GROUNDWATER PUBLIC WATER SUPPLY PROTECTION AND MITIGATION PROGRAM COMPLIANCE REPORT

Former Unisys Site
Lake Success, New York

NYSDEC Site ID# 130045

Prepared for:
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ACRONYMS AND ABBREVIATIONS

AMEC	AMEC E&E, PC
COC	chemical(s) of concern
cis-1,2-DCE	*cis*-1,2-dichloroethene
Freon 113	1,1,2-trichloro-1,2,2-triflouroethane
FS	Feasibility Study
gpm	gallons per minute
IRM	Interim Remedial Measure
Lockheed Martin	Lockheed Martin Corporation
LIPA	Long Island Power Authority
MLWD	Manhasset- Lakeville Water District
µg/L	microgram(s) per liter
NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
OU	Operable Unit
PCE	tetrachloroethene
PWSPMP	Public Water Supply Protection and Mitigation Program
RI	Remedial Investigation
ROD	Record of Decision
Site	Former Unisys Facility
TCE	trichloroethene
TVOC	total volatile organic compounds
VOC	volatile organic compound
WAGNN	Water Authority of Great Neck North

SECTION 1
INTRODUCTION AND BACKGROUND

This Groundwater Public Water Supply Protection and Mitigation Program Compliance Report (hereafter referred to the "Compliance Report") has been developed to evaluate ongoing compliance with the public water supply protection requirements of the remedy selected by the New York State Department of Environmental Conservation (NYSDEC) and New York State Department of Health (NYSDOH) to meet remedial action objectives related to off-Site groundwater impacts from the former Unisys Facility (the Site). The Site is located in the Village of Lake Success and the Town of North Hempstead in Nassau County, New York as shown on **Figure 1-1**. The Site is located at 1111 Marcus Avenue, Lake Success, New York. The Site is bounded by Marcus Avenue to the north, Union Turnpike to the South, Lakeville Road to the west, and the Triad Business Park to the east.

The remedy, described in the December 2014 Record of Decision (ROD), Unisys Corporation, Operable Unit (OU) No. 2 for Site No. 130045 (NYSDEC, 2014), requires that a Public Water Supply Protection and Mitigation Program (PWSPMP) be implemented to protect municipal wells that are, or could be, impacted from historical releases at the Site, "now or in the future, to assure for as long as the wells are used as public water supply sources that drinking water standards are achieved and that the finished water is of no lesser quality as currently distributed due to actions taken as part of this remedy."

Lockheed Martin Corporation (Lockheed Martin) has developed this Compliance Report as requested by NYSDEC (NYSDEC, 2019) to provide a summary of current groundwater conditions, groundwater transport modeling, and document compliance with the ROD requirements relative to the PWSPMP. Groundwater sampling and laboratory analysis performed in accordance with the ROD is being used to track the movement of contaminants of concern (COCs) migrating from the Site. There are two public water supply utilities hydraulically downgradient of the former Unisys Site that serve the area. These are the Water Authority of Great Neck North (WAGNN) (which operates the Community Drive Well Field, the Watermill Lane

Well Field, and the Ravine Road well) and the Manhasset-Lakeville Water District (MLWD) (which operates the well referred to as the Cumberland well). These water suppliers and their well fields are described in more detail in **Section 1.5**. WAGNN and MLWD operate other wells that are not located within the path of the former Unisys Site plume. The Compliance Report addresses only the well fields identified above that are within the path of the plume.

1.1 SITE DESCRIPTION

The Site (which currently occupies 90.5 acres) operated as a manufacturing facility and included a main building along with six smaller buildings (located south of the main building). The smaller buildings formerly included the foundry building, environmental testing building, boiler building, garage, maintenance shop, and lake house building. The main building has since been renovated and primarily consists of office space. Some ancillary structures have also been renovated. The environmental testing building and the lake house building have been removed. The balance of the property consists of paved areas (parking lots) and three stormwater retention basins.

The 90.5-acre Site is designated as OU No. 1 (OU1) and the off-Site groundwater impact is designated as OU2. A ROD was issued for OU1 in March 1997, and amended in January 2015, that specifies the details of construction, operation, maintenance, and monitoring of the remediation of groundwater, soil and soil vapor, and sediments on Site. Current treatment at OU1 includes groundwater, soil vapor, and sub-slab depressurization remediation systems.

The OU1 groundwater remediation system is located on Site and includes a groundwater treatment plant located in the northeast corner of the Site, four remedial groundwater extraction wells (RW-3, EW-1R, RW1-RS, and RW1-RD), and associated on-Site piping located parallel to Marcus Avenue as shown on **Figure 1-2**. Treated water is conveyed to four off-Site diffusion wells for reinjection into the aquifer (DW-11, DW-12, DW-13, and DW-14). These diffusion wells are located northeast of the Site, near the Northern State Parkway between Lakeville and New Hyde Park Roads, on property owned by the New York State Office of Parks, Recreation and Historic Preservation.

The OU2 portion of the groundwater remediation system, initially installed as an interim remedial measure (IRM), is located at the end of Tanners Road and includes a groundwater treatment plant located in the former MLWD water treatment plant sometimes referred to as the Parkway Station.

One remedial groundwater extraction well (RW-100) and associated piping is used to convey the extracted water to the groundwater treatment system. The treated water is pumped to three off-Site diffusion wells for reinjection into the aquifer (DW-100, DW-101 and DW-102). These diffusion wells are located in between the Northern State Parkway and the Long Island Expressway and just west of New Hyde Park Road as shown on **Figure 1-2**.

1.2 SITE HISTORY

The Site was an active manufacturing facility from its startup in 1941 until approximately 1998 when all manufacturing activities ceased. The facility was originally designed and built by the United States Government and was operated under a contract to Sperry Gyroscope Company from 1941 to 1951. In 1951, the property was sold to Sperry Gyroscope Company, which merged with Burroughs in 1986 to form the Unisys Corporation. In 1995, Loral Corporation acquired assets of Unisys Defense Systems, a division of Unisys. In early 1996, Lockheed Martin purchased the electronics and systems integration businesses of Loral Corporation. Lockheed Martin then sold the property in early 2000 to iPark, which has converted the buildings to commercial rental space. The property is roughly split into two condo units, one primarily constituting the western half of the main building owned by 1111 Marcus Avenue Unit 2 Owner, LLC and the second, primarily the eastern half of the main building, owned by WRD Marcus Avenue A, LLC, c/o Waterstone Development, LLC.

In addition to the 90.5 acres that comprise the Site, the property also originally included an additional 3.5 acres where the Town of North Hempstead has its soccer fields (southeast corner) and 55 acres immediately to the east of the Site on which a large manufacturing building was located. This building was demolished, and the 55-acre property was sold to a developer in the 1970s, who constructed the present-day Triad Business Park.

Additional adjacent property containing electrical substations, located south of the Site, was also formerly owned by Unisys; however, the equipment was always operated by the Long Island Power Authority (LIPA), formerly known as the Long Island Lighting Company. LIPA leased the land from Unisys until 1992, when LIPA purchased the property from Unisys. The LIPA property is not part of the 90.5-acre Site.

1.3 SITE GROUNDWATER CONTAMINATION SUMMARY

Prior studies at the Site and off-Site established that releases on the Site resulted in a volatile organic compound (VOC) groundwater plume migrating generally northward/northwestward. As stated above, the NYSDEC has designated the Site as OU1. The Site was divided into two OUs. OU1 currently consists of the 90.5-acre Site property. OU2 is defined as the off-Site area beyond the 90.5-acre property where contaminants in groundwater have migrated from the Site (OU1).The Site and associated extraction wells, diffusion wells, and groundwater treatment systems are shown on **Figure 1-2**.

The COCs identified for the Site are VOCs, specifically: tetrachloroethene (PCE), trichloroethene (TCE), *cis*-1,2-dichloroethene (*cis*-1,2-DCE) and 1,1,2-trichloro-1,2,2-triflouroethane (Freon 113). The term "Total Volatile Organic Compounds (TVOC)" in this document refers to the sum of the concentrations of the VOCs listed above.

1.4 REGULATORY FRAMEWORK

The Site was classified by NYSDEC as a Class 2 Site on May 1, 1991, in the Registry of Inactive Hazardous Waste Disposal Sites in New York State (Site No. 130045). To facilitate remedial decisions, in 1995 the NYSDEC created two OUs: OU1, on-Site impacts and remediation, and OU2, off-Site impacted groundwater. Lockheed Martin signed an Order on Consent No. 1-20160426-40 with the NYSDEC on September 15, 2016. The NYSDEC oversees implementation and compliance with the remedy identified in the OU1 and OU2 RODs.

The OU1 ROD was issued by the NYSDEC in March 1997 for on-Site remediation of soils, sediments, and groundwater at OU1 (NYSDEC, 1997a). An Amendment to the OU1 ROD, issued by the NYSDEC in January 2015 (NYSDEC, 2015), updated various elements of the original ROD.

The OU2 ROD was issued in December 2014 and presented a summary of Site contamination and of the selected remedy. The selected remedy prescribes five elements to mitigate off-Site groundwater impacts. The elements are:

- incorporation of green remediation principles and techniques;
- continued operation of the OU2 IRM groundwater extraction and treatment system;

- an upgrade of the existing OU1 groundwater remediation system to include well RW-3 (a new extraction well);
- a PWSPMP; and
- a Site Management Plan.

The requirements for a PWSPMP directly relate to this Compliance Report. The elements of the PWSPMP are described in the OU2 ROD as follows:

"A program that promotes the distribution of potable water of the highest quality will be developed and implemented, until such time as groundwater standards are achieved in all areas impacted by the Unisys Groundwater Plume. The program will be consistent with the requirements of Subpart 5-1 of the State Sanitary Code and will include, but may not be limited to, the following:

- an installation, operation and maintenance plan for public water supply wellhead treatment systems (including continued operation of all existing systems or installation of additional treatment systems or upgrades to existing systems) on wells affected by Site-related contamination, now or in the future, to assure for as long as the wells are used as public water supply sources that drinking water standards are achieved and that the finished water is of no lesser quality as currently distributed due to actions taken as part of this remedy;
- a monitoring plan that will include, but may not be limited to, groundwater monitoring at sentinel wells installed upgradient of water supply wells that could potentially be affected by the continued migration of the groundwater contamination;
- periodic updates on the groundwater model simulation results to track contaminant migration; and
- a response plan that will be implemented if Site-related contaminant concentration(s) in the sentinel well(s) approach or exceed Site-specific action levels and will include, but may not be limited to, notifying the Department, NYSDOH, County Health Department and the potentially impacted water district and evaluating the rate of movement of Site-related contaminants toward the public supply well(s) and the need for wellhead treatment. If treatment is needed, an appropriate system will be designed, installed and maintained at the wellhead."

1.5 LOCAL WATER UTILITIES

The two public water suppliers affected by the Former Unisys Site include WAGNN and MLWD and their well fields and treatment systems are described below.

1.5.1 Water Authority of Great Neck North

WAGNN provides potable water to the northern areas of the Great Neck Peninsula, which include the villages of Great Neck, Great Neck Estates, Kensington, Kings Point, Saddle Rock, portions of Great Neck Plaza and Thomaston, and portions of the unincorporated areas of the Town of North Hempstead. WAGNN currently operates eight municipal wells for supplying water to its customers. The wells are located singly or in clusters at separate locations typically within the water authority's service area. Specific wells in this Compliance Report are designated both by the utility nomenclature, such as "WAGNN 12" plus the NYSDEC identification number (e.g., N13000). The following wells have been impacted, may be at risk of impact from future migration of the Former Unisys Site Plume (see **Sections 2.0 and 4.0**), or are of particular concern to the water district:

Community Drive Well Field

The Community Drive Well Field consists of three water supply wells, screened in the Magothy aquifer:

- WAGNN 12 (N13000)
- WAGNN 13 (N12999)
- WAGNN 14 (N13821)

The Community Drive water supply wells are currently impacted by the Former Unisys Site Plume. Environmental contaminants that do not originate from the former Unisys Site (e.g. Freon-22 and a herbicide (DCPA)) have also been detected in these wells. Water extracted from these wells is treated by an air-stripper and activated carbon system that has been upgraded to handle current and anticipated future impacts from the Former Unisys Site Plume. The air stripper design basis is for 99.5% removal of 200 micrograms per liter (µg/L) of *cis*-1,2-DCE at 2,800 gallons per minute (gpm). Between 2010 and 2019, average annual pumping rates at the Community Drive Well Field ranged from 650 to 1,630 gpm.

Watermill Lane Well Field

The Watermill Lane Well Field consists of two extraction wells that are screened in upper Glacial and/or Magothy deposits and a third well screened in the deeper Lloyd aquifer:

- WAGNN 2A (N12796)
- WAGNN 9 (N4388)
- WAGNN 11A (N14250) (Lloyd well)

WAGNN Wells 2A (N12796) and 9 (N4388) are currently impacted by COCs related to the Former Unisys Site Plume. WAGNN Well 11A is screened in the deeper Lloyd aquifer than the former Unisys Site Plume in the Upper Glacial and Magothy aquifers.

Groundwater extracted from wells 2A and 9 at the Watermill Lane Well Field is treated by an existing air stripper treatment system to remove chlorinated VOCs. The air stripper design basis is for 99.5% removal of 100 µg/L of PCE at 2,000 gpm and was originally installed to address contamination not related to the former Unisys Site. WAGNN Well 11A is not treated by the air stripper.

Sentinel wells MW-52 MI and ML and MW-53 MI and ML were installed in 2017 and 2019, respectively, to provide early warning related to this well field and the Former Unisys Site Plume. The status of the Former Unisys Site Plume on these wells is discussed in later sections of this report. Between 2010 and 2019, average annual pumping rates at the Watermill Lane Well Field ranged from 670 to 930 gpm.

WAGNN Ravine Road Well

The Ravine Road Well Field consists of a single water supply well that is screened in the Magothy aquifer. Based on mapping by the USGS, this well is located in the northern extent of the Magothy formation on the Great Neck peninsula (Stumm, 2001, [page 16, Figure 7]):

WAGNN 10A (N12735)

This well does not currently have VOC treatment installed. This well is not impacted by the Former Unisys Site Plume based on the groundwater model-predicted extent of impact to groundwater. Groundwater monitoring and periodic groundwater modeling updates track the plume migration and determine if changes in groundwater withdrawal patterns could result in impacts to this well and the need for new sentinel wells upgradient of this location. Between 2010 and 2019, the average annual pumping rate at this well ranged from 150 to 460 gpm.

1.5.2 Manhasset-Lakeville Water District

The MLWD serves the Manhasset-Lakeville area with 18 water supply wells distributed at 13 different locations. The MLWD provides drinking water to portions of the Town of North Hempstead and to all or portions of the following villages: Plandome Manor, Plandome Heights, Flower Hill, Munsey Park, North Hills, New Hyde Park, Lake Success, Great Neck Plaza, Russell Gardens, Thomaston, and Plandome. Based on groundwater data and groundwater transport model simulations, the Cumberland Well (N5099) is the only active MLWD well that has been impacted by the Former Unisys Site Plume.

The MLWD Cumberland Well (N5099) is screened in the Magothy aquifer and was taken out of service in 2011 due to impacts associated with the Former Unisys Site Plume. A wellhead treatment system consisting of an air stripper was placed online in 2016. The Cumberland Well (N5099) has been in service since treatment was installed. The air stripper design basis is for 99.8% removal of 260 µg/L of *cis*-1,2-DCE at 1,050 gpm. The average pumping rate at well N5099 was approximately 900 gpm and 550 gpm in 2017 and 2018, respectively. The location of this well is shown on **Figure 1-3**.

SECTION 2
GROUNDWATER MONITORING

Lockheed Martin continues to sample monitoring wells, sentinel wells, and water supply wells periodically in accordance with a Groundwater Sampling and Analysis Plan that is submitted to and approved by the NYSDEC. With respect to the Community Drive Well Field, the Watermill Lane Well Field, and the Cumberland Well, a series of sentinel wells has been established upgradient of these wells. The supply well and sentinel well identification numbers are listed in the following subsections. Both the supply wells and the sentinel wells are sampled quarterly, and the results are reported to the NYSDEC. Sentinel wells are monitoring wells located to serve as an early warning that the migration of contaminants from the former Unisys Site are approaching a public supply well.

2.1 WAGNN COMMUNITY DRIVE WELL FIELD

The WAGNN Community Drive Well Field consists of three supply wells:

- WAGNN 12 (N13000)
- WAGNN 13 (N12999)
- WAGNN 14 (N13821)

Five sentinel wells are associated with the Community Drive Well Field:

- 43MU
- 43MI
- 31GL
- 31MU
- 31ML

Historical sampling and analysis of the Community Drive Supply Wells and their related sentinel wells indicates that these supply wells have been impacted by the Former Unisys Site Plume. As shown on **Figure 2-1** of this report, the four COCs identified in the Former Unisys Site Plume were detected in water samples collected from the sentinel wells and supply wells N12999, N13000 and N13821. The results are also presented in tabular format on **Table 2-1**.

A groundwater treatment system was installed at the Community Drive Well Field in 2005. The well head treatment system remains in operation and is operated and maintained by the water district.

2.2 WAGNN WATERMILL LANE WELL FIELD

The WAGNN Watermill Lane Well Field consists of two supply wells that are screened in the Magothy and/or Upper Glacial aquifers:

- WAGNN 2A (N12796)
- WAGNN 9 (N4388)

Six sentinel wells are associated with the Watermill Lane Well Field:

- 53 MI
- 53 ML
- 52 MI
- 52 ML
- 45MU
- 45MI

Historical sampling and analysis of the Watermill Lane Supply Wells and their related sentinel wells indicates that Site-related COCs are migrating towards these supply wells. As shown on **Figure 2-2**, the four Site-related COCs identified in the Former Unisys Site Plume were detected in water samples collected from the sentinel wells and from the two supply wells. The results are also presented in tabular format on **Table 2-2**.

The results for the recent third Quarter 2019 sampling event are presented on a hydrogeologic cross-section included as **Figure 2-3**. During this sampling event, the concentration of the Site-related COCs in samples collected from the MW-45 well cluster (the sentinel wells located the furthest from the Watermill Lane supply wells) are relatively similar to previous years' results. Water samples collected from the MW-52 well cluster, which were installed in 2017, have lower concentrations of the COCs than the MW-45 well cluster with some compounds recorded as not detected. The MW-53 well cluster (the sentinel wells located the nearest to the Watermill Lane supply wells) was installed in 2019 and first sampled on August 1, 2019. Low detections of all four COCs were detected in the sample collected from the deeper of these two wells.

In the fourth quarter 2019 sampling event former Unisys Site-related sentinel wells, public water supply wells, and other monitoring wells in the vicinity of the Watermill Lane well field (**Figure 2-4**). All four COCs (*cis*-1,2 DCE, TCE, PCE and Freon 113) related to former Unisys Site are also detected in well CL-4D located close to WAGNN public supply well N12796. **Figure 2-4** also provides and summary of groundwater concentrations for the overall Site for the fourth quarter 2019 sampling event. In addition to the 2019 sampling program, wells MW-52 MI and ML, MW-53 MI and ML, CL4D and N-4388 were sampled on a monthly basis from January through March 2020 (well N-12796 was under construction and out-of-service during this time). The results of these sample analyses displayed a similar trend as was identified in previous 2019 sampling. The data are present on **Figure 2-5** and **Table 2-3**. Groundwater extracted from the Watermill Lane well field continues to be treated by an existing air stripper treatment system which removes these compounds as defined in **Appendix A**.

In summary, the most recent data collected from the Watermill Lane sentinel wells and supply wells N12796 and N4388 appear to indicate that Site-related COCs from the former Unisys Site are present at these supply wells. As such, Lockheed Martin has prepared a Response Plan, which is included as **Section 4** of this document.

2.3 WAGNN RAVINE ROAD WELL

WAGNN Well 10A (N12735) is not currently impacted by the Former Unisys Site Plume. Recent 2019 results provided from WAGNN indicate the Site COCs are not detected in this well as presented in **Table 2-4**.

2.4 MANHASSET-LAKEVILLE WATER DISTRICT

The MLWD Cumberland Well Field consists of one supply well:

- MLWD Cumberland Well (N5099)

Four sentinel wells are associated with the Cumberland Well Field:

- 51 MI
- 51 ML
- 46 MI
- 46 ML

Historical sampling and analysis of the Cumberland Well and its associated sentinel wells indicates that this supply well has been impacted by the Former Unisys Site Plume. As shown on **Figure 2-6**, the four Site-related COCs identified in the Former Unisys Site Plume were detected in water samples collected from the sentinel wells and the supply well. The results are also presented in tabular format on **Table 2-5**.

A groundwater treatment system was installed at the Cumberland well in 2016. The well head treatment system remains in operation and is operated and maintained by the water district. All public supply wells are monitored by the water districts at frequencies established by the Nassau County Department of Health

SECTION 3
GROUNDWATER MODEL

Groundwater flow and solute transport model simulations (CDM Smith, 2012a,b,c) were developed and described in detail in the OU2 Remedial Investigation/Feasibility Study (RI/FS) Reports (ARCADIS, 2012a,b,c) for the Site. The groundwater flow model was based on the stratigraphy and hydrogeologic properties represented in the Nassau County regional model supplemented with data from OU1, OU2, and other nearby boring logs. For the OU2 RI/FS studies, the groundwater flow model was used to simulate transient groundwater flow patterns from 1940 to 2007 to demonstrate that the model could reasonably represent observed groundwater heads and gradients and temporal water level variations due to changes in pumping and recharge. The groundwater flow and solute transport model was applied to evaluate current and potential future groundwater flow and TVOC transport in the vicinity of the Site and potential groundwater plume impacts to downgradient receptors.

The OU2 ROD (NYSDEC, 2014) stipulates that periodic updates to the groundwater model occur to incorporate new data and update predictions of plume migration and groundwater quality. The Lockheed Martin Site groundwater model is maintained and updated with recent geologic data from the installation of new wells and recent water level and analytical data from quarterly sampling was used to update the groundwater model as documented in in the 2019 Groundwater Model Update Report (CDM Smith, 2020). The updated modeling report is provided in **Appendix B**.

For the 2019 *Groundwater Public Water Supply Protection and Mitigation Program Compliance Report*, the following groundwater model updates and/or analyses were completed:

- The groundwater flow model simulation period was extended through September 2019.
- Based on lithological descriptions in the well cluster 53 vertical profile boring, aquifer properties in the groundwater model near well cluster 53 and the Watermill Lane well field were adjusted. Groundwater elevation data from several available nearby monitoring wells located north of the Watermill Lane wells, informed the model updates.

- Based on groundwater quality data collected since 2016 and transport simulations with the updated groundwater model, the current (2019) limits of the TVOC groundwater plume limits were estimated for different depth horizons.

- Groundwater flow and mass transport simulations were conducted to estimate potential future TVOC concentrations in the pumped groundwater at the WAGNN Community Drive well field (N12999, N13000 and N13821), the WAGNN Watermill Lane well field (N4388 and N12796), the MLWD Cumberland well field (N5099), and the WAGNN Ravine Road Well (N12375).

The projections of future TVOC concentration trends have been updated as part of this model update (CDM Smith, 2020).

Table 3-1 lists the maximum simulated TVOC concentration at the water supply and sentinel wells over a 20-year period from January 2020 along with estimates of percent of *cis*-1,2-DCE, PCE, TCE, and Freon 113 that make up the TVOC based on percentages measured at individual sentinel wells. The simulated TVOC concentrations at WAGNN Watermill Lane and Community Drive well fields are 30 µg/L. The simulated maximum TVOC concentration at Cumberland well N5099 is 210 µg/L. Maximum simulated TVOC concentrations at the sentinel well clusters are two to 12 times greater than maximum simulated TVOC concentrations at the water supply wells.

Simulation results suggest the former Unisys groundwater plume may arrive at the WAGNN Ravine Road well N12735 at concentrations of 1 to 4 µg/L in approximately 15 to 20 years from the end of 2019.

Model simulation results will continue to be used to interpret groundwater quality monitoring data and predict TVOC plume migration. .

SECTION 4
COMPLIANCE ASSESSMENT AND RESPONSE PLAN

The compliance assessment begins with an evaluation of current groundwater concentrations at the public water supply wells. The measured concentrations are presented for the public water supply wells in **Table 4-1** and compared with the existing treatment system design basis to assess the current status of protection of the public water supplies. In addition, future maximum groundwater concentrations over the next five years at the public water supply wells projected by the updated groundwater model are compared with the existing treatment system design basis in **Table 4-2**. Based on these evaluations, the following findings are made concerning the protection of public water supply wells:

- The WAGNN Community Drive Well Field is impacted by the Former Unisys Site Plume, which is treated by the existing treatment system. Current and projected concentrations over the next five years do not exceed the air stripper design basis indicating additional treatment does not need to be considered at this time.

- The WAGNN Watermill Lane Well Field is impacted by the Former Unisys Site Plume. The low-level presence of *cis*-1,2-DCE, TCE, PCE and Freon 113 indicates that the Former Unisys Site Plume is at the well field. Current and projected concentrations over the next five years do not exceed the design basis indicating additional treatment does not need to be considered at this time.

- The WAGNN Ravine Road Well 10A (N12735) is not impacted by the Former Unisys Site Plume. Projected concentrations indicate the well will not be impacted by the Former Unisys Plume in the next five years; however, long-term projections (15 to 20 years) show a potential impact in the 1 to 4 µg/L range.

- The MLWD Cumberland Well is impacted by the Former Unisys Site Plume, which is treated by the existing treatment system. Current and projected concentrations over the next five years do not exceed the air stripper design basis indicating additional treatment does not need to be considered at this time.

- A sentinel network is established that provides monitoring for groundwater concentrations approaching the water supply wells except the WAGNN Ravine Road Well 10A (N12735) where a sentinel well is planned in the next few years. Groundwater concentration projections indicate there is no immediate threat to this well from the former Unisys Site Plume in the next five years.

The only change from conditions prior to 2019 represented by the above findings is the presence of the Former Unisys Site Plume at the WAGNN Watermill Lane Well Field and the potential presence in the long term (15 to 20 years) of the Former Unisys Site Plume at the WAGNN Ravine Road Well. Although current and projected future concentrations over the next five years are below concentrations at which additional treatment is likely to be required, the concentrations at sentinel and public water supply wells should continue to be monitored against projections to identify deviations that may trigger a response.

A formal Response Plan with action levels for the sentinel wells will be established when the PWSPMP document is revised. In the interim, the above assessment establishes that existing treatment systems are adequate to handle current and near-term groundwater concentrations from the Former Unisys Site plume. Recent sampling data has established the presence of the former Unisys Site Plume at the Watermill Lane well field. These findings lead to the recommended responses in the following sections.

4.1 AGENCY NOTIFICATION

Sentinel wells MW-53 MI and ML were installed in 2019 and sampled initially in August of 2019. Based on the data collected from these two recently installed wells, and on the past year of water samples collected from WAGNN supply well 2A (N12796), this report serves as Lockheed Martin's notification to the NYSDEC, NYSDOH, Nassau County Department of Health, and WAGNN that COCs from the former Unisys Site has impacted WAGNN supply wells 2A (N12796) and 9 (N4388).

4.2 ADDITIONAL SAMPLING TO CONFIRM SAMPLING RESULTS

The WAGNN Watermill Lane supply wells and associated sentinel wells will continue to be sampled quarterly by Lockheed Martin for analysis in accordance with the Groundwater Sampling and Analysis Plan that was submitted to the NYSDEC. In addition, a series of monthly samples were collected from the MW53 wells and well CL-4D and WAGNN wells 2A and 9 to confirm the former Unisys Plume presence and contaminant concentrations in the Watermill Lane well field area.

4.3 RECOMMENDATION FOR WATERMILL LANE TREATMENT EVALUATION

The existing Watermill Lane treatment system includes an air stripping system for removal of VOCs. At this time, no modifications to the air stripper treatment system will be required to address possible current or future projected concentrations of COCs from the Former Unisys Site Plume at the Watermill Lane supply wells. The existing system was designed and installed at an earlier date and the design basis for the system was removal of up to 100 µg/L of PCE to non-detect levels. The existing air stripper system is expected to effectively remove the VOCs associated with the Former Unisys Site Plume; even though, *cis*-1,2-DCE has a slightly lower Henry's Law constant than PCE. Given that *cis*-1,2-DCE is the compound of highest concentration in the Former Unisys Site Plume, the performance capability of the air stripping treatment system was specifically evaluated for *cis*-1,2-DCE. A screening level evaluation of the air stripper performance is included in **Appendix A.** Lockheed Martin will work with WAGNN to perform additional and refined evaluations, as needed, and establish treatment-based action-levels specific to *cis*-1,2-DCE for the Watermill Lane supply wells.

4.4 RECOMMENDATION FOR FINALIZATION OF THE PWSPMP

Preparation of the PWSPMP began in 2016 but completion has been on hold, primarily to allow for installation and initial monitoring of additional sentinel wells associated with the Watermill Lane well field. The NYSDEC, NYSDOH, and the Nassau County Department of Health (State and County Agencies) have previously reviewed and provided their comments on the draft version of the PWSPMP, which is an element of the 2014 OU-2 ROD and an integral component of the Compliance Report. Following installation of the two additional sentinel wells in 2019, the draft PWSPMP is being updated in 2020. State and County Agencies are awaiting the revised version of the PWSPMP for additional review. The PWSPMP will establish action levels for the water supply and sentinel wells for each respective public water supply well field and will further define the Response Plan associated with the observed VOC concentrations and provide recommended action levels. The draft PWSPMP will be revised in cooperation with the NYSDEC and provided to WAGNN and MLWD. The PWSPMP will establish action levels for the supply and sentinel wells for each well field and further define the Response Plan associated with observed concentrations safe action levels.

4.5 RECOMMENDATION FOR CONTINUED GROUNDWATER AND TVOC MASS TRANSPORT MODELING

Groundwater flow and TVOC mass transport simulation results will continue to be updated to track groundwater quality monitoring results and to predict TVOC plume migration. Groundwater results will be compared to the most recent model simulations on an annual basis. Groundwater model updates will be conducted to calibrate measured results with simulations, incorporate existing geologic conditions, and document water supply pumping conditions that may significantly affect groundwater quality. The groundwater model will be updated at least every two years. Lockheed Martin believes the existing groundwater monitoring program, and the groundwater transport model will accurately predict Site-related COC concentrations projected to reach the Watermill Lane supply wells from the former Unisys plume. The evaluations indicate that Site-related COC concentrations will not exceed the capacity of the existing groundwater treatment systems currently deployed at the water supply wells defined herein for at least the next five years.

4.6 RECOMMENDATIONS FOR SAMPLING PROGRAM

Lockheed Martin believes the current monitoring program and modeling analyses are sufficient to monitor the water quality in the each of the public water supply wells and associated sentinel wells.

SECTION 5
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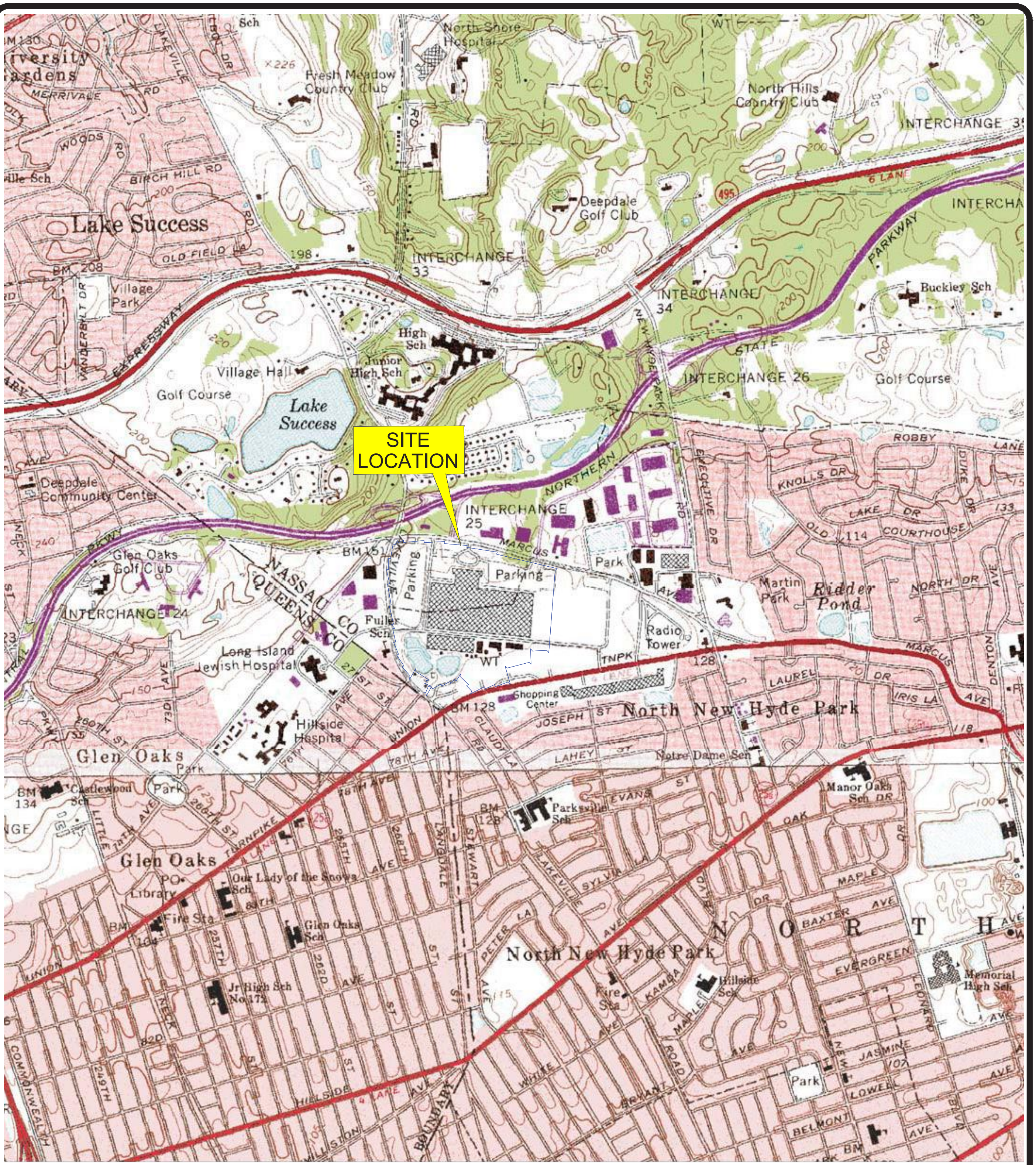
Stumm, Frederick, 2001. Hydrogeology and Extent of Saltwater Intrusion of the Great Neck Peninsula, Great Neck, Long Island, New York. United States Geological Survey, Water-Resources Investigations Report 99-4280.

FIGURES



0 2000 4000

SCALE IN FEET

SOURCES: U.S.G.S TOPOGRAPHIC SERIES (NY)
SEA CLIFF, DATED 1968, PHOTOREVISED 1979
HORIZONTAL DATUM: NAD1927, VERTICAL DATUM: NGVD1929
LATITUDE: 040° 45' 22.07"N, LONGITUDE: 073° 41' 53.55"W

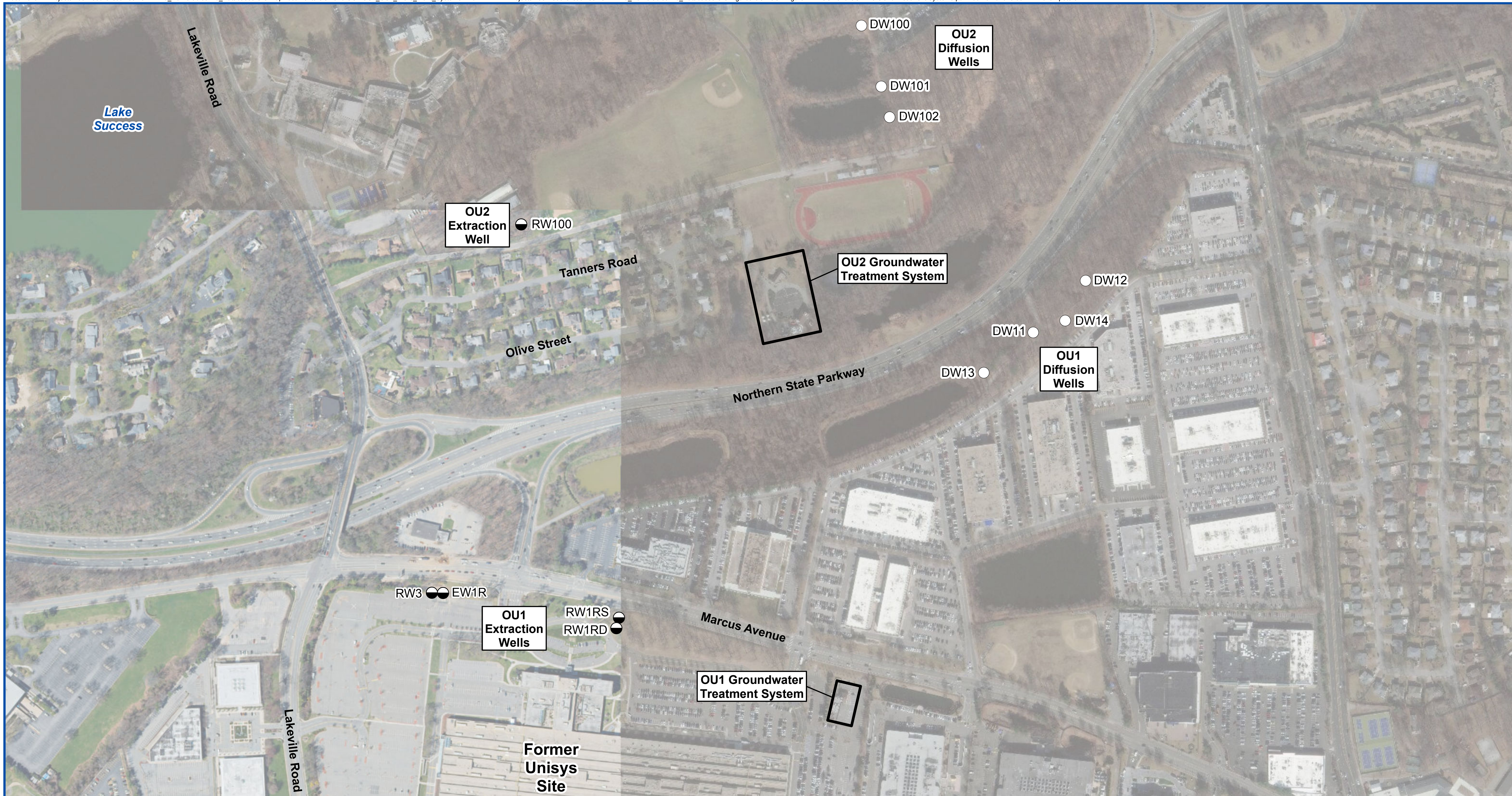
N

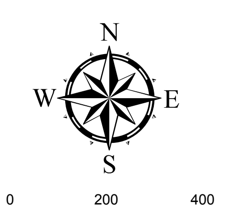
PROJECT:	Lockheed Martin Corporation Former Unisys Site
LOCATION:	Lake Success, New York
TITLE:	SITE LOCATION MAP

amec

APPROVED	EW	FIGURE
DRAFTED	BRT	1-1
PROJECT#	3617-18-7446	
DATE	05-15-20	

Z:\PROJECTS\LOCKHEED_MARTIN_CORP\GREAT_NECK\2019_GW_REPORT\FIGURES\FIGURE_1 - SITE_LOCATION.DWG





Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

◒ EXTRACTION/RECOVERY WELL LOCATION

○ DIFFUSION WELL

LOCATION OF OU1 AND OU2 WELLS AND TREATMENT SYSTEMS

LOCKHEED MARTIN
FORMER UNISYS SITE
LAKE SUCCESS, NEW YORK

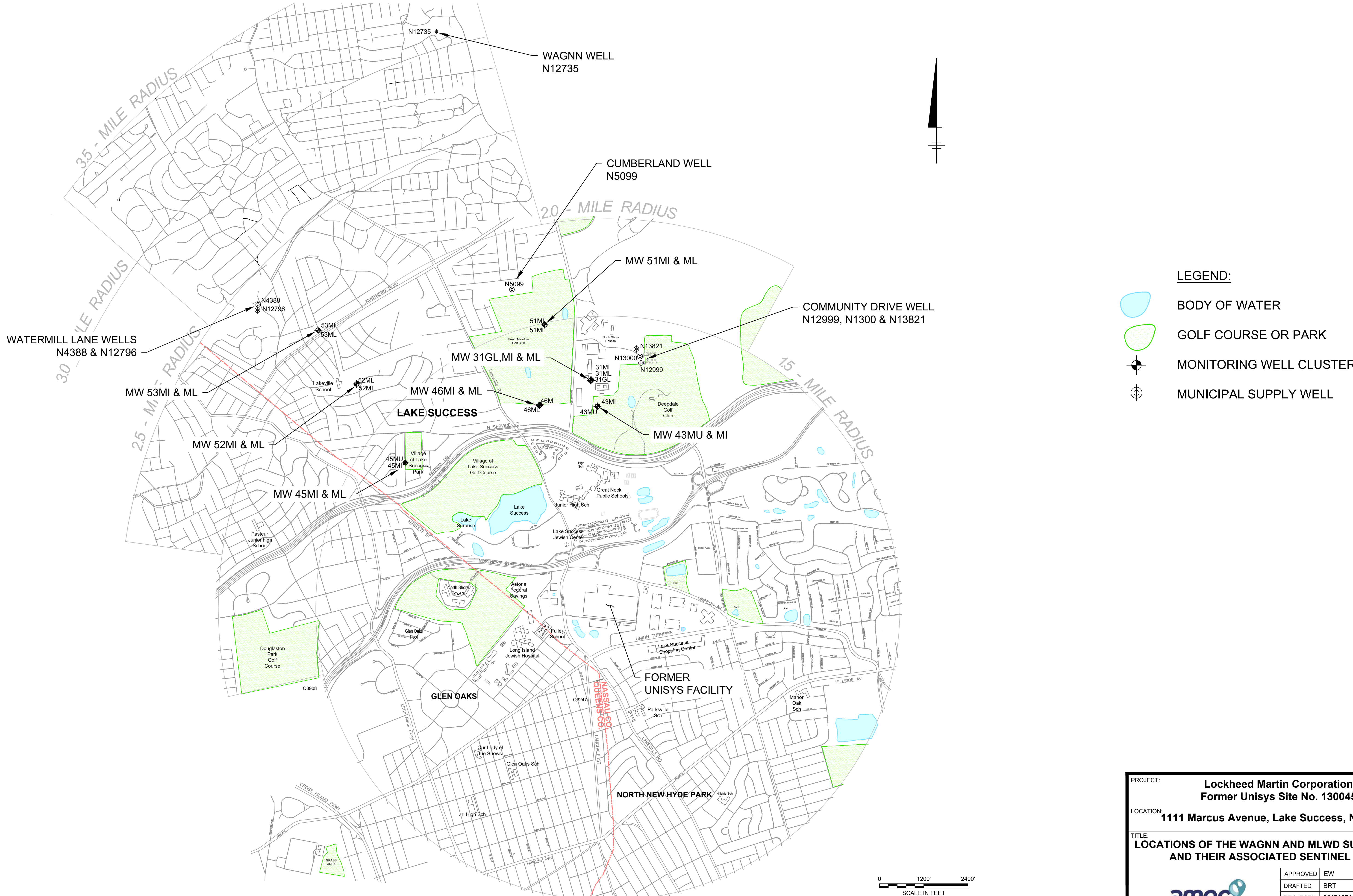
amec

DRAFTED: BRP 11/06/18

APPROVED: EW 11/06/18

DATE: 11/06/2018

FIGURE 1-2



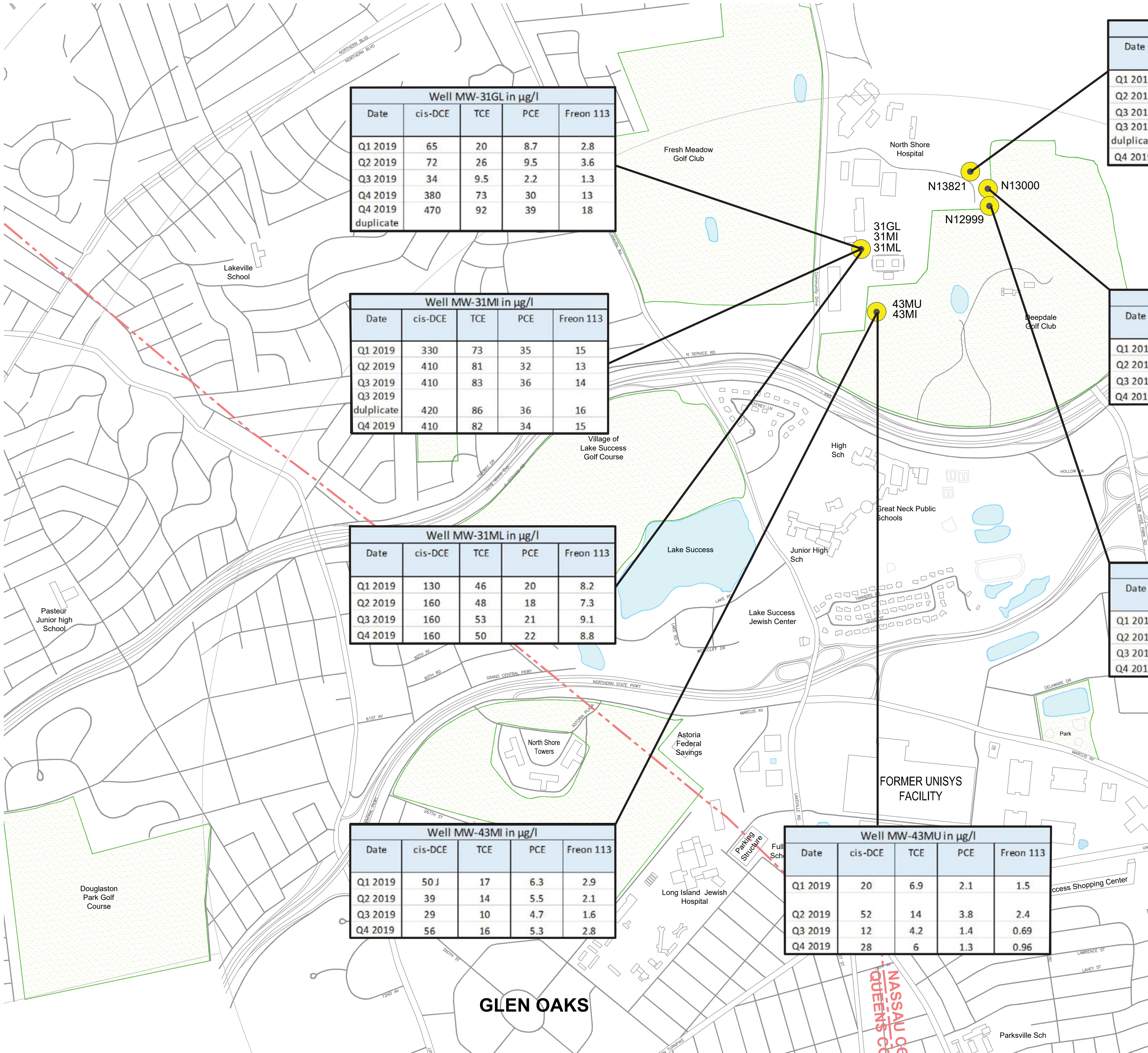
PROJECT: **Lockheed Martin Corporation**
Former Unisys Site No. 130045

LOCATION: **1111 Marcus Avenue, Lake Success, NY 11042**

TITLE: **LOCATIONS OF THE WAGNN AND MLWD SUPPLY WELLS AND THEIR ASSOCIATED SENTINEL WELLS**

amec

APPROVED	EW	FIGURE
DRAFTED	BRT	1-3
PROJECT#	3617187446	
DATE	05-21-20	



Well MW-31GL in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	65	20	8.7	2.8
Q2 2019	72	26	9.5	3.6
Q3 2019	34	9.5	2.2	1.3
Q4 2019	380	73	30	13
Q4 2019 duplicate	470	92	39	18

Well MW-31MI in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	330	73	35	15
Q2 2019	410	81	32	13
Q3 2019	410	83	36	14
Q3 2019 dulplicate	420	86	36	16
Q4 2019	410	82	34	15

Well MW-31ML in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	130	46	20	8.2
Q2 2019	160	48	18	7.3
Q3 2019	160	53	21	9.1
Q4 2019	160	50	22	8.8

Well MW-43MI in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	50 J	17	6.3	2.9
Q2 2019	39	14	5.5	2.1
Q3 2019	29	10	4.7	1.6
Q4 2019	56	16	5.3	2.8

Well MW-43MU in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	20	6.9	2.1	1.5
Q2 2019	52	14	3.8	2.4
Q3 2019	12	4.2	1.4	0.69
Q4 2019	28	6	1.3	0.96

Well N13821 in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	0.5 U	0.5 U	0.5 U	0.5 U
Q2 2019	0.5 U	0.5 U	0.5 U	0.5 U
Q3 2019	4.8	1.2	0.83	0.21 J
Q3 2019 dulplicate	4.7	1.2	0.84	0.22 J
Q4 2019	11	2.7	1.8	0.51

Well N13000 in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	7.2	2	1.2	0.37 J
Q2 2019	11	2.8	1.7	0.56
Q3 2019	12	3.2	2	0.57
Q4 2019	0.26 J	0.58	0.14 J	0.5 U

Well N12999 in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	0.14 J	0.28 J	0.5 U	0.5 U
Q2 2019	1.4	0.63	0.26 J	0.5 U
Q3 2019	0.5 U	0.27 J	0.5 U	0.5 U
Q4 2019	0.3 J	0.36 J	0.5 U	0.5 U

LEGEND:

- BODY OF WATER
- GOLF COURSE OR PARK
- SAMPLED WELL LOCATION
- U COMPOUND UNDETECTED
- J CONCENTRATION IS ESTIMATED

FREON 113 - 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE

cis-DCE - cis-1,2-DICHLOROETHENE

PCE - TETRACHLOROETHENE

TCE - TRICHLOROETHENE

µg/L- MICROGRAMS PER LITER

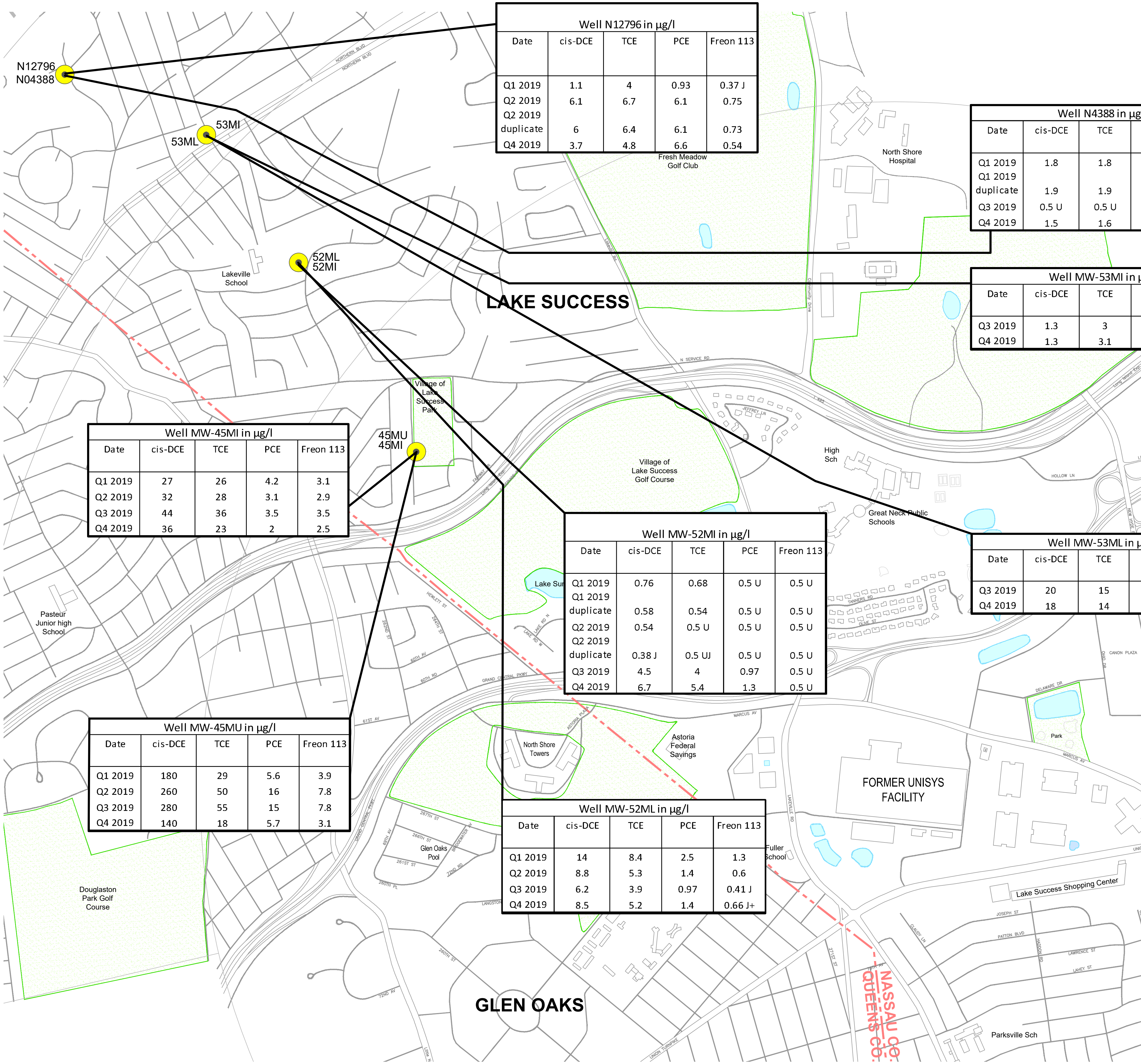
PROJECT: **Lockheed Martin Corporation Former Unisys Site No. 130045**

LOCATION: **Lake Success, New York**

TITLE: **2019 DATA FOR THE COMMUNITY DRIVE PUMPING WELLS AND ASSOCIATED SENTINEL WELLS**

amec

APPROVED	EW	FIGURE
PREPARED	EMP	
DRAFTED	BRT	
PROJECT#	3617187447	2-1
DATE	02-10-20	



Well N12796 in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	1.1	4	0.93	0.37 J
Q2 2019	6.1	6.7	6.1	0.75
Q2 2019 duplicate	6	6.4	6.1	0.73
Q4 2019	3.7	4.8	6.6	0.54

Well N4388 in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	1.8	1.8	2.8	0.2 J
Q1 2019 duplicate	1.9	1.9	2.7	0.2 J
Q3 2019	0.5 U	0.5 U	0.5 U	0.5 U
Q4 2019	1.5	1.6	2	0.5 U

Well MW-53MI in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q3 2019	1.3	3	0.57	0.5 U
Q4 2019	1.3	3.1	0.64	0.5 U

Well MW-45MI in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	27	26	4.2	3.1
Q2 2019	32	28	3.1	2.9
Q3 2019	44	36	3.5	3.5
Q4 2019	36	23	2	2.5

Well MW-52MI in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	0.76	0.68	0.5 U	0.5 U
Q1 2019 duplicate	0.58	0.54	0.5 U	0.5 U
Q2 2019	0.54	0.5 U	0.5 U	0.5 U
Q2 2019 duplicate	0.38 J	0.5 UJ	0.5 U	0.5 U
Q3 2019	4.5	4	0.97	0.5 U
Q4 2019	6.7	5.4	1.3	0.5 U

Well MW-53ML in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q3 2019	20	15	3.4	1.4
Q4 2019	18	14	2.9	1.4

Well MW-45MU in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	180	29	5.6	3.9
Q2 2019	260	50	16	7.8
Q3 2019	280	55	15	7.8
Q4 2019	140	18	5.7	3.1

Well MW-52ML in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	14	8.4	2.5	1.3
Q2 2019	8.8	5.3	1.4	0.6
Q3 2019	6.2	3.9	0.97	0.41 J
Q4 2019	8.5	5.2	1.4	0.66 J+

LEGEND:

- BODY OF WATER
- GOLF COURSE OR PARK
- SAMPLED WELL LOCATION
- U COMPOUND UNDETECTED
- J CONCENTRATION IS ESTIMATED

FREON 113 - 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE

cis-DCE - cis-1,2-DICHLOROETHENE

PCE - TETRACHLOROETHENE

TCE - TRICHLOROETHENE

µg/L- MICROGRAMS PER LITER

PROJECT: Lockheed Martin Corporation Former Unisys Site No. 130045

LOCATION: Lake Success, New York

TITLE: 2019 DATA FOR THE WATERMILL LANE PUMPING WELLS AND ASSOCIATED SENTINEL WELLS

amec

APPROVED	EW
PREPARED	EMP
DRAFTED	BRT
PROJECT#	3617187447
DATE	05-21-20

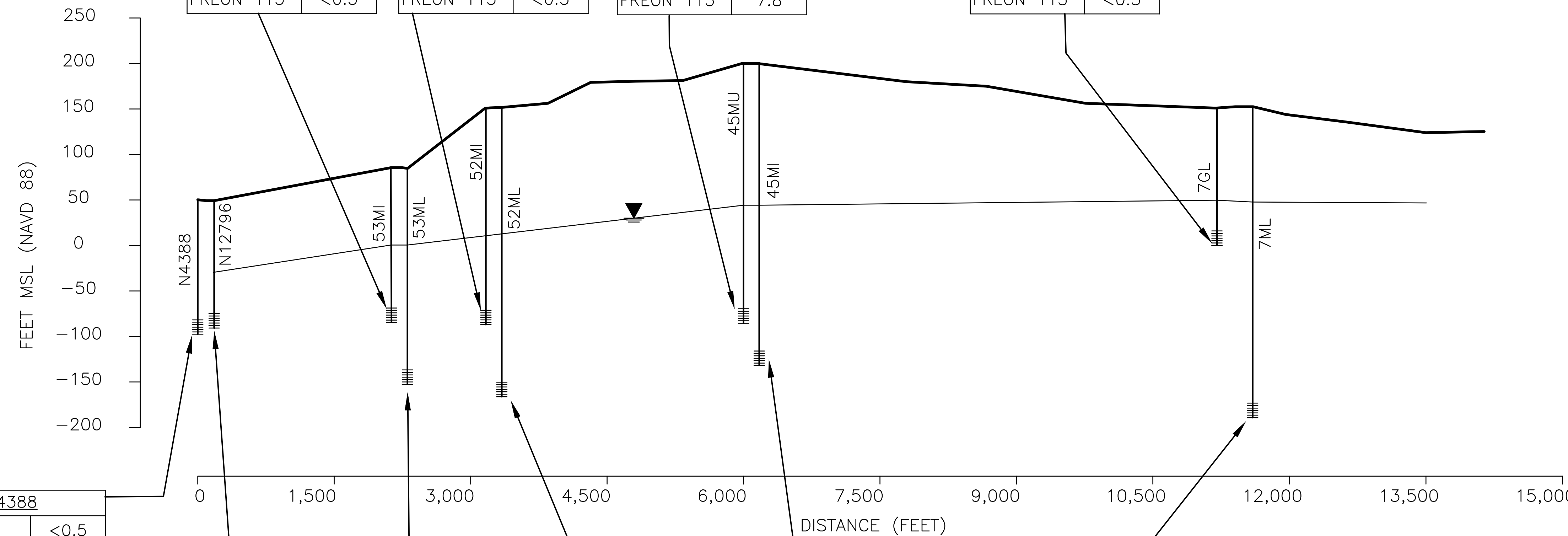
FIGURE 2-2

53MI	
PCE	0.57
TCE	3
CIS−1,2 DCE	1.3
FREON 113	<0.5

52MI	
PCE	0.97
TCE	4
CIS−1,2 DCE	4.5
FREON 113	<0.5

45MU	
PCE	15
TCE	55
CIS−1,2 DCE	280
FREON 113	7.8

7GL	
PCE	1.1
TCE	1.5
CIS−1,2 DCE	1.8
FREON 113	<0.5



N4388	
PCE	<0.5
TCE	<0.5
CIS−1,2 DCE	<0.5
FREON 113	<0.5

N12796	
PCE	6.6
TCE	4.8
CIS−1,2 DCE	3.7
FREON 113	0.54

53ML	
PCE	3.4
TCE	15
CIS−1,2 DCE	20
FREON 113	1.4

52ML	
PCE	0.97
TCE	3.9
CIS−1,2 DCE	6.2
FREON 113	0.41

45MI	
PCE	3.5
TCE	36
CIS−1,2 DCE	44
FREON 113	3.5

7ML	
PCE	26
TCE	47
CIS−1,2 DCE	200
FREON 113	6.9

NOTES:

1. UNITS ARE ug/L
2. SAMPLING EVENT 8/02/2019.
3. <0.5= NOT DETECTED AT A DETECTION LEVEL OF 0.5 ug/L.

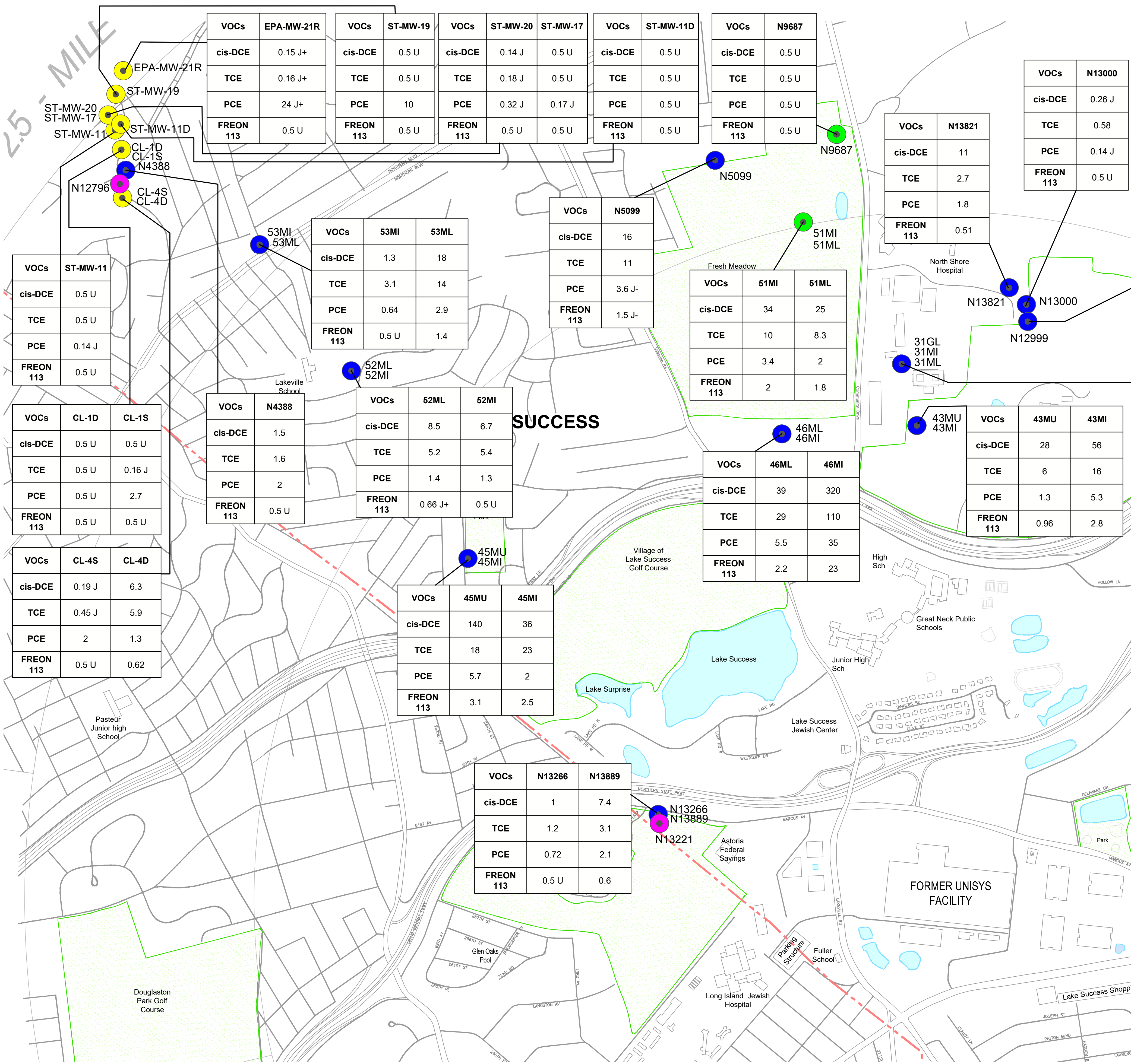
Prepared/Date: BRT 05/15/20
Checked/Date: EMP 05/15/20

0 750 1500 3000
SCALE IN FEET

LOCKHEED MARTIN CORPORATION
FORMER UNISYS SITE
LAKE SUCCESS, NEW YORK
MONITORING/SENTINEL WELLS

amec

HYDROGEOLOGIC
CROSS-SECTION THIRD QUATER 2019
Project 3617-18-7446
Figure 2-3



VOCs	EPA-MW-21R
cis-DCE	0.15 J+
TCE	0.16 J+
PCE	24 J+
FREON 113	0.5 U

VOCs	ST-MW-19
cis-DCE	0.5 U
TCE	0.5 U
PCE	10
FREON 113	0.5 U

VOCs	ST-MW-20	ST-MW-17
cis-DCE	0.14 J	0.5 U
TCE	0.18 J	0.5 U
PCE	0.32 J	0.17 J
FREON 113	0.5 U	0.5 U

VOCs	ST-MW-11D
cis-DCE	0.5 U
TCE	0.5 U
PCE	0.5 U
FREON 113	0.5 U

VOCs	N9687
cis-DCE	0.5 U
TCE	0.5 U
PCE	0.5 U
FREON 113	0.5 U

VOCs	N13000
cis-DCE	0.26 J
TCE	0.58
PCE	0.14 J
FREON 113	0.5 U

VOCs	N13821
cis-DCE	11
TCE	2.7
PCE	1.8
FREON 113	0.51

VOCs	N12999
cis-DCE	0.3 J
TCE	0.36 J
PCE	0.5 U
FREON 113	0.5 U

VOCs	N5099
cis-DCE	16
TCE	11
PCE	3.6 J-
FREON 113	1.5 J-

VOCs	53MI	53ML
cis-DCE	1.3	18
TCE	3.1	14
PCE	0.64	2.9
FREON 113	0.5 U	1.4

VOCs	51MI	51ML
cis-DCE	34	25
TCE	10	8.3
PCE	3.4	2
FREON 113	2	1.8

VOCs	31GL	31MI	31ML
cis-DCE	410	470	160
TCE	82	92	50
PCE	34	39	22
FREON 113	15	18	8.8

VOCs	ST-MW-11
cis-DCE	0.5 U
TCE	0.5 U
PCE	0.14 J
FREON 113	0.5 U

VOCs	CL-1D	CL-1S
cis-DCE	0.5 U	0.5 U
TCE	0.5 U	0.16 J
PCE	0.5 U	2.7
FREON 113	0.5 U	0.5 U

VOCs	N4388
cis-DCE	1.5
TCE	1.6
PCE	2
FREON 113	0.5 U

VOCs	52ML	52MI
cis-DCE	8.5	6.7
TCE	5.2	5.4
PCE	1.4	1.3
FREON 113	0.66 J+	0.5 U

VOCs	46ML	46MI
cis-DCE	39	320
TCE	29	110
PCE	5.5	35
FREON 113	2.2	23

VOCs	43MU	43MI
cis-DCE	28	56
TCE	6	16
PCE	1.3	5.3
FREON 113	0.96	2.8

VOCs	CL-4S	CL-4D
cis-DCE	0.19 J	6.3
TCE	0.45 J	5.9
PCE	2	1.3
FREON 113	0.5 U	0.62

VOCs	45MU	45MI
cis-DCE	140	36
TCE	18	23
PCE	5.7	2
FREON 113	3.1	2.5

VOCs	N13266	N13889
cis-DCE	1	7.4
TCE	1.2	3.1
PCE	0.72	2.1
FREON 113	0.5 U	0.6

LEGEND:

- BODY OF WATER
- GOLF COURSE OR PARK
- WELL LOCATION SAMPLED FOR VOCS AND CHLORIDE
- WELL LOCATION SAMPLED FOR VOCS, CHLORIDE, AND BROMIDE
- WELL LOCATION SAMPLED FOR FREON 113, CIS-DCE, PCE, AND TCE ONLY
- WELL NOT SAMPLED

U - UNDETECTED

J - VALUE IS ESTIMATED

VOC - VOLATILE ORGANIC COMPOUND

FREON 113 - 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE

cis-DCE - cis-1,2-DICHLOROETHENE

PCE - TETRACHLOROETHENE

TCE - TRICHLOROETHENE

NOTE:

All VOC VALUES ARE IN µg/L (MICROGRAMS PER LITER)

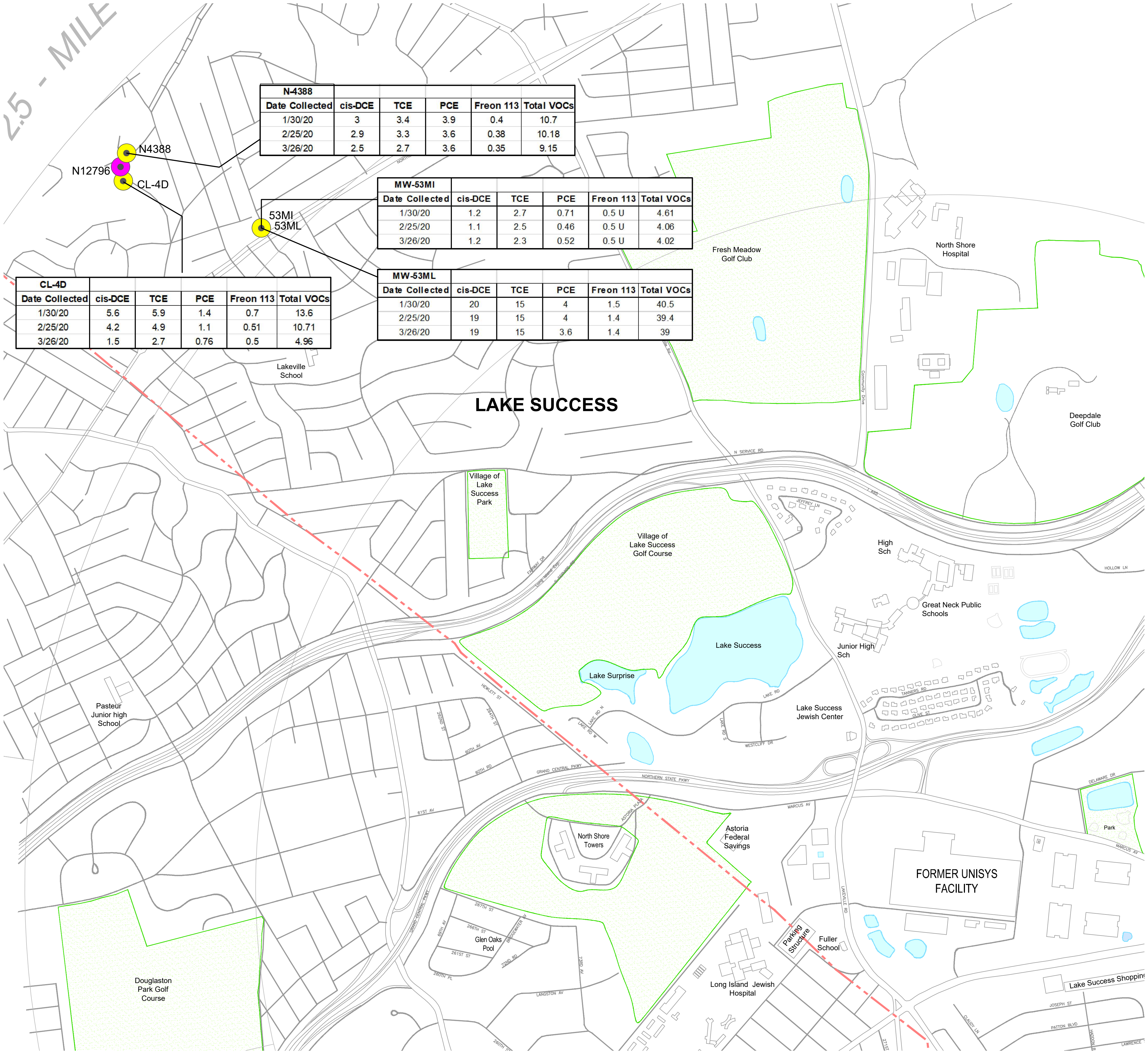
PROJECT: **Lockheed Martin Corporation Former Unisys Site**

LOCATION: **Lake Success, New York**

TITLE: **LOCATIONS AND RESULTS OF WELLS SAMPLED FORMER UNISYS SITE OCTOBER-NOVEMBER 2019**

amec

APPROVED BY	EW	FIGURE
PREPERED BY	EMP	
DRAFTED BY	BRT	2-4
PROJECT#	3617-18-7447	
DATE	05-15-20	



N-4388					
Date Collected	cis-DCE	TCE	PCE	Freon 113	Total VOCs
1/30/20	3	3.4	3.9	0.4	10.7
2/25/20	2.9	3.3	3.6	0.38	10.18
3/26/20	2.5	2.7	3.6	0.35	9.15

MW-53MI					
Date Collected	cis-DCE	TCE	PCE	Freon 113	Total VOCs
1/30/20	1.2	2.7	0.71	0.5 U	4.61
2/25/20	1.1	2.5	0.46	0.5 U	4.06
3/26/20	1.2	2.3	0.52	0.5 U	4.02

CL-4D					
Date Collected	cis-DCE	TCE	PCE	Freon 113	Total VOCs
1/30/20	5.6	5.9	1.4	0.7	13.6
2/25/20	4.2	4.9	1.1	0.51	10.71
3/26/20	1.5	2.7	0.76	0.5	4.96

MW-53ML					
Date Collected	cis-DCE	TCE	PCE	Freon 113	Total VOCs
1/30/20	20	15	4	1.5	40.5
2/25/20	19	15	4	1.4	39.4
3/26/20	19	15	3.6	1.4	39

LEGEND:

- BODY OF WATER
- GOLF COURSE OR PARK
- WELL LOCATION SAMPLED FOR VOCS
- WELL NOT SAMPLED
- U - UNDETECTED
- J - VALUE IS ESTIMATED
- VOC - VOLATILE ORGANIC COMPOUND
- FREON 113 - 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE
- cis-DCE - cis-1,2-DICHLOROETHENE
- PCE - TETRACHLOROETHENE
- TCE - TRICHLOROETHENE

NOTE:

All VOC VALUES ARE IN µg/L

0 600 1200
SCALE IN FEET

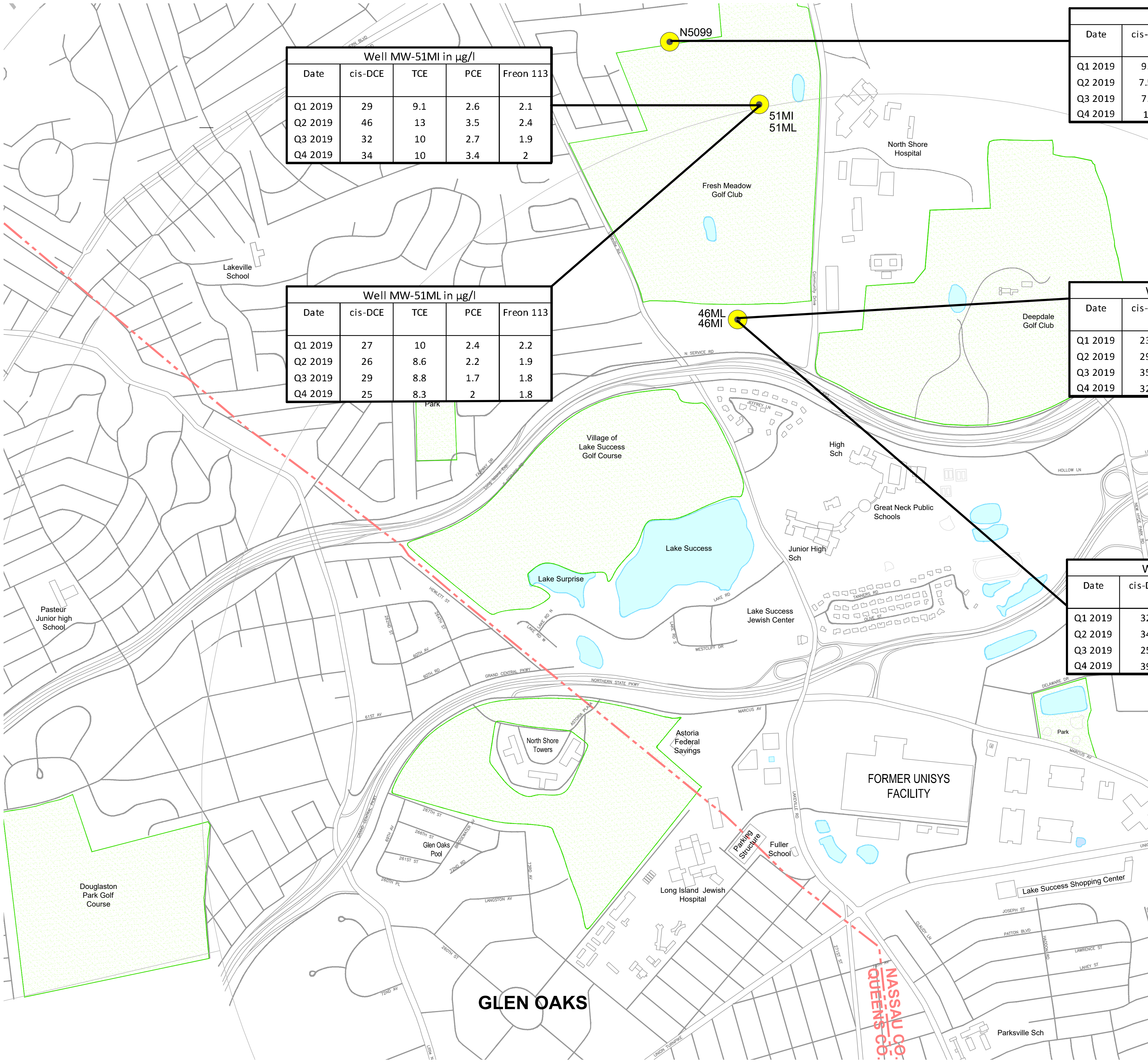
PROJECT: Lockheed Martin Corporation
Former Unisys Site

LOCATION: Lake Success, New York

TITLE: LOCATIONS OF WELLS SAMPLED
DURING JANUARY, FEBRUARY AND MARCH 2020

amec

APPROVED BY	EW	FIGURE
PREPERED BY	EMP	
DRAFTED BY	BRT	2-5
PROJECT#	3617-18-7446	
DATE	05-14-20	



Well N5099 in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	9.5	6.7 J	2.3 J	0.87 J
Q2 2019	7.5 J	5.3 J	1.9	0.76
Q3 2019	7.8	5.3	2	0.91
Q4 2019	16	11	3.6 J-	1.5 J-

Well MW-51MI in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	29	9.1	2.6	2.1
Q2 2019	46	13	3.5	2.4
Q3 2019	32	10	2.7	1.9
Q4 2019	34	10	3.4	2

Well MW-51ML in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	27	10	2.4	2.2
Q2 2019	26	8.6	2.2	1.9
Q3 2019	29	8.8	1.7	1.8
Q4 2019	25	8.3	2	1.8

Well MW-46MI in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	230	95	29	19
Q2 2019	290	120	37	23
Q3 2019	350	120	37	22
Q4 2019	320	110	35	23

Well MW-46ML in µg/l

Date	cis-DCE	TCE	PCE	Freon 113
Q1 2019	32	24	4.3	1.9
Q2 2019	34	24	3.7	1.5
Q3 2019	25	15	1.8	0.99
Q4 2019	39	29	5.5	2.2

LEGEND:

- BODY OF WATER
- GOLF COURSE OR PARK
- SAMPLED WELL LOCATION
- U COMPOUND UNDETECTED
- J CONCENTRATION IS ESTIMATED

FREON 113 - 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE

cis-DCE - cis-1,2-DICHLOROETHENE

PCE - TETRACHLOROETHENE

TCE - TRICHLOROETHENE

µg/L- MICROGRAMS PER LITER

0 600 1200
SCALE IN FEET

PROJECT: **Lockheed Martin Corporation Former Unisys Site No. 130045**

LOCATION: **Lake Success, New York**

TITLE: **2019 DATA FOR THE CUMBERLAND PUMPING WELL AND ASSOCIATED SENTINEL WELLS**

amec

APPROVED	EW
PREPARED	EMP
DRAFTED	BRT
PROJECT#	3617187447
DATE	05-15-20

FIGURE **2-6**

TABLES

Table 2-1

2019 Data from the Community Drive Pumping Wells and Associated Sentinel Wells

Well #	Date	cis-1,2-Dichloroethene	Q	Trichloroethene	Q	Tetrachloroethene	Q	Freon 113	Q
31GL	1/24/2019	65		20		8.7		2.8	
	4/23/2019	72		26		9.5		3.6	
	7/30/2019	34		9.5		2.2		1.3	
	10/30/2019	380		73		30		13	
DUP	10/30/2019	470		92		39		18	
31MI	1/24/2019	330		73		35		15	
	4/23/2019	410		81		32		13	
	7/30/2019	410		83		36		14	
DUP	7/30/2019	420		86		36		16	
	10/30/2019	410		82		34		15	
31ML	1/24/2019	130		46		20		8.2	
	4/23/2019	160		48		18		7.3	
	7/30/2019	160		53		21		9.1	
	10/30/2019	160		50		22		8.8	
43MI	1/23/2019	50	J	17		6.3		2.9	
	4/24/2019	39		14		5.5		2.1	
	8/2/2019	29		10		4.7		1.6	
	11/4/2019	56		16		5.3		2.8	
43MU	1/23/2019	20		6.9		2.1		1.5	
	4/24/2019	52		14		3.8		2.4	
	8/2/2019	12		4.2		1.4		0.69	
	11/4/2019	28		6		1.3		0.96	
N12999	1/25/2019	0.14	J	0.28	J	0.5	U	0.5	U
	4/25/2019	1.4		0.63		0.26	J	0.5	U
	8/2/2019	0.5	U	0.27	J	0.5	U	0.5	U
	11/1/2019	0.3	J	0.36	J	0.5	U	0.5	U
N13000	1/25/2019	7.2		2		1.2		0.37	J
	4/25/2019	11		2.8		1.7		0.56	
	8/2/2019	12		3.2		2		0.57	
	11/1/2019	0.26	J	0.58		0.14	J	0.5	U
N13821	1/25/2019	0.5	U	0.5	U	0.5	U	0.5	U
	4/25/2019	0.5	U	0.5	U	0.5	U	0.5	U
	8/2/2019	4.8		1.2		0.83		0.21	J
DUP	8/2/2019	4.7		1.2		0.84		0.22	J
	11/1/2019	11		2.7		1.8		0.51	

Notes:

Concentrations are in micrograms per liter (µg/L)

J = Estimated

U = Undetected at the corresponding reporting limit

Q = Data qualifier

DUP = Duplicate sample collected

Table 2-2

2019 Data from the Watermill Lane Pumping Wells and Associated Sentinel Wells

Well #	Date	cis-1,2-Dichloroethene	Q	Trichloroethene	Q	Tetrachloroethene	Q	Freon 113	Q
45MI	1/24/2019	27		26		4.2		3.1	
	4/24/2019	32		28		3.1		2.9	
	8/2/2019	44		36		3.5		3.5	
	10/30/2019	36		23		2		2.5	
45MU	1/24/2019	180		29		5.6		3.9	
	4/24/2019	260		50		16		7.8	
	8/2/2019	280		55		15		7.8	
	10/30/2019	140		18		5.7		3.1	
52MI	1/23/2019	0.76		0.68		0.5	U	0.5	U
DUP	1/23/2019	0.58		0.54		0.5	U	0.5	U
	4/23/2019	0.54		0.5	U	0.5	U	0.5	U
DUP	4/23/2019	0.38	J	0.5	UJ	0.5	U	0.5	U
	7/31/2019	4.5		4		0.97		0.5	U
	10/31/2019	6.7		5.4		1.3		0.5	U
52ML	1/23/2019	14		8.4		2.5		1.3	
	4/23/2019	8.8		5.3		1.4		0.6	
	7/31/2019	6.2		3.9		0.97		0.41	J
	10/31/2019	8.5		5.2		1.4		0.66	J+
53MI	8/1/2019	1.3		3		0.57		0.5	U
	10/31/2019	1.3		3.1		0.64		0.5	U
53ML	8/1/2019	20		15		3.4		1.4	
	10/31/2019	18		14		2.9		1.4	
N04388	1/25/2019	1.8		1.8		2.8		0.2	J
DUP	1/25/2019	1.9		1.9		2.7		0.2	J
	8/2/2019	0.5	U	0.5	U	0.5	U	0.5	U
	11/1/2019	1.5		1.6		2		0.5	U
N12796	1/25/2019	1.1		4		0.93		0.37	J
	4/25/2019	6.1		6.7		6.1		0.75	
DUP	4/25/2019	6		6.4		6.1		0.73	
	8/2/2019	3.7		4.8		6.6		0.54	

Notes:

Concentrations are in micrograms per liter (µg/L)

J = Estimated

U = Undetected at the corresponding reporting limit

Q = Data qualifier

DUP = Duplicate sample collected

Table 2-3

January, February and March 2020 Groundwater Analytical Results for MW-53 MI, MW-53ML, CL-4D and N-4388

Well #	Date	*cis* -1,2-Dichloroethene	Q	Trichloroethene	Q	Tetrachloroethene	Q	Freon 113	Q
MW-53MI	1/30/20	1.2		2.7		0.71		0.5	U
	2/25/20	1.1		2.5		0.46	J	0.5	U
	3/26/20	1.2		2.3		0.52		0.5	U
MW-53ML	1/30/20	20		15		4		1.5	
	2/25/20	19		15		4		1.4	
	3/26/20	19		15		3.6		1.4	
CL-4D	1/30/20	5.6		5.9		1.4		0.7	
	2/25/20	4.2		4.9		1.1		0.51	
	3/26/20	1.5		2.7		0.76		0.5	U
N-4388	1/30/20	3		3.4		3.9		0.4	J
	2/25/20	2.9		3.3		3.6		0.38	J
	3/26/20	2.5		2.7		3.6		0.35	J

Notes:

Concentrations are in micrograms per liter (µg/L)

Q = Data qualifier

U = Undetected at corresponding detection level

J= Estimated

Table 2-4
2019 Data from the Ravine Road Pumping Well

Well #	Date	cis-1,2-Dichloroethene	Q	Trichloroethene	Q	Tetrachloroethene	Q	Freon 113	Q
N12735	1/9/2019	0.50	U	0.50	U	0.50	U	0.50	U
	4/10/2019	0.50	U	0.50	U	0.50	U	0.50	U
	7/3/2019	0.50	U	0.50	U	0.50	U	0.50	U

Notes:

Well N12735 does not have VOC treatment

Concentrations are in micrograms per liter (µg/L)

U = Undetected at the corresponding reporting limit

Q = Data qualifier

Table 2-5
2019 Data from the Cumberland Pumping Well and Associated Sentinel Wells

Well #	Date	cis-1,2-Dichloroethene	Q	Trichloroethene	Q	Tetrachloroethene	Q	Freon 113	Q
46MI	1/23/2019	230		95		29		19	
	4/25/2019	290		120		37		23	
	8/5/2019	350		120		37		22	
	11/1/2019	320		110		35		23	
46ML	1/23/2019	32		24		4.3		1.9	
	4/25/2019	34		24		3.7		1.5	
	8/5/2019	25		15		1.8		0.99	
	11/1/2019	39		29		5.5		2.2	
51MI	1/23/2019	29		9.1		2.6		2.1	
	4/24/2019	46		13		3.5		2.4	
	7/31/2019	32		10		2.7		1.9	
	11/4/2019	34		10		3.4		2	
51ML	1/23/2019	27		10		2.4		2.2	
	4/24/2019	26		8.6		2.2		1.9	
	7/31/2019	29		8.8		1.7		1.8	
	11/4/2019	25		8.3		2		1.8	
N05099	1/25/2019	9.5		6.7	J	2.3	J	0.87	J
	4/25/2019	7.5	J	5.3	J	1.9		0.76	
	7/31/2019	7.8		5.3		2		0.91	
	11/1/2019	16		11		3.6	J	1.5	J

Notes:
Concentrations are in micrograms per liter (µg/L)
J = Estimated
Q = Data qualifier

Table 3-1 — Summary of Groundwater Modeling Concentrations

Lockheed Martin Corporation
Former Unisys Facility Great Neck
Lake Success, New York

Well Field	Sentinel Well Cluster	Maximum Simulated TVOC Concentration at Sentinel Wells (µg/L)	Timing of Sentinel Well Simulated Maximum (years after Jan 2020)	Maximum Simulated TVOC Concentration at Supply Wells (µg/L)	Timing of Supply Well Simulated Maximum (years after Jan 2020)	Estimated Percent PCE Based on Sentinel Well Data	Estimated Percent TCE Based on Sentinel Well Data	Estimated Percent cis-1,2-DCE Based on Sentinel Well Data	Estimated Percent Freon 113 Based on Sentinel Well Data
Community Drive	31	630	4-6 years	30	0-4 years	8%	20%	69%	3%
Community Drive	43	130	1-3 years	30	0-4 years	12%	24%	62%	2%
Watermill Lane	45	360	0-1 years	30	16-18 years	6%	29%	62%	3%
Watermill Lane	52	120	3-5 years	30	16-18 years	5%	29%	65%	1%
Watermill Lane	53	140	10-11 years	30	16-18 years	10%	50%	38%	2%
Ravine Road	--	--	--	4	15-20 years	--	--	--	--
Cumberland	46	510	0-2 years	210	8-10 years	7%	33%	56%	4%
Cumberland	51	710	11-13 years	210	8-10 years	7%	22%	67%	4%

Notes:

Percent PCE, TCE, cis-1,2-DCE and Freon 113 based on average concentrations at each well cluster for sampling results from years 2015 – 2019.

Table 4-1 — Comparison of Public Water Supply Well Concentrations to Existing Treatment Design Basis

Lockheed Martin Corporation
Former Unisys Facility Great Neck
Lake Success, New York

Well Field	PWS Well ID	Former Unisys Site Plume Impact (2019)	PWS Treatment Design Basis	Maximum PWS Concentration[1]	Are Maximum Measured PWS Concentrations Below PWS Treatment Capacity?
Community Drive	WAGNN-12 (N13000) WAGNN-13 (N12999) WAGNN-14 (N13821)	YES	200 µg/L *cis* -1,2-DCE	12 µg/L *cis* -1,2-DCE 3.2 µg/L TCE 2.7 µg/L PCE 0.57 µg/L Freon 113 18 µg/L TVOC	YES[2]
Watermill Lane	WAGNN-9 (N4388) WAGNN-2A (N12796)	Yes	100 µg/L PCE	6.1 µg/L *cis* -1,2-DCE 6.7 µg/L TCE 6.6 µg/L PCE 0.78 µg/L Freon 113 20 µg/L TVOC	YES[3]
Ravine Road	WAGNN-10A (N12735)	NO	NA	<0.50 µg/L *cis* -1,2-DCE <0.50 µg/L TCE <0.50 µg/L PCE <0.50 µg/L Freon 113 <2.0 µg/L TVOC	YES[4]
Cumberland	MLWD (N5099)	YES	260 µg/L *cis* -1,2-DCE	16 µg/L *cis* -1,2-DCE 11 µg/L TCE 3.6 µg/L PCE 1.5 µg/L Freon 113 32 µg/L TVOC	YES[2]

Notes:
NA = Not applicable
PWS = Public water supply
TVOC = Total volatile organic compounds (sum of the four site contaminants of concern)
[1]Maximum concentration in single PWS or sentinel well in the past year (first quarter 2019 through fourth quarter 2019)
[2]*cis* -1,2-DCE is the least volatile of the Former Unisys Site Plume contaminants of concern and TVOC is less than the PWS treatment design basis
[3]PCE is more volatile than *cis* -1,2-DCE and TCE, but concentrations are sufficiently lower than the PCE design basis (see Appendix A).
[4]Site contaminants of concern are not currently present at this well.

Table 4-2 — Comparison of Model Simulated Maximum Public Water Supply Well Concentrations in Next Five Years to Existing Treatment System Design Basis

Lockheed Martin Corporation
Former Unisys Facility Great Neck
Lake Success, New York

Well Field	PWS Well ID	Former Unisys Site Plume Impact in Five (years after Jan 2020)	PWS Treatment Design Basis	Maximum Projected PWS Concentration Over Next Five Years[1]	Are Maximum Predicted PWS Concentrations in Next Five Years Below PWS Treatment Capacity?
Community Drive	WAGNN-12 (N13000) WAGNN-13 (N12999) WAGNN-14 (N13821)	YES	200 µg/L *cis* -1,2-DCE	<20 µg/L *cis* -1,2-DCE <10 µg/L TCE <5 µg/L PCE <2 µg/L Freon 113 < 30 µg/L TVOC	YES[3]
Watermill Lane	WAGNN-9 (N4388) WAGNN-2A (N12796)	Yes	100 µg/L PCE	<15 µg/L *cis* -1,2-DCE <10 µg/L TCE <2 µg/L PCE <2 µg/L Freon 113 < 20 µg/L TVOC	YES[2]
Ravine Road	WAGNN-10A (N12735)	NO	NA	Plume not expected to be present	YES
Cumberland	MLWD (N5099)	YES	260 µg/L *cis* -1,2-DCE	<115 µg/L *cis* -1,2-DCE <60 µg/L TCE <30 µg/L PCE <10 µg/L Freon 113 < 170 µg/L TVOC	YES[3]

Notes:
NA = Not Applicable
[1]Maximum concentration in single PWS or sentinel well in the past year (fourth quarter 2018 through third quarter 2019)
[3]PCE is more volatile than *cis* -1,2-DCE and TCE, but concentrations are sufficiently lower than the PCE design basis (see Appendix A).
[3]TVOC is less than the design design basis concentration and PCE, TCE, and Freon 113 are more easily stripped than cis-1,2-DCE

APPENDICES

Appendix A – Screening Evaluation of Watermill Lane Air Stripper for *cis*-1,2-DCE

Job No.	3617187447	Sheet 1 of 5		**amec**
Phase	04	Task 4I		
Job Name	LM-GN Compliance Report			
By	SCP	Date 2/12/20		
Checked By	EWT	Date 5/19/20		511 Congress Street Portland, ME 04101 +1 (207) 775-5401 Fax +1 (207 772-4762

Purpose: Perform a screening level analysis of the equivalent design basis of cis-1,2-DCE for the Watermill Lane Air Stripper.

Method: Use the AirStrip Release 1.1 model to mimic the design basis using PCE of the Watermill Lane air stripper for its stated design parameters, then substitute cis-1,2-DCE for PCE and determine water influent concentration of cis-1,2-DCE achieves a similar effluent concentration as the design point for PCE.

Constants and Input Watermill Lane Air Stripper Design Basis

Water Flow Rate	2000	gpm
Tower Diameter	10	ft
Packing Height	40	ft
Packing Type	3.5-inch tri-packs	
Water loading rate	25	gpm/ft^2
Air-Water Ratio	44:1	
Influent PCE conc.	100	µg/L
Effluent PCE conc.	0.5	µg/L
Design temperature	52	°F

Calculations:

Step 1 - Air stripper design parameters were entered into the AirStrip program and PCE removal was modeled. In the model the design temperature was lowered to 33°F to achieve the same 99.5% removal listed in the design basis. This adjustment is similar to adding a safety factor to the design. It is not known what safety factors may have been included in the orginal air stripper design. Model output is attached.

Step 2 - Once the air stripper model was matching the design basis removal for PCE, the infuent compound was changed from PCE to cis-1,2-DCE and the influent concentration of cis-1,2-DCE was reduced until the same 0.5 µg/L effluent concentration was achieved. The model estimates that an influent concentration of 61 µg/L of cis-1,2-DCE would result in a 0.5 µg/L effluent concentration.

Step 3- The same operating parameters were also provided to Raschig, the manufacturer of the Jaeger packing used in the Watermill Lane air stripper. Their model predicts slightly lower effluent concentrations than the AirStrip program of 0.06 µg/L for PCE at an influent concentration of 0.5 µg/L and 0.1 µg/L for cis-1,2-DCE at an influent concentration of 61 µg/L .

Conclusion:

A 61 µg/L influent cis-1,2-DCE concentration would achieve the same effluent concentration (0.5 µg/L) as the design basis PCE influent concentration of 100 µg/L. There is an order of magnitude safety factor built into the PCE effluent concentration design basis (0.5 µg/L vs an MCL of 5 µg/L). The MCL for cis-1,2-DCE is higher than for PCE, however, the 61 µg/L is a reasonable conservative estimation for comparing with TVOC concentratons in the influent until a more detailed analysis is performed.

******* A N A L Y S I S   OF   S T R I P P I N G   T O W E R *******

PROJECT : Unisys Water Mill Lane Calc - PCE   DATE : 2/14/2020

ENGINEER : AMEC   PAGE : 1/2

PHYSICAL CONSTANTS

Design temperature	:	33.0 degrees F.
Density of water	:	62.4 lb/ft^3
Density of air	:	0.0805 lb/ft^3
Viscosity of water	:	1.18E-03 lb/ft.s
Viscosity of air	:	1.13E-05 lb/ft.s
Surface tension of water	:	76 dyne/cm
Atmospheric pressure	:	1.00 atm

CONTAMINANT PROPERTIES

Name	:	Tetrachloroethylene
Molecular weight	:	165.8 g/mol
Boiling point	:	250 degrees F.
Molal volume at boiling point	:	0.1280 L/mol
Henry's Constant	:	0.59000
Enthalpy upon dissolution in water	:	3581 cal/mol
Molecular diffusivity in air	:	7.16E-05 ft^2/s
Molecular diffusivity in water	:	4.31E-09 ft^2/s

PACKING PROPERTIES

Name	:	Jaeger Tripacks
Packing Material	:	Plastic
Nominal Size	:	3.50 inch
Specific Area	:	38.1 ft^2/ft^3
Critical surface tension	:	33 dyne/cm
Packing depth	:	40.0 ft
Air friction factor	:	14

******* A N A L Y S I S   OF   S T R I P P I N G   T O W E R *******

PROJECT : Unisys Water Mill Lane Calc - PCE DATE : 2/14/2020

ENGINEER : AMEC PAGE : 2/2

LOADING RATES

Water mass loading rate	:	3.5 lb/ft^2.s	*
Air mass loading rate	:	0.198 lb/ft^2.s	*
Water volumetric loading rate	:	24.99 gpm/ft^2	*
Air volumetric loading rate	:	1100 gpm/ft^2	*
Air pressure gradient	:	0.070 " H2O/ft	#
Volumetric air/water ratio	:	44.0	
Stripping factor	:	9.5	

MASS TRANSFER PARAMETERS

Percentage of packing area wetted	:	54.8 %	
Wetted packing area	:	20.9 ft^2/ft^3	*
Transfer rate constant in water	:	0.000464 ft/s	
Transfer rate constant in air	:	0.010562 ft/s	
Overall transfer rate constant	:	0.000386 ft/s	
Overall mass transfer coefficient	:	0.0080 1/s	
NTU	:	5.7781	
HTU	:	6.9227 ft	

CONTAMINANT REMOVAL

Influent concentration	:	100.0 ug/L	
Effluent concentration	:	0.5 ug/L	
Fraction removed	:	99.5 %	
Mass of contaminant removed	:	0.02985 lb/ft^2.day	*
Concentration in airstream	:	0.00595 mg/ft^2.ft^3	

* Expressed per unit of stripping tower cross-sectional area
# Expressed per unit of tower length

******* A N A L Y S I S   O F   S T R I P P I N G   T O W E R *******

PROJECT : Unisys Water Mill Lane Calc-cis-1,2-DCE   DATE : 2/14/2020

ENGINEER : AMEC   PAGE : 1/2

PHYSICAL CONSTANTS

Design temperature	:	33.0 degrees F.
Density of water	:	62.4 lb/ft^3
Density of air	:	0.0805 lb/ft^3
Viscosity of water	:	1.18E-03 lb/ft.s
Viscosity of air	:	1.13E-05 lb/ft.s
Surface tension of water	:	76 dyne/cm
Atmospheric pressure	:	1.00 atm

CONTAMINANT PROPERTIES

Name	:	cis-1,2-Dichloroethylene
Molecular weight	:	97.0 g/mol
Boiling point	:	140 degrees F.
Molal volume at boiling point	:	0.0862 L/mol
Henry's Constant	:	0.32000
Enthalpy upon dissolution in water	:	3800 cal/mol
Molecular diffusivity in air	:	9.11E-05 ft^2/s
Molecular diffusivity in water	:	5.47E-09 ft^2/s

PACKING PROPERTIES

Name	:	Jaeger Tripacks
Packing Material	:	Plastic
Nominal Size	:	3.50 inch
Specific Area	:	38.1 ft^2/ft^3
Critical surface tension	:	33 dyne/cm
Packing depth	:	40.0 ft
Air friction factor	:	14

******* A N A L Y S I S   OF   S T R I P P I N G   T O W E R *******

PROJECT : Unisys Water Mill Lane Calc-cis-1,2-DCE   DATE : 2/14/2020

ENGINEER : AMEC   PAGE : 2/2

LOADING RATES

Water mass loading rate	:	3.5 lb/ft^2.s	*
Air mass loading rate	:	0.198 lb/ft^2.s	*
Water volumetric loading rate	:	24.99 gpm/ft^2	*
Air volumetric loading rate	:	1100 gpm/ft^2	*
Air pressure gradient	:	0.070 " H2O/ft	#
Volumetric air/water ratio	:	44.0	
Stripping factor	:	4.8	

MASS TRANSFER PARAMETERS

Percentage of packing area wetted	:	54.8 %	
Wetted packing area	:	20.9 ft^2/ft^3	*
Transfer rate constant in water	:	0.000523 ft/s	
Transfer rate constant in air	:	0.012396 ft/s	
Overall transfer rate constant	:	0.000378 ft/s	
Overall mass transfer coefficient	:	0.0079 1/s	
NTU	:	5.6730	
HTU	:	7.0509 ft	

CONTAMINANT REMOVAL

Influent concentration	:	61.0 ug/L	
Effluent concentration	:	0.5 ug/L	
Fraction removed	:	99.1 %	
Mass of contaminant removed	:	0.01814 lb/ft^2.day	*
Concentration in airstream	:	0.00361 mg/ft^2.ft^3	

*   Expressed per unit of stripping tower cross-sectional area
#   Expressed per unit of tower length

Appendix B – Groundwater Modeling Report

Unisys Site No. 130045
Lake Success, New York

Groundwater Model Update for 2019 Groundwater Public Water Supply Protection and Mitigation Program Compliance Report

May 22, 2020

CDM Smith

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Appendices

Appendix A Excerpt from Groundwater Model Documentation Report, Remedial Investigation Report for Operable Unit No. 2 for the Unisys Site, Great Neck, NY (CDM Smith, May 2012)

Appendix B Simulated 2015 TVOC Groundwater Plume Map

Appendix C Simulated Water Level Elevation Time History Graphs

Appendix D Simulated 2019 TVOC Groundwater Plume Maps for Upper Glacial and Magothy Model Layers

Groundwater Model Update for 2019 Groundwater Public Water Supply Protection and Mitigation Program Compliance Report

1. Introduction

This report presents an overview of the groundwater modeling completed for the *2019 Groundwater Public Water Supply Protection and Mitigation Program Compliance Report (*AMEC E&E, February 2020*)*.

2. Groundwater Flow and Solute Transport Model Background

2.1 OU2 Remedial Investigation (RI) and Feasibility Study (FS)

A groundwater flow and solute transport model was developed as part of the Operable Unit 2 (OU2) Remedial Investigation (RI) and Feasibility Study (FS) for the former Unisys site (hereafter referenced as "the Site"). The groundwater flow model was based on the stratigraphy and hydrogeologic properties represented in the Nassau County regional model (NCRM) and supplemented with local data from Site investigations. The RI/FS groundwater flow model was used to simulate transient groundwater flow conditions from 1940 to 2007 to demonstrate that the model could reasonably represent observed groundwater heads and gradients and temporal water level variations due to changes in pumping and recharge. The groundwater flow and solute transport model was applied to evaluate current and potential future groundwater flow and total volatile organic compound (TVOC) transport in the vicinity of the Site and potential groundwater plume impacts to downgradient receptors. TVOC is defined as the sum of tetrachloroethene (PCE), trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), vinyl chloride and trichlorotrifluoroethane (Freon 113) groundwater concentrations. The development and application of the groundwater flow and solute transport model is described in detail in an appendix to the OU2 RI and FS reports (*Remedial Investigation Report. Operable Unit No. 2 for the Unisys Site. Great Neck New York. Site No. 130045*; ARCADIS, May 2012 and *Feasibility Study. Operable Unit No. 2 for the Unisys Site. Great Neck New York. Site No. 130045*; ARCADIS, May 2012).

Excerpts from the *Groundwater Model Documentation Report* (CDM Smith; May 2012), an appendix to the OU2 RI report, showing the estimated limits of the TVOC plume based on 2010 reported groundwater concentrations at monitoring wells are included in **Appendix A.** This starting TVOC plume distribution was used as the initial condition for the OU2 RI/FS groundwater plume transport projection simulations.

2.2 Groundwater Flow and Solute Transport Model Updates for Sentinel Well Site Evaluation

In 2014, the New York State Department of Environmental Conservation (NYSDEC) issued the *Record of Decision for Unisys Corporation Operable Unit Number 02: Offsite Groundwater* (NYSDEC, December 2014; hereafter referenced as "OU2 ROD"). One element of the selected groundwater remedy described in the OU2 ROD is the requirement to evaluate existing sentinel well locations upgradient of water supply wells and, if needed, to install additional sentinel monitoring wells.

In 2016, The groundwater flow and solute transport model was updated to support the selection of sentinel well sites to monitor groundwater plume migration. For this model update, the period of the historical groundwater flow simulation was extended through 2015, incorporating 2008 – 2015 water supply and OU1 and OU2 remediation pumping data and monthly groundwater recharge. No additional calibration of model hydraulic properties or boundary conditions was performed for this task. Model simulated heads for the extended 2008 – 2015 period generally tracked trends and patterns observed in measured groundwater elevations near the Site.

Model simulations were conducted to review OU2 FS projections and to estimate potential future TVOC concentrations in the pumped groundwater at the Water Authority of Great Neck North (WAGNN) Community Drive well field (N12999, N13000 and N13821), the WAGNN Water Mill Lane well field (N4388 and N12796), and at the Manhasset Lakeville Water District (MLWD) Cumberland well field (N5099). The locations of these well fields and associated water supply wells are shown on **Figure 1**.

The TVOC solute transport simulations in this updated analysis used an estimated 2015 TVOC distribution as a starting condition. This TVOC distribution was based on the mapping developed for the OU2 RI and FS reports, 2011 – 2015 groundwater quality data from wells at the leading edge of the plume, and simulations of 2010 – 2015 groundwater flow and TVOC solute transport. The estimated 2015 TVOC plume distribution is contained in **Appendix B**. The groundwater modeling analysis is described in *OU2 ROD Implementation Groundwater Modeling* (CDM Smith; January 2016). The simulated groundwater plume arrival time at water supply wells was several years earlier than projected in the OU2 RI/FS reports; this difference was a result of the updated groundwater plume mapping and differences in groundwater pumping assignments.

The groundwater flow and solute transport model updates were used to identify existing wells that would serve as sentinel monitoring wells, as well as locations for new monitoring (sentinel) wells upgradient of the WAGNN Water Mill Lane well field. In 2017 and 2019, respectively, well cluster 52 and well cluster 53 were installed. Both well clusters are located upgradient of the Water Mill Lane well field. The sentinel wells identified for each well field are listed in **Table 1**.

Figure 1. Site Map and Cross-Section Locations

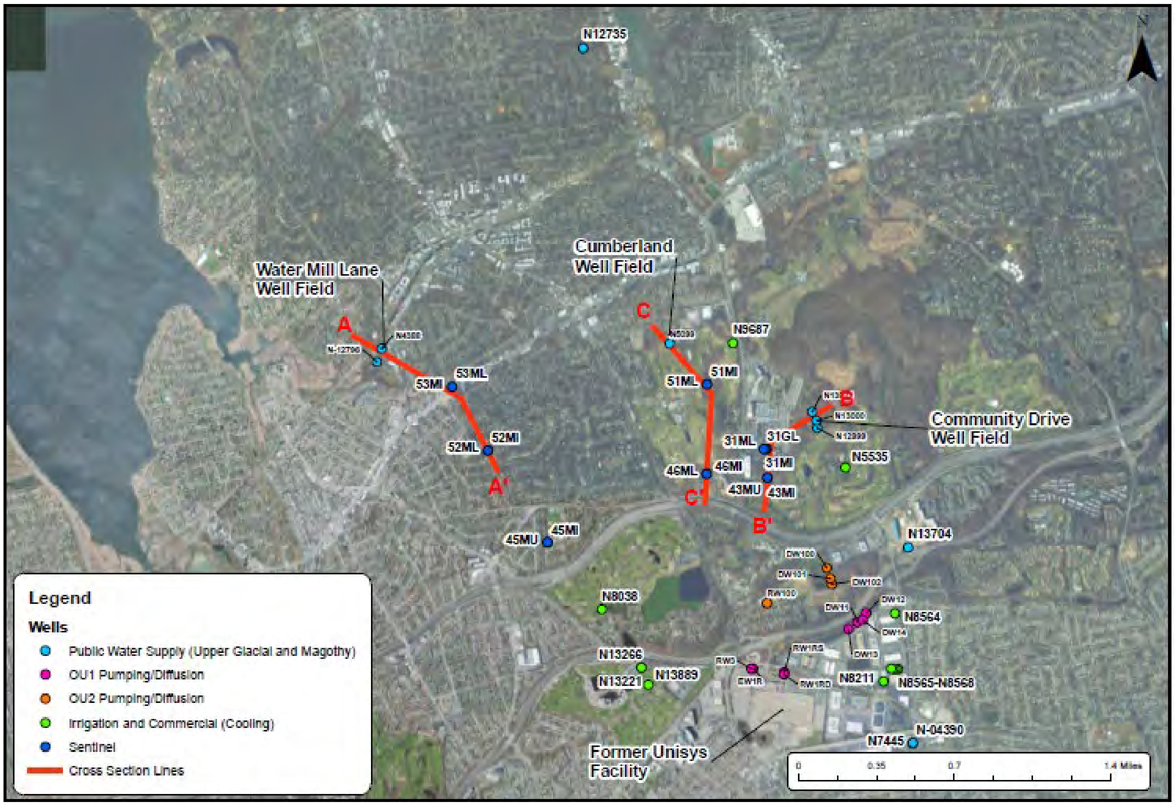


Table 1. Sentinel Well Details

Sentinel Well	Associated Well Field	Screened Aquifer	Screen Interval (feet below groundwater surface)
52MI	WAGNN Water Mill Lane	Middle Magothy	215 to 235
52ML	WAGNN Water Mill Lane	Basal Magothy	300 to 320
53MI	WAGNN Water Mill Lane	Middle Magothy	137 to 157
53ML	WAGNN Water Mill Lane	Basal Magothy	222 to 242
45MU	WAGNN Water Mill Lane	Upper Magothy	279 to 289
45MI	WAGNN Water Mill Lane	Middle Magothy	323 to 333
31GL	WAGNN Community Drive	Upper Magothy	180 to 200
31MI	WAGNN Community Drive	Middle Magothy	235 to 255
31ML	WAGNN Community Drive	Basal Magothy	335 to 355
43MU	WAGNN Community Drive	Upper Magothy	218 to 228
43MI	WAGNN Community Drive	Basal Magothy	310 to 330
46MI	MLWD Cumberland	Middle Magothy	292 to 302
46ML	MLWD Cumberland	Basal Magothy	353 to 363
51MI	MLWD Cumberland	Upper Magothy	183 to 203
51ML	MLWD Cumberland	Basal Magothy	312 to 322

2.3 2019 Groundwater Public Water Supply Protection and Mitigation Program Compliance Report

For the *2019 Groundwater Public Water Supply Protection and Mitigation Program Compliance Report*, the following groundwater model updates and analyses were completed:

- The groundwater flow model simulation period was extended through September 2019.
- Model layers and aquifer properties in the groundwater model near well cluster 53 and the Water Mill Lane well field were adjusted. Groundwater flow model calibration was checked using water level data from nearby monitoring wells.
- Based on groundwater quality data collected since the groundwater model update in 2016 and transport simulations with the updated groundwater flow model, the current (2019) limits of the TVOC groundwater plume limits were estimated.
- Groundwater flow and solute transport simulations were conducted to estimate potential future TVOC concentrations in the pumped groundwater at the WAGNN Community Drive well field (N12999, N13000 and N13821), the WAGNN Water Mill Lane well field (N4388 and N12796), and at the MLWD Cumberland well field (N5099). Simulation results were also reviewed to evaluate whether TVOC plume impacts to WAGNN well N12735 (Ravine Road Well Field) are projected. This well is located approximately 1.4 miles north of the Cumberland well field.

Each of these tasks is described in greater detail in the sections below.

3. 2019 Groundwater Flow Model Update

For the *2019 Groundwater Public Water Supply Protection and Mitigation Program Compliance Report*, the period of the historical groundwater flow simulation was extended through September 2019, incorporating recent (2016 – 2019) water supply and OU1 and OU2 remediation pumping data and monthly groundwater recharge.

Additional grid nodes were added near the Water Mill Lane well field to simulate groundwater flow gradients near the pumping wells in more detail. The updated model grid in the vicinity of the former Unisys site and the WAGNN and MLWD water supply well fields is shown in **Figure 2**.

The overall limits of the model were not changed and are consistent with the OU2 RI/FS model. Horizontally, the model area encompasses all of Queens and Nassau counties and extends from the Brooklyn-Queens border to the west to the Nissequogue and Connetquot Rivers in Suffolk County to the east. The northern perimeter of the model follows Long Island's coastline and the southern perimeter extends into the Atlantic Ocean, just beyond the south shore barrier islands.

Model layers in the vicinity of the Water Mill Lane well field were adjusted based on the boring logs associated with the new monitoring well clusters 52 and 53, and the Water Mill Lane wells.

The boring logs for the new well clusters and Water Mill Lane wells indicate the presence of a clay and/or silt layer at an approximate elevation of -125 to -90 feet relative to mean sea level (MSL). It is possible that this interval represents the North Shore confining unit described in

Hydrogeology and Extent of Saltwater Intrusion of the Great Neck Peninsula, Great Neck, Long Island, New York (Stumm, 2001). The sediments immediately below the clay layer are described as “sand and large gravel” and “coarse sand with silty spots” in the well boring logs for wells N4388 and N12796, respectively; however, these borings do not extend to the Raritan clay which is approximately 70 feet deeper. The vertical profile boring drilled prior to the installation of well cluster 53 indicates the presence of sand immediately below the clay underlain by sediments comprised of sand and silt, and silt and clay to the top of the Raritan clay. The model layers were adjusted to represent the lithology observed at the well cluster 53 location, and it was assumed that a similar lithology exists at depth near the Water Mill Lane wells.

Aquifer properties assigned to model layers in this area were revised based on specific capacity data from Water Mill Lane well N12796. Additionally, water level elevations at well cluster 53 and monitoring wells associated with the Stanton Cleaners site which is located north of the Water Mill Lane well field, were used to inform aquifer property assignments in the model. Water level data collected at wells screened above and below the clay layer indicate a larger vertical head difference than is observed in wells closer to the former Unisys Site. Model layer and aquifer properties were adjusted so that the model simulated heads and vertical head differences were consistent with observations.

Cross sections depicting model layers are shown in **Figure 3** (WAGNN Water Mill Lane well field vicinity), **Figure 4** (WAGNN Community Drive well field vicinity), and **Figure 5** (MLWD Cumberland well vicinity). The locations of these cross sections are shown on Figure 1.

Model aquifer property assignments are summarized in **Table 2**. Apart from the changes in aquifer property assignments near well cluster 53 and the Water Mill Lane well field, the model properties are the same as in the OU2 RI/FS groundwater model. The model layers representing the “confining unit” shown in cross section A-A’ were assigned the aquifer properties listed for the “North Shore Confining Unit”.

Figure 2. Model Grid Near Former Unisys Site

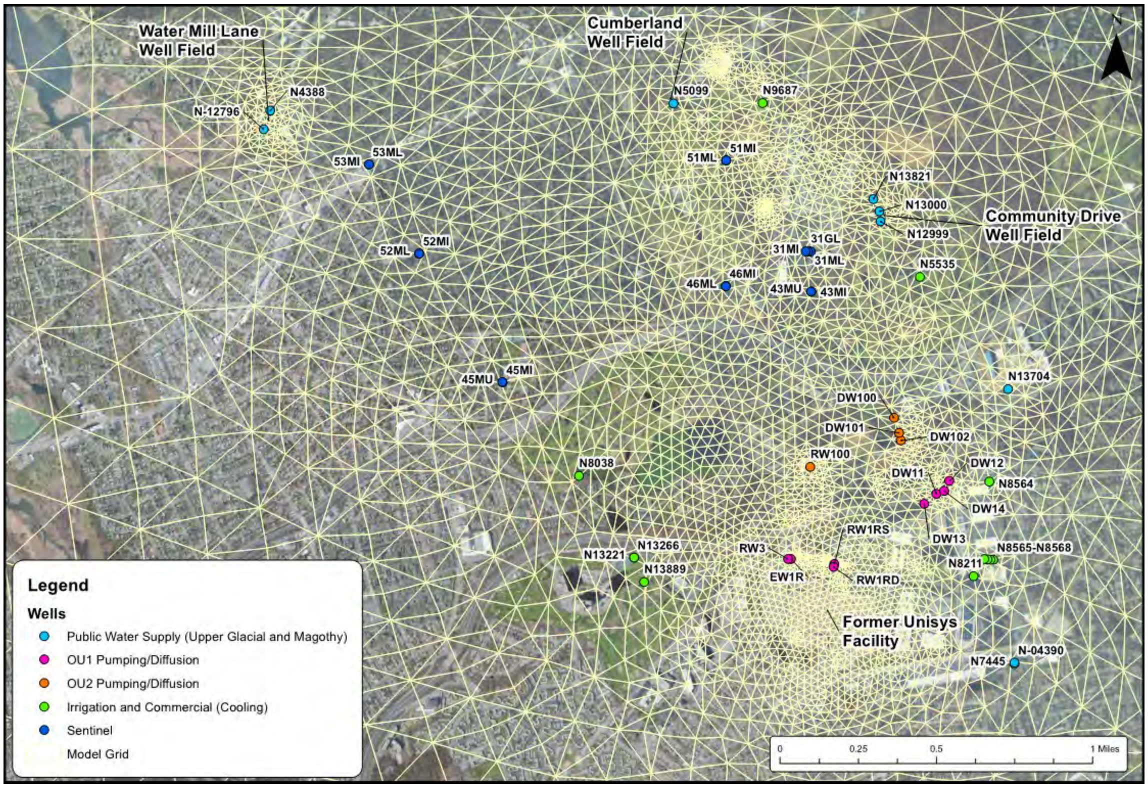


Figure 3. Cross Section A-A' Depicting Model Layers Near WAGNN Water Mill Lane Well Field

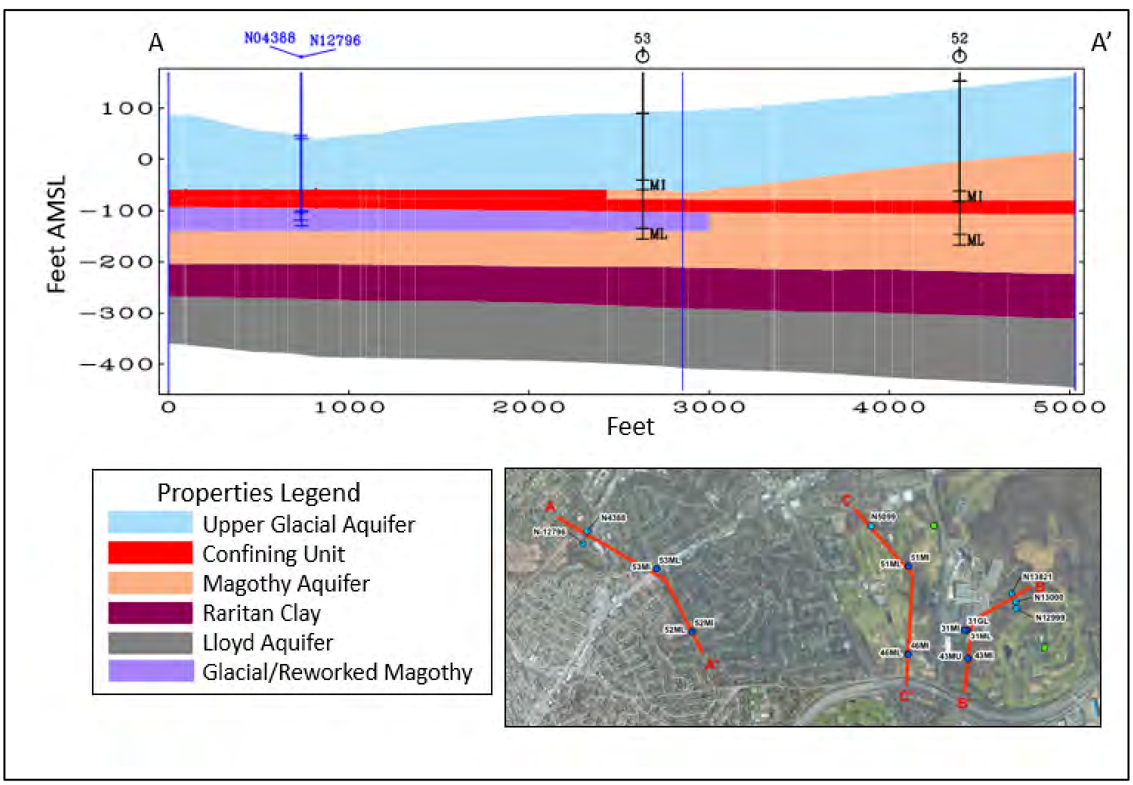


Figure 4. Cross Section B-B' Depicting Model Layers Near WAGNN Community Drive Well Field

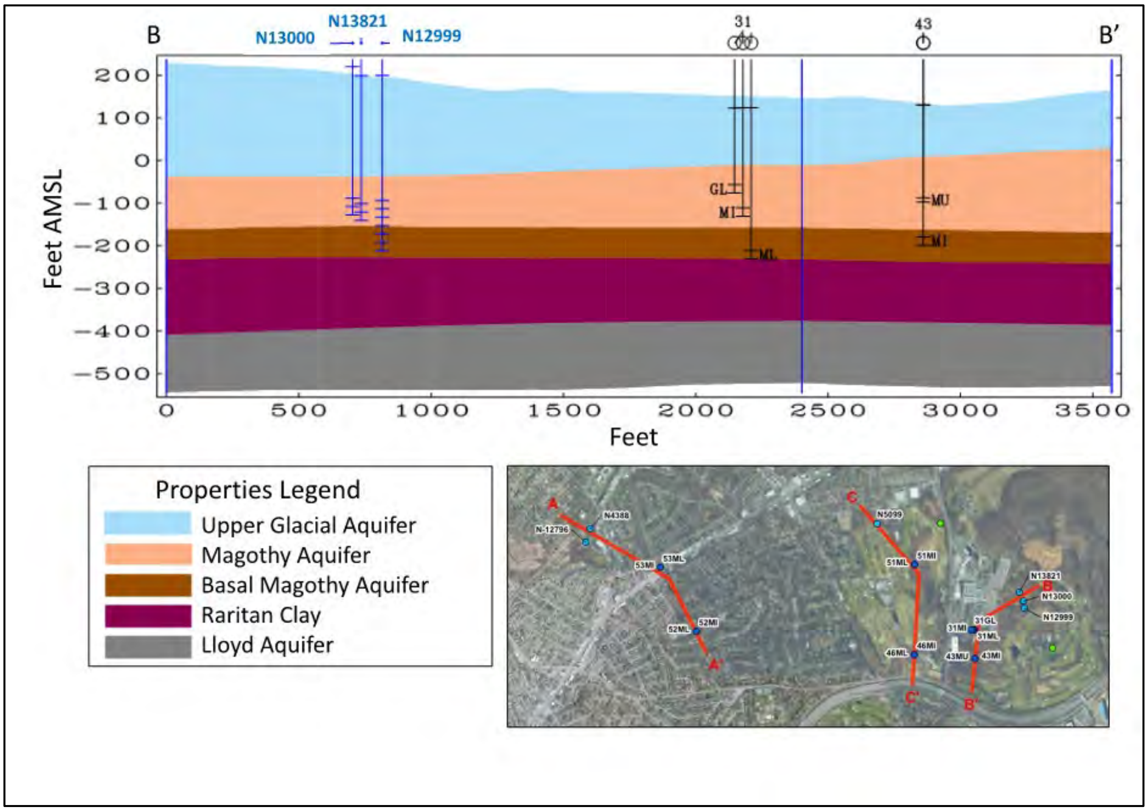


Figure 5. Cross Section C-C' Depicting Model Layers Near MLWD Cumberland Well

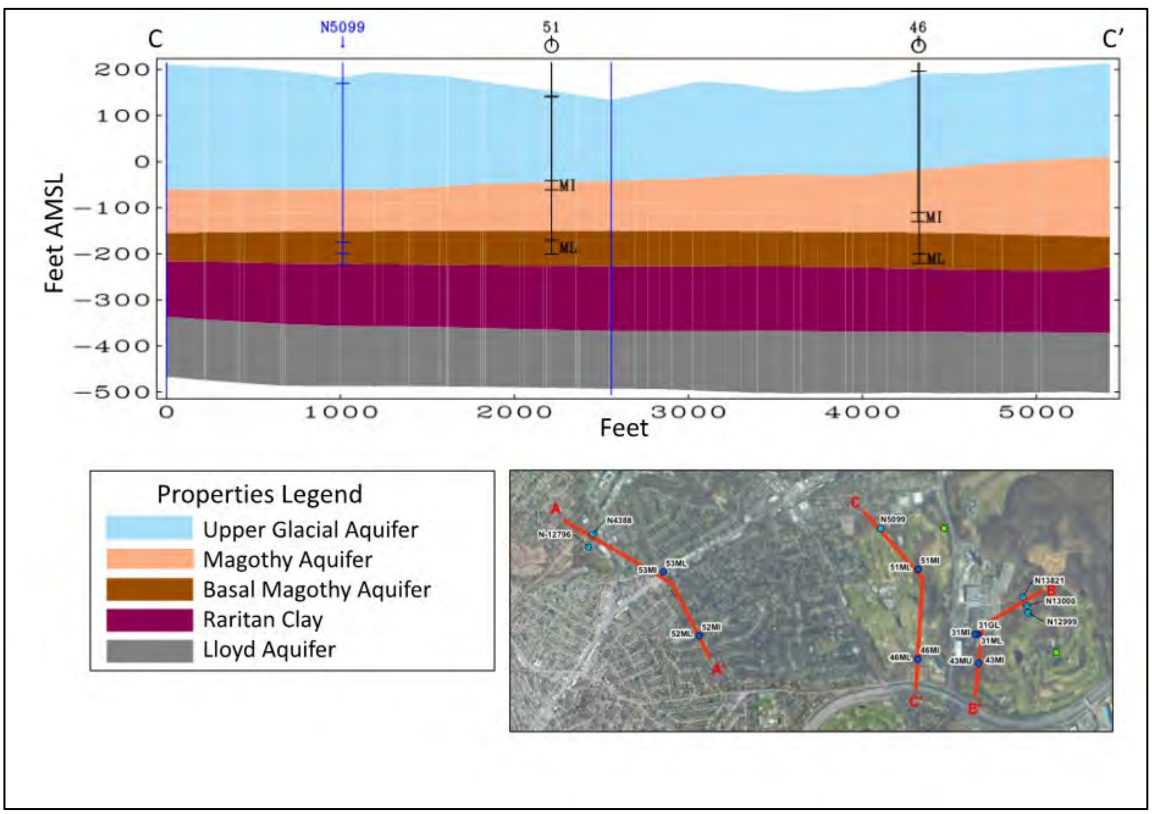


Table 2. Model Aquifer Properties Near Site

Hydrogeologic Unit	K_h (ft/day)	K_v (ft/day)	S_y	S (1/ft)
Lloyd Aquifer	40	4	0.25	1.0E-06
Raritan Clay	0.3 – 3	0.0001 – 0.02	0.25	1.0E-06
North Shore Aquifer	100	10	0.25	1.0E-06
North Shore Confining Unit	1	0.005	0.25	1.0E-06
Magothy Aquifer	10 – 125	0.04 – 3.5	0.25	1.0E-06
Upper Glacial Aquifer	5 – 250	0.2 – 20	0.25	1.0E-06
Outwash	70 – 250	0.2 – 20	0.25	1.0E-06
Moraine	5 – 30	0.3 – 0.5	0.25	1.0E-06

The updated groundwater flow model was used to simulate transient groundwater flow conditions for the period from 1940 through September 2019 to demonstrate that the model could reasonably represent observed groundwater heads and gradients and temporal water level variations due to changes in pumping and recharge. The simulation period includes recent conditions when the OU1 and OU2 remediation systems, including new OU1 remediation pumping wells EW-1R and RW-3, are operating.

Details for groundwater pumping wells shown on Figure 1 are summarized in **Table 3** and **Table 4**. Lloyd aquifer pumping wells are not shown on Figure 1 or listed in tables, because the focus of ongoing groundwater monitoring and the *2019 Groundwater Public Water Supply Protection and Mitigation Program Compliance Report* is groundwater flow and quality conditions in the Upper Glacial and Magothy aquifers near the former Unisys site.

Following initial groundwater flow model updates, model calibration was confirmed by comparing time histories of simulated heads with observed data and adjusting model aquifer properties so that simulated heads were consistent with measured values. Simulated water level time history graphs for the sentinel wells listed in Table 1 are presented in **Appendix C**. A plan view map showing contours of simulated September 2019 Magothy aquifer piezometric heads is presented in **Figure 6.**

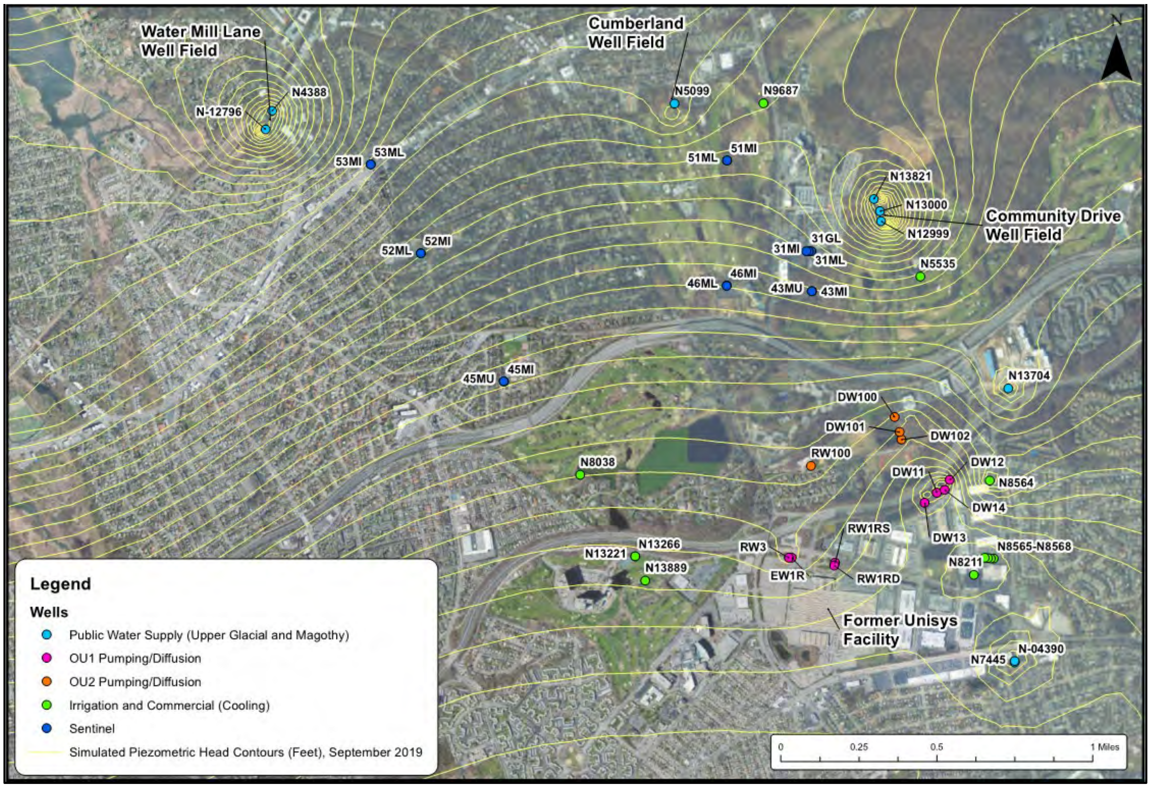
Table 3. Details for Remediation Wells Shown in Figure 1

Well	Remediation System	Well Type	Aquifer	Screened Interval (feet bgs)	Average 2019 Pumping or Injection (Rounded gpm, Jan – Sep)
EW1R	OU1	Extraction	Magothy	195 to 225	445
RW1RS	OU1	Extraction	Upper Glacial /Magothy	144 to 164 172 to 202	145
RW1RD	OU1	Extraction	Magothy	238 to 268	150
RW3	OU1	Extraction	Magothy	300 to 385	120
RW100	OU2	Extraction	Magothy	190 to 210 238 to 260 276 to 324	400
DW11	OU1	Diffusion	Magothy	275 to 411	345
DW12	OU1	Diffusion	Magothy	308 to 396	30
DW13	OU1	Diffusion	Magothy	250 to 320 340 to 380	200
DW14	OU1	Diffusion	Magothy	270 to 322 372 to 390 398 to 424	285
DW100	OU2	Diffusion	Magothy	299 to 331 415 to 419	170
DW101	OU2	Diffusion	Magothy	333 to 383 393 to 408	50
DW102	OU2	Diffusion	Magothy	365 to 413	180

Table 4. Details for Water Supply and Commercial Wells Shown in Figure 1

Well	Well Type	Owner	Aquifer	Screened Interval (feet bgs)	Average 2019 Pumping (gpm, Jan – Sep)
N4388	Public Water Supply	WAGNN	Upper Glacial	125 to 145	150
N12796	Public Water Supply	WAGNN	Upper Glacial	110 to 130	430
N12999	Public Water Supply	WAGNN	Magothy	294 to 304 312 to 322 392 to 412	570
N13000	Public Water Supply	WAGNN	Magothy	308 to 348	630
N13821	Public Water Supply	WAGNN	Magothy	300 to 340	500
N12735	Public Water Supply	WAGNN	Magothy	93 to 108 122 to 164	330
N5099	Public Water Supply	MLWD	Magothy	345 to 378 383 to 393	800
N13704	Public Water Supply	MLWD	Magothy	300 to 320	630
N4390	Public Water Supply	WAWNC	Magothy	261 to 296	460
N7445	Public Water Supply	WAWNC	Magothy	388 to 448	290
N5535	Irrigation	Deepdale CC	Magothy	330 to 350	40
N9687	Irrigation	Fresh Meadow CC	Magothy	203 to 243	40
N8038	Irrigation	Lake Success Park GC	Magothy	272 to 295	0
N13221	Irrigation	North Shore Towers CC	Upper Glacial	195 to 235	10
N13266	Irrigation	North Shore Towers CC	Upper Glacial	200 to 240	10
N13889	Irrigation	North Shore Towers CC	Magothy	396 to 459	20
N8564	Cooling - Pumping	We're Associates	Magothy	170 to 190	60 (based on 2018 record)
N8499	Cooling - Pumping	We're Associates	Upper Glacial	160 to 180	0
N8565D	Cooling - Diffusion	We're Associates	Magothy	200 to 260	15 (1/4 of 60 gpm)
N8566D	Cooling - Diffusion	We're Associates	Magothy	190 to 250	15 (1/4 of 60 gpm)
N8567D	Cooling - Diffusion	We're Associates	Magothy	190 to 250	15 (1/4 of 60 gpm)
N8568D	Cooling - Diffusion	We're Associates	Magothy	201 to 241	15 (1/4 of 60 gpm)

Figure 6. Simulated September 2019 Magothy Aquifer Piezometric Heads



4. Groundwater Flow Model and TVOC Solute Transport Simulations for 2019 Groundwater Public Water Supply Protection and Mitigation Program Compliance Report

4.1 Groundwater Flow Model Simulations for TVOC Projection Simulations

Model simulations were conducted to estimate potential future TVOC concentrations in the pumped groundwater at the WAGNN Community Drive well field (N12999, N13000 and N13821), the WAGNN Water Mill Lane well field (N4388 and N12796), and at MLWD Cumberland well field (N5099). Simulation results were also reviewed to evaluate whether TVOC plume impacts to WAGNN well N12735 are projected.

Future transport of the TVOC groundwater plume was simulated for 20 years for several pumping conditions:

- Historical Pumping Case: A ten-year transient groundwater flow simulation was developed that incorporates monthly water supply pumping rates and groundwater recharge assignments based on reported data for years 2000 to 2009. The simulation incorporates OU1 and OU2 groundwater remediation pumping as described in the OU2 ROD, and is comparable to the transient simulations used for the evaluation of sentinel well locations described in the earlier section “Groundwater Flow and Solute Transport Model Updates for Sentinel Well Site Evaluation”.

- 2018 Pumping Case: A one-year transient groundwater flow simulation was developed that incorporates monthly water supply pumping rates from 2018, and average groundwater recharge. The simulation also incorporates OU1 and OU2 groundwater remediation pumping as described in the OU2 ROD.

Average annual pumping rates for the 10-year (Historical Pumping Case) and one-year (2018 Pumping Case) transient simulation are listed in **Table 5.** In the model simulation, the WAGNN Community Drive well field (N12999, N13000 and N13821), the WAGNN Water Mill Lane well field (N4388 and N12796), and at MLWD Cumberland well field (N5099) operate continuously, at different pumping rates assigned to each well each month. The assigned monthly pumping rates are based on historical pumping records for each well.

Two additional groundwater flow simulations were developed from the 2018 Pumping Case described above:

- Water Mill Lane Test Case 1: The 2018 Pumping Case, as described above, but no pumping is assigned to well N12796. Pumping at well N4388 is simulated, based on 2018 pumping records. In the simulation, the monthly pumping rate at N4388 ranges from about 0 to 900 gpm, and the average pumping rate is approximately 450 gpm.

- Water Mill Lane Test Case 2: The 2018 Pumping Case, as described above, but no pumping is assigned to well N4388. Pumping at well N12796 is simulated, based on 2018 pumping records. In the simulation, the monthly pumping rate at N12796 ranges from about 70 to 720 gpm, and the average pumping rate is approximately 350 gpm.

Table 5. Groundwater Pumping Rates (gallons per minute) at Water Supply Wells

Detail	WAGNN Water Mill Lane	WAGNN Community Drive	MLWD Cumberland
Average Annual Pumping Rate (Range provided for simulation years in 10-year transient simulation, 2000 - 2009)	700 to 980	930 to 1,920	310 to 840
Average Annual Pumping Rate – 2018	800	1,460	620
Average Pumping Rate – 2019 (Jan – Sep)	580	1,700	800

4.2 TVOC Solute Transport Simulation

The TVOC solute transport simulations for the *2019 Groundwater Public Water Supply Protection and Mitigation Program Compliance Report* used an estimated 2019 TVOC distribution as a starting condition. This mapped distribution represents the estimated limits of the TVOC groundwater plume associated with the former Unisys site. The TVOC distribution is based on the earlier TVOC mapping developed for the OU2 RI and FS reports, 2011 – 2019 groundwater quality data from wells at the leading edge of the plume, and simulations of 2010 – 2019 groundwater flow and TVOC solute transport.

The 2019 mapped groundwater plume extends to the Water Mill Lane well field. The well field, which is already serviced by an existing groundwater treatment system, is impacted by the former Unisys site Plume. The estimated 2019 TVOC plume distribution, which is shown as the maximum TVOC concentration for the model layers representing the Upper Glacial and Magothy aquifers, is presented in **Figure 7** (posted TVOC concentrations are rounded values). Maps showing the estimated 2019 TVOC plume distribution for the model layers representing the Upper Glacial aquifer, and for model layers representing the upper, middle and basal Magothy are contained in **Appendix D.**

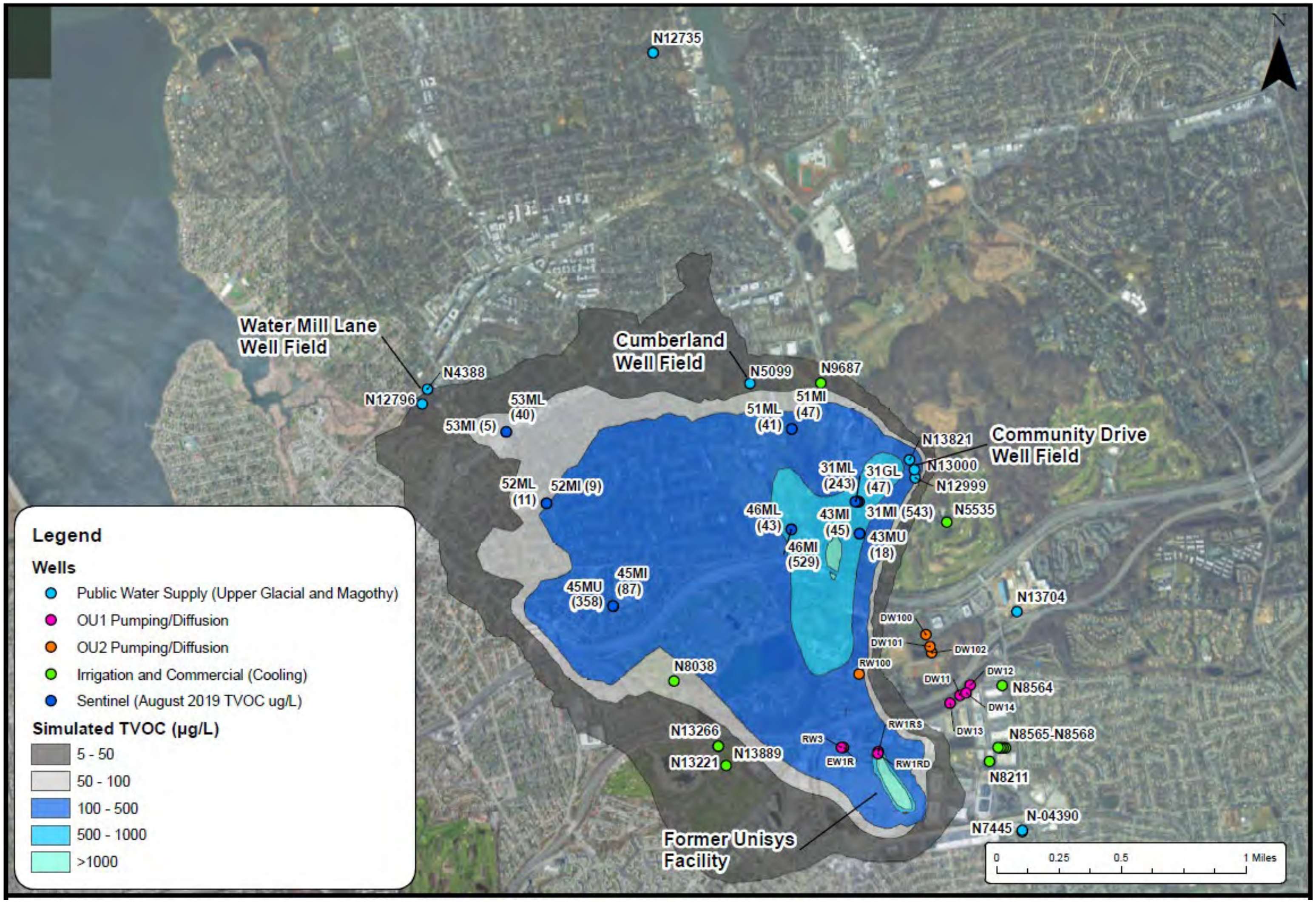
A comparison of the estimated 2015 TVOC distribution presented in Appendix B, which was developed as part of the earlier analysis for sentinel well site selection, with that presented in Figure 7 indicates some notable differences. For example, the estimated 2019 TVOC plume limits have a greater northward extent than the 2015 mapping in Appendix B, and there are locations within the estimated 2015 TVOC plume limits where the mapped concentrations are greater in the 2019 map than in the 2015 map. There are some locations, however, where the current 2019 mapping includes lower TVOC concentrations than the earlier 2015 mapping. Solute transport simulation tests conducted during the recent groundwater model update, evaluation of recent groundwater quality data, and subsequent comparisons of simulated and observed concentrations at monitoring wells and supply wells, suggested that there were locations where TVOC plume concentrations were previously overestimated. Based on the simulation results and observed groundwater concentrations, adjustments were made to the TVOC plume mapping that honored past data but also resulted in a simulated 2010 to 2019 concentration time history consistent with recent measured data.

Consistent with the RI/FS simulations, a TVOC source term was added to the solute transport simulations to represent the potential contribution of additional mass from a continuing source in the former dry well area on site (near southeast corner of main building). The mass loading rate in the source term was based on trial and error model simulation tests that were conducted to generally match simulated TVOC concentration values and trends with actual pumped groundwater concentrations at the OU1 pumping wells.

Although contaminated soils were removed as part of earlier remediation efforts in the former dry well area, some mass may remain in the subsurface. An 18-year half-life was assigned to the simulated former dry well source based on observed reductions in pumped influent concentrations at the OU1 extraction wells. Simulation results indicate that the former dry well source is captured by the OU1 remediation pumping wells and does not affect simulated future concentrations at the water supply wells.

No degradation of the TVOC mass in groundwater was specified, which results in a conservative estimate of mass in the groundwater during the simulation. Consistent with transport simulations conducted earlier for the OU2 RI and FS, a retardation coefficient of 1.0 was specified for the TVOC mass for simulating no adsorption of TVOC mass during transport, which results in faster plume arrival times and potentially conservatively high estimates of maximum TVOC concentrations. Based on a review of trends in individual volatile organic compound (PCE, TCE, cis-1,2-DCE, Freon 113) concentrations over time and distance from the former Unisys site, there are no apparent indications that degradation or retardation are occurring in groundwater. The effective porosity assigned to all model layers is 0.18. Previous simulations used a value of 0.20; however, simulation tests completed during the recent model update indicated that a slightly lower effective porosity may be more appropriate.

Figure 7. Simulated 2019 TVOC Groundwater Plume, Associated with the former Unisys Site, Shown as Maximum TVOC Concentration Over Upper Glacial and Magothy Aquifer Model Layers



4.3 Projected Future TVOC Concentrations at Nearby Water Supply Wells

Projected future TVOC solute transport was simulated for a period of 20 years, with the transport simulations theoretically start at the beginning of year 2020. The estimated TVOC distribution shown in Figure 7 was used as a starting condition, and assumed to be representative of January 1, 2020 groundwater plume limits and concentrations associated with the former Unisys site groundwater plume. The purpose of the projection simulations is to estimate potential maximum TVOC concentrations that may impact the water supply wells. In addition, simulation results can be referenced and checked as new groundwater quality data become available.

Four solute transport projection simulations were completed:

- The 10-year transient groundwater flow simulation described above (Historical Pumping Case) was repeated to create a 20-year transport simulation period. The simulation allowed for comparison with previous projection simulations used for siting sentinel well locations.
- The one-year transient groundwater flow simulation described above (2018 Pumping Case) was repeated 20 times to create a 20-year transport simulation period. This simulation represents more recent water supply pumping patterns in the area.
- Similarly, the groundwater flow simulations described under Water Mill Lane Test Case 1 and Water Mill Test Case 2 were repeated 20 times to create a 20-year transport simulation period. These simulations represent potentially different pumping operations at the Water Mill Lane well field, where both wells have operated somewhat intermittently at times.

Simulated average pumped groundwater TVOC concentrations at the WAGNN Water Mill Lane well field, WAGNN Community Drive well field, and at the MLWD Cumberland well, are shown respectively, in **Figures 8, 9, and 10** for the "Historical Pumping Case" transport simulation. Projected TVOC concentrations in this simulation are generally similar to concentrations simulated for the other scenarios described above.

Figures 8 – 10 also show the reported August 2019 TVOC concentrations at each water supply well. For the Community Drive and Cumberland Road well fields, the model is conservative and simulated concentrations at the start of the simulation (assumed January 2020) are higher than concentrations reported at the water supply wells in August 2019.

Figure 8. Simulated Pumped Groundwater TVOC Concentrations at Water Mill Lane Well Field

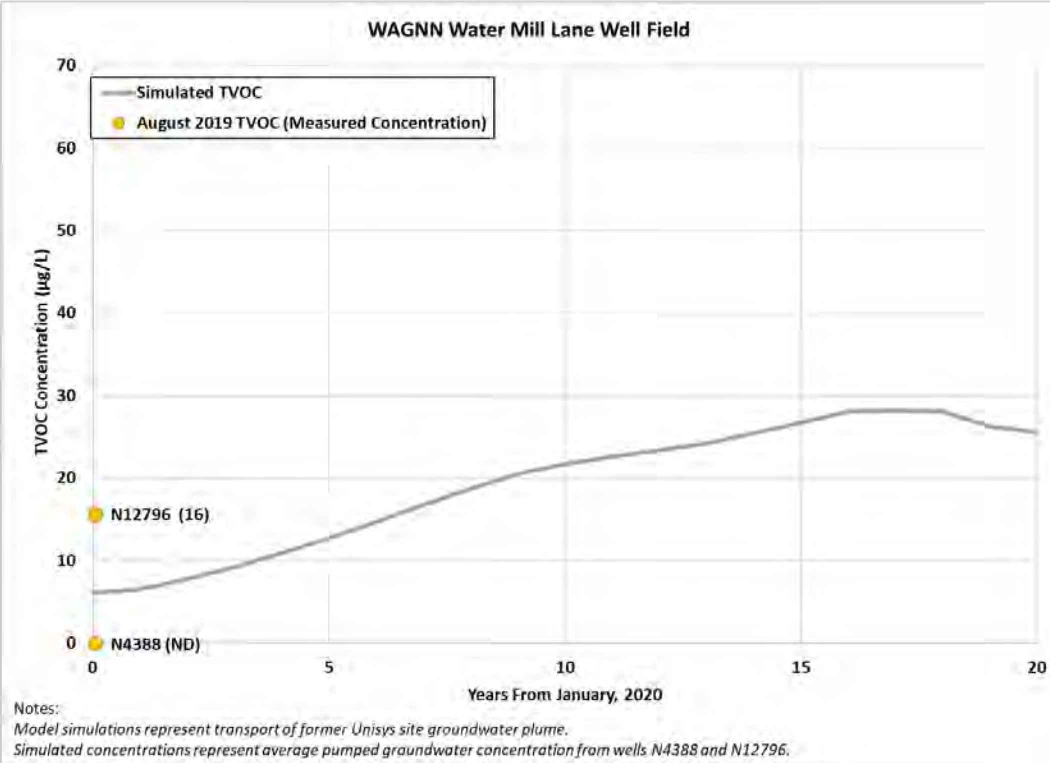


Figure 9. Simulated Pumped Groundwater TVOC Concentrations at Community Drive Well Field

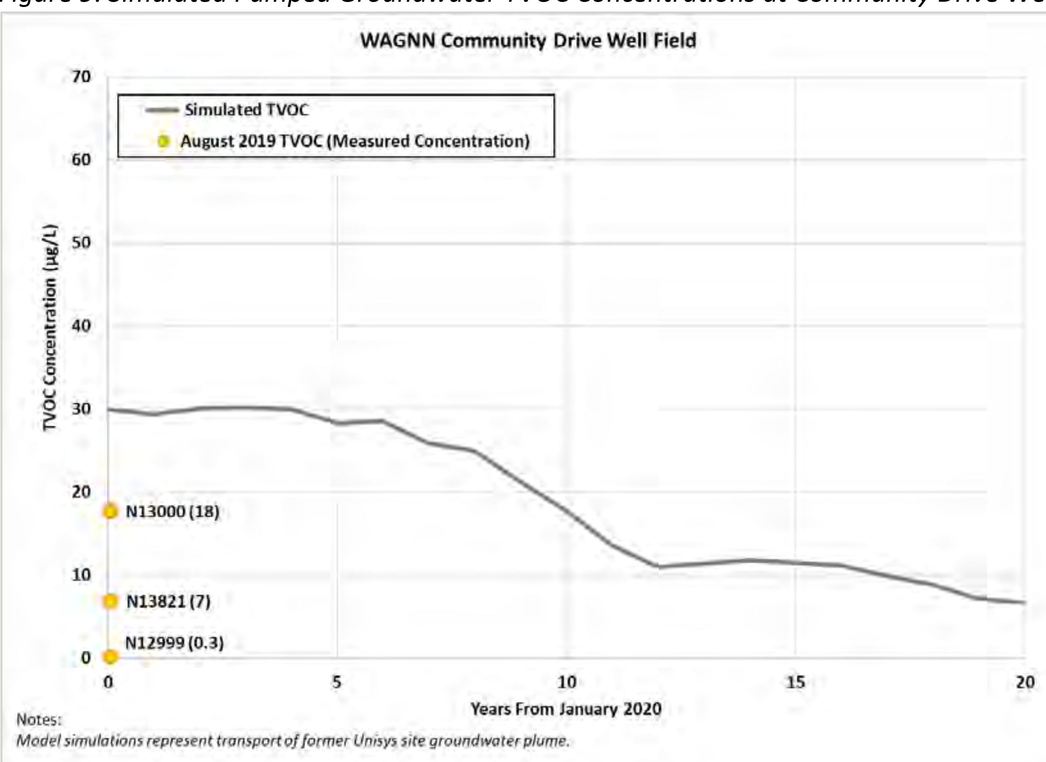
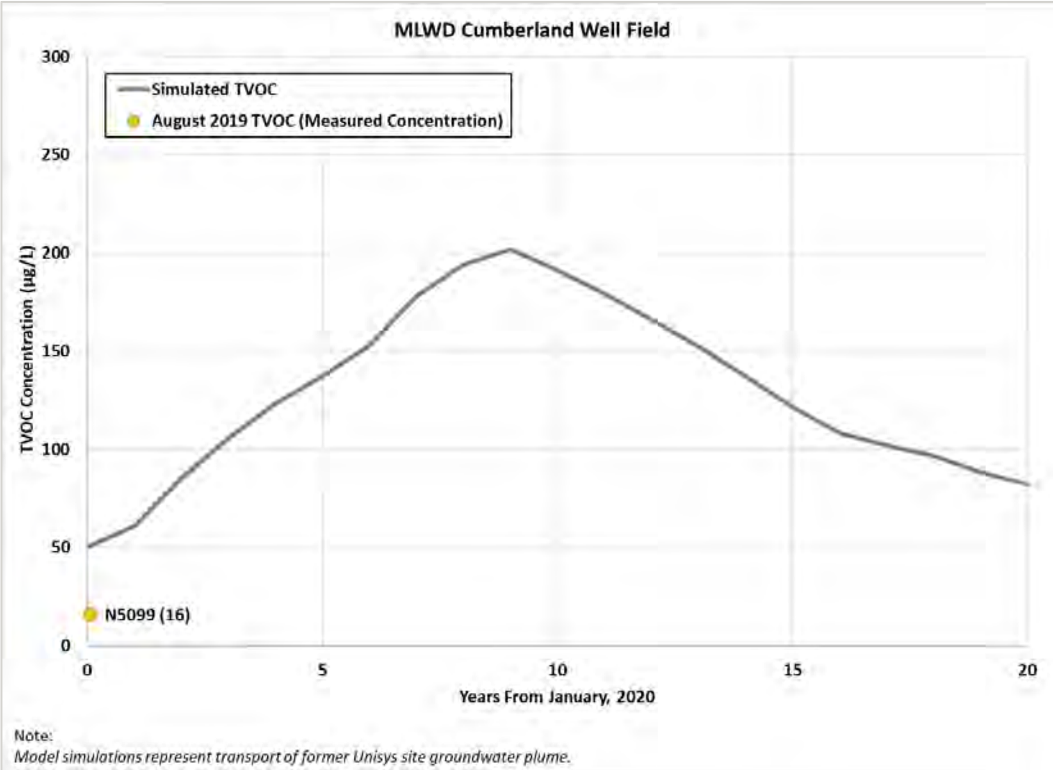


Figure 10. Simulated Pumped Groundwater TVOC Concentrations at the Cumberland Well



For the Water Mill Lane wells, the simulated TVOC concentrations are lower than what has been reported at the well field. This is because the TVOC concentrations represented in the model simulations are TVOC concentrations associated with the groundwater plume migrating from the former Unisys Site. The Water Mill Lane well field is already serviced by a groundwater treatment system that addresses historical VOC impacts from other sources.

Table 6 lists the maximum simulated TVOC concentration (rounded value) at each well field and sentinel well cluster for the "Historical Pumping Case" simulation described above. Simulation results suggest the former Unisys groundwater plume may arrive at well N12735 at concentrations ranging from 1 to 4 µg/L in approximately 15 to 20 years.

Table 7 lists estimates of potential individual VOC concentrations at the water supply wells over the next five years, based on the simulated transport in the four solute transport projection simulations described above. These estimates were calculated using the simulated TVOC concentrations for the first five years of the projection simulations, and the percentages listed in Table 6. The ranges provided in Table 7 reflect both the simulated range of projected TVOC concentrations for the different pumping conditions and the different individual VOC percentages calculated from the sentinel well monitoring data.

The Water Mill Lane supply wells are listed individually because of the position of these wells relative to the former Unisys site groundwater plume migration pathway, and the sometimes-intermittent operation of these wells. In 2018, for example, there were months when primarily only one well was in operation.

Care should be taken in comparing future measured concentrations with the estimates provided in Table 7, since the well pumping rates assigned in the model for the projection simulations may not reflect well field operations in the period preceding and during the well sampling event. Model assumptions should be checked against actual groundwater flow and quality conditions to confirm that comparisons of data with model simulation results are appropriate.

5. Projected Future TVOC Concentrations at Sentinel Well Locations

The graphs presented in **Figures 11 to 17** show the maximum simulated TVOC concentration at each sentinel well cluster, based on the simulated transport of the former Unisys groundwater plume. Simulation results are presented for the "Historical Pumping Case" transport simulation described above. These graphs may be used to supplement groundwater quality data review in the future, to inform the analysis of groundwater quality trends and to confirm the current conceptual understanding of the TVOC groundwater plume migration. Table 6 lists the maximum simulated TVOC concentration at each well cluster.

At several monitoring locations, the measured August 2019 TVOC concentration is close in value to the simulated maximum concentration. In keeping with the Groundwater Public Water Supply Protection and Mitigation Program, the groundwater and solute transport model simulation results are periodically checked against monitoring data and, if needed, the model is updated to better represent observed groundwater flow and quality conditions.

The potential composition of the TVOC groundwater plume at the wells can be estimated using approximate percentages of reported cis-1,2-DCE, TCE and PCE relative to TVOC concentrations at each well cluster. TVOC concentrations at sentinel wells from the August 2019 monitoring event are posted in Figure 7 for reference.

Figure 11. Simulated Maximum TVOC Concentration at Well Cluster 45 (Water Mill Lane Sentinel Well).

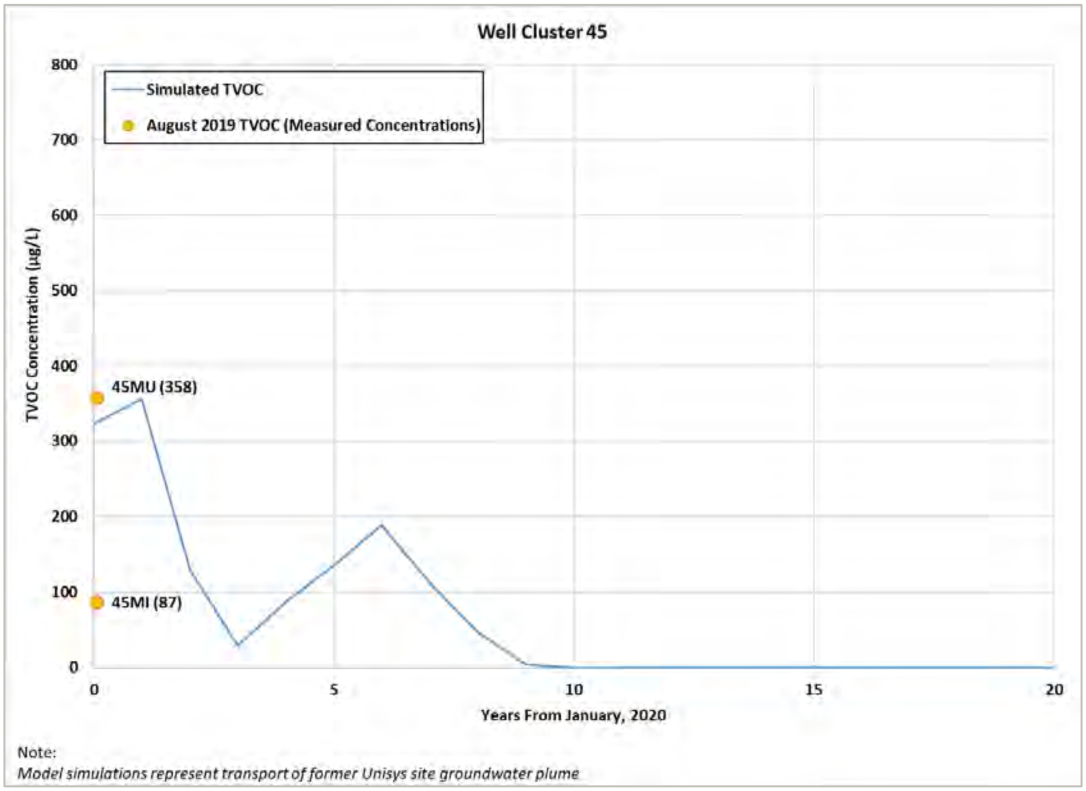


Figure 12. Simulated Maximum TVOC Concentration at Well Cluster 52 (Water Mill Lane Sentinel Well)

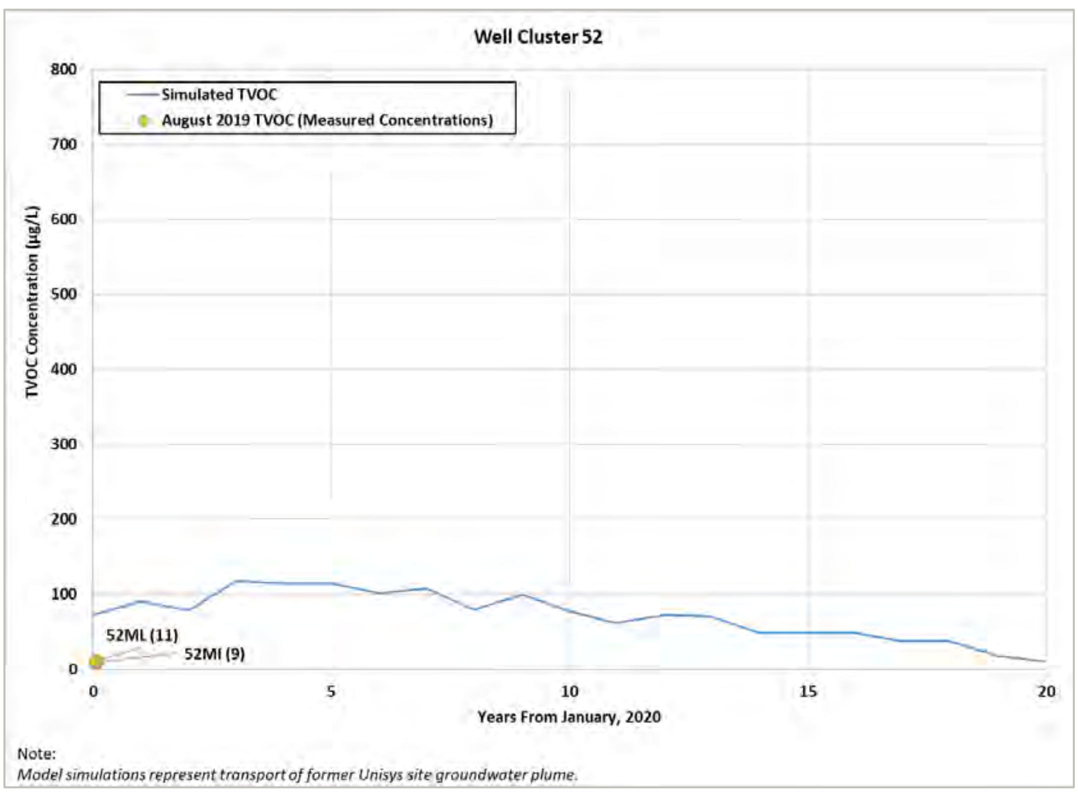


Figure 13. Simulated Maximum TVOC Concentration at Well Cluster 53 (Water Mill Lane Sentinel Well)

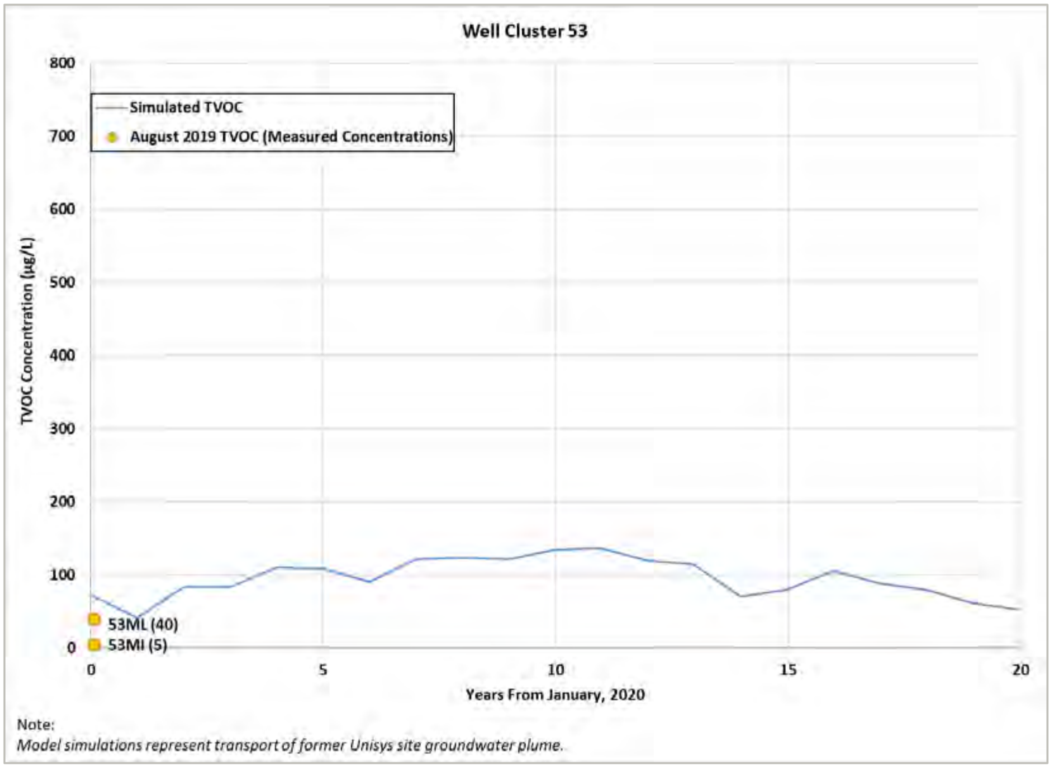


Figure 14. Simulated Maximum TVOC Concentration at Well Cluster 43 (Community Drive Sentinel Well)

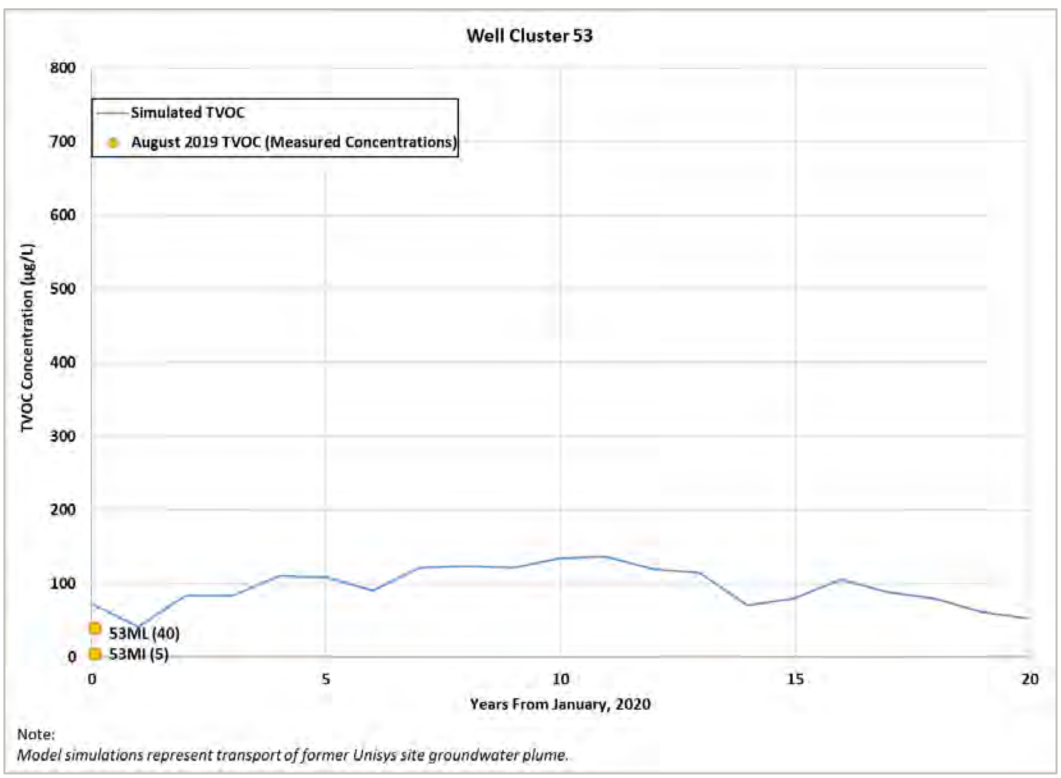


Figure 15. Simulated Maximum TVOC Concentration at Well Cluster 31 (Community Drive Sentinel Well)

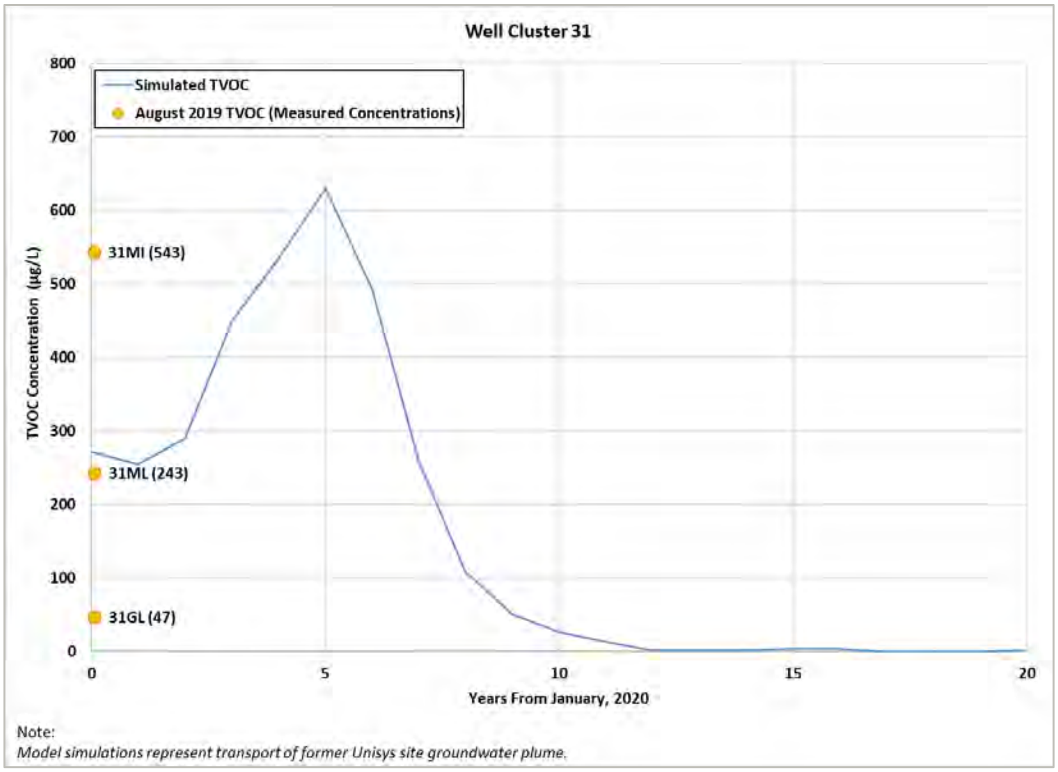


Figure 16. Simulated Maximum TVOC Concentration at Well Cluster 46 (Cumberland Sentinel Well)

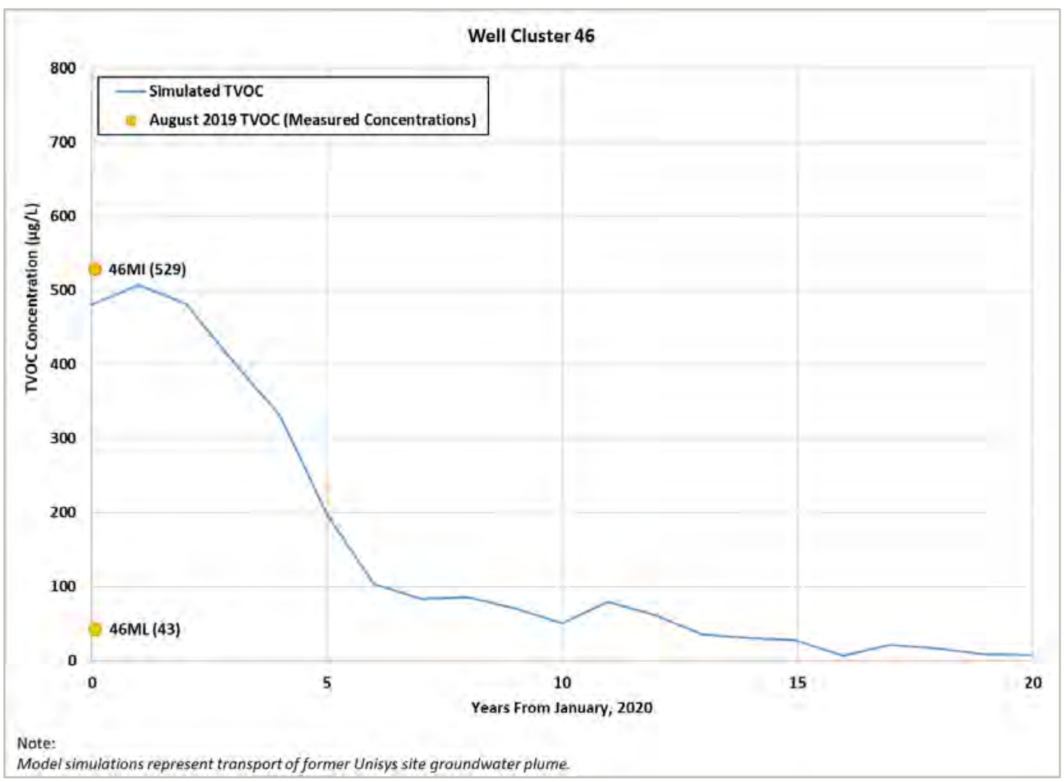
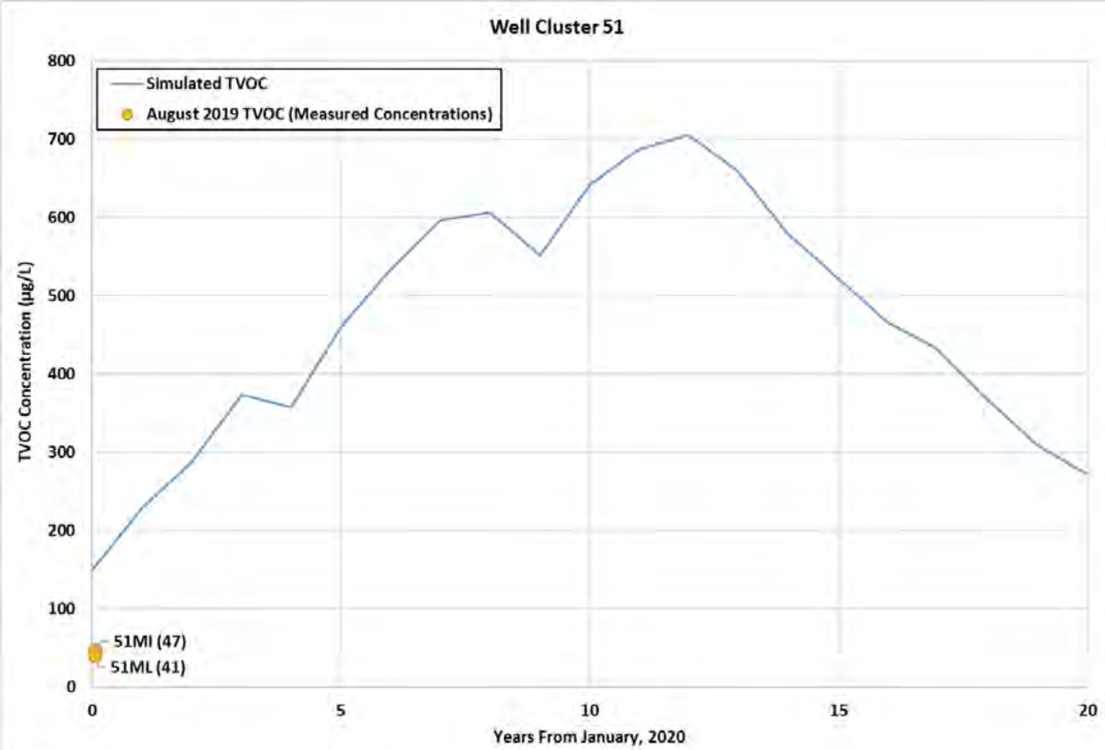


Figure 17. Simulated Maximum TVOC Concentration at Well Cluster 51 (Cumberland Sentinel Well)



Note:
Model simulations represent transport of former Unisys site groundwater plume.

Table 6. Simulated Maximum TVOC Concentrations at Water Supply and Sentinel Wells From 20-Year TVOC Solute Transport Projection Simulation for "Historical Pumping Case" Transport Simulation

Well Field	Sentinel Well Cluster	Maximum Simulated TVOC Concentration at Supply Wells (µg/L)	Maximum Simulated TVOC Concentration at Sentinel Wells (µg/L)	Estimated Percent PCE Based on Sentinel Well Data	Estimated Percent TCE Based on Sentinel Well Data	Estimated Percent cis-1,2-DCE Based on Sentinel Well Data	Estimated Percent Freon 113 Based on Sentinel Well Data
Water Mill Lane	45	30	360	6%	29%	62%	3%
Water Mill Lane	52	30	120	5%	29%	65%	1%
Water Mill Lane	53	30	140	10%	50%	38%	2%
Community Drive	31	30	630	8%	20%	69%	3%
Community Drive	43	30	130	12%	24%	62%	2%
Cumberland Well	46	210	510	7%	33%	56%	4%
Cumberland Well	51	210	710	7%	22%	67%	4%
Ravine Road Well Field (N12735)	--	4	--	--	--	--	--

Notes:

(1) Percent PCE, TCE, cis-1,2-DCE and Freon 113 based on average concentrations at each well cluster for sampling results from years 2015 – August 2019 (only one sample from wells 53MI and 53ML)

(2) August 2019 TVOC concentrations at sentinel wells are shown on Figure 7.

(3) Historical Pumping Case: A ten-year transient groundwater flow simulation, described in Section 4.1, that incorporates monthly water supply pumping rates and groundwater recharge assignments based on reported data for years 2000 to 2009. For the 20-year transport simulation, the 10-year transient flow field was repeated.

Table 7. Simulated TVOC Concentrations and Estimated Individual VOC Concentrations at Water Supply Wells for Projection Years 1-20

Projection Simulation Year	Simulated TVOC Concentration (µg/L)	Estimated PCE Concentration (µg/L)	Estimated TCE Concentration (µg/L)	Estimated cis-1,2-DCE Concentration (µg/L)	Estimated Freon 113 Concentration (µg/L)
WAGNN Water Mill Lane Well Field - N4388					
1	Less than 10	Less than 2	Less than 5	Less than 10	Less than 2
2	Less than 10	Less than 2	Less than 5	Less than 10	Less than 2
3	5 to 15	Less than 2	Less than 10	Less than 10	Less than 2
4	5 to 15	Less than 2	Less than 10	Less than 10	Less than 2
5	10 to 20	Less than 2	Less than 10	5 to 15	Less than 2
10	20 to 30	Less than 5	5 to 15	5 to 20	Less than 2
15	20 to 30	Less than 5	5 to 15	5 to 20	Less than 2
20	20 to 30	Less than 5	5 to 15	5 to 20	Less than 2
WAGNN Water Mill Lane Well Field - N12796					
1	Less than 10	Less than 2	Less than 5	Less than 10	Less than 2
2	Less than 10	Less than 2	Less than 5	Less than 10	Less than 2
3	10 to 15	Less than 2	Less than 10	Less than 10	Less than 2
4	10 to 15	Less than 2	Less than 10	Less than 10	Less than 2
5	10 to 20	Less than 2	Less than 10	5 to 15	Less than 2
10	15 to 30	Less than 5	5 to 15	5 to 20	Less than 2
15	15 to 30	Less than 5	5 to 15	5 to 20	Less than 2
20	15 to 30	Less than 5	5 to 15	5 to 20	Less than 2
WAGNN Community Drive Well Field (Combined Average for Well Field)					
1	15 to 30	Less than 5	Less than 10	10 to 20	Less than 2
2	15 to 30	Less than 5	Less than 10	10 to 20	Less than 2
3	15 to 30	Less than 5	Less than 10	10 to 20	Less than 2
4	10 to 30	Less than 5	Less than 10	5 to 20	Less than 2
5	10 to 30	Less than 5	Less than 10	5 to 20	Less than 2
10	10 to 20	Less than 5	Less than 5	5 to 15	Less than 2
15	10 to 20	Less than 5	Less than 5	5 to 15	Less than 2
20	Less than 10	Less than 2	Less than 5	Less than 10	Less than 2
WAGNN Ravine Road Well Field - N12735					
1 to 10	0	0	0	0	0
15	Less than 2	Less than 2	Less than 2	Less than 2	Less than 2
20	Less than 5 (4 µg/L)	Less than 2	Less than 2	Less than 5	Less than 2
MLWD Cumberland Well - N5099					
1	60 to 70	Less than 10	10 to 25	30 to 50	Less than 5
2	85 to 90	5 to 10	15 to 30	45 to 60	Less than 5
3	105 to 120	5 to 15	20 to 40	55 to 80	Less than 10
4	120 to 145	10 to 20	25 to 50	65 to 100	Less than 10
5	135 to 170	20 to 30	25 to 60	75 to 115	Less than 10
10	190 to 210	10 to 30	40 to 70	105 to 140	Less than 10
15	120 to 145	5 to 20	25 to 50	65 to 100	Less than 10
20	70 to 80	5 to 10	15 to 30	35 to 55	Less than 5

6. References

ARCADIS, 2012. Remedial Investigation Report. Operable Unit No. 2 for the Unisys Site. Great Neck New York. Site No. 130045; May 2012

ARCADIS, 2012. Feasibility Study. Operable Unit No. 2 for the Unisys Site. Great Neck New York. Site No. 130045; May 2012

CDM Smith, 2016. OU2 ROD Implementation Groundwater Modeling; January 2016

CDM Smith, 2012. Groundwater Model Documentation Report; May 2012

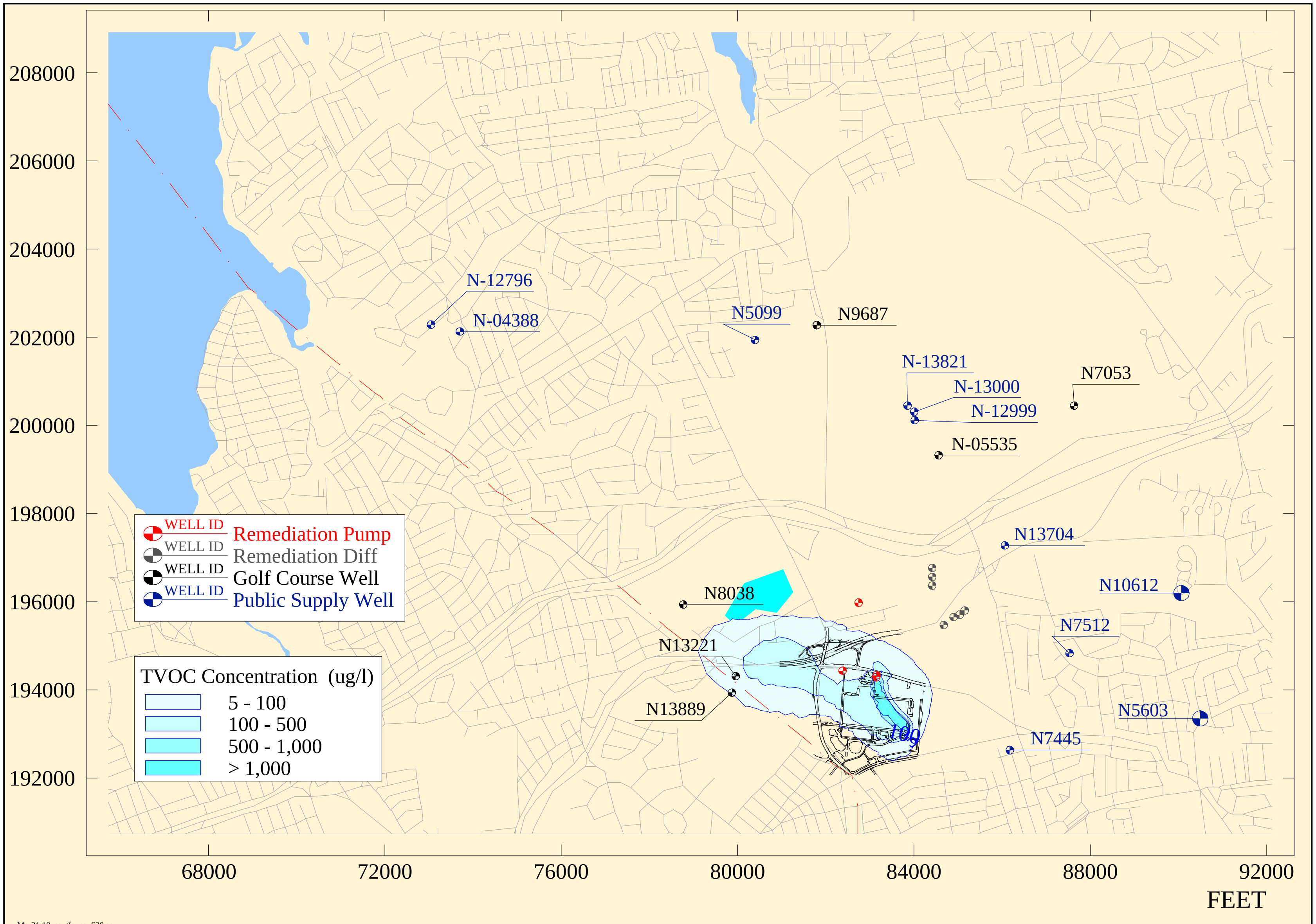
Stumm, 2001. Hydrogeology and Extent of Saltwater Intrusion of the Great Neck Peninsula, Great Neck, Long Island, New York. United States Geological Survey Water-Resources Investigations Report 99-4280

Unisys Site No. 130045
Lake Success, New York

Groundwater Model Update for 2019 Groundwater Public Water Supply Protection and Mitigation Program Compliance Report

Appendix A

Excerpt from Groundwater Model Documentation Report, Remedial Investigation Report for Operable Unit No. 2 for the Unisys Site, Great Neck, NY (CDM Smith, May 2012)

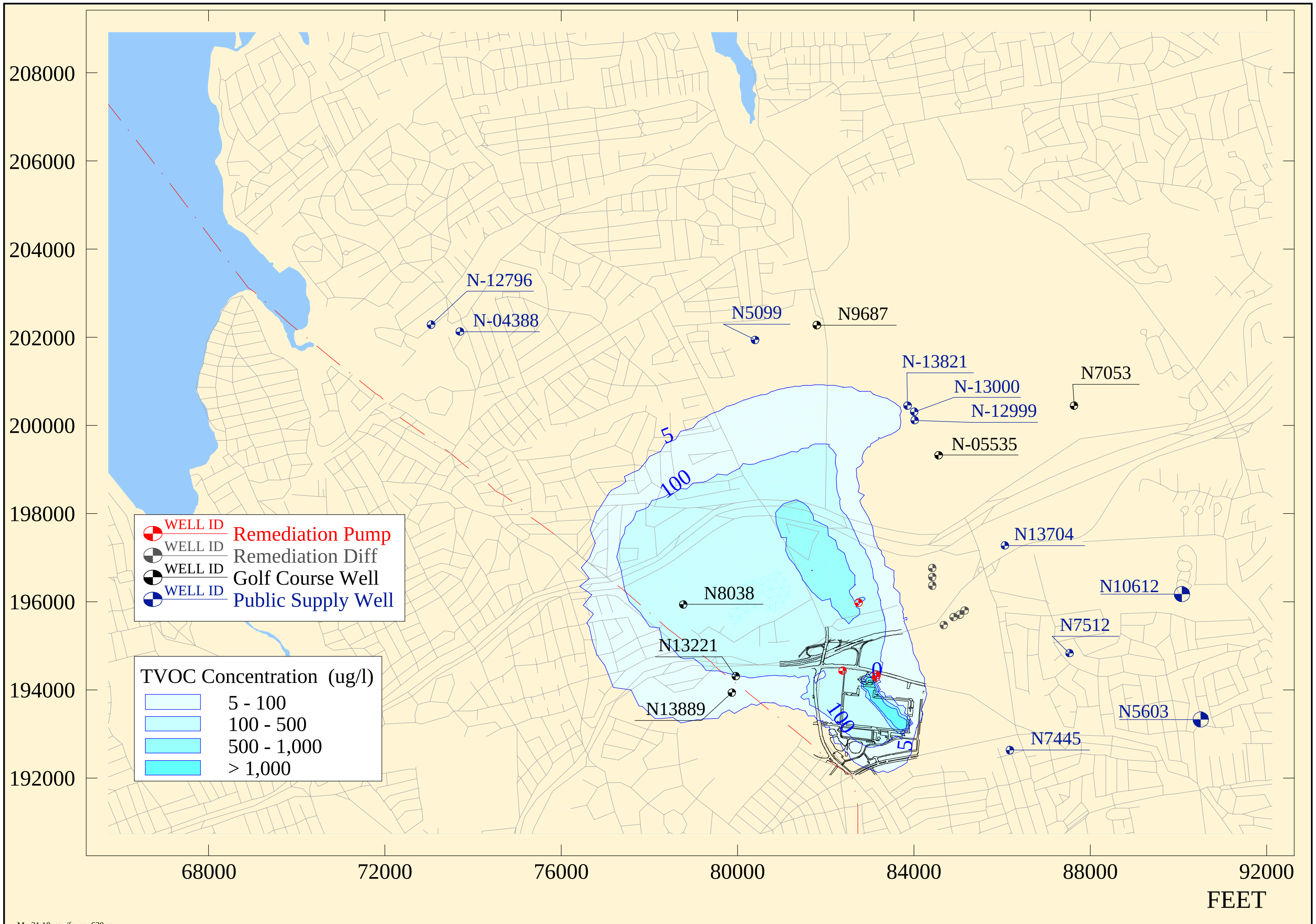


CDM Smith

Starting Plume Extent - Upper Glacial Aquifer
Former Unisys Site, Great Neck, NY
Groundwater Model Documentation

FIGURE 5-1

Excerpt from Groundwater Model Documentation Report, Remedial Investigation Report Operable Unit No. 2 for the Unisys Site, Great Neck, NY (CDM Smith, May 2012)

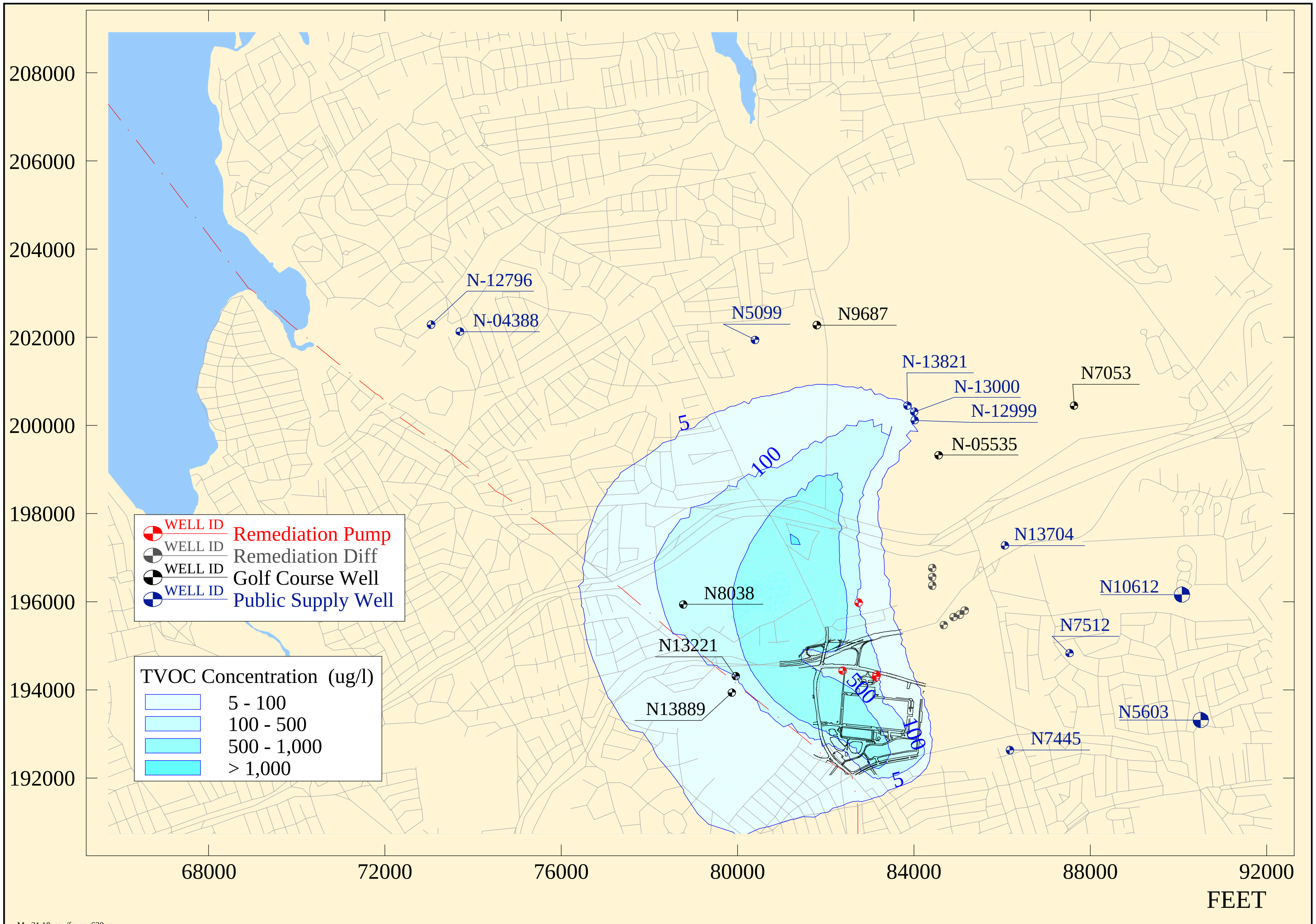


CDM Smith

Starting Plume Extent - Upper Magothy Aquifer
Former Unisys Site, Great Neck, NY
Groundwater Model Documentation

FIGURE 5-2

Excerpt from Groundwater Model Documentation Report, Remedial Investigation Report Operable Unit No. 2 for the Unisys Site, Great Neck, NY (CDM Smith, May 2012)

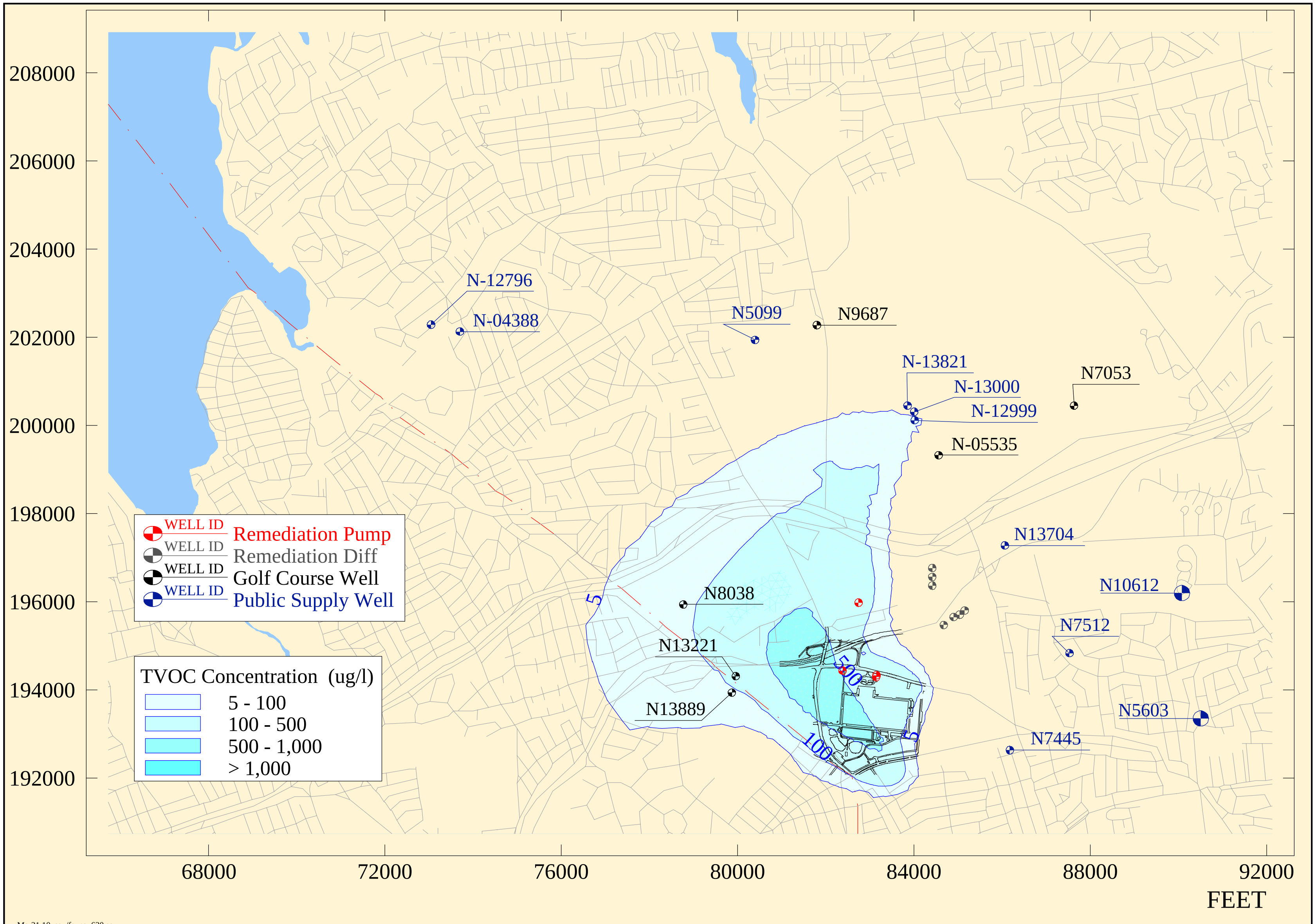


CDM Smith

Starting Plume Extent - Middle Magothy Aquifer
Former Unisys Site, Great Neck, NY
Groundwater Model Documentation

FIGURE
5-3

Excerpt from Groundwater Model Documentation Report, Remedial Investigation Report Operable Unit No. 2 for the Unisys Site, Great Neck, NY (CDM Smith, May 2012)



CDM Smith

Starting Plume Extent - Basal Magothy Aquifer
Former Unisys Site, Great Neck, NY
Groundwater Model Documentation

FIGURE 5-4

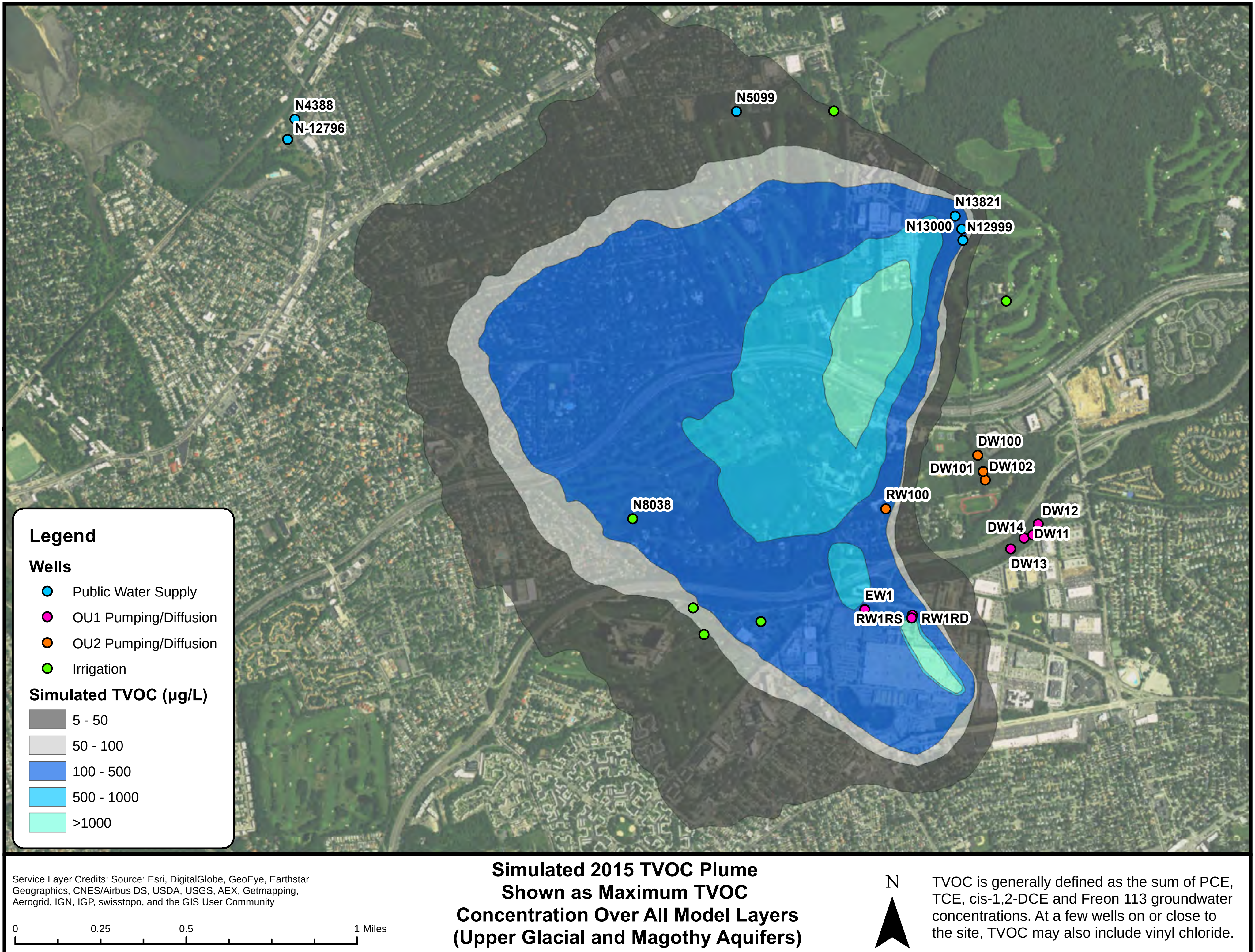
Excerpt from Groundwater Model Documentation Report, Remedial Investigation Report Operable Unit No. 2 for the Unisys Site, Great Neck, NY (CDM Smith, May 2012)

Unisys Site No. 130045
Lake Success, New York

Groundwater Model Update for 2019 Groundwater Public Water Supply Protection and Mitigation Program Compliance Report

Appendix B

Simulated 2015 TVOC
Groundwater Plume Map



Simulated 2015 TVOC Plume Shown as Maximum TVOC Concentration Over All Model Layers (Upper Glacial and Magothy Aquifers)

TVOC is generally defined as the sum of PCE, TCE, cis-1,2-DCE and Freon 113 groundwater concentrations. At a few wells on or close to the site, TVOC may also include vinyl chloride.

Unisys Site No. 130045
Lake Success, New York

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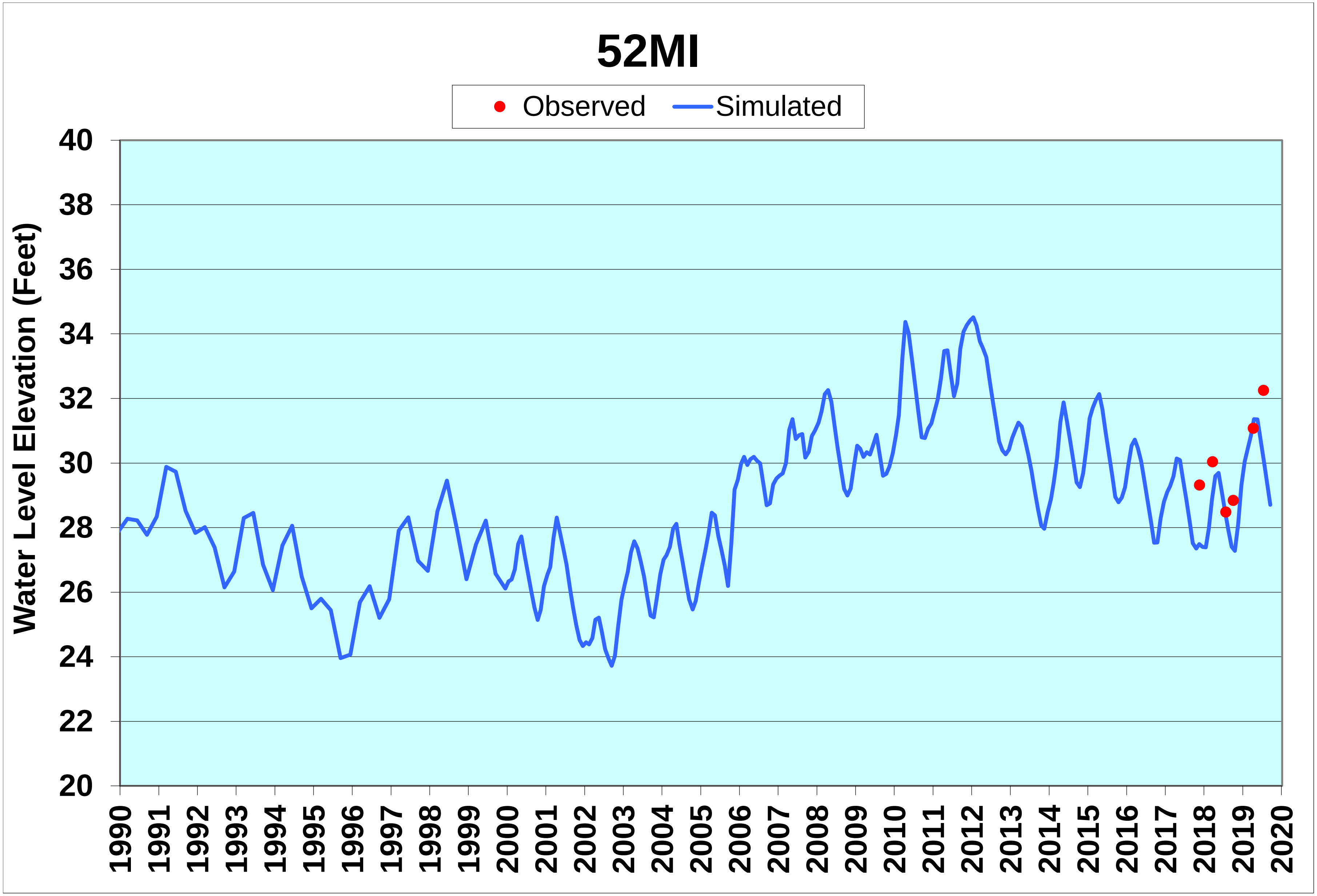
Appendix C

Simulated Water Level Elevation Time History Graphs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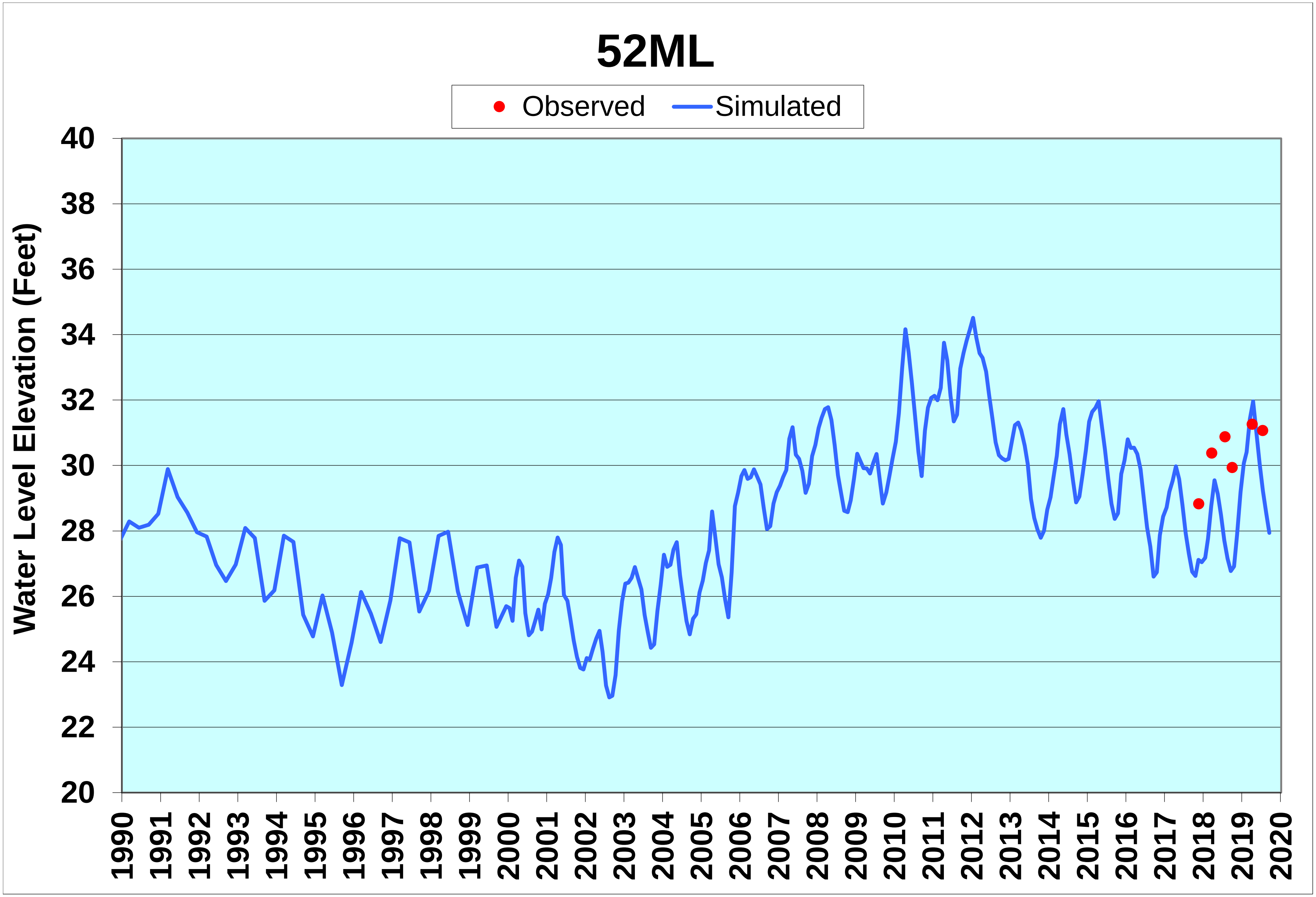

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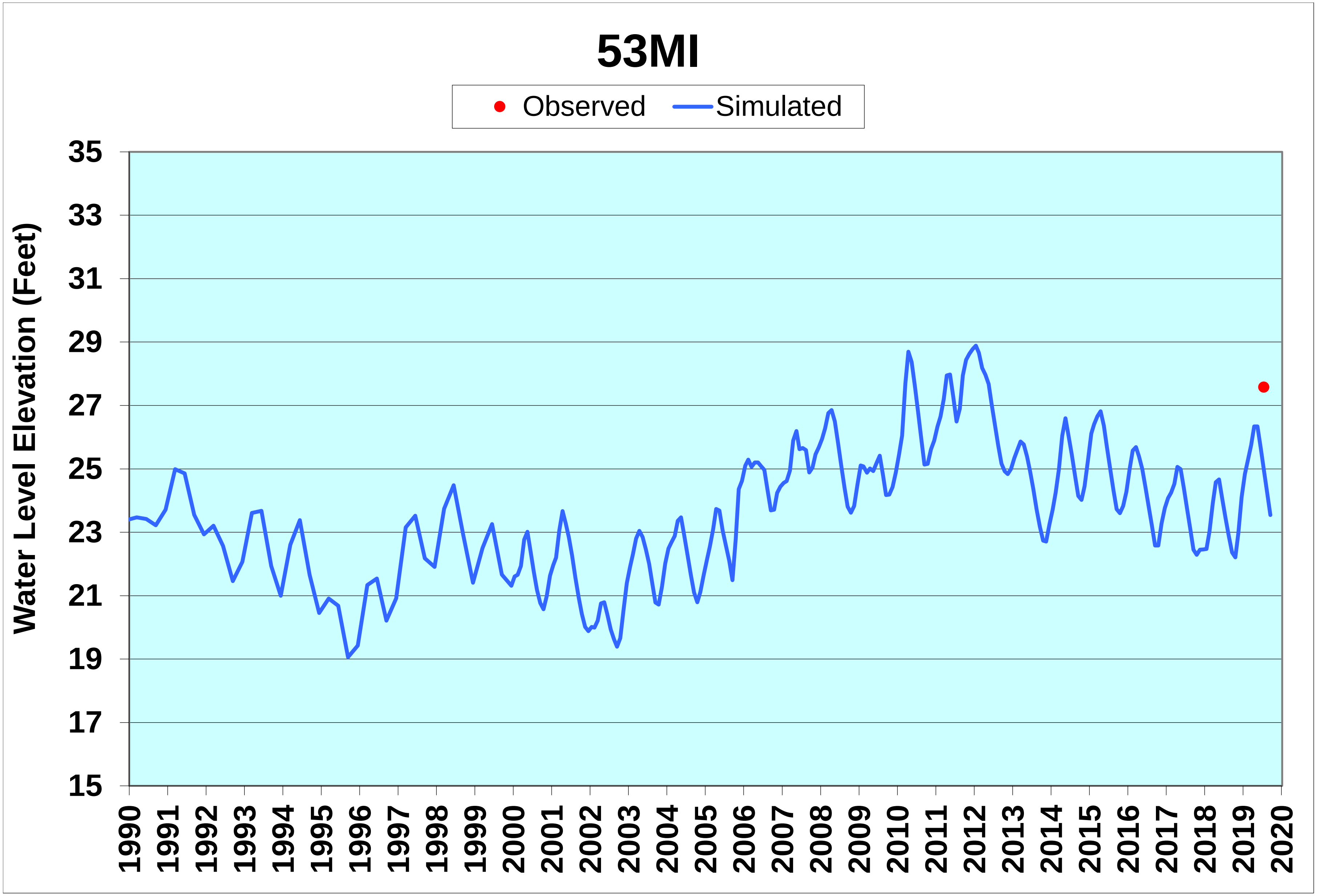
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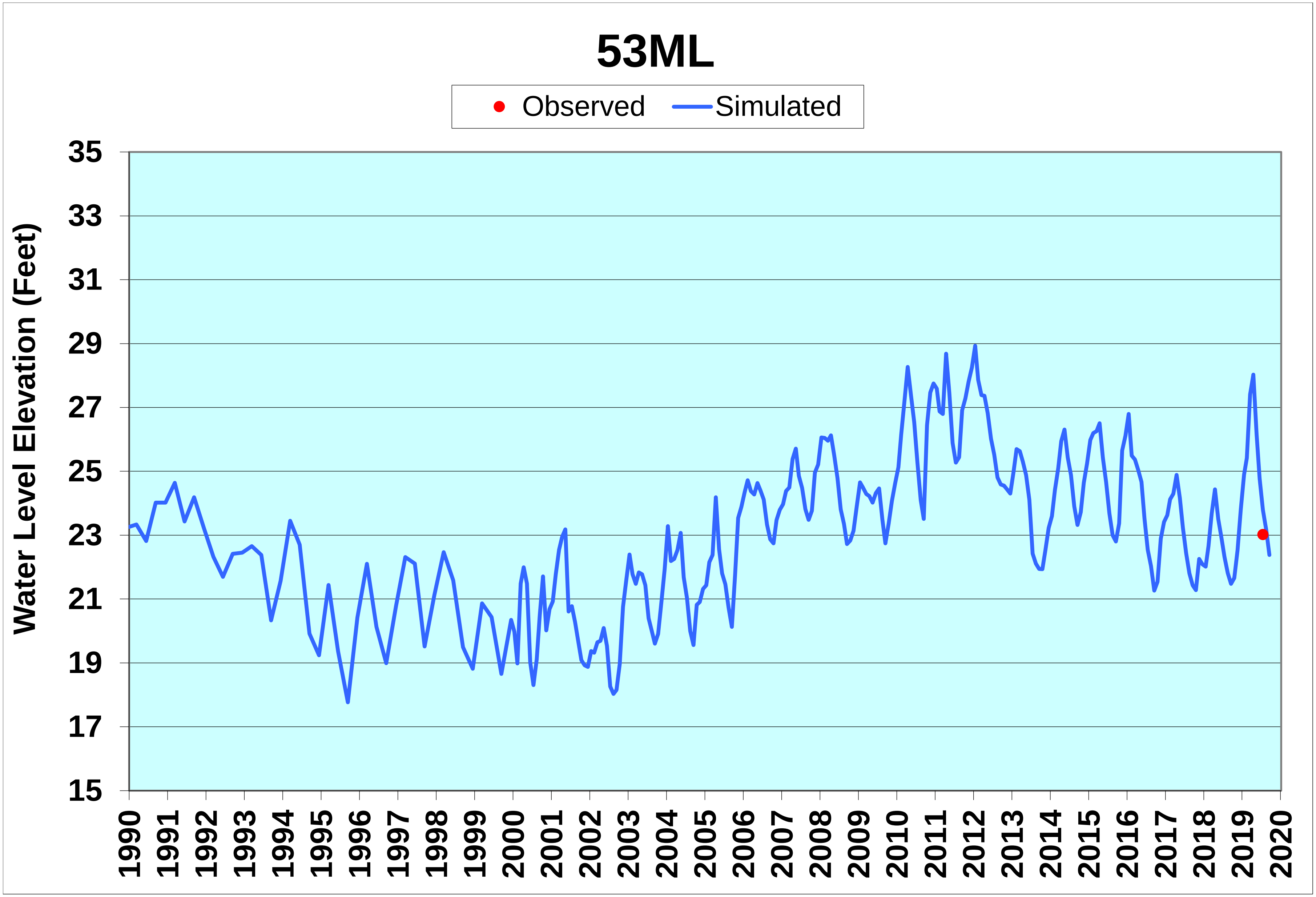
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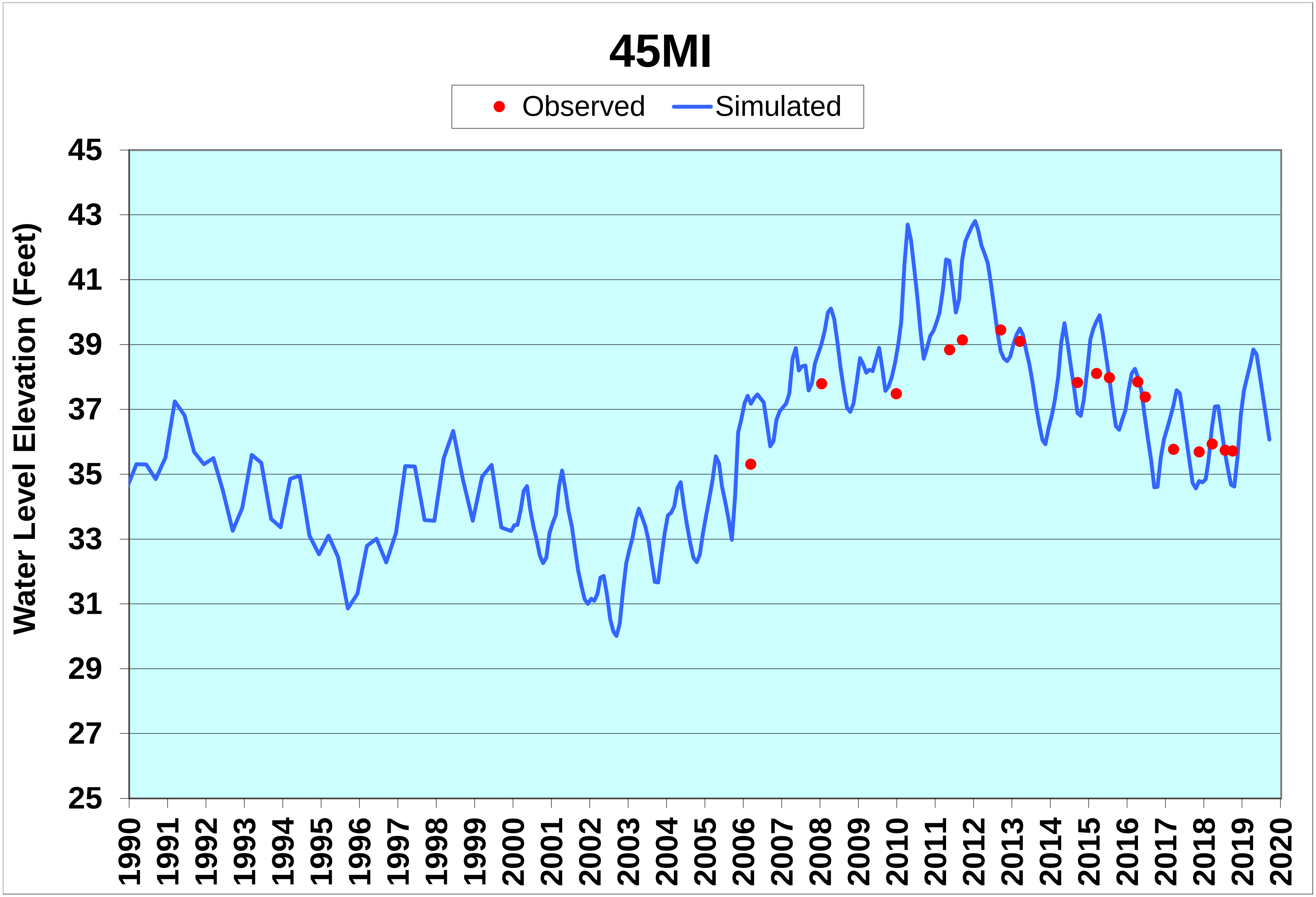
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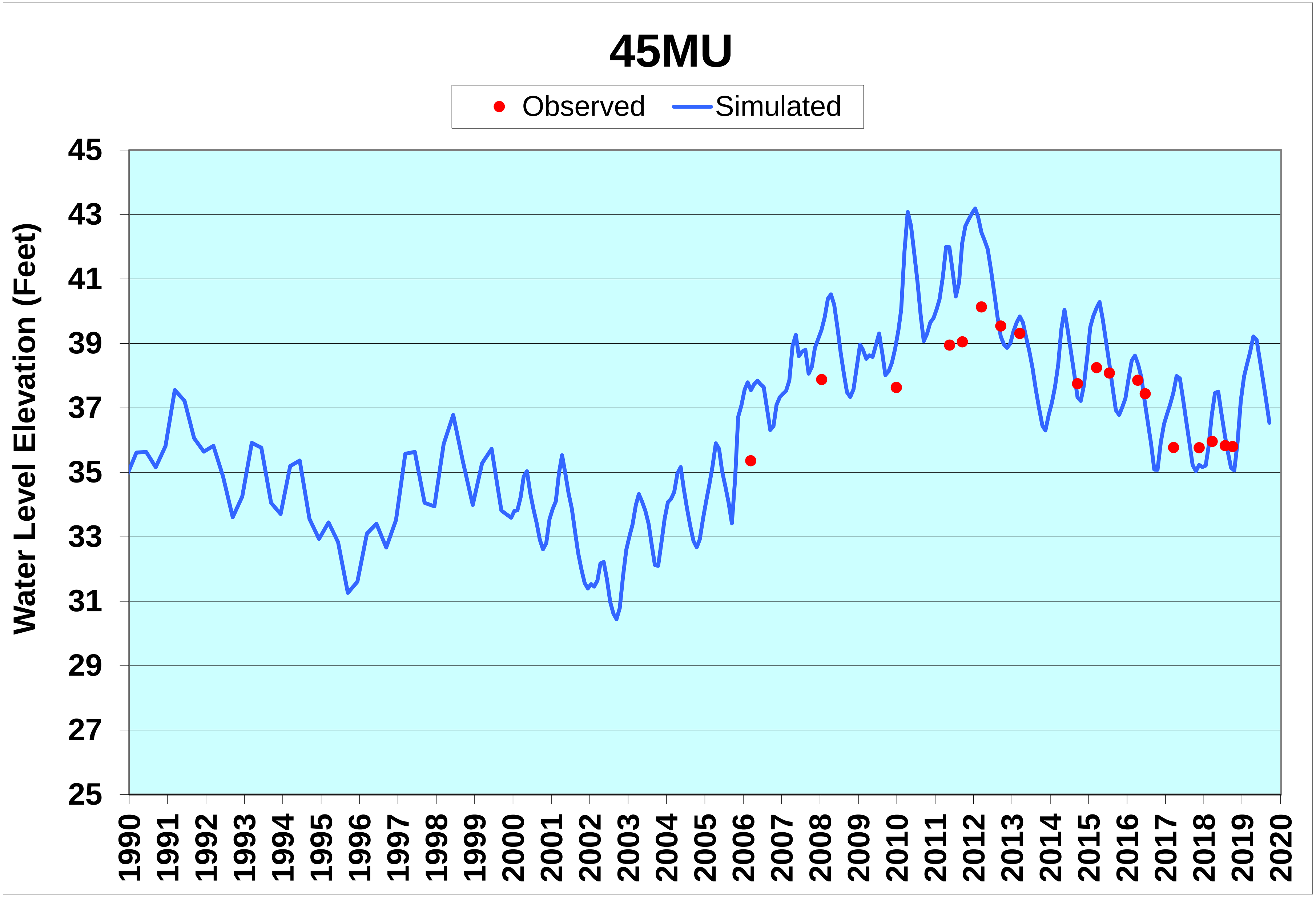

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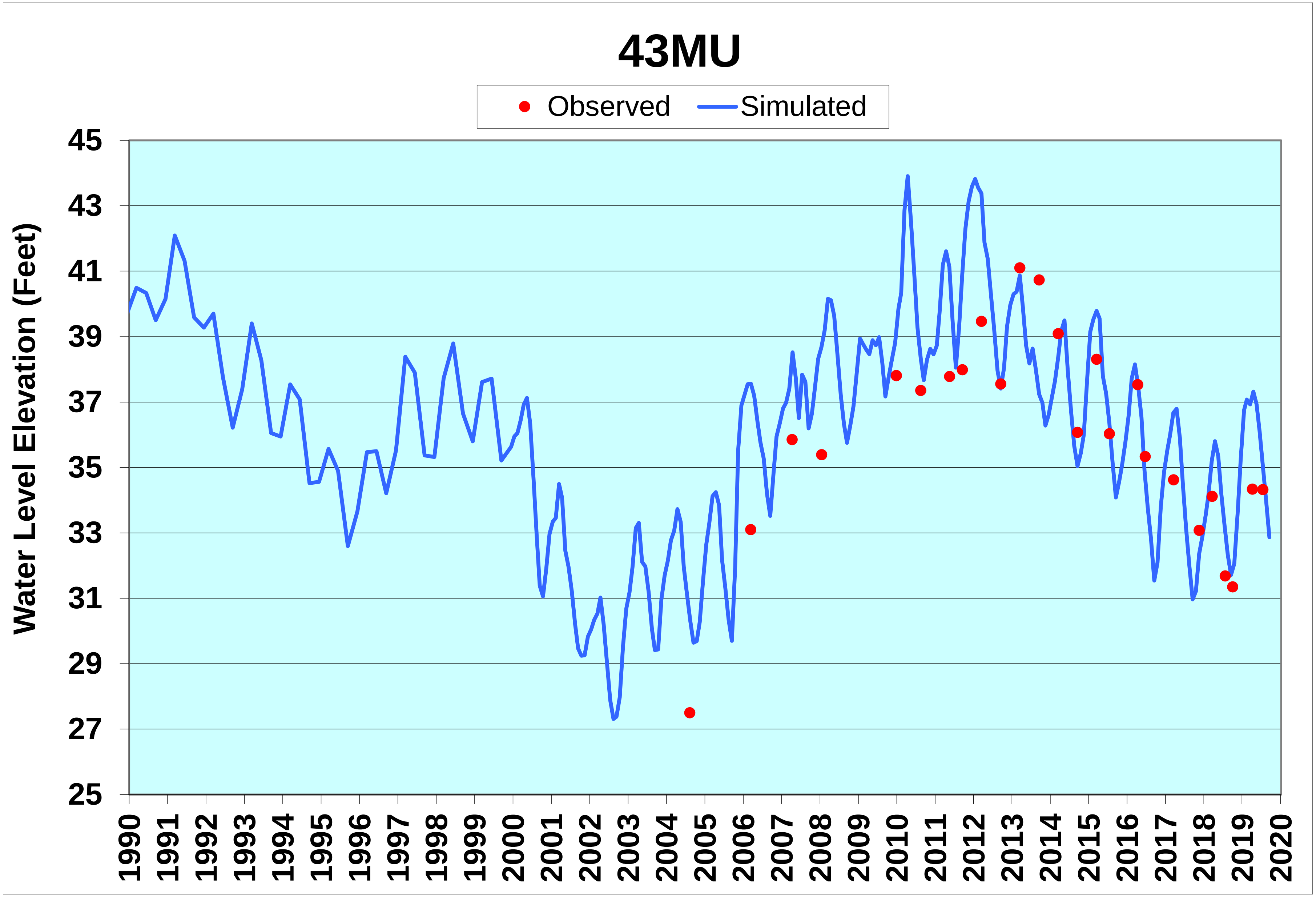
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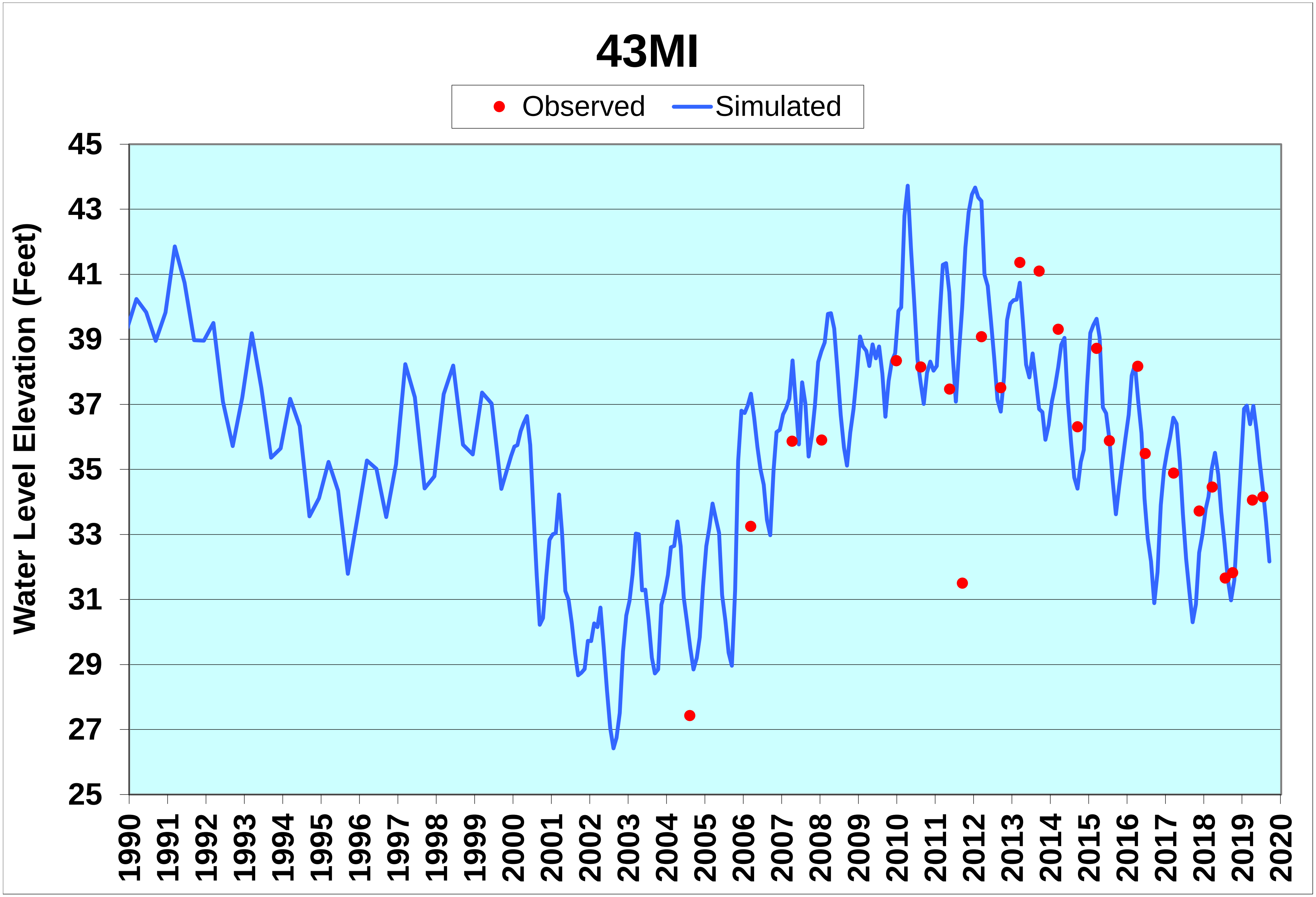
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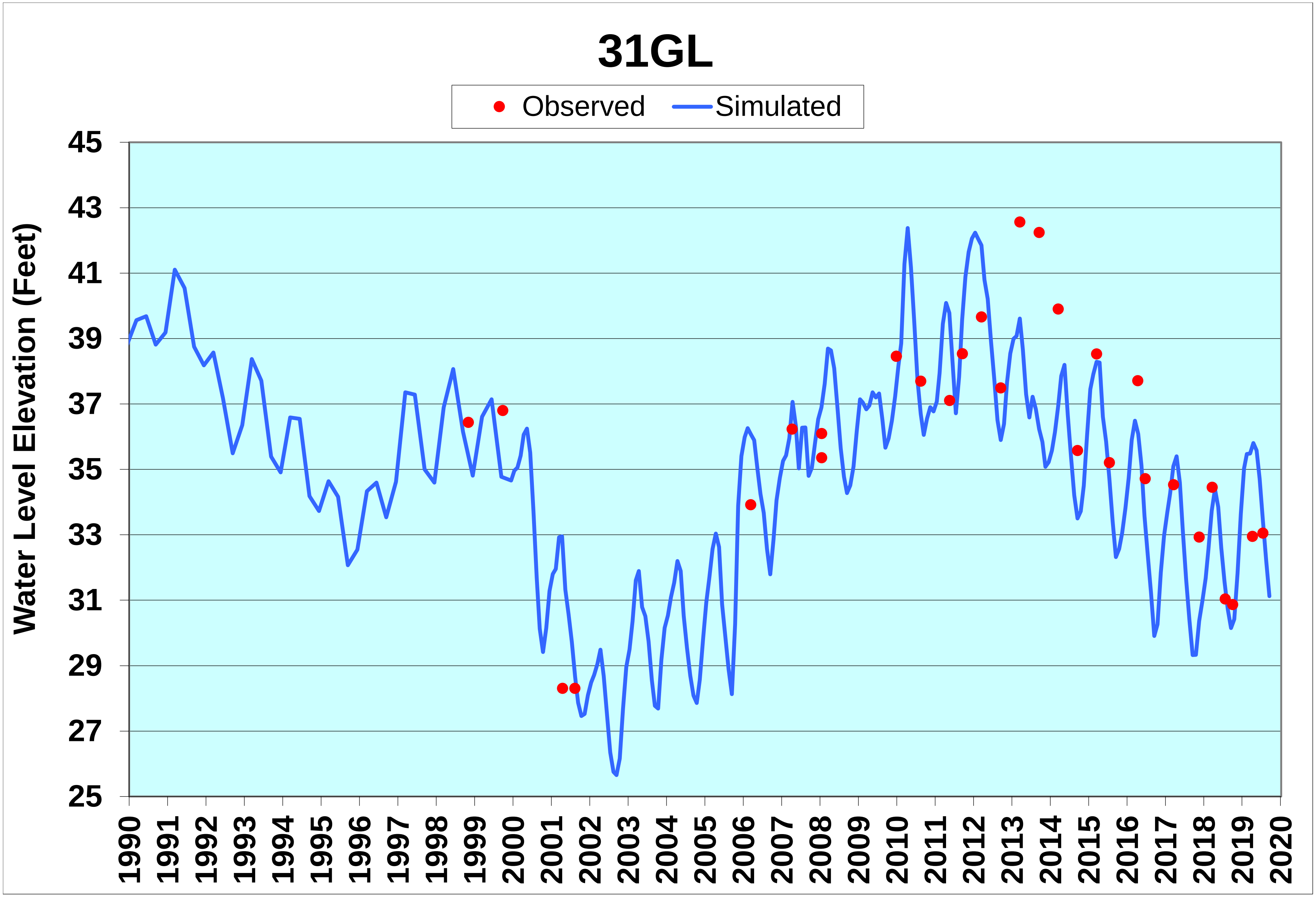
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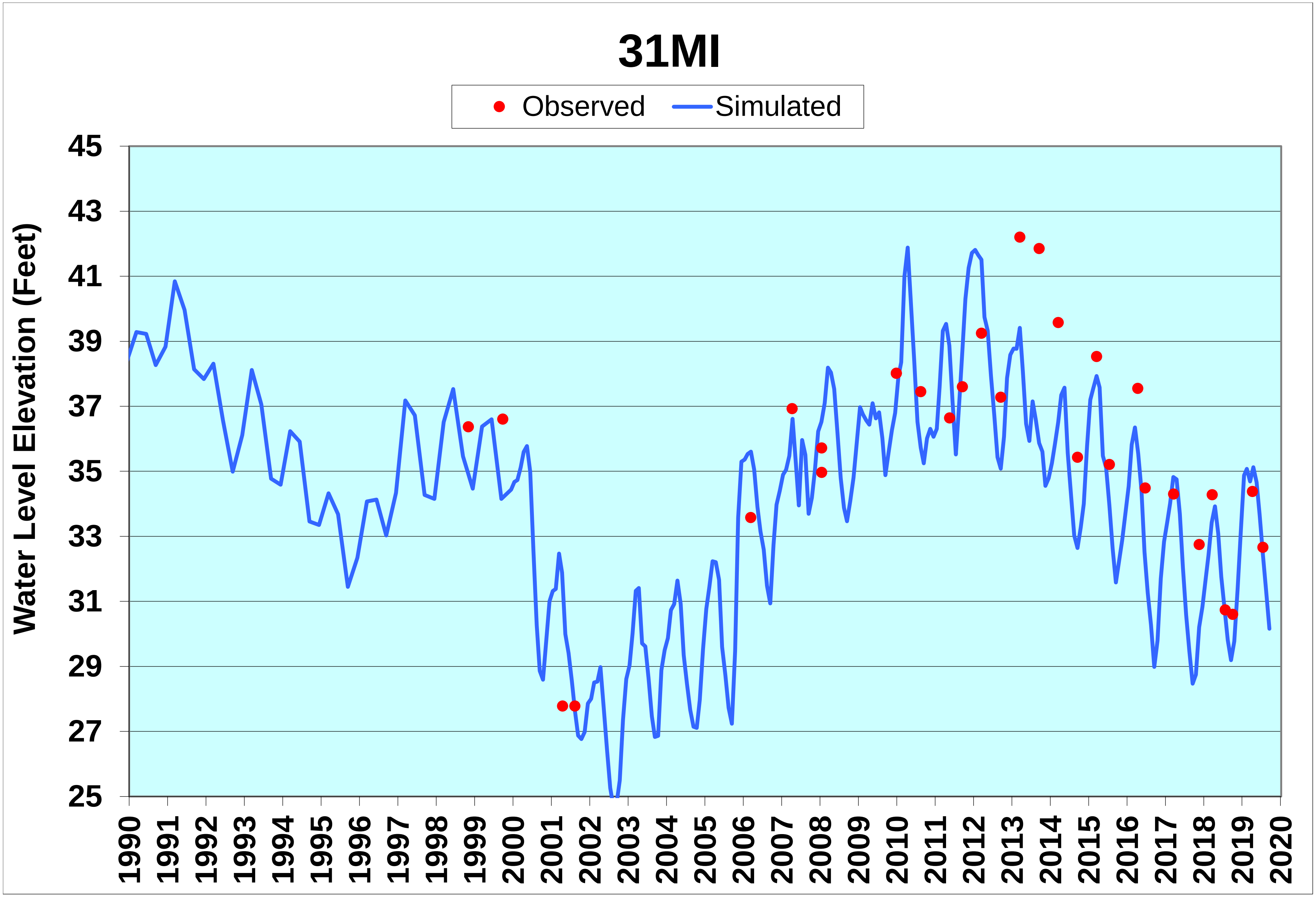

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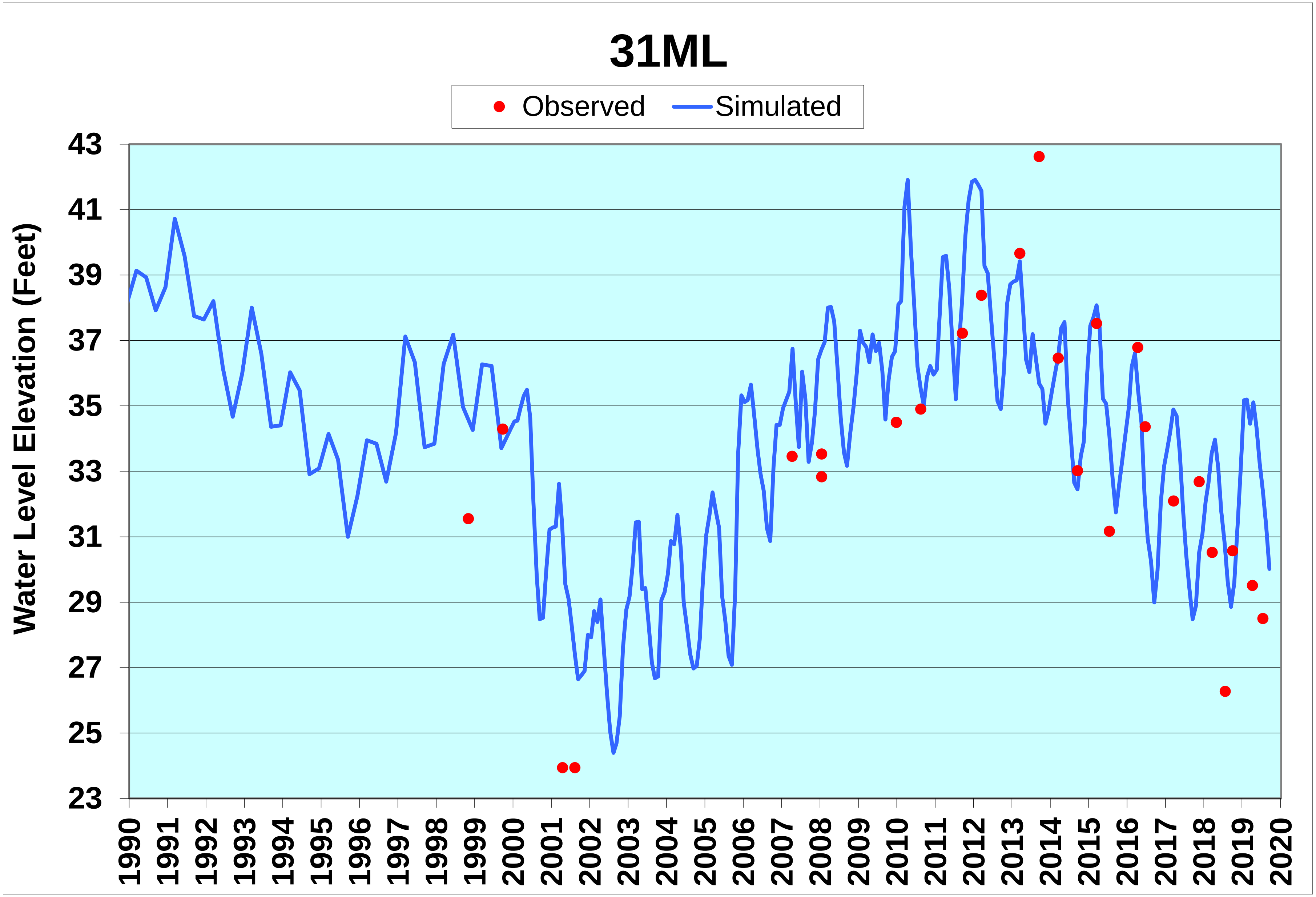

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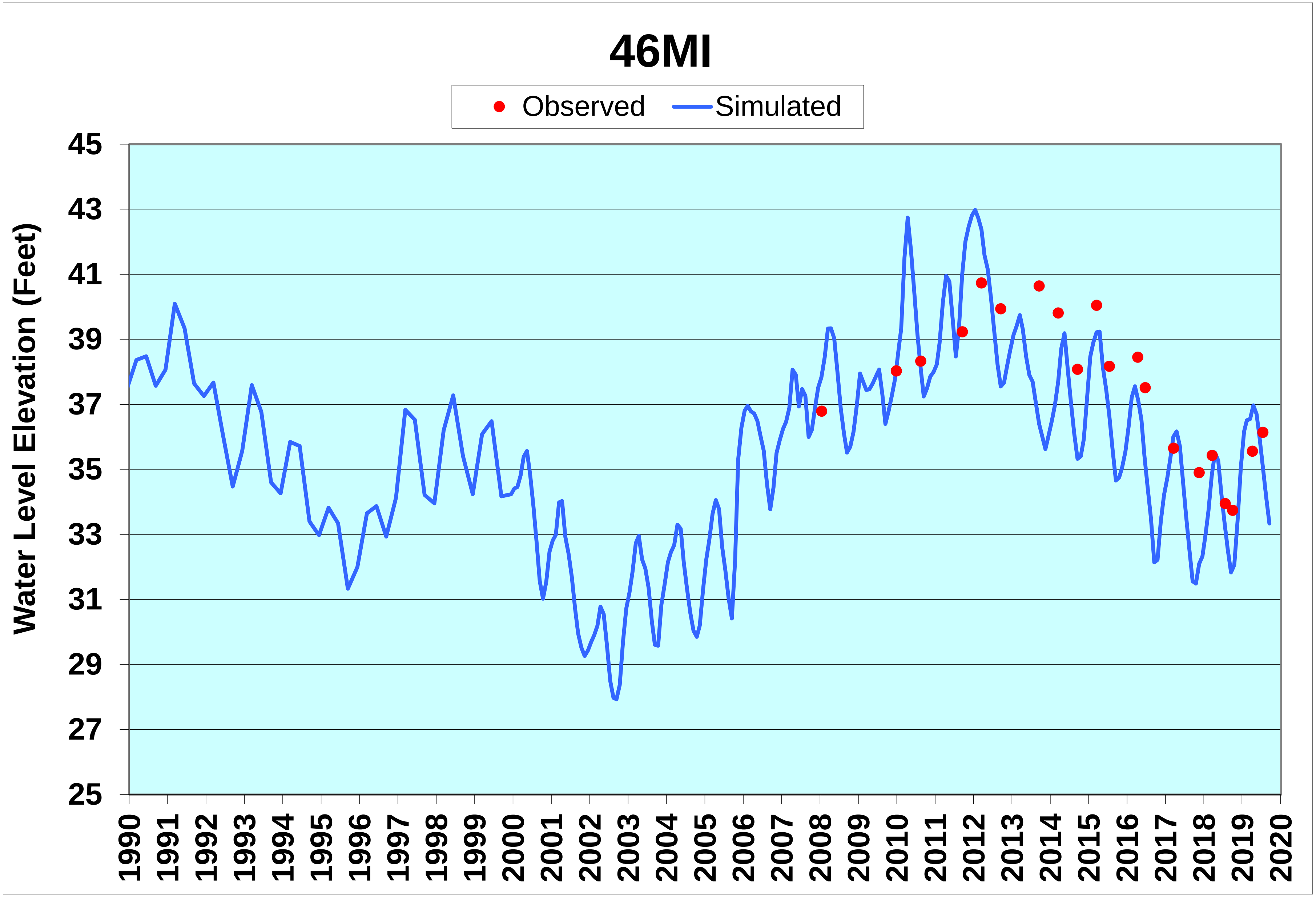
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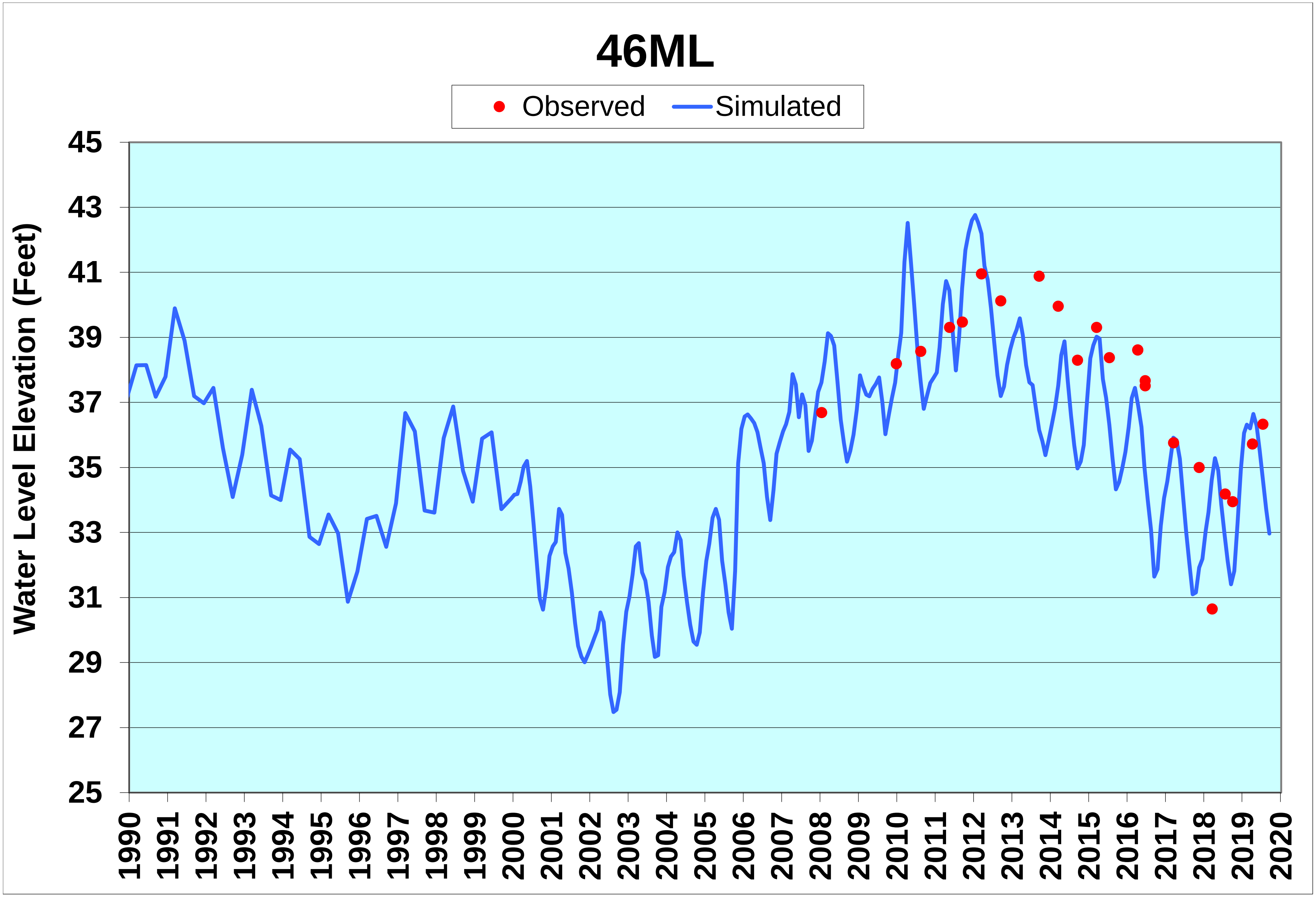
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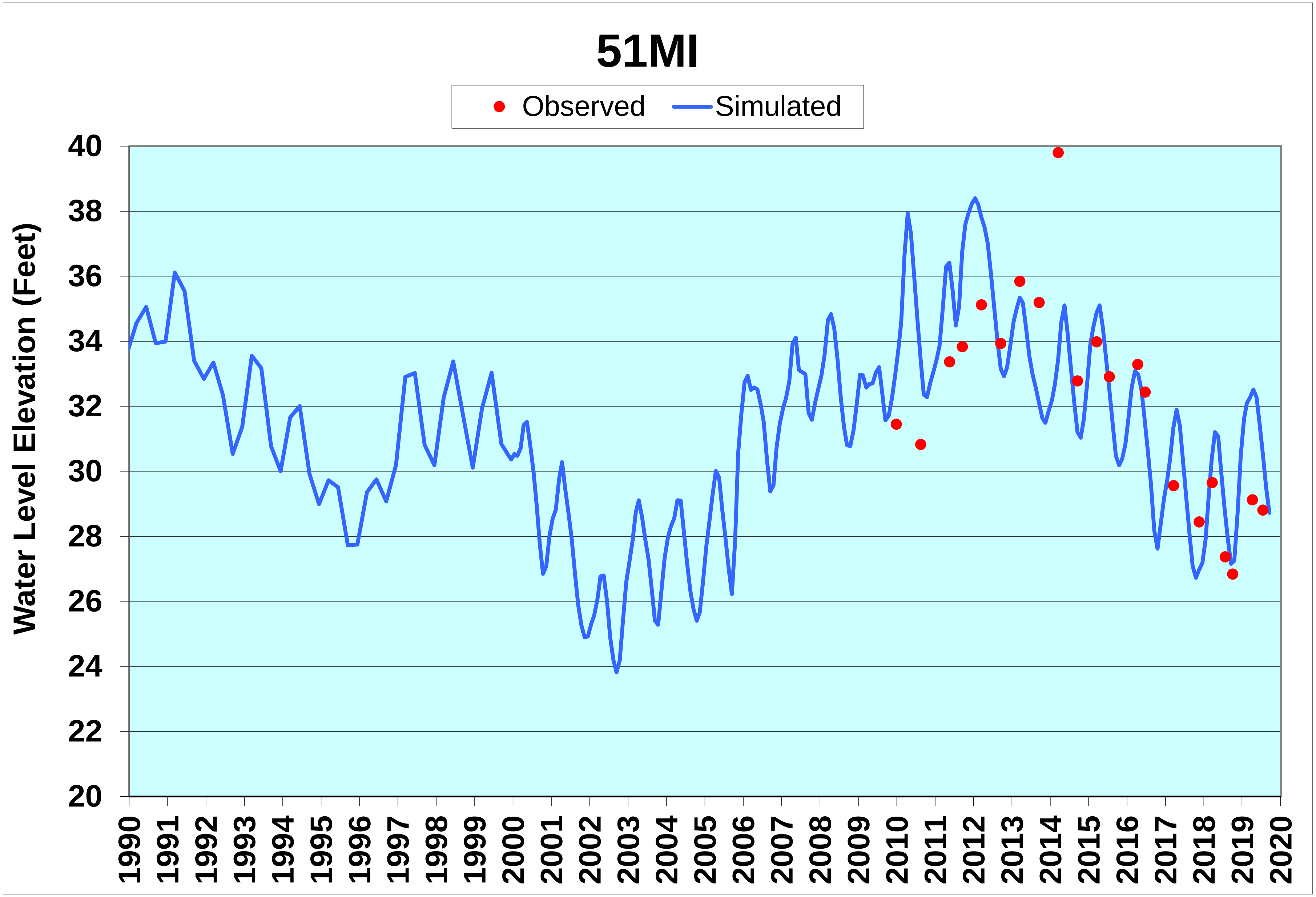
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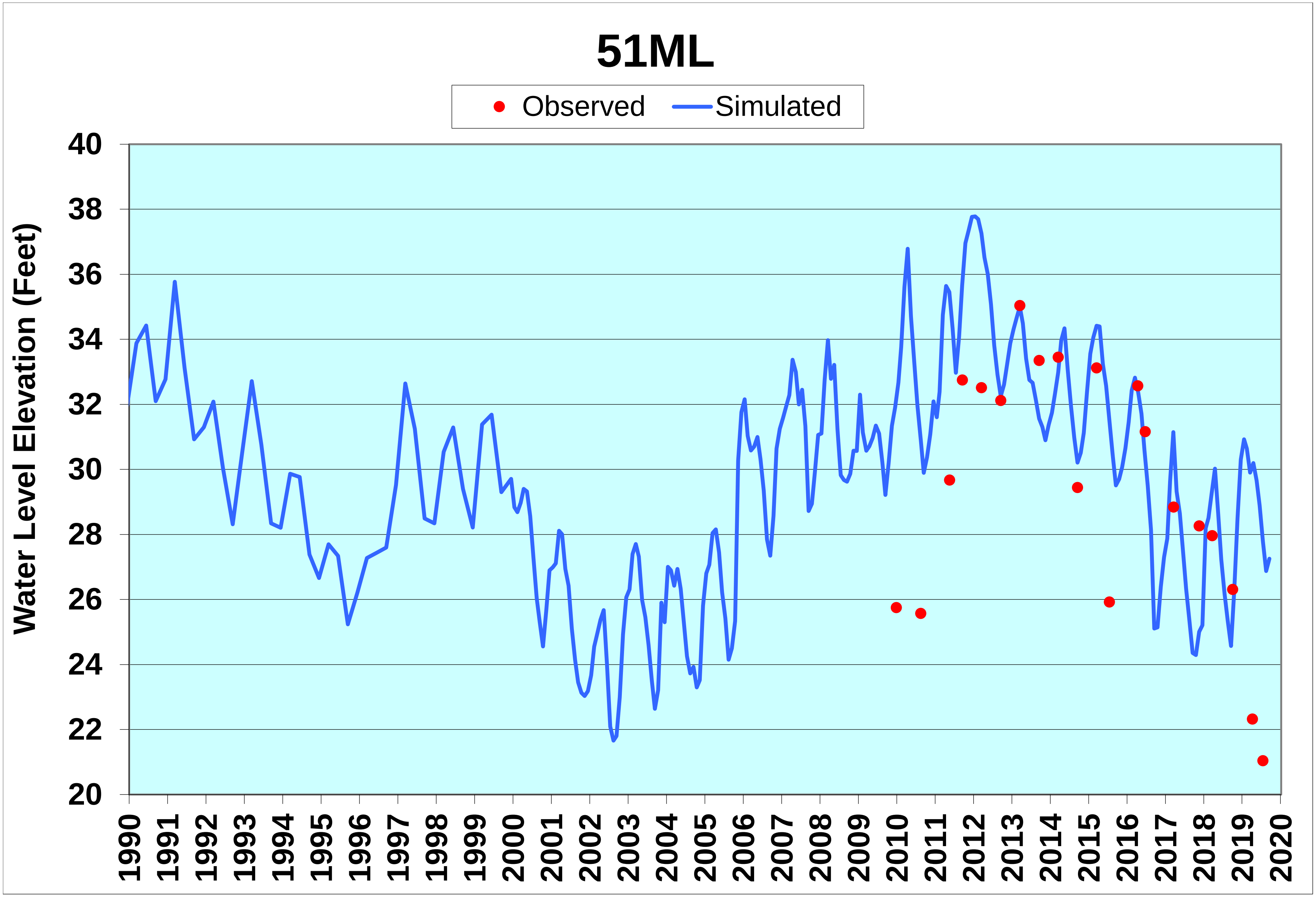

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Unisys Site No. 130045
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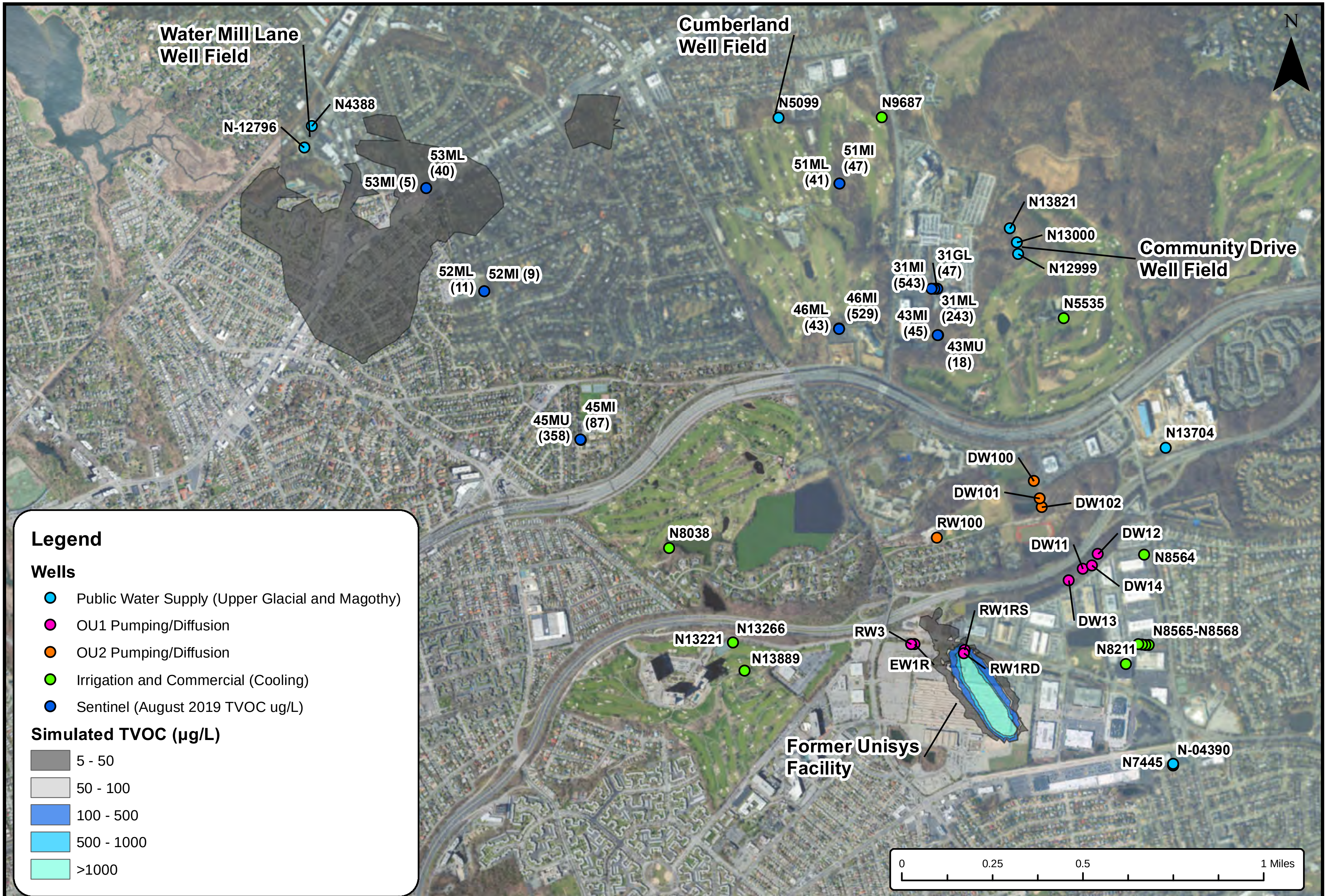
Appendix D

Simulated 2019 TVOC Groundwater Plume Maps for Upper Glacial and Magothy Model Layers



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 1
Upper Glacial Simulated TVOC Concentrations
September 2019

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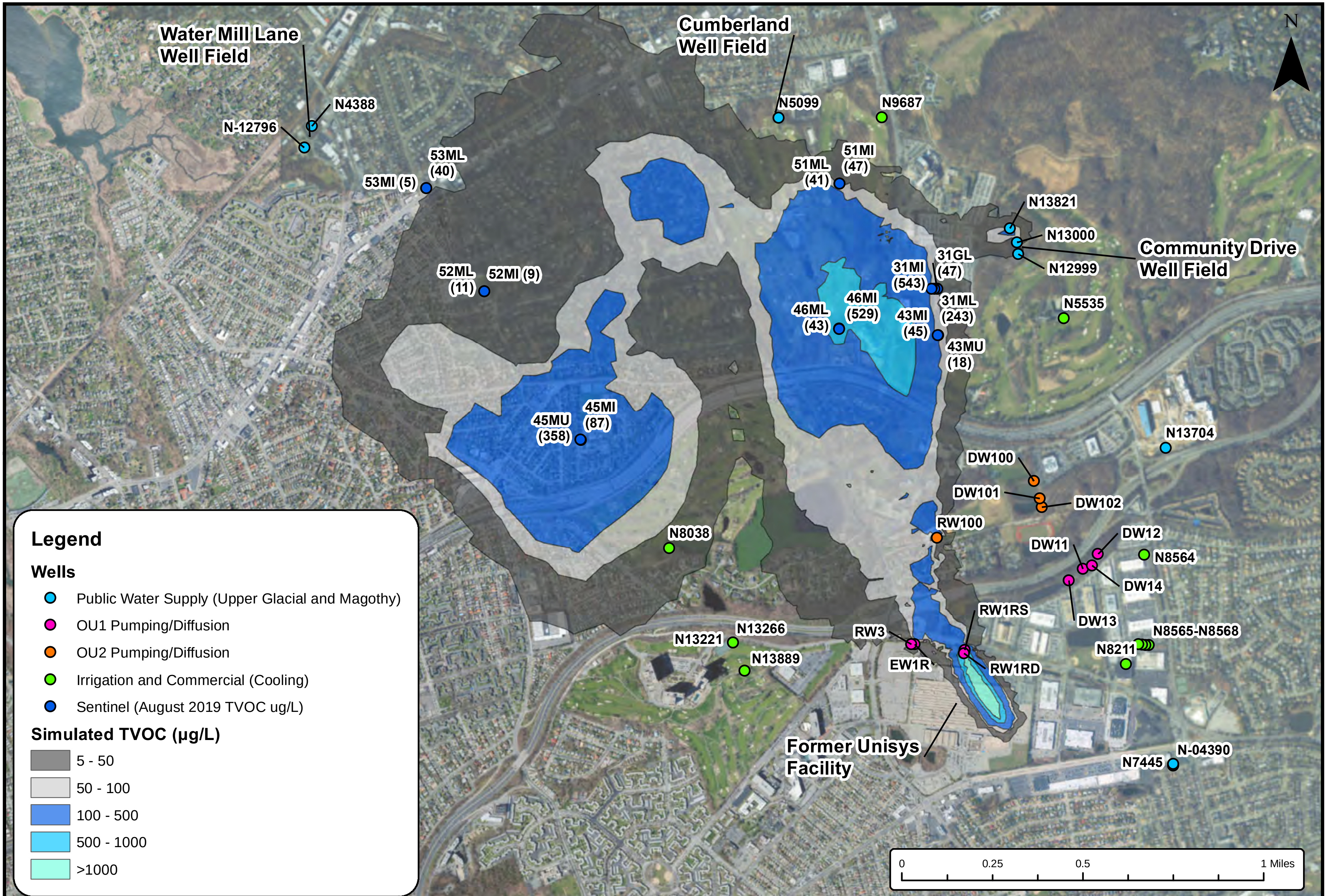
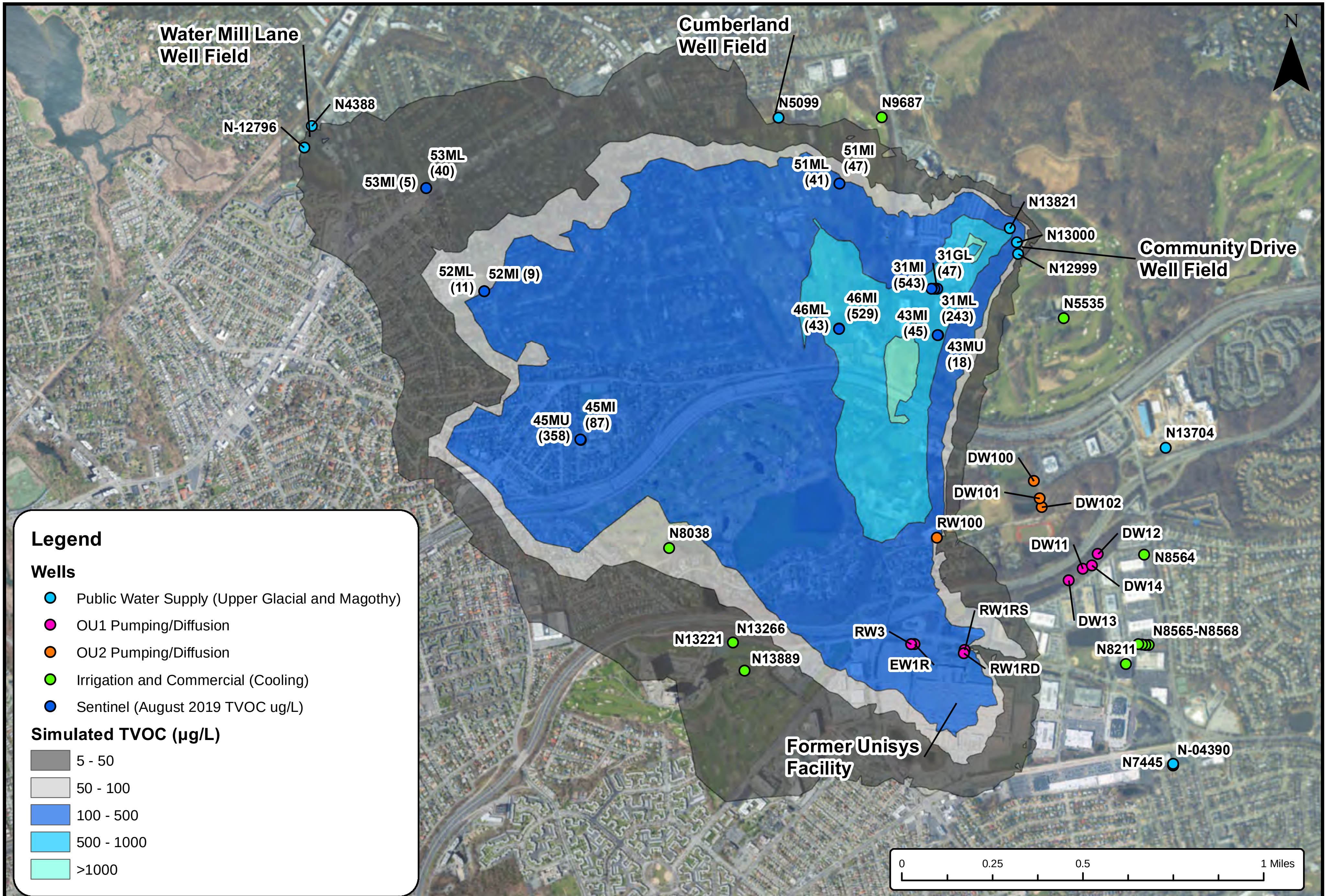


Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 2
Upper Magothy Simulated TVOC Concentrations
September 2019

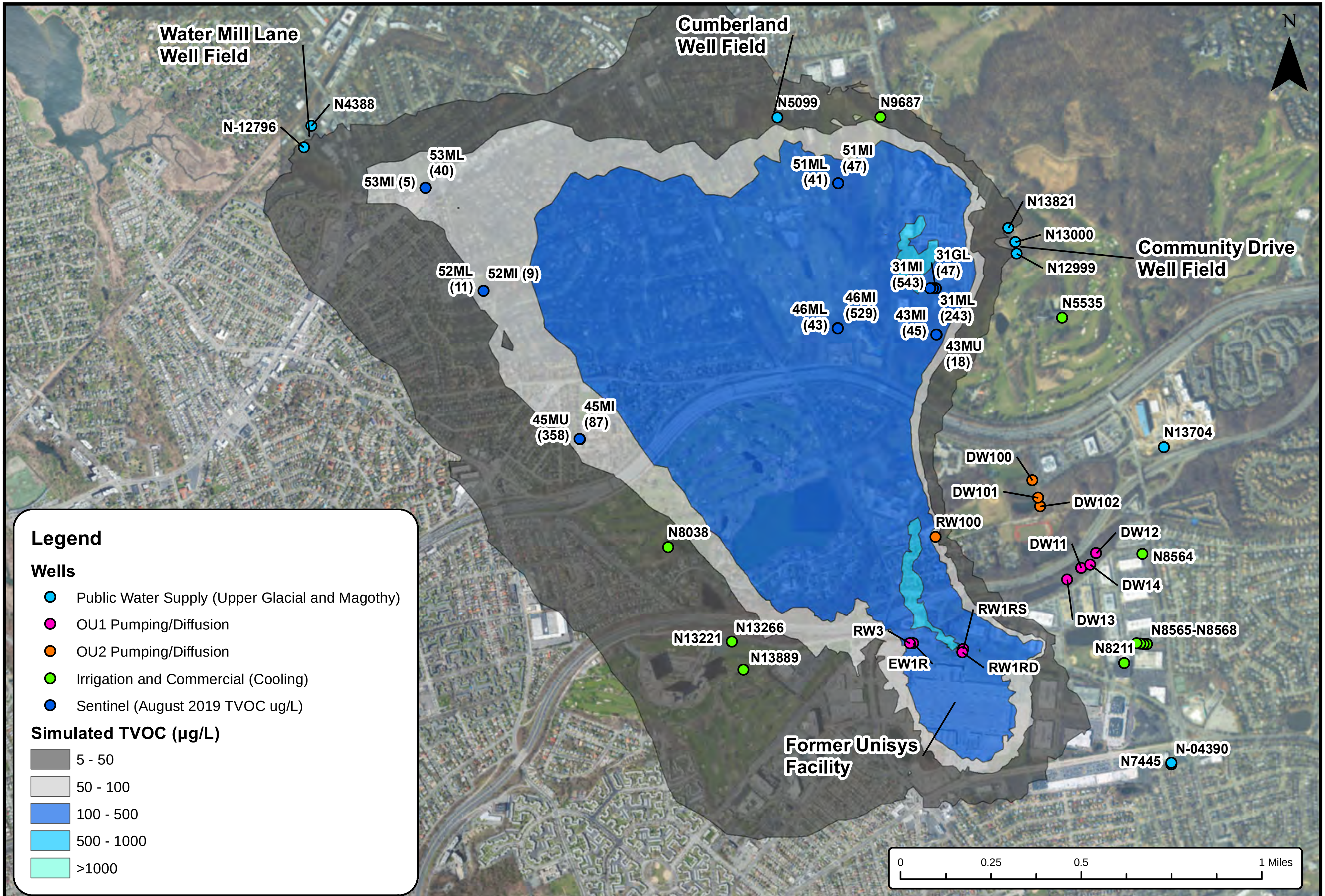
D:\LMC\Figure2_UM_Concentrations.mxd



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 3
Middle Magothy Simulated TVOC Concentrations
September 2019

D:\LMC\Figure3_MM_Concentrations.mxd



Service Layer Credits: Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community

Figure 4
Basal Magothy Simulated TVOC Concentrations
September 2019

D:\LMC\Figure4_BM_Concentrations.mxd