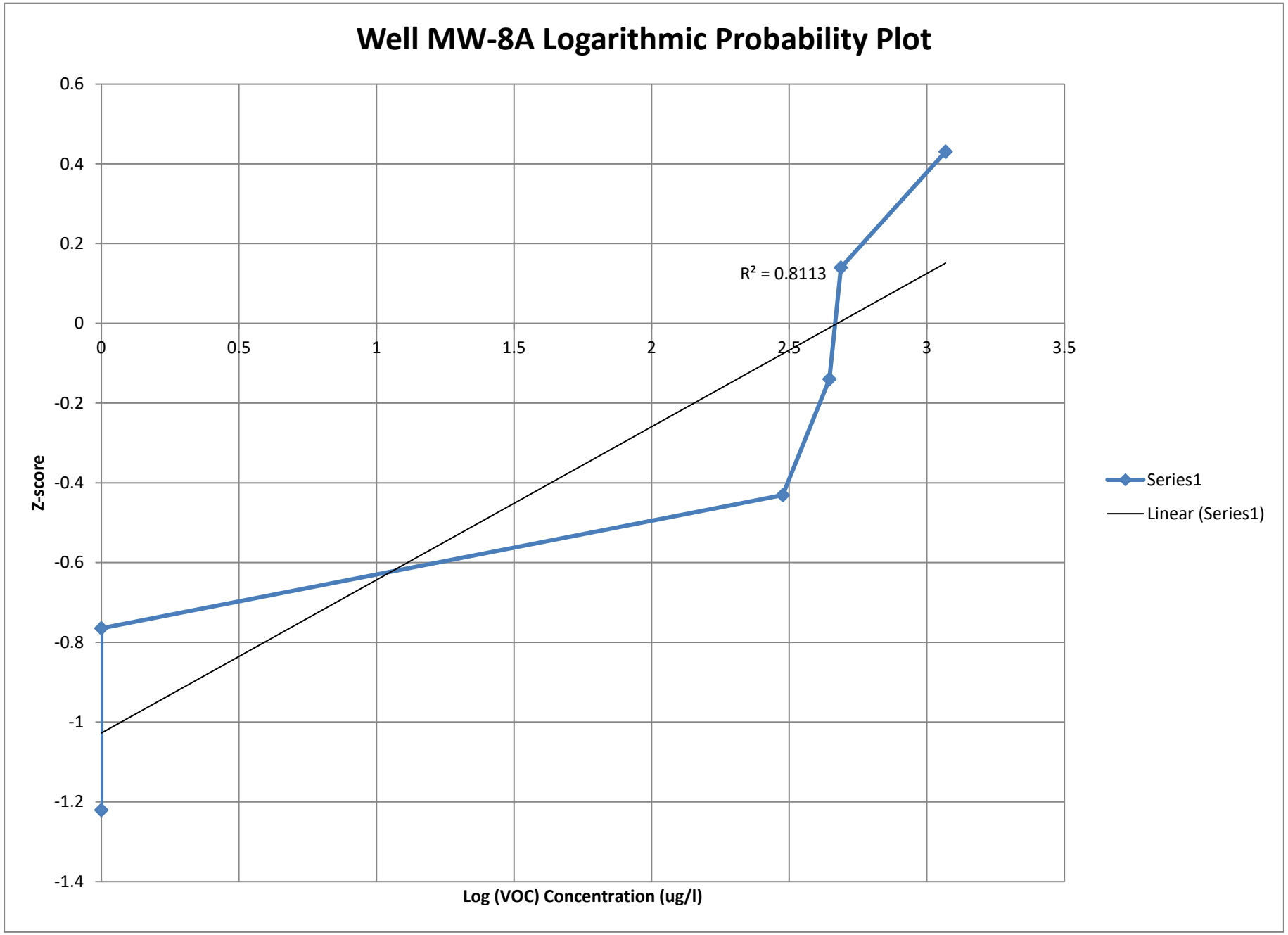
*Logarithmic Probability Plot Statistical Calculations*

| position | Date | Total VOCs (ug/l) | Log of Concentration | Cumulative Probability | z-score |
|---|---|---|---|---|---|
| 1 | 12/14/18 | 3.9 | 0 | 0.111111111 | -1.22064 |
| 2 | 6/22/17 | 11.1 | 0 | 0.222222222 | -0.76471 |
| 3 | 6/25/18 | 11.9 | 2.4765384 | 0.333333333 | -0.43073 |
| 4 | 5/22/19 | 14.1 | 2.646174797 | 0.444444444 | -0.13971 |
| 5 | 9/22/17 | 14.7 | 2.687847494 | 0.555555556 | 0.13971 |
| 6 | 8/26/19 | 21.5 | 3.068052935 | 0.666666667 | 0.430727 |

Notes:


Well MW-8A Probability Plot
0.8
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
z-score
0
5
10
15
20
25
VOC Concentration (ug/l)
R² = 0.9105
Series1
Linear (Series1)


Well MW-8A Total VOCs Over Time
Total VOCs (ug/l)
25
20
15
10
5
0
3/6/17
6/14/17
9/22/17
12/31/17
4/10/18
7/19/18
10/27/18
2/4/19
5/15/19
8/23/19
12/1/19
Date
y = 0.0052x - 212.04
Series1
Linear (Series1)


Well MW-8A Logarithmic Probability Plot
0.6
0.4
0.2
0
-0.2
-0.4
-0.6
-0.8
-1
-1.2
-1.4
0
0.5
1
1.5
2
2.5
3
3.5
Z-score
Log (VOC) Concentration (ug/l)
R² = 0.8113
Series1
Linear (Series1)