



CAPTURE ZONE ANALYSIS REPORT

**TOWN OF RAMAPO LANDFILL SITE
250 TORNE VALLEY ROAD
HILLBURN, ROCKLAND COUNTY, NEW YORK**

NYSDEC SITE NUMBER #344004; USEPA CERCLIS ID NYD000511493

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1.0 INTRODUCTION

Sterling Environmental Engineering, P.C. (STERLING) has prepared this Capture Zone Analysis (CZA) Report on behalf of the Town of Ramapo for the Ramapo Landfill (the “Landfill”) located at 250 Torne Valley Road in the Village of Hillburn, Town of Ramapo, Rockland County, New York. A Site Location Map on a United States Geological Survey quadrangle map is provided as Figure 1, and a Site Vicinity Map on an aerial image is provided as Figure 2. The Landfill is a Superfund National Priorities List (NPL) site and is regulated by the United States Environmental Protection Agency (USEPA), CERCLIS ID NYD000511493. The Landfill property is also registered by the New York State Department of Environmental Conservation (NYSDEC) as a Class 4 Inactive Hazardous Waste Disposal Site, Registry No. 344004.

The Landfill was placed on the NPL in September 1983. The USEPA issued a Record of Decision (ROD) dated March 31, 1992, which was modified in December 1997 by Explanation of Significant Difference (ESD).

1.1 Purpose of Capture Zone Report

A “Capture Zone” refers to a three-dimensional region that contributes the groundwater extracted by one or more wells or drains. For successful hydraulic containment, contaminants moving with groundwater must follow flow lines that are captured by the containment system (Methods for Monitoring Pump-and-Treat Performance, EPA/600/R-94/123, June 1994). Contaminants will not extend outside of the Capture Zone if the contaminant plume is hydraulically contained in the Capture Zone.

The Fifth USEPA Five-Year Review Report for the Ramapo Landfill Superfund Site (February 21, 2020) identified that the extraction well capture efficiency cannot be determined based on fluctuating iron and manganese levels in multiple downgradient wells and downgradient exceedances of chromium. Chromium was detected above its maximum contaminant level (MCL) of 0.05 mg/L at sentinel monitoring location 10-R during the May 2018 sampling event at 0.181 mg/L. USEPA requested a CZA to determine the source of the exceedances (i.e., Landfill versus naturally occurring background conditions) and assist in determining capture efficiency of the leachate collection system. This CZA Report summarizes the work completed in substantial conformance to the NYSDEC-approved Capture Zone Analysis Work Plan (the “Work Plan”) dated November 29, 2022. The Work Plan was prepared in accordance with the USEPA guidance document entitled “A Systematic Approach for Evaluation of Capture Zones at Pump and Treat Systems,” EPA/600/R-08/003, January 2008.

2.0 BACKGROUND INFORMATION

2.1 Site Description and History

The Landfill is located on the western side of the Ramapo Mountains on Torne Valley Road and east of the New York State Thruway, Route 17, and Route 59. The Landfill encompasses approximately 86 acres and consists of two major northern and southern lobes.

Prior to Landfill operations in the 1950s and 1960s, portions of the property area were excavated for gravel. In 1971, the Town was permitted by the Rockland County Department of Health (RCDOH) to operate a sanitary landfill. Under various operators, municipal solid waste (MSW) was accepted in the Landfill until 1984 and construction and demolition (C&D) debris was accepted until 1989.

Substances reportedly disposed into the Landfill include industrial sludge and other wastes reportedly from pharmaceutical companies, sewage sludge, municipal refuse, asbestos, C&D debris, yard debris, paint sludge (presumably from an automotive plant) and liquid wastes (reportedly from a paper company).

The Landfill was placed on the Superfund National Priorities List (NPL) in September 1983. Between 1980 and 1988, the NYSDEC and the Town entered into four Orders on Consent that resulted in phasing out the Landfill operations, constructing a surface water and groundwater diversion system and a leachate collection and transport system, and conducting a Remedial Investigation and Feasibility Study (RIFS). The leachate collection system was constructed along the downgradient edge of the Landfill from 1984 to 1985. Initially, collected leachate was conveyed by pumps and lift stations to a wastewater treatment pond in the southwest corner of the Landfill property. After aeration and settling, treated water was discharged to the Ramapo River. Since 1996, leachate has been discharged to the Rockland County Sewer District (RCSD) No. 1 Western Ramapo Treatment Plant.

2.2 Leachate Collection System Improvements

In 1992, a ROD was signed by the USEPA that called for installing a cap over the Landfill, and installing systems to control surface water runoff, contaminated groundwater, and leachate. The ROD also imposed property deed restrictions, and the development of a monitoring program and a contingency plan to protect nearby users of groundwater.

The leachate collection system improvements consisted of deepening existing stone-filled collector trenches, and constructing new stone-filled trenches, new extraction wells, and new lift stations to better collect Landfill leachate. A remedial design was prepared in 1994, and the leachate collection system improvements began construction in May 1996. The completed leachate collection system improvements became operational in November 1997.

2.3 Long-Term Monitoring

The selected remedies for the Landfill include Institutional Controls (IC) through a Declaration of Covenants and Restrictions that restricts disturbance of the Landfill cover and places restrictions on site use and offsite groundwater use restrictions, and onsite Engineering Controls (EC) provided by the Landfill cover and leachate collection systems, groundwater containment, fencing and access controls, air and water quality monitoring, and regular inspections and maintenance activities. The Covenant of Restrictions and Environmental Easements were filed with the Rockland County Clerk on August 28, 2012 and October 10, 2012. Post-closure air and water quality monitoring, leachate removal, and inspections and maintenance at the Landfill have been provided by the Town of Ramapo since 1999. A Site Management Plan (SMP) incorporates the Institutional/Engineering Control (IC/EC) Plan, the Inspection and Monitoring Plan, and the Operation and Maintenance Plan to provide for the continual post-closure monitoring and maintenance of the Landfill.

The current groundwater monitoring program consists of collecting samples every 5th quarter from the Landfill monitoring wells (eight “OS” overburden monitoring wells, one “OS/I” monitoring well, three downgradient “I” intermediate monitoring wells, and three downgradient “R” bedrock monitoring wells), two private water supply wells, and four public municipal water supply wells. Sampling locations are shown on Figure 3.

A new upgradient monitoring well cluster (UP-OS, UP-I, and UP-R) was installed in 2016 to determine natural upgradient groundwater conditions. Static depth to water measurements are collected from locations shown on Figure 3 to determine groundwater flow patterns. The water samples are analyzed for certain 6 NYCRR Part 360 Baseline parameters plus site specific volatile organic compounds (VOC).

Through June 2011, leachate and groundwater from the Landfill extraction well network were pumped to the Rockland County Sewer Treatment Plant located at 4 Route 340, Orangeburg, New York. Starting in June 2011, leachate/groundwater collected by the Landfill extraction wells has been pumped to the RCSD No. 1 Western Ramapo Treatment Plant in Hillburn, New York. Analytical testing of the Landfill leachate/groundwater occurs on a biannual basis from a manhole located upstream of the discharge to the leachate wet well.

2.4 Site Geology/Hydrogeology

The geology units that are present at the Landfill and the surrounding area are described in Table A. The descriptions were obtained from the USEPA Five-Year Report (February, 2020) and the URS Work Plan for the RI/FS at the Ramapo Landfill (August 1989).

The main surface waters in the vicinity of the site are the Ramapo River, Torne Brook, and Candle Brook. The Ramapo River, located approximately 300 feet from the southwest corner of the site, is a NYSDEC Class "A" water, which may be used as a source of water supply for drinking, culinary, or food-processing purposes. Torne Brook, which flows near the western boundary of the site, and Candle Brook, a tributary of Torne Brook, are NYSDEC Class "B" waters, suitable for primary contact recreation and any other use, except as a source of water supply for drinking, culinary, or food-processing purposes. The United States Geological Survey has identified an area of less than ten acres near the headwaters of Candle Brook as a wetland.

The site is underlain by a sequence of glacially derived unconsolidated sediments that overlie bedrock, which is composed of granitic and biotite gneiss. The bedrock geology is structurally complex with numerous fault systems in the area. A fracture trace analysis identified a number of lineaments in the vicinity of the site, the most obvious one being the Ramapo fault (approximately 1.25 miles southeast of the site), which strikes northeast and dips steeply southeast. Two other lineaments observed within the immediate area of the Landfill include one that lies adjacent to the west side of the Landfill and trends northeast. This lineament may represent faulting or other subsurface structures controlling deflections in Torne Brook. The second lineament trends east-west and appears to cross the central portion of the Landfill.

The shallow aquifer is composed of permeable sediments consisting of a grey to brown, very loose to loose sand or sandy gravel with some silt with a hydraulic conductivity on the order of 1×10^{-4} centimeters per second (cm/sec) and a medium-dense to very dense silty sand or gravelly sand with abundant boulders and cobbles with hydraulic conductivity ranging from 5.1×10^{-5} to 1.4×10^{-4} cm/sec. Below these sand units is a thin weathered rock zone ranging in thickness from a few inches to nearly five feet with hydraulic conductivity ranging from 4×10^{-5} to 1.5×10^{-3} cm/sec. Underlying the weathered rock zone is a granitic and biotite gneiss bedrock aquifer. In some locations, highly fractured zones were found within the bedrock suggesting faulting. Hydraulic conductivity for the bedrock aquifer ranged from 8.9×10^{-5} to 1×10^{-2} cm/sec.

Past investigations found that shallow (water-table aquifer) groundwater generally flows toward Torne Brook and the Ramapo River with Torne Brook acting as the discharge area for the water table aquifer. Groundwater in the bedrock aquifer likely flows beneath Torne Brook. Vertical flow measurements indicate that groundwater generally flows downward.

Table A. Geologic Units and Hydraulic Conductivity at Ramapo Landfill

Stratigraphic Unit	Approximate Thickness (ft)	Estimated Hydraulic Conductivity (cm/sec)
Glacial Outwash/Colluvium-Sand or Sandy Gravel with some Silt (loose)	0-50	1×10^{-4}
Glacial Till-Silty Sand or gravelly sand with boulders and cobbles (dense)	15-50	5.1×10^{-5} to 1.4×10^{-4}
Weathered bedrock	<0.5-5	4×10^{-5} to 1.5×10^{-3}
Granitic and biotite gneiss bedrock	----	8.9×10^{-5} to 1×10^{-2}

3.0 CAPTURE ZONE ANALYSIS METHODS

The CZA was completed in substantial conformance to the NYSDEC-approved Work Plan dated November 29, 2022, and included the following steps:

1. Basis of Design Review
2. Extraction Well Inspection
3. Extraction Well Groundwater Characterization
4. Pumping Assessment
5. Groundwater Quality Characterization
6. Data Reduction and Assessment

The goal of the CZA was to determine the Capture Zone and assess the effectiveness of the leachate collection system extraction wells.

3.1 Basis of Design Review

The following documents were reviewed to determine the Basis of Design for the active leachate extraction wells:

- URS, December 1998, “Construction Monitoring Report, Ramapo Landfill Remediation”
- URS, June 1994, “Design Analysis Report Final Phase for the Ramapo Landfill”
- URS, September 1991, “Remedial Investigation and Feasibility Study at the Ramapo Landfill”
- Leggette, Brashears, & Graham, Inc., October 1980, “Progress Report Hydrogeologic Investigations at the Town of Ramapo Sanitary Landfill”

The leachate collection system was designed to effectively intercept contaminated groundwater leaving the Landfill for offsite treatment. The design included specific improvements, as shown on Figure 4, and included the installation of seven extraction wells (W-1 through W-7) along with a passive gravity interceptor trench system. The extraction wells were installed in an area where the original gravity collection trench was installed above the groundwater table.

The leachate interception gravity system starts at the northeast extent of the Landfill and runs along the northeast side of Torne Valley Road and terminates at the southern boundary of the Landfill. The extraction well collection system parallels the deeper leachate interception gravity system that starts on the northeast side of the Landfill and terminates at the same location as the extraction well system discharge line at Manhole A-5. Leachate is removed by a pump station located on the Landfill property and pumped to the RCSD #1 Facility where the collected water is treated and discharged to the Hudson River. The interception gravity system that parallels the leachate extraction well system consists of one-sided slotted PVC pipes of varying diameter that are located approximately 5 to 10 feet below ground surface (bgs) with some sections being part of the deep collector system at depths up to 20 feet bgs. The PVC pipes connect with lift pump stations that convey intercepted leachate to the RCSD #1 Facility.

The extraction wells are located on the western side of the Landfill along Torne Valley Road between monitoring well pair MW-3 and monitoring well cluster MW-8. The layout of the extraction well system is approximately 700 feet in length. Extraction wells W-5, W-6, and W-7 are approximately 20 feet deep and are screened in dense sand and approximately 2.0 feet into bedrock. Extraction wells W-1, W-2, W-3, and W-4, are deeper ranging from 38 to 51 feet in depth and are screened in dense sand and up to 10 feet into bedrock. Drilling logs for the extraction wells are provided in Appendix A.

3.1.1 Capture Zone Target Flow

The leachate collection system as designed was expected to generate between 40 to 50 gallons per minute (gpm) for a total maximum yearly collection of 26.3 million gallons per year (MGY). Of this, approximately 30-40 gpm was expected to be collected by the extraction wells (i.e., 15.8 to 21.0 MGY). Extraction wells W-1 through W-4 are intended to accommodate an extraction rate up to 20 gpm each, while extraction wells W-5 through W-7 are intended to accommodate up to 5 gpm each. Level controls in each extraction well are intended to promote an upward flow from the bedrock aquifer towards the extraction wells to prevent groundwater from migrating offsite. Target pump control elevations from the 1998 Construction Monitoring Report are listed in Table B. Note that extraction wells W-5 and W-6 were installed at an elevation higher than the typical groundwater elevation. Based on review of the 1994 Design Analysis Report, extraction wells W-5 and W-6 appear to serve as contingency wells that are intended to operate only in high groundwater conditions.

The Town records monthly totals of leachate discharged for offsite treatment. The highest discharge volumes occurred immediately after construction of the improvements with approximately 22.9 MGY collected in both 1997 and 1998. From 1999 to 2022, discharge volumes have ranged from approximately 7.3 to 18.4 MGY.

Table B. Groundwater Extraction Well Design Elevations

Extraction Well No.	Elevation Of Well Bottom (feet)	Pump Off Elevation (feet)	Pump On Elevation (feet)	Alarm Elevation (feet)
W-1	274.5	293.0	298.0	298.5
W-2	270.2	293.0	298.0	298.5
W-3	285.5	293.5	298.5	299.0
W-4	291.0	299.0	304.0	304.5
W-5	328.5	332.5	334.5	335.0
W-6	330.0	334.0	336.0	336.5
W-7	324.5	328.5	330.5	331.0

3.1.2 Capture Zone Target Contaminants

As documented in the 1994 Design Analysis Report, USEPA and NYSDEC selected benzene, chromium, iron, and manganese as contaminants that are representative of the Landfill leachate. The leachate collection system improvements were designed to create Enhanced Capture Zones near the MW-6 well pair (i.e., the northern improvements), near the MW-1 well pair (i.e., the deepened collector), and near the MW-3 well pair and MW-8 well cluster (i.e., the extraction wells). Maps of the target contaminants and enhanced capture zones are shown in Appendix D.

Groundwater monitoring data for these parameters has been collected from the downgradient monitoring wells since 1990. Tables and graphs displaying the historical concentrations of these target parameters are included in Tables 4 through 7.

3.2 Extraction Well Inspection

On April 19, 2023, STERLING performed an inspection of extraction wells W-1 through W-7. All extraction wells were shut down 48 hours prior to the inspection to allow water levels to return to static conditions. Representatives from the Town Department of Public Works (DPW) opened the well vaults and removed the well caps from each well. STERLING recorded water levels at each well and surveyed the water elevations using a sub-inch accuracy Trimble global positioning system (GPS). At the time of the inspection, the static water elevations were above the “pump on” elevations indicated in Table B; therefore, each well should have turned on automatically if the pump controls were in the design locations. Each well was individually powered on by placing the well controller into the “Auto” setting. Only the pump in extraction well W-1 turn on automatically, indicating that the “pump on” control sensors for the remaining wells required adjustment. Note that the pump in W-6 was inoperable at the time of the inspection but was replaced in May 2023.

The extraction well pumps were then put into “manual” mode to force the pumps to turn on and the well yield was measured. Table C summarizes the well yield during the April 19, 2023 inspection compared to the pump test yields at construction completion. The current well yields were generally lower than the construction completion yields; however, the current yields have adequate capacity to achieve the total target extraction of 20 to 30 gpm.

Table C. Extraction Well and Pump Specifications

Extraction Well	Depth (feet)	Construction Completion Well Yield (GPM)	April 19, 2023 Well Yield (GPM)
W-1	44.3	21.5	14.5
W-2	42.5	26.2	14.4
W-3	29.3	25.4	12.0
W-4	34.0	24.3	17.6
W-5	20.2	5.95	7.5
W-6	18.5	7.9	0.0
W-7	19.2	7.6	18.9

3.2.1 Extraction Well Inspection and Pumping Level Adjustments

The extraction wells are equipped with totalizing flow meters that record the cumulative volume of groundwater extracted from each well. Cumulative flow readings for 2023 are summarized in Table 1. Following the April 19, 2023 well inspection, STERLING reviewed the cumulative flow data and observed that only wells W-1 and W-7 were consistently discharging water. This reinforced that the pump controls required adjustment. The Town made adjustments to the well controls from May to July 2023, which resulted in increased flow from extraction wells W-2 and W-3. Extraction well discharge volumes are summarized below.

W-1

Extraction well W-1 has displayed the most consistent discharge trend of the seven extraction wells. Flow in 2023 was consistently around 2,000 to 3,000 gallons per day (gpd).

W-2

Extraction well W-2 displayed little to no discharge until the pump controls were adjusted in May 2023 by lowering the “pump on” elevation. Following adjustment, W-2 discharged around 10,000 to 20,000 gpd until November 2023 when discharge decreased to around 5,000 to 7,000 gpd. The decrease in discharge is attributed to an increase in discharge from extraction well W-3.

W-3

Extraction well W-3 displayed little to no discharge until the pump controls were adjusted in June 2023 and then again in October 2023. Following adjustment, W-3 discharged approximately 1,000 to 6,000 gpd.

W-4

Extraction well W-4 displayed little to no flow throughout 2023. As indicated in Section 4, review of the pumping assessment suggests that pumping from W-4 may not be necessary based on the current drawdown regime.

W-5

Extraction well W-5 displayed little to no flow throughout 2023. This is consistent with the 1994 Design Analysis Report that indicates the well was installed in the upper “loose sands” aquifer to serve as a contingency in the event of a high groundwater condition.

W-6

Extraction well W-6 displayed little to no flow throughout 2023. This is consistent with the 1994 Design Analysis Report that indicates the well was installed in the upper “loose sands” aquifer to serve as a contingency in the event of a high groundwater condition.

W-7

Extraction well W-7 has displayed low but consistent discharge throughout 2023. As indicated in Section 4, the pump controls for W-7 appear to be correctly set. W-7 was designed and installed to provide the lowest pumping capacity of the installed wells, other than contingency wells W-5 and W-6.

3.3 Extraction Well Groundwater Characterization

On October 24, 2023, groundwater samples were collected from extraction wells W-1 through W-7 and analyzed for Target Analyte List (TAL) Metals. Samples were collected by bailing water directly from the extraction wells, as the extraction wells are not equipped with sampling locations and require opening of the well caps. Sample results are summarized in Table 2 that indicate exceedances of the leachate indicators chromium, iron, manganese, and sodium. Note that chromium only exceeded the applicable standard at extraction well W-2. This indicates that the extraction wells are capturing Landfill leachate.

3.4 Pumping Assessment

On October 24, 2023, a non-vented Van Essen Micro Diver pressure transducer set to record data in one-minute intervals was installed in extraction wells W-1 through W-7 and six monitoring wells (3-OS/I, 3-R, 8-OS, 8-I, 8-R, and 9-R) for groundwater elevation monitoring. Groundwater elevation data were obtained during pumping and non-pumping conditions to assess the Capture Zone drawdown. Following the transducer installation, the pumps were turned on to document the pumping condition for approximately six days (October 24 – 30, 2023). The extraction wells were then turned off for a period of approximately three days (October 30 – November 1, 2023) to document groundwater recovery conditions. The pumps were then turned on again for a second pumping period of approximately six days (November 2 – 8, 2023). All pressure transducers were removed on November 8, 2023. Hydrographs displaying the results of the pumping assessments are provided in Appendix B. Raw data from the pressure transducers are provided on a flash drive in Appendix C.

3.5 Groundwater Quality Characterization

On October 30, 2023 during the initial pumping assessment with all extraction wells operating, groundwater samples were collected and analyzed for TAL Metals from two lift stations (W-20 and A-5), and eleven downgradient monitoring wells (3-OS/I, 3-R, 8-OS, 8-I, 8-R, 9-OS, 9-I, 9-R, 10-OS, 10-I, and 10-R). A field duplicate sample (DUP10302023) and Matrix Spike/Matrix Spike Duplicates were collected from monitoring well 9-OS in accordance with the Work Plan. Analytical results for groundwater samples are compared to the NYSDEC Division of Water Technical and Operational Guidance Series 1.1.1 (TOGS 1.1.1), Ambient Water Quality Standards and Guidance Values (June 2004). The results of the groundwater sampling are displayed in Table 2.

3.6 Data Reduction and Assessment

Collected data were compiled, reduced, and assessed as reported in Section 4. The following assessments were prepared:

- Groundwater contour maps for each day of the pumping assessment to evaluate groundwater drawdown. Contour maps are provided as Figures 5 through 19. Groundwater elevation data are summarized in Table 3.
- Contaminant concentration trend data tables and graphs for target leachate indicator parameters benzene, chromium, iron, and manganese. Concentration trends are provided in Tables 4 through 7.
- A groundwater drawdown cross section was prepared using Figure 3-11 from the 1991 RIFS to assess the actual groundwater drawdown compared to the design drawdown.

4.0 DATA REDUCTION AND ANALYSIS

Following completion of the data collection described in Section 3, the data were reduced and analyzed to assess the existing capture zone.

4.1 Review Site Data, Site Conceptual Model, and Remedy Objectives

As described in Sections 2 and 3, specific improvements to the Landfill leachate collection system were designed, installed, and became operational in 1997 to create Enhanced Capture Zones on the downgradient side of the Landfill. Seven extraction wells (W-1 through W-7) were installed to capture leachate in an area where the original gravity collection trench was installed above the groundwater table. The extraction wells and a network of gravity collection trenches compose the current leachate collection system, as shown on Figure 4.

Review of the 1991 RIFS, 1994 Design Analysis Report, and 1998 Construction Monitoring Report indicate that the leachate collection system improvements were designed based on a detailed site investigation and design process.

The hydraulic conductivity of each hydrogeologic unit was estimated by conducting variable-head slug tests on the monitoring well network. The 1980 Hydrogeologic Investigation Progress Report includes a water budget and flow net analysis. The Water Budget included as Figure 22 that demonstrates groundwater flow through the Landfill at the time consisted of surface infiltration and subsurface flow through the underlying glacial till. Flow through the glacial till exits into the Torne Brook as a gaining stream. The deeper bedrock aquifer as an upward gradient along the western limit of the Landfill in the vicinity of Torne Brook. The Water Budget remains representative of current conditions with the exception of surface infiltration through the Landfill. The constructed Landfill cover system prevents surface water infiltration and directs surface water to a network of swales to convey surface water off the Landfill cover. Therefore, the quantity of leachate entering groundwater is expected to be less today than when the leachate collection system was installed.

The extraction wells were designed to capture Landfill leachate at a location where the flow net analysis indicated a deeper groundwater flow regime that could not be recovered with gravity collection trenches. As shown in the boring logs in Appendix A, extraction wells W-1, W-2, W-3, and W-4, range in depth from 38 to 51 feet and are screened in dense sand and up to 10 feet into bedrock. Extraction wells W-5, W-6, and W-7 are located farther north at higher elevation and are approximately 20 feet deep and are screened in dense sand and approximately 2.0 feet into bedrock.

Geologic cross sections were prepared for the 1991 RIFS that are included as Figures 23, 24, and 25. Cross Section B-C runs north to south along the western side of the Landfill and Cross Section G-H runs east to west through the Landfill and Torne Brook. As shown in Figures 21 through 25, the target capture zone can be defined laterally as the area running north to south between extraction well W-1 and W-7. The capture zone can be defined vertically as primarily the glacial till overburden. Extraction wells W-1, W-2, W-3, W-4, and W-7 are screened into the underlying bedrock surface aquifer to maintain an upward gradient in the bedrock aquifer towards the extraction wells. As shown in Figure 21, the capture zone is intended to intercept regional groundwater flow that comingles with Landfill leachate. As a closed landfill with an impermeable cover, the quantity of leachate generation is expected to decrease with time. Because the capture zone is intercepting regional groundwater flow, the quantity of water recovered by the extraction wells is not expected to decrease with time; however, the quality of the recovered water is expected to improve with time.

Based on review of the investigation, design, and construction documents, the conceptual site model for the extraction well locations and target capture zone remain valid.

4.2 Groundwater Elevations

On October 24, 2023, a non-vented Van Essen Micro Diver pressure transducer set to record data in one-minute intervals was installed in extraction wells W-1 through W-7 and six monitoring wells (3-OS/I, 3-R, 8-OS, 8-I, 8-R, and 9-R) for groundwater elevation monitoring. Groundwater elevation data were obtained during pumping and non-pumping conditions to assess the Capture Zone drawdown. Following the transducer installation, the pumps were turned on to document the pumping condition for approximately six days (October 24 – 30, 2023). The extraction wells were then turned off for a period of approximately three days (October 30 – November 1, 2023) to document groundwater recovery conditions. The pumps were then turned on again for a second pumping period of approximately six days (November 2 – 8, 2023). All pressure transducers were removed on November 8, 2023.

Groundwater contour maps are provided as Figures 5 through 19 for each day of the pumping assessment to evaluate groundwater drawdown. Groundwater elevation data are summarized in Table 3.

4.2.1 Contour Maps Static Pump Off Condition

Figures 11 through 14 summarize the bedrock aquifer groundwater elevations for the non-pumping period from October 31 to November 2, 2023. As shown in the figures, regional groundwater flow is to the southwest, which is consistent with historical trends and the conceptual site model.

4.2.2 Contour Maps - Pumping Condition

Figures 5 through 10 and 15 through 19 summarize the bedrock aquifer groundwater elevations for the pumping period from October 25 to 30, 2023 and from November 3 to November 8, 2023. Pronounced localized drawdown is observed around extraction wells W-1 and W-2 with lesser drawdown observed around extraction well W-3. A notable inward flow gradient is observed towards extraction wells W-1, W-2, and W-3. A slight inward gradient is observed around extraction well W-7. The drawdown conditions are best observed on Figures 10 and 19 at the conclusion of the pumping periods. Drawdown around extraction wells W-1, W-2, and W-3 is expected based on the flow rates summarized in Table 1.

Two additional groundwater contour maps are included as Figures 20 and 21 that show the expected groundwater condition at the target “pump on” and “pump off” elevations from the 1998 Construction Completion Report as summarized in Table B. The design elevations reveal a similar condition with pronounced drawdown around extraction wells W-1 through W-4 with smaller drawdown around W-7. The design elevations for extraction wells W-5 and W-6 indicate a flow direction to the southwest towards extraction wells W-1 through W-4, which supports that extraction wells W-5 and W-6 are intended to serve as contingency wells for high groundwater conditions.

The groundwater elevations from November 1, 2023 (pump off condition) and November 8, 2023 (pump on condition) were plotted on Cross Section B-C as shown on Figure 26. The design “pump on” and “pump off” elevations were also plotted to show the design drawdown zone. Even though the extraction wells are not achieving the design drawdown at the current settings, an inward gradient is being achieved and downgradient water quality is being maintained.

4.2.3 Hydrographs

Groundwater elevations were continuously recorded for each extraction well and six monitoring wells (3-OS/I, 3-R, 8-OS, 8-I, 8-R, and 9-R). Hydrographs for each well displaying the results of the pumping assessments are provided in Appendix B. Raw data from the pressure transducers are provided on a flash drive in Appendix C.

W-1

The hydrograph for extraction well W-1 displays frequent and repeated cycling of the well pump to maintain a water elevation of approximately 300.6 and 303.2 feet above mean sea level (amsl) during the pumping periods. Following shutdown of the pump on October 30, 2023, the water level recovered to a static elevation of approximately 307.3 feet amsl. The pumping data indicates the pump controller settings are above the design “pump on” and “pump off” elevations by 5.2 and 7.6 feet, respectively. The designed span between the “pump on” and “pump off” is 5.0 feet. The hydrograph indicates that the span for W-1 during the pumping assessment was approximately 2.6 feet. The repeated cycling could become a maintenance concern for the pump. A throttling valve could be considered to maintain a consistent flow rate over a longer pump cycle.

W-2

The hydrograph for extraction well W-2 displays steady groundwater drawdown of approximately 1.25 feet that reached a stabilized drawdown condition at approximately 304 feet amsl, which is above the design “pump on” elevation of 298.0 feet amsl. Following shutdown of the pump on October 30, 2023, the water level recovered to a static elevation of approximately 305.75 feet amsl. Immediately prior to pump shutdown on October 30, 2023, an increase in water elevation was observed that corresponded to a rain event. A hydrograph for the water level in the Ramapo River is included in Appendix F that displays the increase in regional surface water from the rain event.

W-3

The hydrograph for extraction well W-3 displays frequent and repeated cycling of the well pump to maintain a water elevation of approximately 304 to 306.1 feet amsl during the pumping periods. Following shutdown of the pump on October 30, 2023, the water level recovered to a static water elevation of approximately 307.4 feet amsl. The pumping data indicates the pump controller settings are above the design “pump on” and “pump off” elevations by 7.6 and 10.5 feet, respectively. The designed span between the “pump on” and “pump off” is 5.0 feet. The hydrograph indicates that the span for W-3 during the pumping assessment was approximately 2.1 feet. The repeated cycling could become a maintenance concern for the pump. A throttling valve could be considered to maintain a consistent flow rate over a longer pump cycle.

W-4

The hydrograph for extraction well W-4 displays groundwater drawdown of approximately 0.6 feet during the initial pumping period. Stabilized drawdown is observed during the pumping periods at approximately 307.7 feet amsl. Following shutdown of the pump on October 30, 2023, the water level recovered to approximately 308.8 feet amsl. As indicated in Table 1, extraction well W-4 was not pumping water during the pumping assessment; therefore, this hydrograph is representative of an observation well that indicates W-4 is within the radius of influence of extraction wells W-1, W-2, and W-3. As shown in Figure 26, less drawdown is expected at W-4. Based on the current settings for extraction wells W-1, W-2, and W-3, flow from W-4 may not be necessary to achieve adequate capture.

W-5

The hydrograph for extraction well W-5 displays a static groundwater condition of approximately 329.5 feet amsl, which is below the design “pump on” elevation. This is consistent with W-5 serving as a contingency well for high groundwater conditions.

W-6

The hydrograph for extraction well W-6 displays a static groundwater condition of approximately 334.75 feet amsl, which is below the design “pump on” elevation. This is consistent with W-6 serving as a contingency well for high groundwater conditions.

W-7

The hydrograph for extraction well W-7 displays repeated cycling of the well pump to maintain a water elevation of approximately 331.4 to 333.3 feet amsl during the pumping periods. Following shutdown of the pump on October 30, 2023, the water level recovered to a static elevation of approximately 333.7 feet amsl. The pumping data indicates the pump controller settings are above the design “pump on” and “pump off” elevations by 2.8 and 2.9 feet, respectively. The designed span between the “pump on” and “pump off” is 2.0 feet. The hydrograph indicates that the span for W-7 during the pumping assessment was approximately 1.9 feet. The repeated cycling could become a maintenance concern for the pump. A throttling valve could be considered to maintain a consistent flow rate over a longer pump cycle.

3-OS/I

Consistent drawdown was observed during the pumping periods, which indicates that 3-OS/I is within the radius of influence of extraction well W-7. Minor interference is observed from the rain event that occurred on October 30, 2023, which is indicated by the increase in groundwater elevation at the end of the initial pumping period.

3-R

Consistent but small drawdown was observed during the pumping periods, which indicates that 3-R is within the radius of influence of extraction well W-7. Minor interference is observed from the rain event that occurred on October 30, 2023, which is indicated by the increase in groundwater elevation at the end of the initial pumping period.

8-OS

Consistent drawdown was observed during the pumping periods, which indicates that 8-OS is within the radius of influence of extraction wells W-1, W-2, and W-3. Notable interference is observed from the rain event that occurred on October 30, 2023, which is indicated by the increase in groundwater elevation at the end of the initial pumping period.

8-I

Consistent drawdown was observed during the pumping periods, which indicates that 8-I is within the radius of influence of extraction wells W-1, W-2, and W-3. Notable interference is observed from the rain event that occurred on October 30, 2023, which is indicated by the increase in groundwater elevation at the end of the initial pumping period.

8-R

Consistent drawdown was observed during the pumping periods, which indicates that 8-R is within the radius of influence of extraction wells W-1, W-2, and W-3. The repeated cycling of extraction wells W-1 and W-3 is observed in the 8-R hydrograph. Notable interference is observed from the rain event that occurred on October 30, 2023, which is indicated by the increase in groundwater elevation at the end of the initial pumping period.

9-R

Consistent drawdown was observed during the pumping periods, which indicates that 9-R is within the radius of influence of extraction wells W-1, W-2, and W-3. The repeated cycling of extraction wells W-1 and W-3 is observed in the 9-R hydrograph. Notable interference is observed from the rain event that occurred on October 30, 2023, which is indicated by the increase in groundwater elevation at the end of the initial pumping period.

4.3 Evaluation of Concentration Trends

As documented in the 1994 Design Analysis Report, USEPA and NYSDEC selected benzene, chromium, iron, and manganese as contaminants that are representative of the Landfill leachate. Groundwater monitoring data for these parameters have been collected from the downgradient monitoring wells since 1990. Contaminant concentration trend data tables and graphs for the target leachate indicator parameters are provided in Tables 4 through 7.

Benzene

Concentrations of benzene were historically detected at monitoring wells 5-OS, 8-OS, 8-I, and 8-R. As shown in Table 4, benzene concentrations display a downward trend and have not been detected above the applicable water quality standard since the leachate collection improvements became operational in 1997.

Chromium

Concentrations of chromium have been historically detected above the applicable water quality standard at monitoring wells 3-OS/I and 3-R adjacent to extraction well W-7 and at monitoring wells 8-OS, 8-I, and 8-R adjacent to extraction well W-2. No exceedances have been reported at downgradient bedrock monitoring well 9-R, and only one exceedance has been detected at downgradient bedrock monitoring well 10-R, which initiated the recommendation for this CZA. Following the exceedance at downgradient bedrock monitoring well 10-R in May 2018, no exceedances have been detected over five sample events from July 2019 to October 2023.

Iron

Concentrations of iron have displayed a decreasing trend since June 1999 in downgradient monitoring wells in the vicinity of the extraction wells (i.e., the 8 and 9 well clusters). Only two exceedances have been detected at downgradient bedrock monitoring well 10-R with the most recent exceedance occurring in May 2018. Since the May 2018 exceedance, no exceedances have been detected at 10-R over five sample events from July 2019 to October 2023.

Manganese

Concentrations of manganese have displayed stable to decreasing trend since June 1999 in downgradient monitoring wells in the vicinity of the extraction wells (i.e., the 8 and 9 well clusters). Only two exceedances have been detected at downgradient bedrock monitoring well 10-R with the most recent exceedance

occurring in May 2018. Since the May 2018 exceedance, no exceedances have been detected at 10-R over five sample events from July 2019 to October 2023.

5.0 CONCLUSIONS & RECOMMENDATIONS

This CZA was completed in response to the Fifth USEPA Five-Year Review Report for the Ramapo Landfill Superfund Site (February 21, 2020) that identified that the extraction well capture efficiency cannot be determined based on fluctuating iron and manganese levels in multiple downgradient wells and downgradient exceedances of chromium.

5.1 Conclusions

As described in this report, the following conclusions are supported:

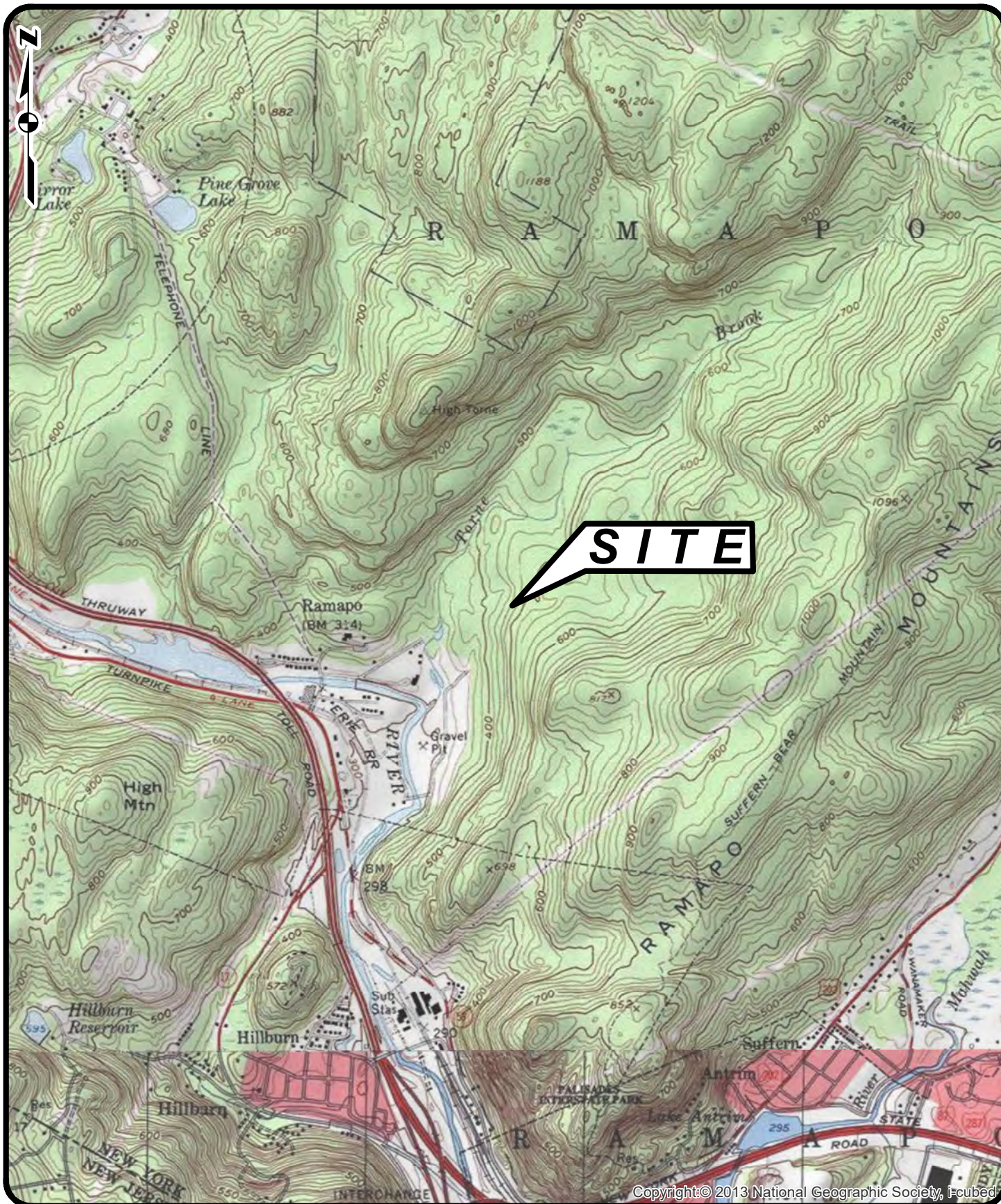
- The Conceptual Site Model developed from the site investigation and design of the leachate collection system improvements remains valid for current site conditions.
- The extraction wells are intercepting and collecting primarily regional groundwater that comingles with Landfill leachate when flowing east to west.
- The bedrock aquifer is influenced by surface water during rain events, which will increase that quantity of non-leachate water that is collected by the extraction wells.
- The current drawdown is less than the targets identified in the 1998 Construction Monitoring Report; however, the current settings during the CZA were sufficient to induce an upward and inward groundwater flow gradient towards the extraction wells to intercept and collect Landfill leachate. Increasing drawdown will likely result in extracting more regional groundwater and surface water that is not comingled with leachate, which is not the intent of the extraction system.

5.2 Recommendations

As described in this report, the CZA indicated that the extraction wells are inducing an upward and inward groundwater flow gradient towards the extraction wells to intercept and collect Landfill leachate. The following recommendations are made:

- Extraction Wells W-1, W-3, and W-7: consult the pump manufacturer regarding the optimum pump cycle frequency. If necessary, consider methods to maintain a consistent flow while maximizing the cycle time, such as with a throttling valve.
- Extraction Wells W-2, W-4, W-5, and W-6: No changes are recommended.
- The continued performance of the leachate collection system is recommended to be assessed through cumulative flow readings from each of the extraction wells and regular downgradient sampling in accordance with the Post-Closure Monitoring program. As indicated in this report, parameter exceedances have not been detected at sentinel well 10-R since 2018. The current settings appear to be adequately controlling leachate migration. The combination of extraction rates and downgradient data are expected to provide adequate protection of groundwater.

FIGURES



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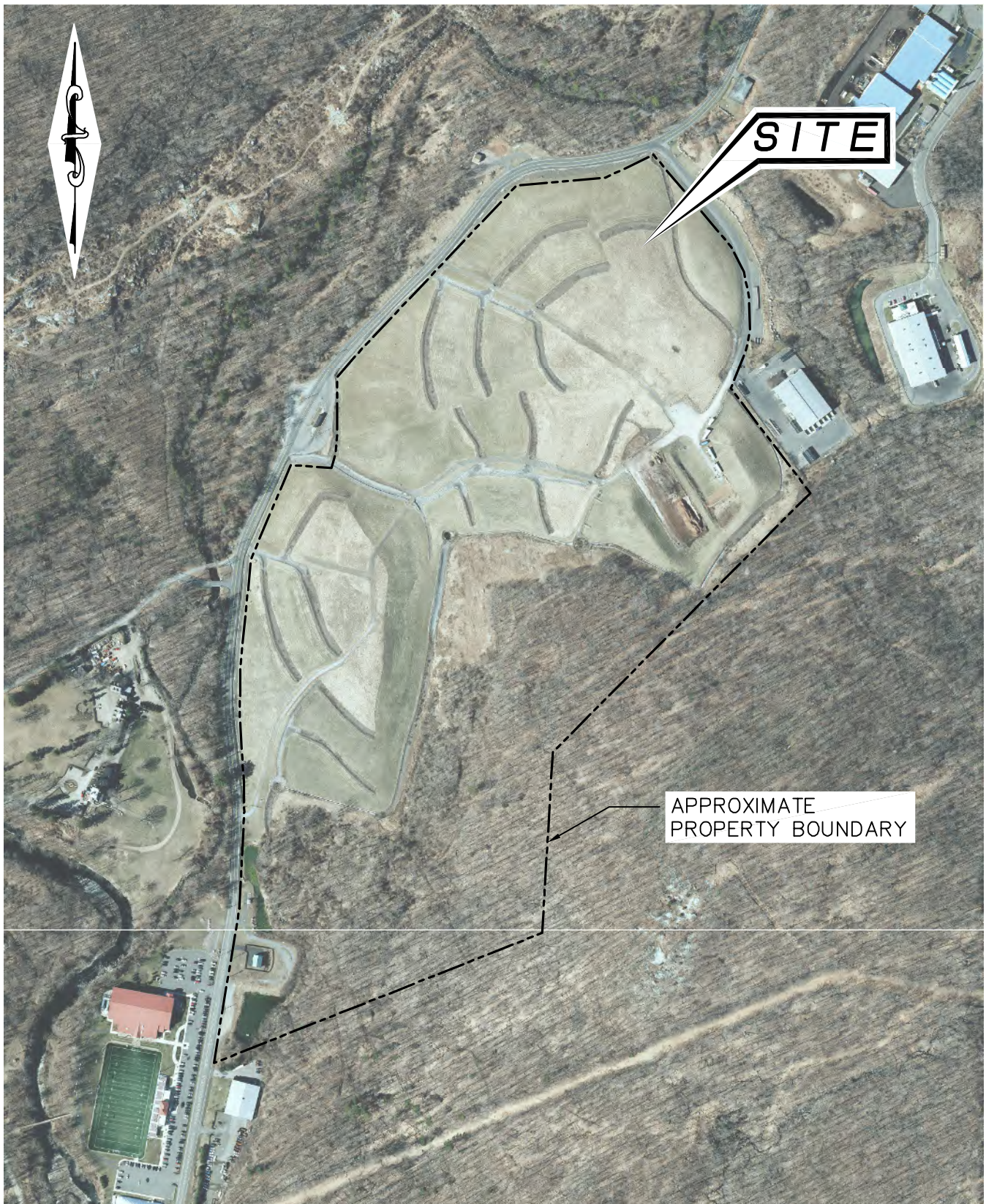
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24 Wade Road • Latham, New York 12110

SITE LOCATION MAP TOWN OF RAMAPO LANDFILL

TOWN OF RAMAPO

ROCKLAND CO., NY

PROJ.NO. 20010	DATE: 10/14/2020	SCALE: 1" = 2,000'	DWG.NO. 20010001G	FIGURE 1
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MAP REFERENCE: NEW YORK STATEWIDE DIGITAL ORTHOIMAGERY PROGRAM, PHOTOGRAPHY CIRCA 2013.

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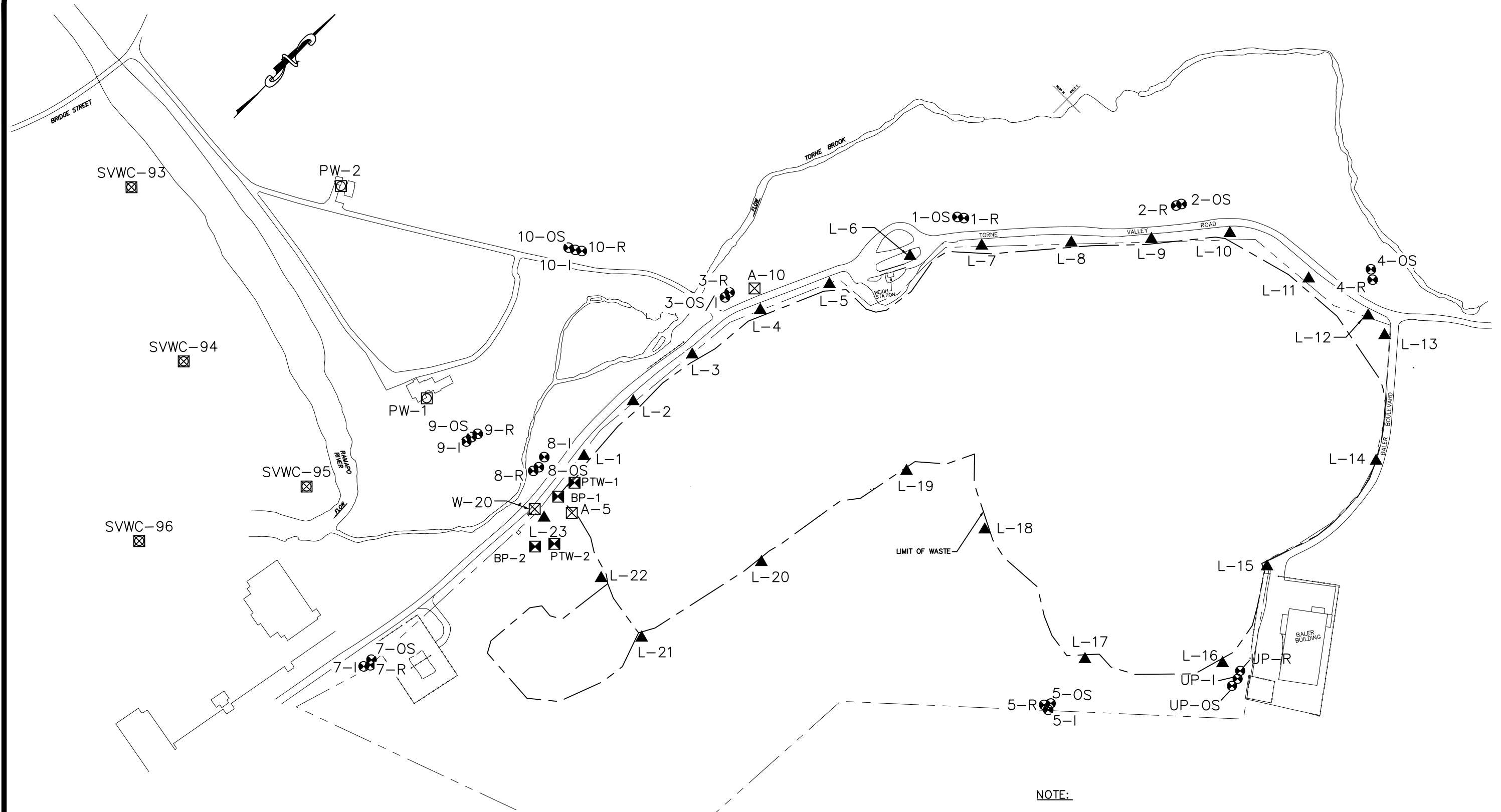
SITE VICINITY MAP
TOWN OF RAMAPO
LANDFILL

TOWN OF RAMAPO

ROCKLAND CO., N.Y.

PROJ. No.: 20010	DATE: 6/24/14	SCALE: 1" = 500'	DWG. NO. 20010036	FIGURE 2
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20010\Drawings-Maps-Figures\ACAD\20010037.ProposedMWLocations_2016-10-14.dwg / 19/2024 2:25 PM



LEGEND:

- UP-R ● MONITORING WELL CLUSTER (2016)
- 5-OS ● MONITORING WELL
- PW-1 □ EXISTING PRIVATE WATER SUPPLY WELL
- SVWC-93 ⊠ EXISTING SUPPLY WELL (UNITED WATER/SUEZ-NA)
- L-1 ▲ LANDFILL PERIMETER AIR MONITORING POINT
- A-10 ⊠ ON-SITE RECEPTOR STRUCTURE
- PTW-1 ⊠ LANDFILL DESIGN PUMPING TEST LOCATION

NOTE:

1. BASE MAP FROM DWG. NO. 32, MODIFICATIONS TO LEACHATE COLLECTION SYSTEM PLAN, BY URS CONSULTANTS, INC., BUFFALO, NY, JUNE 1994.

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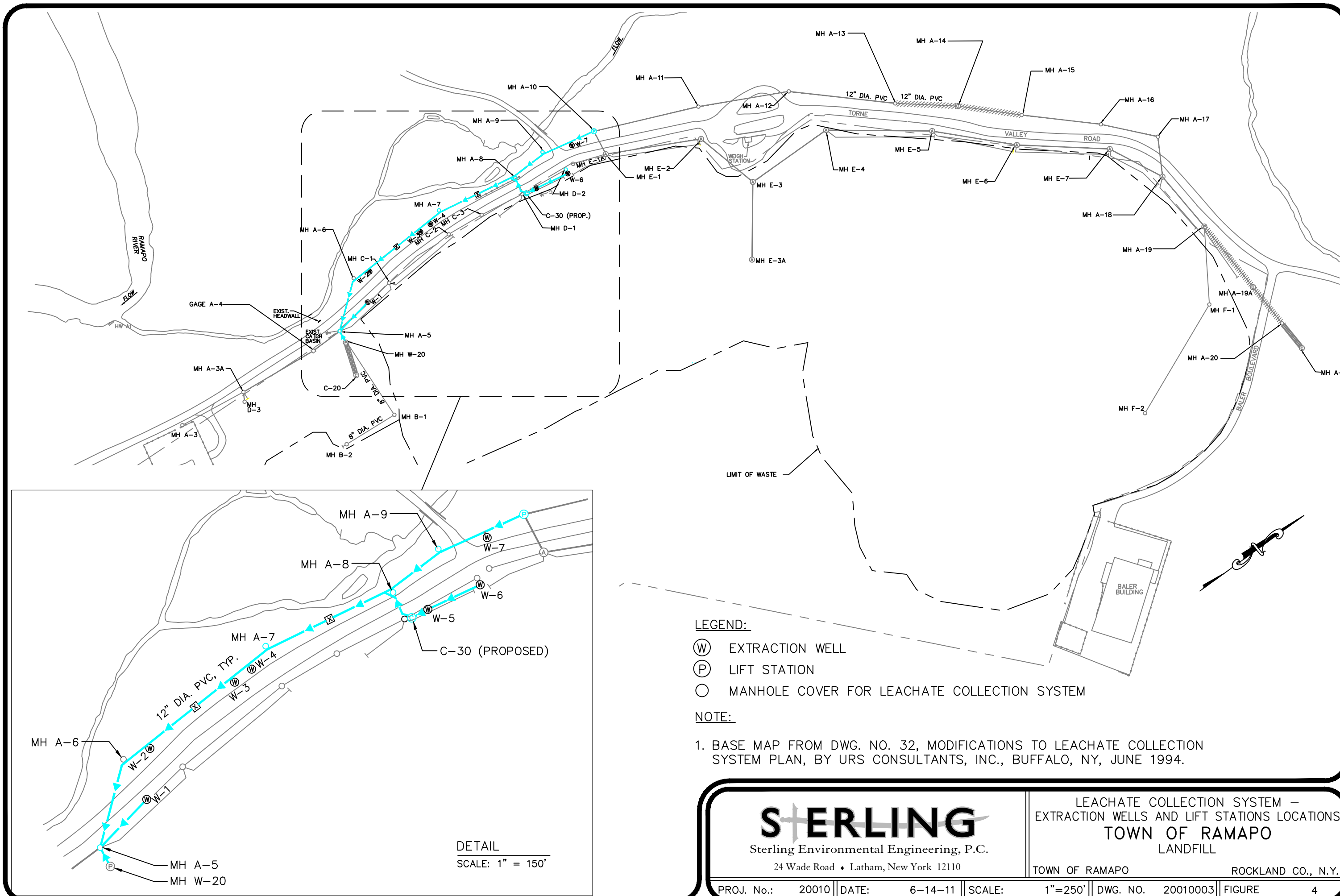
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GROUNDWATER MONITORING WELLS AND
AIR QUALITY MONITORING LOCATIONS
TOWN OF RAMAPO LANDFILL

TOWN OF RAMAPO

ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 4/28/2017 | SCALE: 1" = 300' | DWG. NO. 20010037 | FIGURE 3



LEGEND:

- (W) EXTRACTION WELL
- (P) LIFT STATION
- (O) MANHOLE COVER FOR LEACHATE COLLECTION SYSTEM

NOTE:

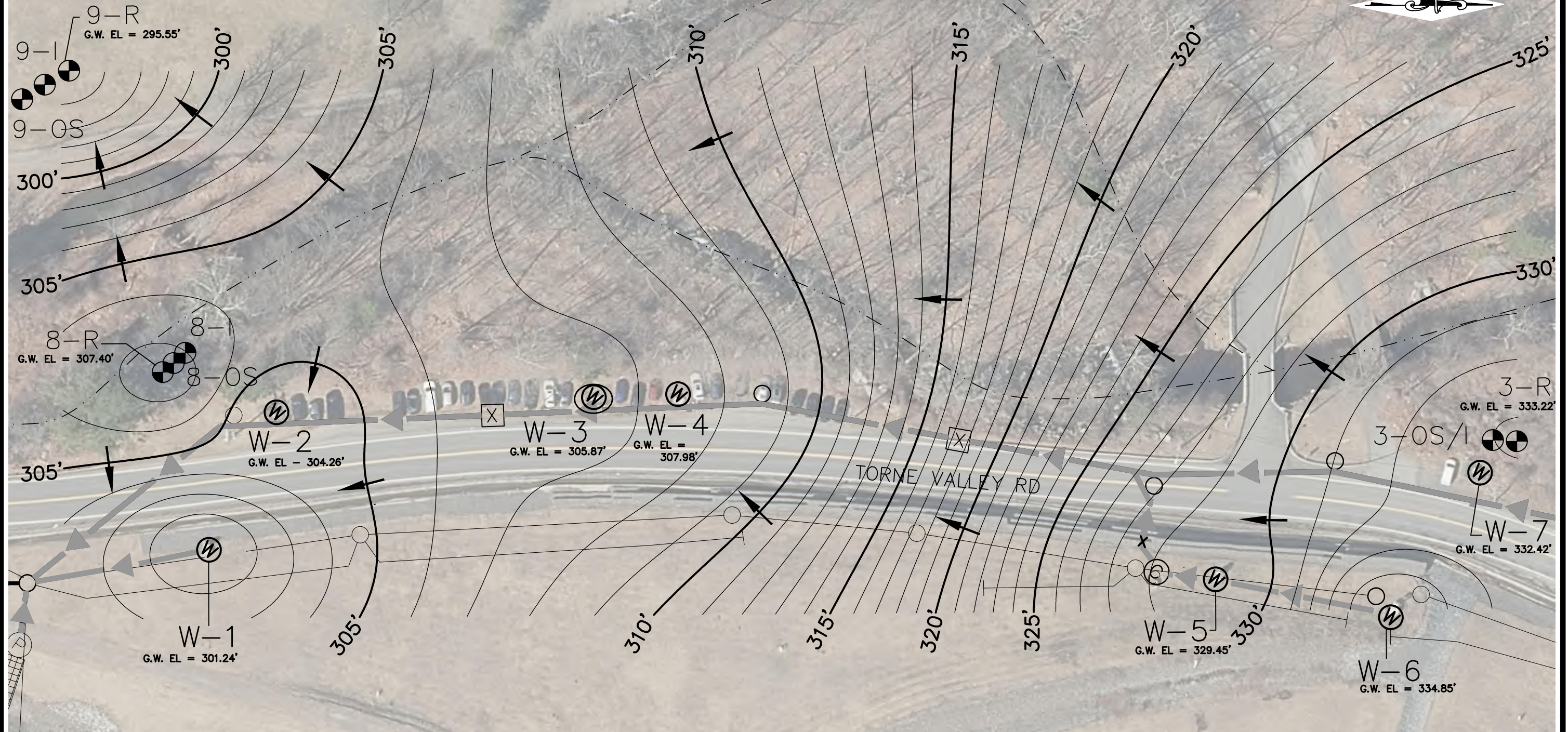
1. BASE MAP FROM DWG. NO. 32, MODIFICATIONS TO LEACHATE COLLECTION SYSTEM PLAN, BY URS CONSULTANTS, INC., BUFFALO, NY, JUNE 1994.

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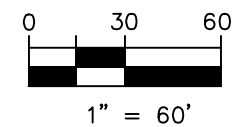
LEACHATE COLLECTION SYSTEM –
EXTRACTION WELLS AND LIFT STATIONS LOCATIONS
TOWN OF RAMAPO
LANDFILL

TOWN OF RAMAPO ROCKLAND CO., N.Y.



LEGEND:

- 305'** ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
- GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
- EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- 9-R MONITORING WELL
- G.W. EL. = 295.55' GROUNDWATER ELEVATION
- W-1 RECOVERY WELL



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

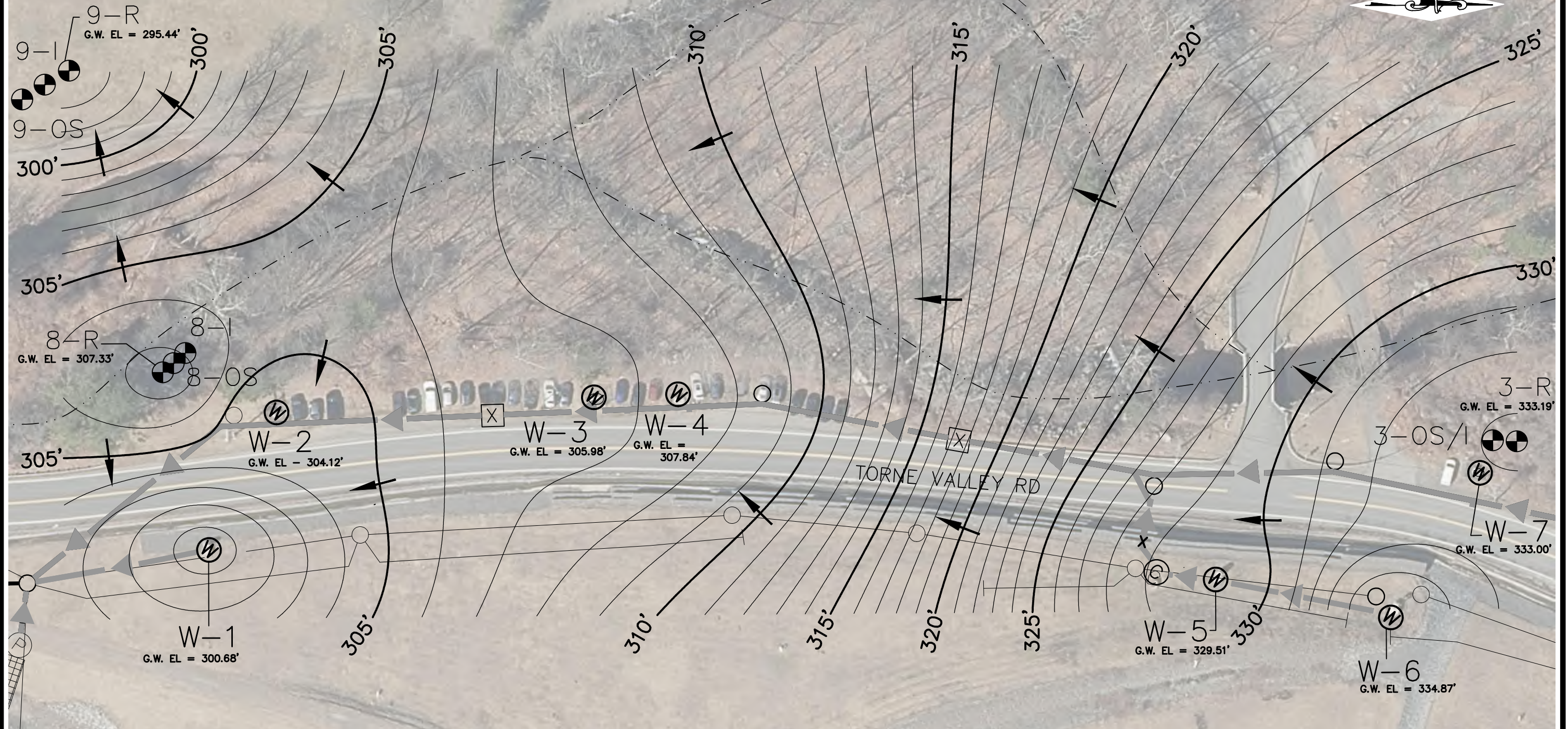
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BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS - OCTOBER 25, 2023 12:00 AM
TOWN OF RAMAPO LANDFILL
PUMPING PERIOD

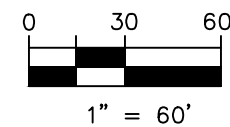
TOWN OF RAMAPO ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 12/21/2023 | SCALE: 1" = 60' | DWG. NO. 20010062 | FIGURE 5



LEGEND:

- 305'** ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
- GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
- EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- 9-R MONITORING WELL
- GROUNDWATER ELEVATION
- W-1 RECOVERY WELL



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

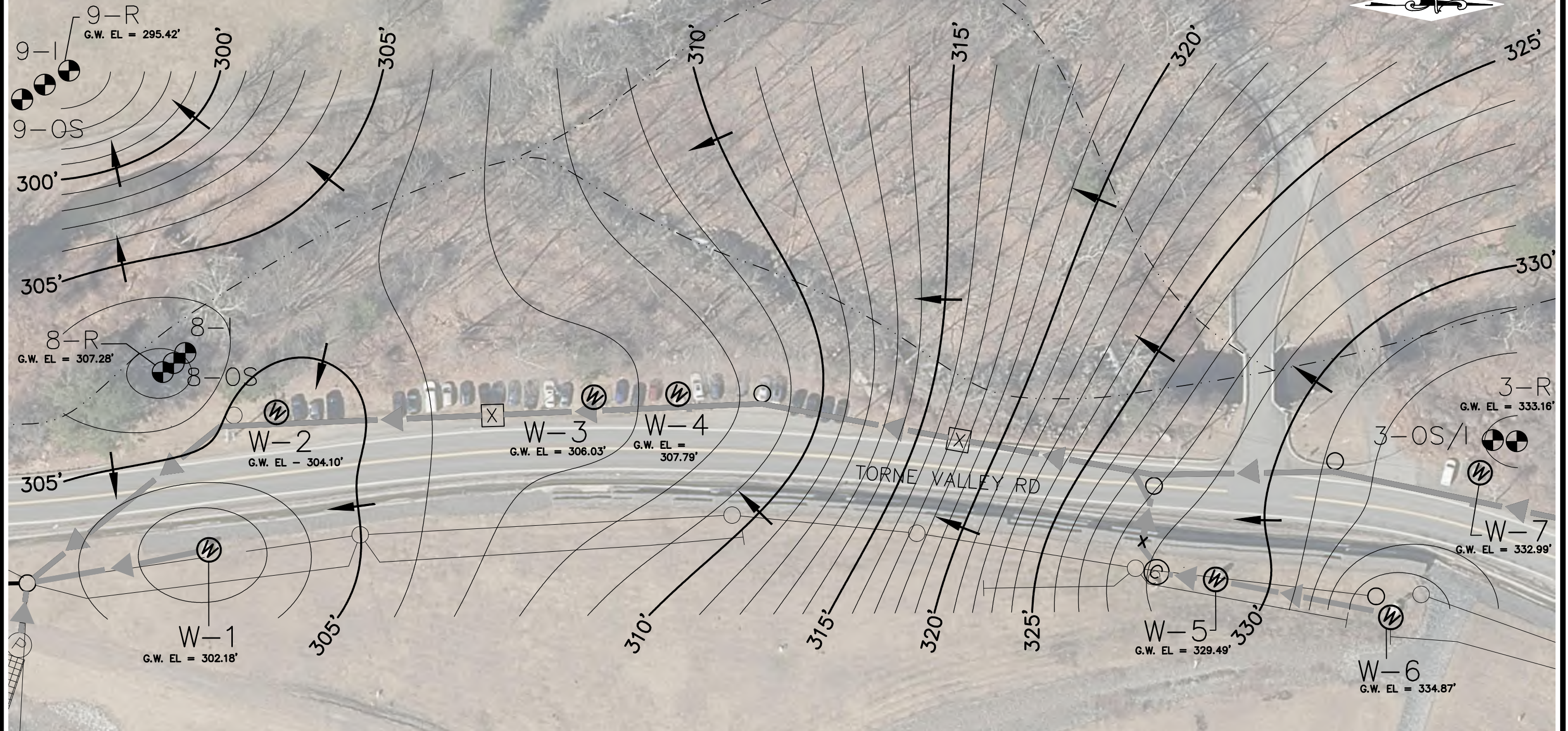
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BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS — OCTOBER 26, 2023 12:00 AM
TOWN OF RAMAPO LANDFILL
PUMPING PERIOD

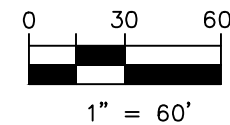
TOWN OF RAMAPO ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 12/21/2023 | SCALE: 1" = 60' | DWG. NO. 20010063 | FIGURE 6



LEGEND:

- 305' ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
- GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
- ← EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- ⊕ 9-R MONITORING WELL
- G.W. EL = 295.42' GROUNDWATER ELEVATION
- ⊕ W-1 RECOVERY WELL



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

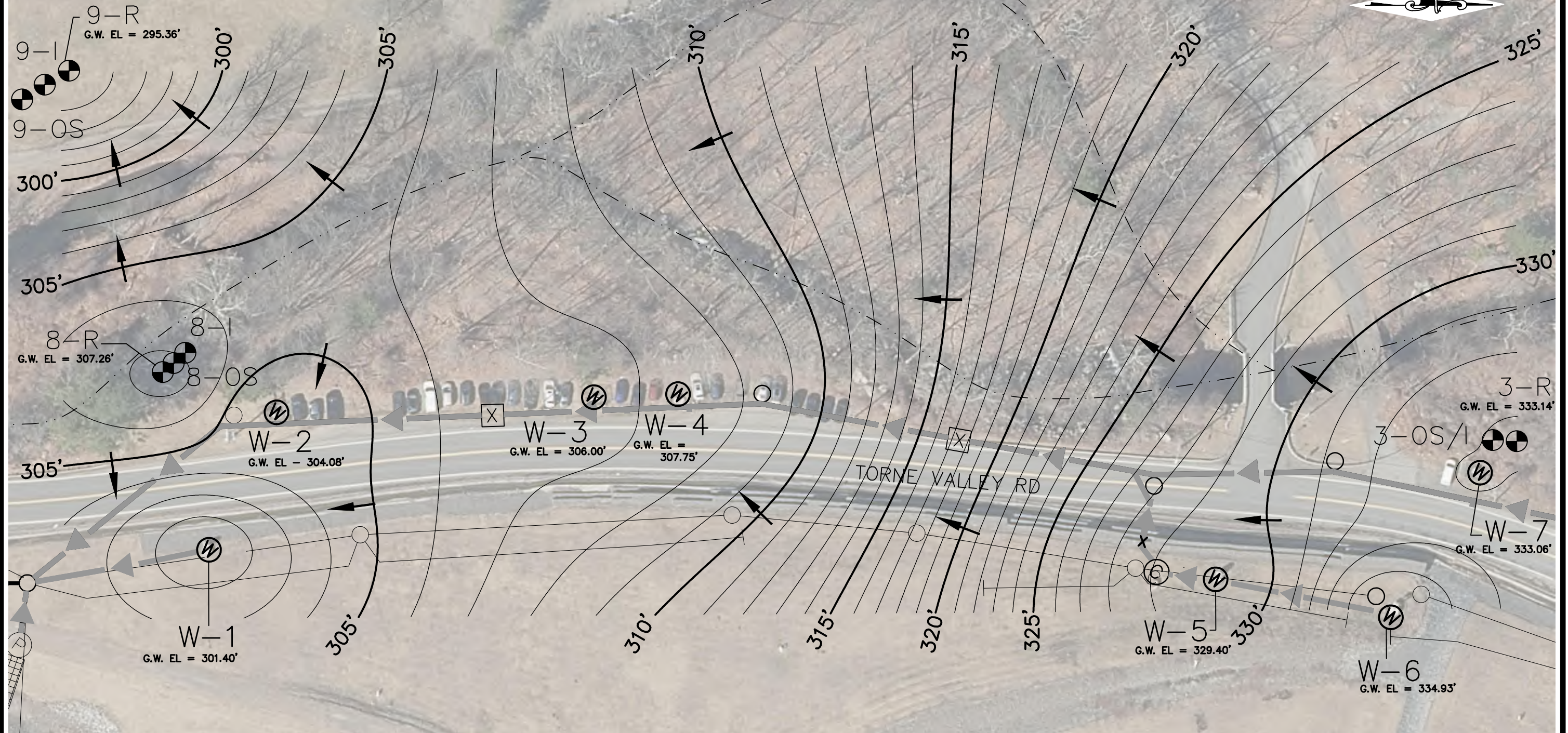
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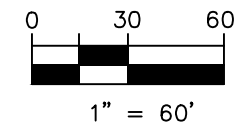
BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS — OCTOBER 27, 2023 12:00 AM
TOWN OF RAMAPO LANDFILL
PUMPING PERIOD

TOWN OF RAMAPO ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 12/21/2023 | SCALE: 1" = 60' | DWG. NO. 20010064 | FIGURE 7



- LEGEND:**
- 305' ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
 - GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
 - ← EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
 - ↗ APPROXIMATE GROUNDWATER FLOW DIRECTION
 - ⊕ 9-R MONITORING WELL
 - G.W. EL. = 295.36' GROUNDWATER ELEVATION
 - ⊕ W-1 RECOVERY WELL



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

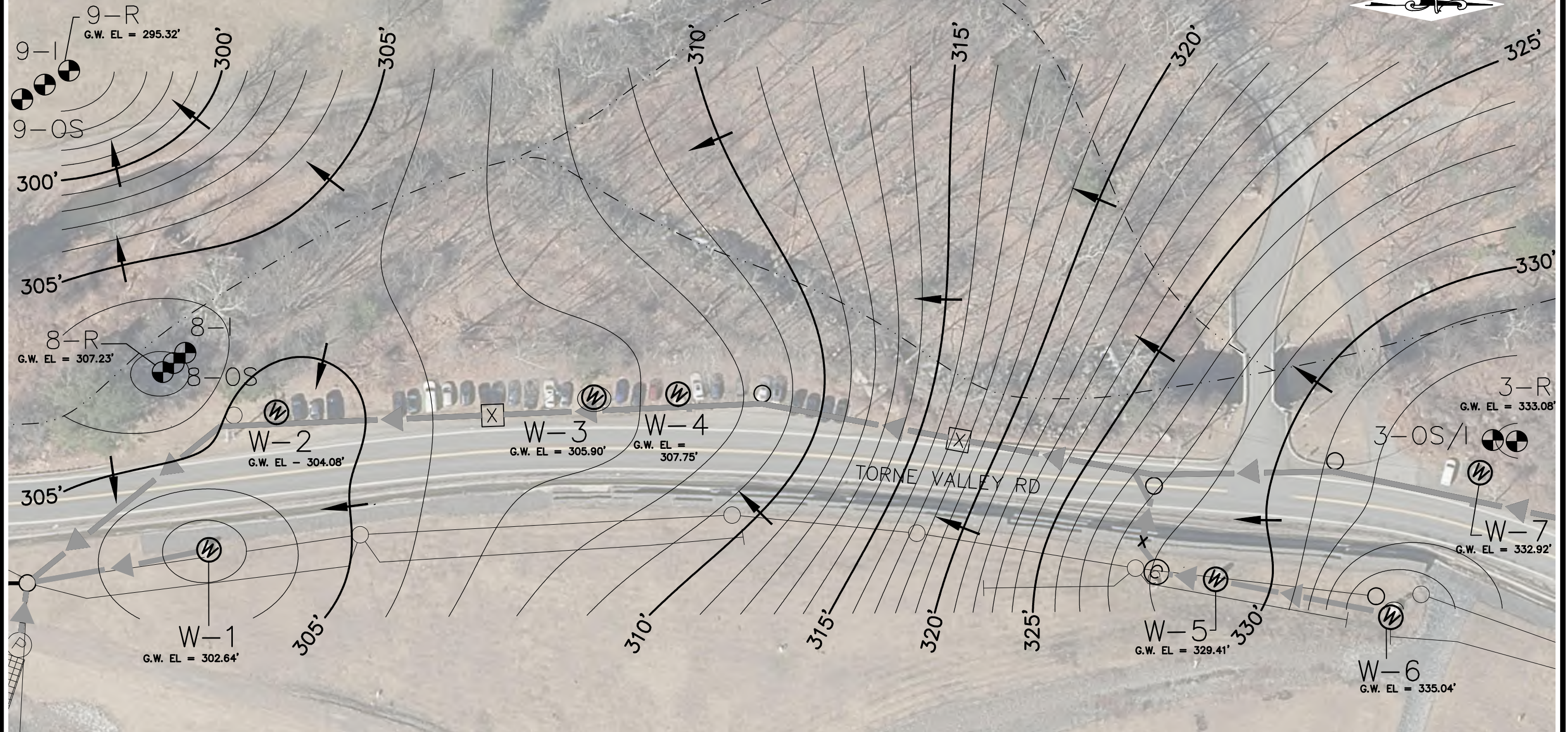
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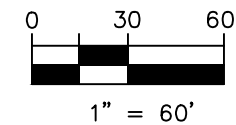
BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS — OCTOBER 28, 2023 12:00 AM
TOWN OF RAMAPO LANDFILL
PUMPING PERIOD

TOWN OF RAMAPO ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 12/21/2023 | SCALE: 1" = 60' | DWG. NO. 20010065 | FIGURE 8



- LEGEND:**
- 305' GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
 - GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
 - EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
 - APPROXIMATE GROUNDWATER FLOW DIRECTION
 - 9-R MONITORING WELL
 - W-1 RECOVERY WELL
 - G.W. EL. = 295.32' GROUNDWATER ELEVATION



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

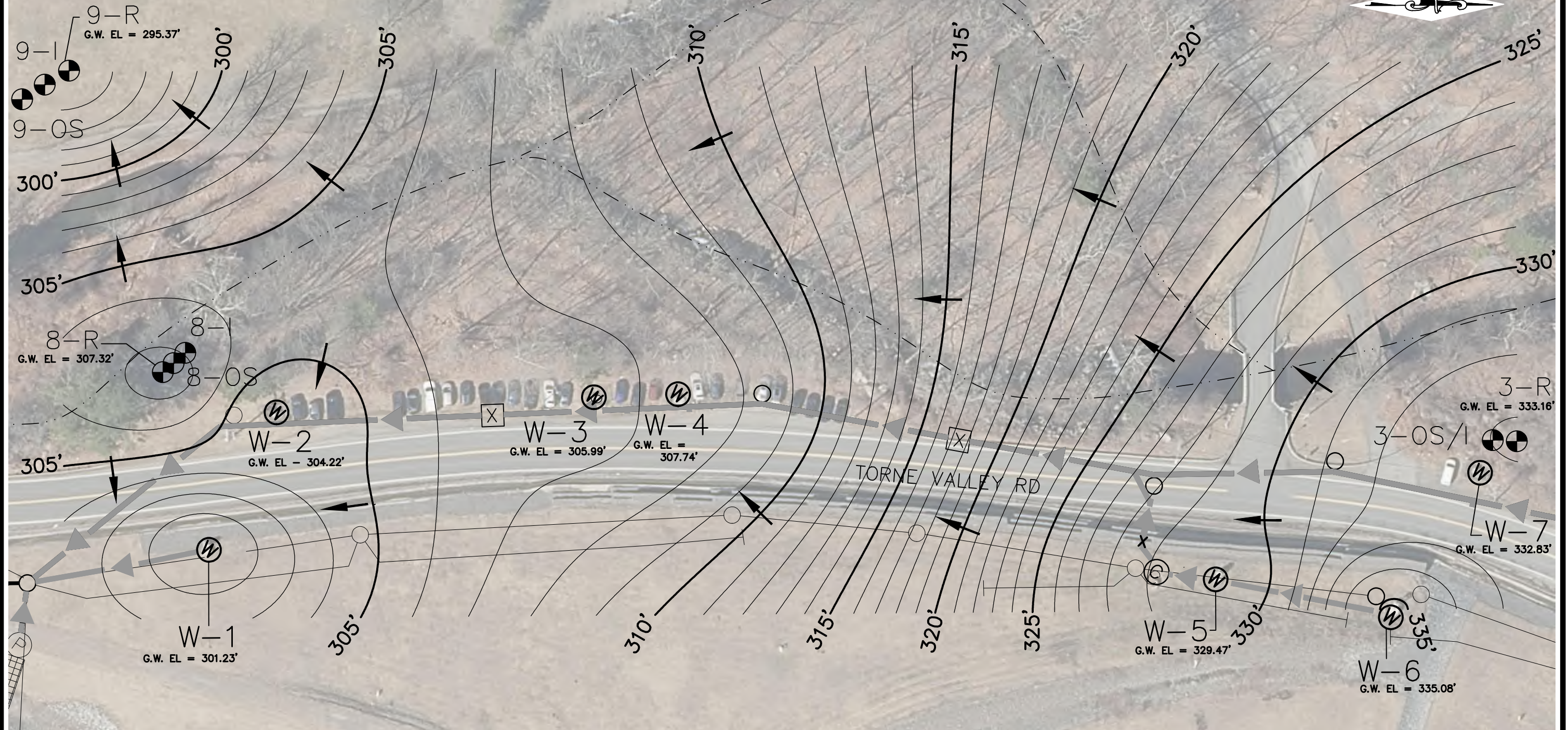
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BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS - OCTOBER 29, 2023 12:00 AM
TOWN OF RAMAPO LANDFILL
PUMPING PERIOD

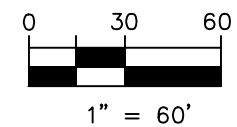
TOWN OF RAMAPO ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 12/21/2023 | SCALE: 1" = 60' | DWG. NO. 20010066 | FIGURE 9



LEGEND:

- 305'** ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
- GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
- EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- 9-R MONITORING WELL
- G.W. EL. = 295.37' GROUNDWATER ELEVATION
- W-1 RECOVERY WELL



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

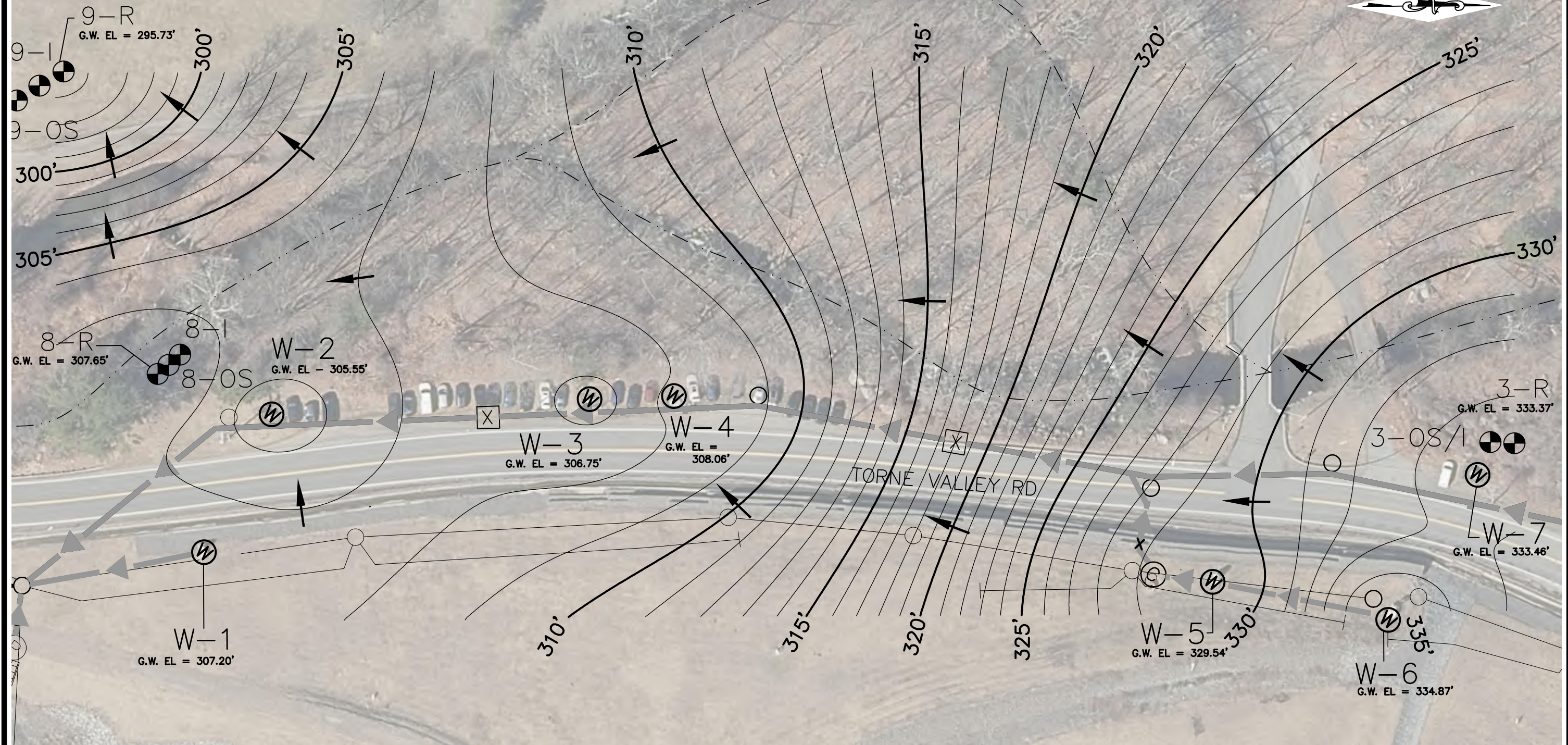
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BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS — OCTOBER 30, 2023 12:00 AM
TOWN OF RAMAPO LANDFILL
PUMPING PERIOD

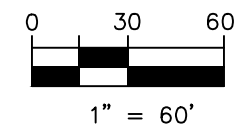
TOWN OF RAMAPO ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 12/21/2023 | SCALE: 1" = 60' | DWG. NO. 20010067 | FIGURE 10



LEGEND:

- 305' ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
- GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
- ← EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
- ↖ APPROXIMATE GROUNDWATER FLOW DIRECTION
- 9-R MONITORING WELL
- G.W. EL = 295.73' GROUNDWATER ELEVATION
- ⊕ W-1 RECOVERY WELL



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

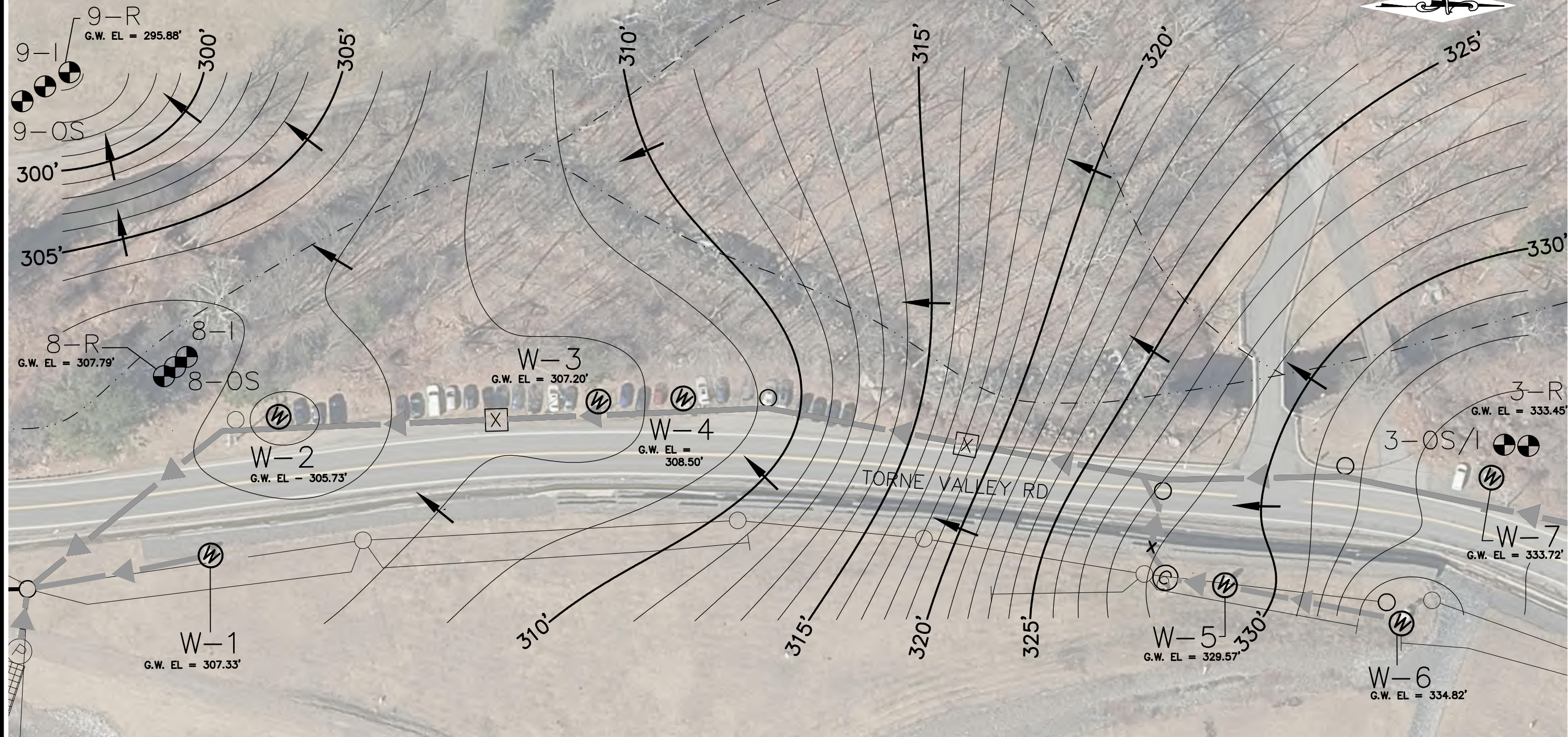
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BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS - OCTOBER 31, 2023 12:00 AM
TOWN OF RAMAPO LANDFILL
NON-PUMPING PERIOD

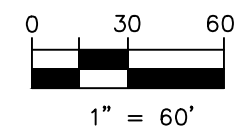
TOWN OF RAMAPO ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 12/22/2023 | SCALE: 1" = 60' | DWG. NO. 20010069 | FIGURE 11



LEGEND:

- 305'** ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
- GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
- ← EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- ⊕ 9-R MONITORING WELL
- G.W. EL. = 295.88' GROUNDWATER ELEVATION
- ⊕ W-1 RECOVERY WELL



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

STERLING

Sterling Environmental Engineering, P.C.

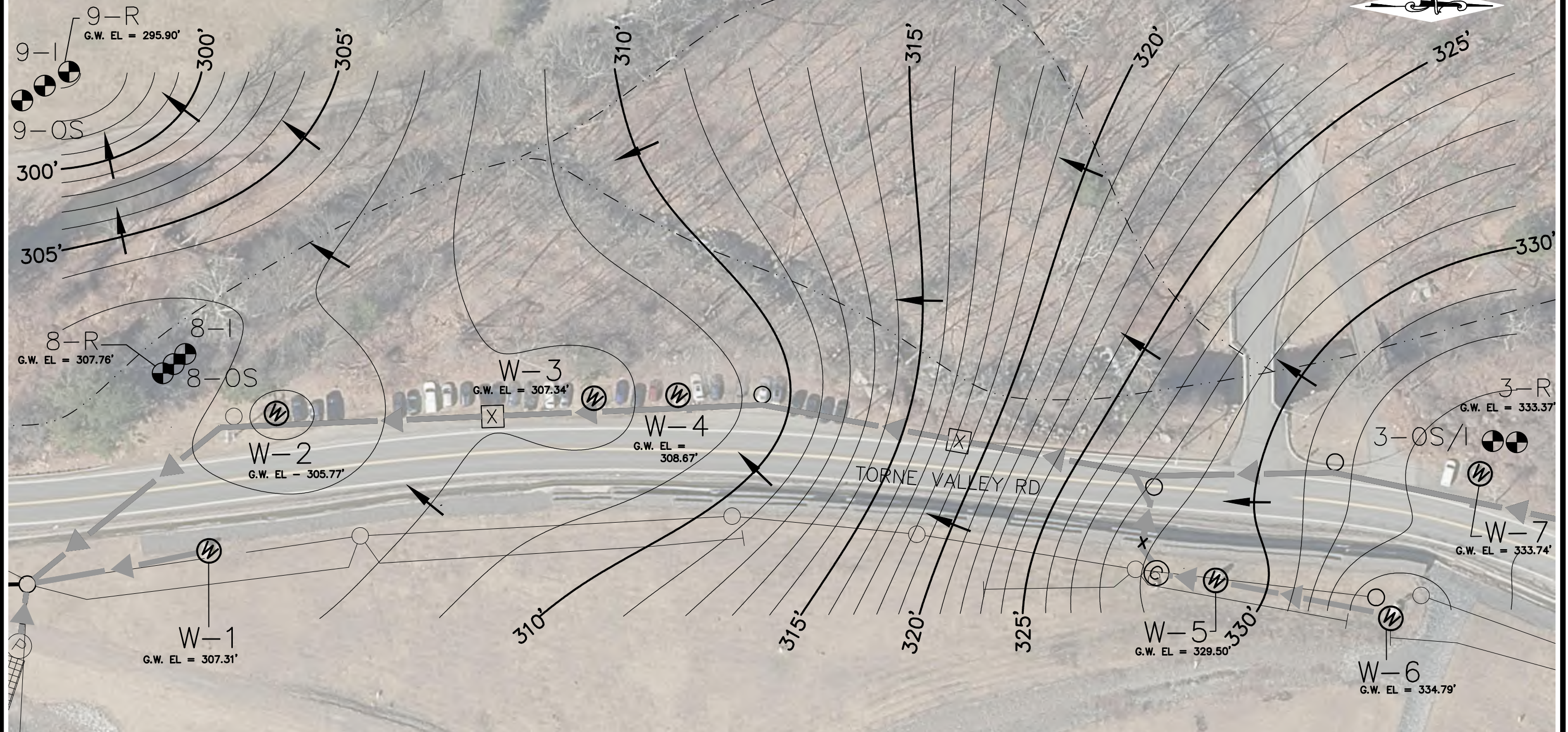
24 Wade Road • Latham, New York 12110

BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS — NOVEMBER 1, 2023 12:00 AM
TOWN OF RAMAPO LANDFILL
NON-PUMPING PERIOD

TOWN OF RAMAPO

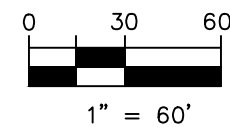
ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 12/21/2023 | SCALE: 1" = 60' | DWG. NO. 20010068 | FIGURE 12



LEGEND:

- 305'** ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
- GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
- EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- 9-R MONITORING WELL
- G.W. EL. = 295.90' GROUNDWATER ELEVATION
- W-1 RECOVERY WELL



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

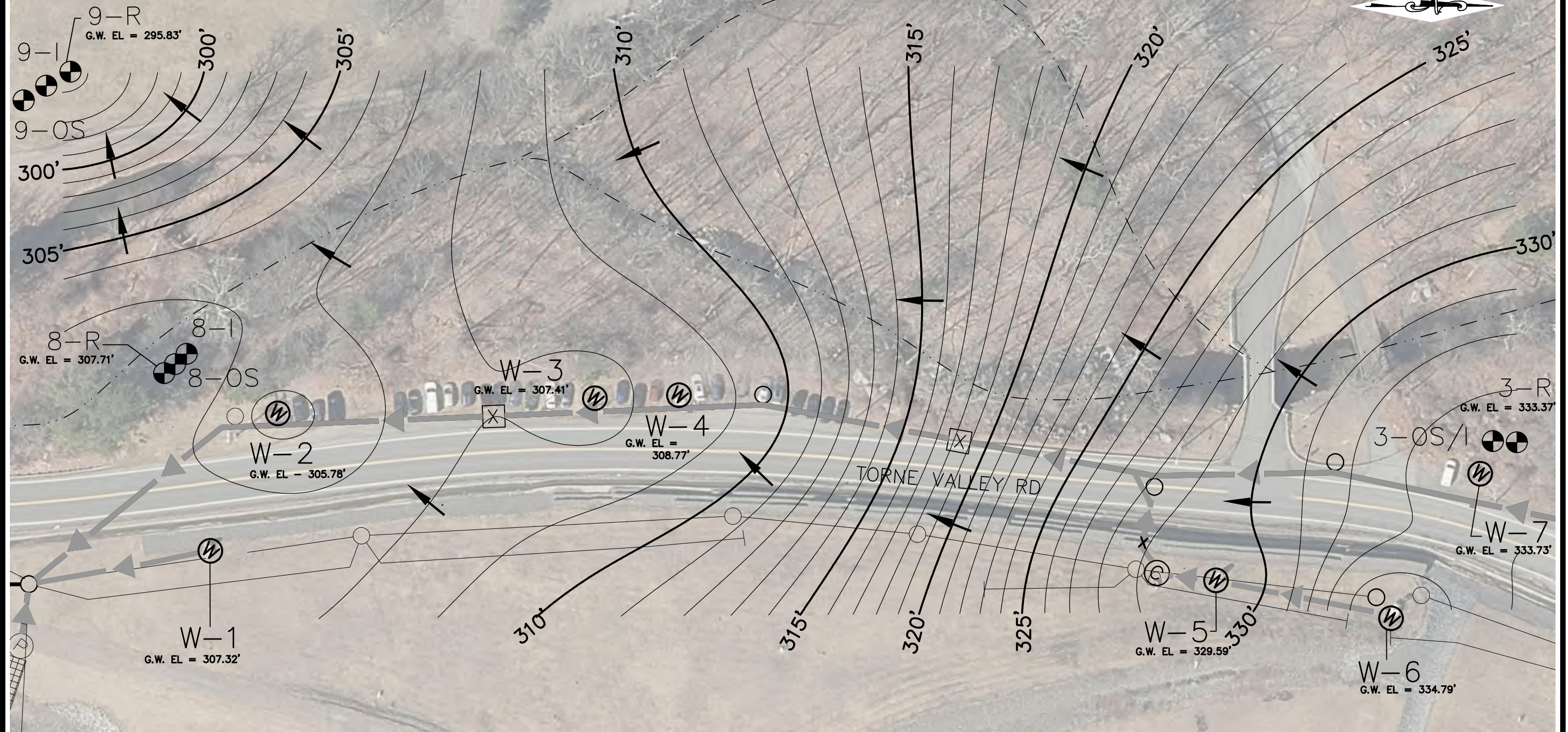
STERLING

Sterling Environmental Engineering, P.C.
24 Wade Road • Latham, New York 12110

BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS — NOVEMBER 2, 2023 12:00 AM
TOWN OF RAMAPO LANDFILL
NON-PUMPING PERIOD

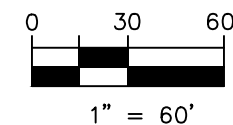
TOWN OF RAMAPO ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 12/22/2023 | SCALE: 1" = 60' | DWG. NO. 20010070 | FIGURE 13



LEGEND:

- 305' ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
- GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
- ← EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- ⊕ 9-R MONITORING WELL
- G.W. EL. = 295.83' GROUNDWATER ELEVATION
- ⊕ W-1 RECOVERY WELL



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

STERLING

Sterling Environmental Engineering, P.C.

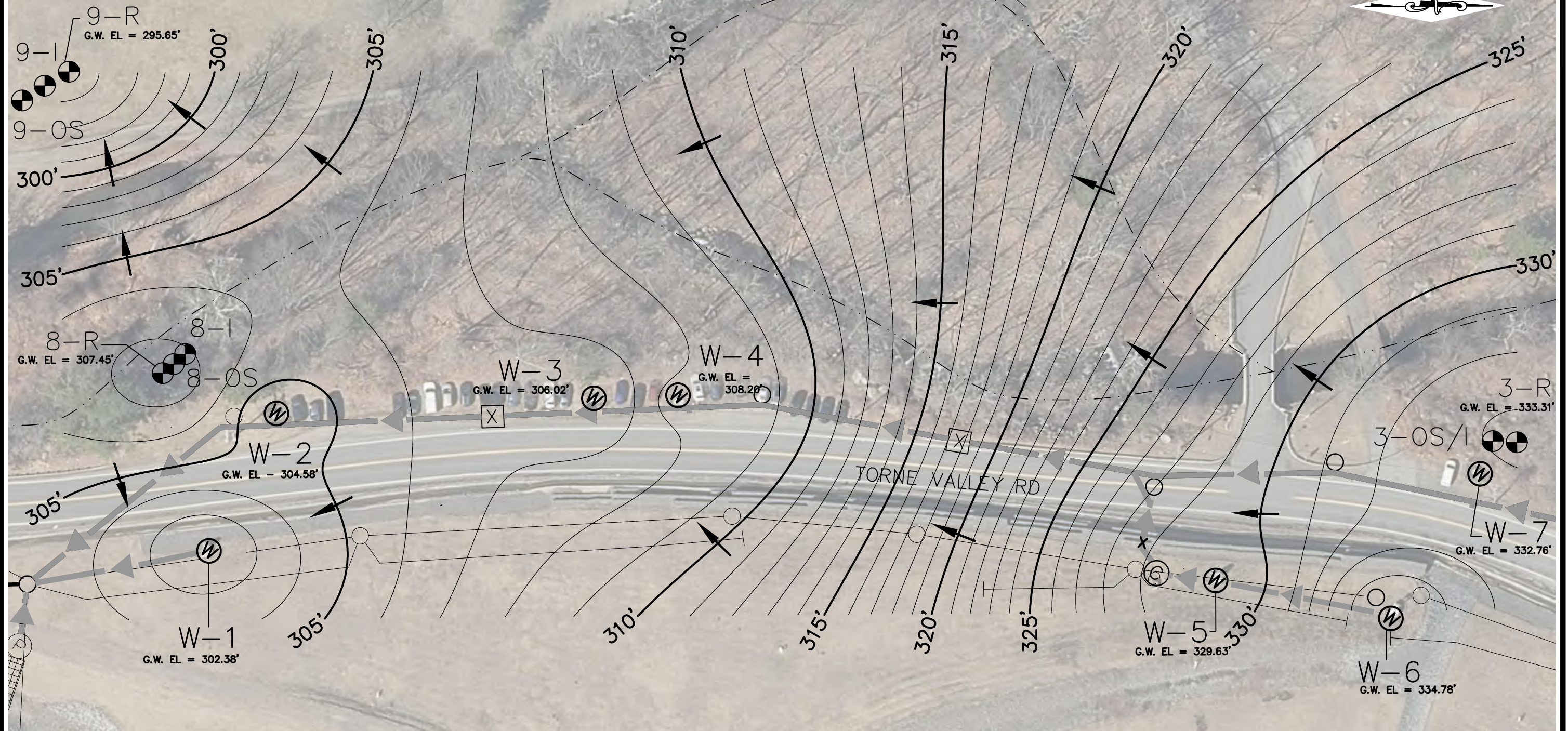
24 Wade Road • Latham, New York 12110

BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS — NOVEMBER 3, 2023 12:00 AM
TOWN OF RAMAPO LANDFILL
NON-PUMPING PERIOD

TOWN OF RAMAPO

ROCKLAND CO., N.Y.

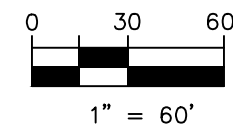
PROJ. No.: 20010 | DATE: 12/22/2023 | SCALE: 1" = 60' | DWG. NO. 20010071 | FIGURE 14



LEGEND:

- 305' ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
- GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
- ← EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
- ↗ APPROXIMATE GROUNDWATER FLOW DIRECTION
- 9-R MONITORING WELL
- G.W. EL = 295.65' GROUNDWATER ELEVATION
- ⊗ W-1 RECOVERY WELL

MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.



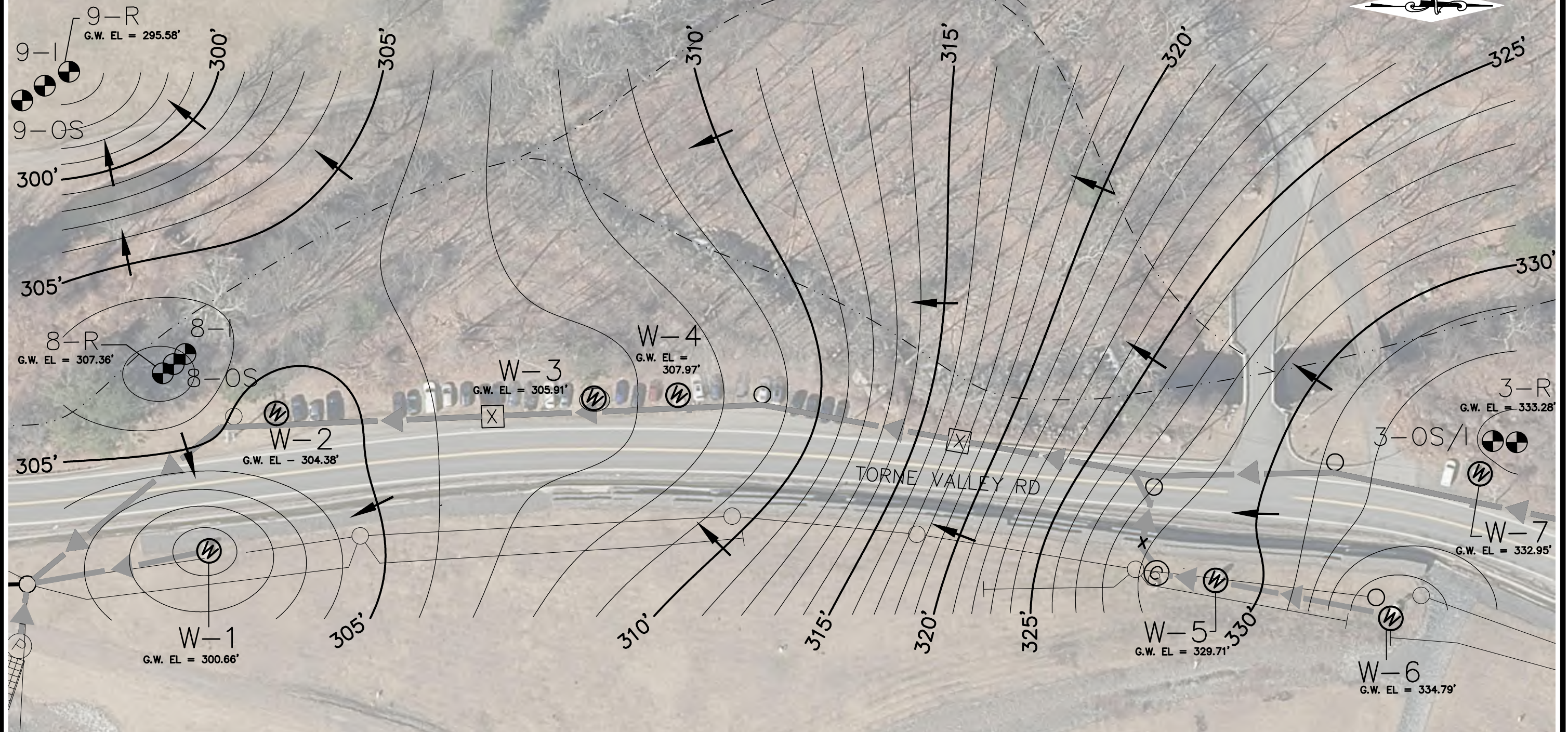
STERLING

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24 Wade Road • Latham, New York 12110

BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS — NOVEMBER 4, 2023 12:00 AM
TOWN OF RAMAPO LANDFILL
PUMPING PERIOD

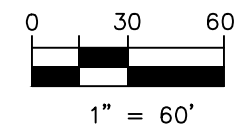
TOWN OF RAMAPO ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 12/22/2023 | SCALE: 1" = 60' | DWG. NO. 20010072 | FIGURE 15



LEGEND:

- 305'** ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
- GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
- EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- 9-R MONITORING WELL
- G.W. EL. = 295.58'** GROUNDWATER ELEVATION
- W-1 RECOVERY WELL



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

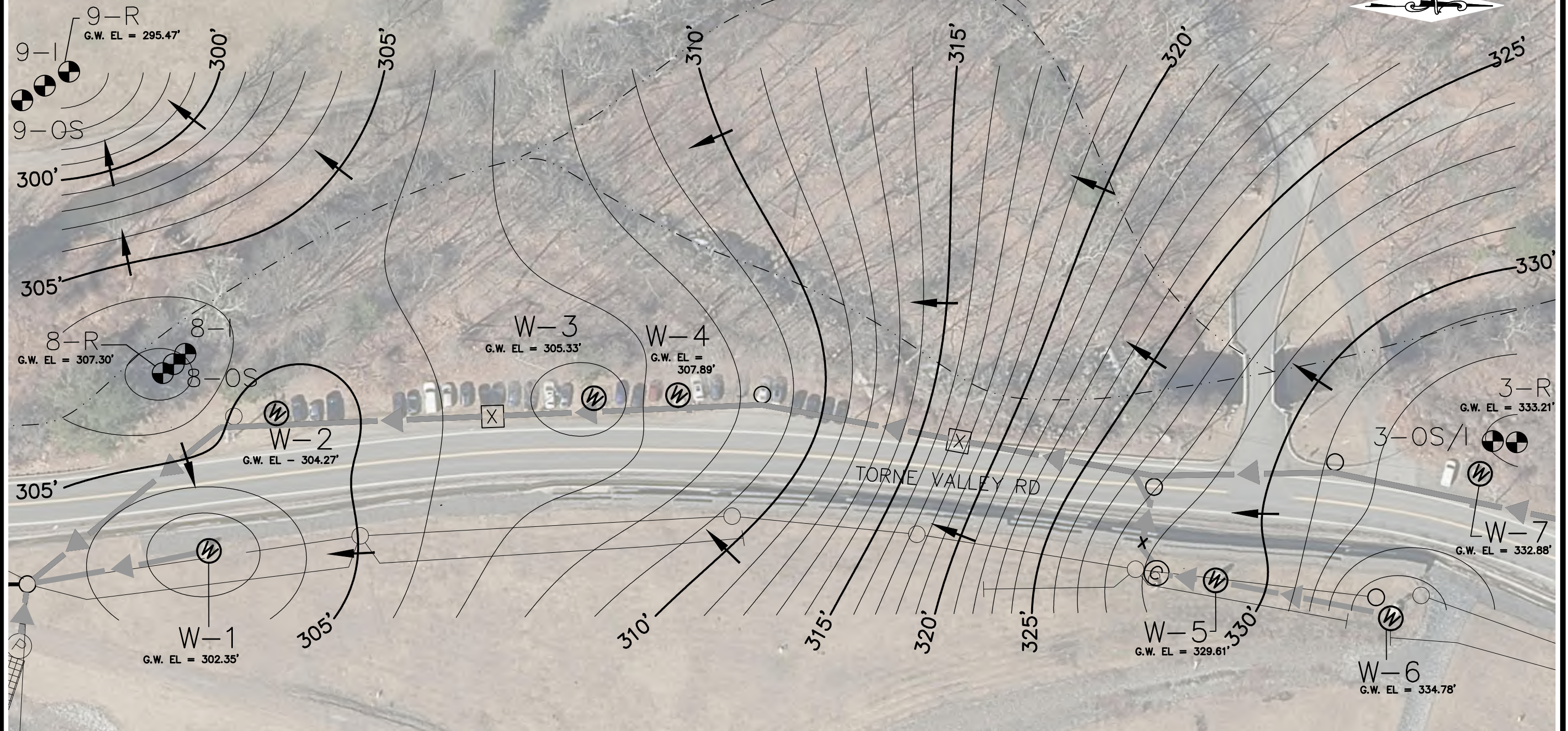
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BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS — NOVEMBER 5, 2023 12:00 AM
TOWN OF RAMAPO LANDFILL
PUMPING PERIOD

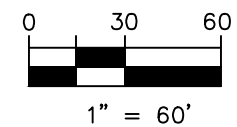
TOWN OF RAMAPO ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 12/22/2023 | SCALE: 1" = 60' | DWG. NO. 20010073 | FIGURE 16



LEGEND:

- 305'** ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
- GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
- EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- 9-R MONITORING WELL
- G.W. EL. = 295.47' GROUNDWATER ELEVATION
- W-1 RECOVERY WELL



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

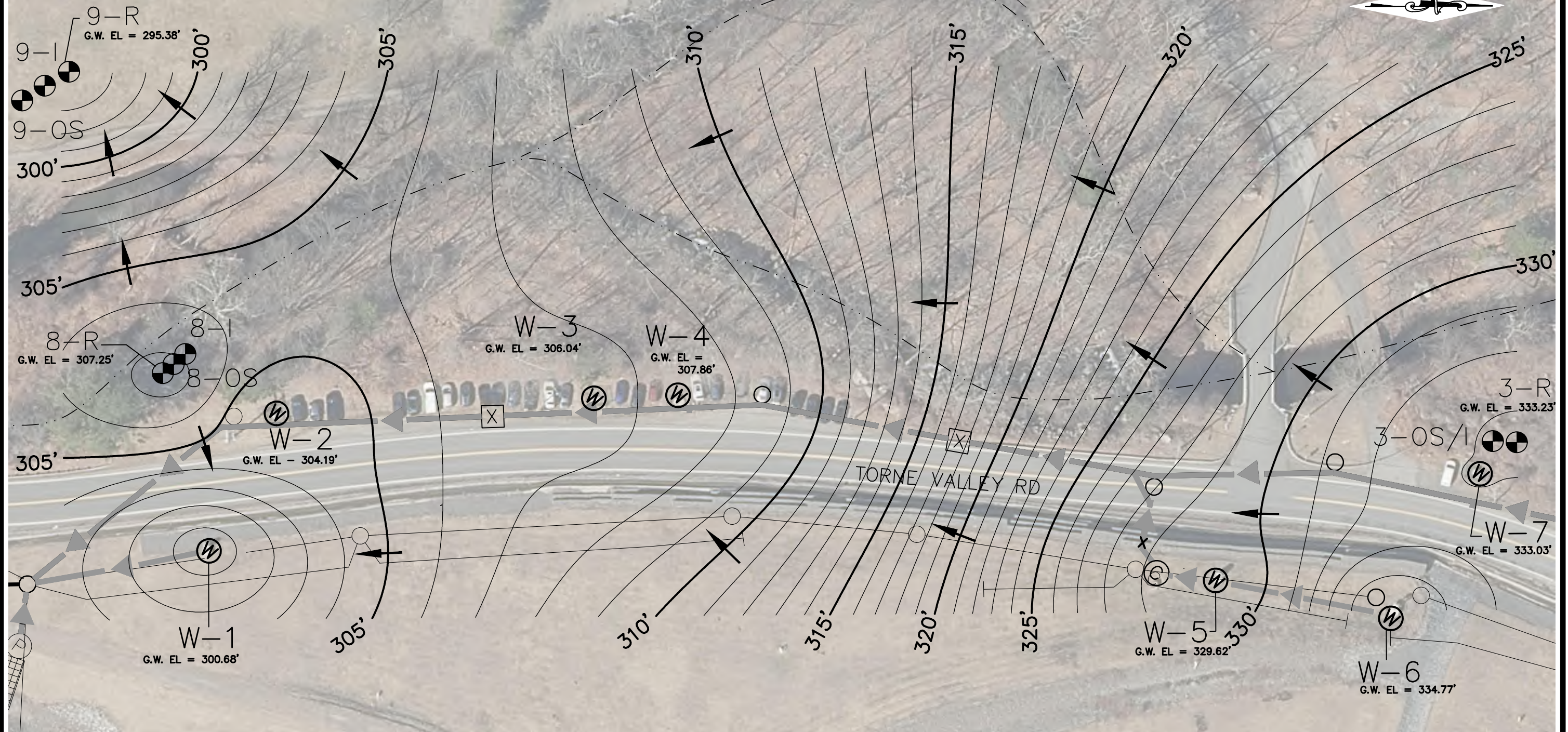
STERLING

Sterling Environmental Engineering, P.C.
24 Wade Road • Latham, New York 12110

BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS — NOVEMBER 6, 2023 12:00 AM
TOWN OF RAMAPO LANDFILL
PUMPING PERIOD

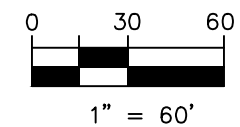
TOWN OF RAMAPO ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 12/22/2023 | SCALE: 1" = 60' | DWG. NO. 20010074 | FIGURE 17



LEGEND:

- 305'** ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
- GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
- ← EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
- ↖ APPROXIMATE GROUNDWATER FLOW DIRECTION
- 9-R MONITORING WELL
- G.W. EL. = 295.38' GROUNDWATER ELEVATION
- ⊗ W-1 RECOVERY WELL



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

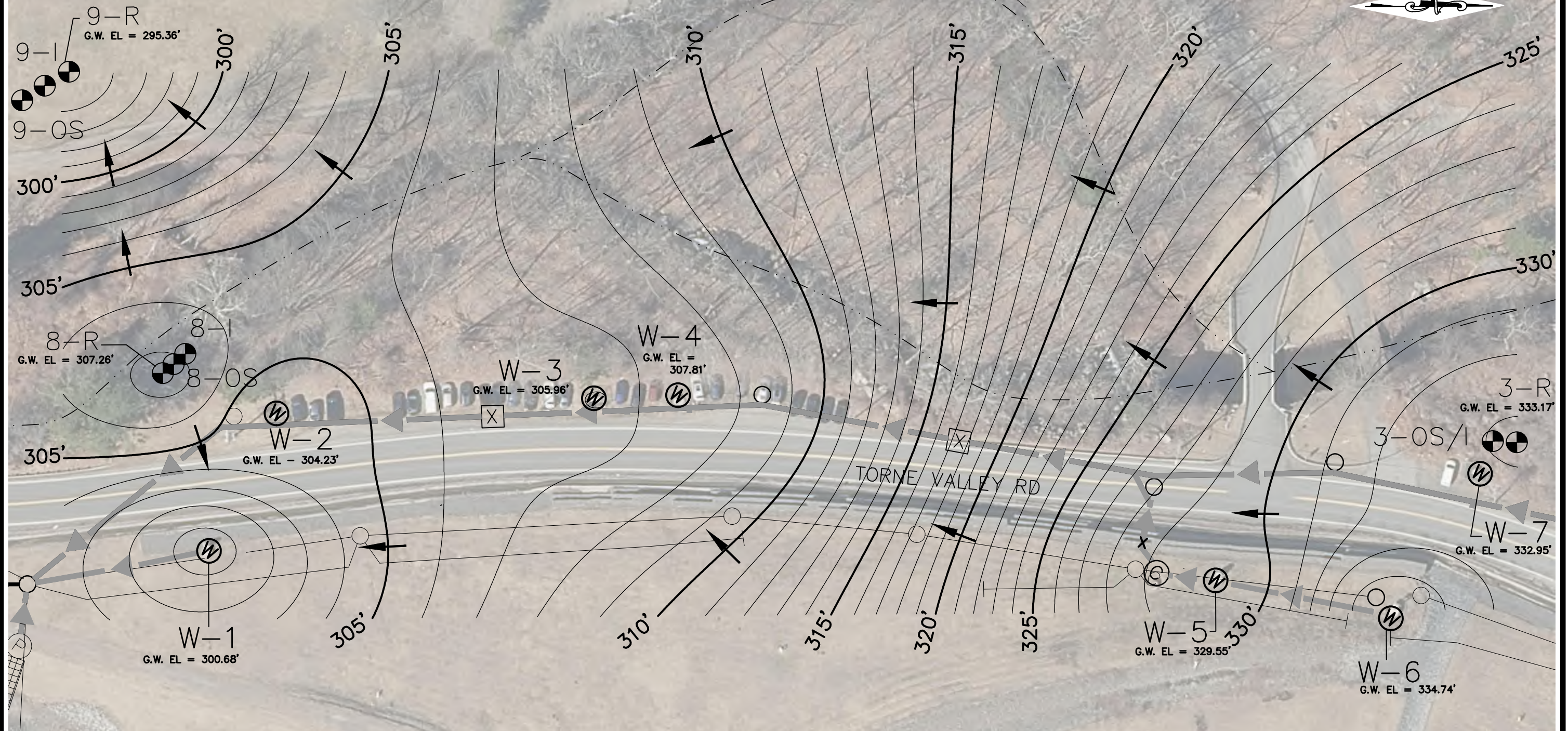
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BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS — NOVEMBER 7, 2023 12:00 AM
TOWN OF RAMAPO LANDFILL
PUMPING PERIOD

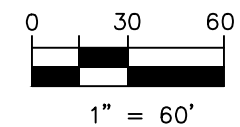
TOWN OF RAMAPO ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 12/22/2023 | SCALE: 1" = 60' | DWG. NO. 20010076 | FIGURE 18



LEGEND:

- 305' ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
- GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
- ← EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
- ↗ APPROXIMATE GROUNDWATER FLOW DIRECTION
- ⊙ 9-R MONITORING WELL
- G.W. EL = 295.36' GROUNDWATER ELEVATION
- ⊙ W-1 RECOVERY WELL



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

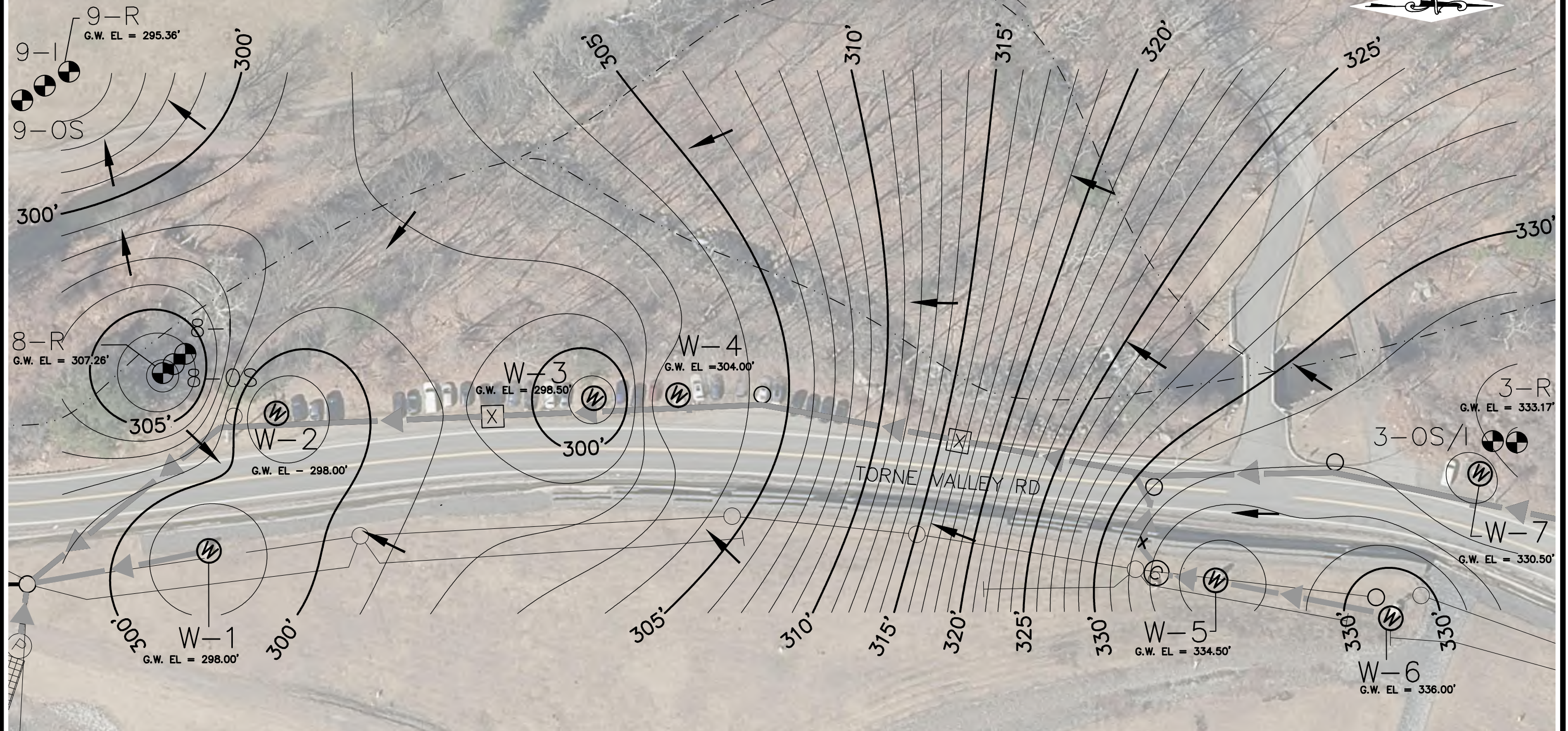
STERLING

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BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS — NOVEMBER 8, 2023 12:00 AM
TOWN OF RAMAPO LANDFILL
PUMPING PERIOD

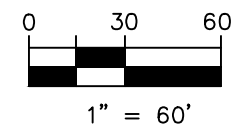
TOWN OF RAMAPO ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 12/22/2023 | SCALE: 1" = 60' | DWG. NO. 20010075 | FIGURE 19



LEGEND:

- 305'** ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
- GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
- EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- 9-R MONITORING WELL
- G.W. EL. = 298.00'** GROUNDWATER ELEVATION
- W-1 RECOVERY WELL



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

STERLING

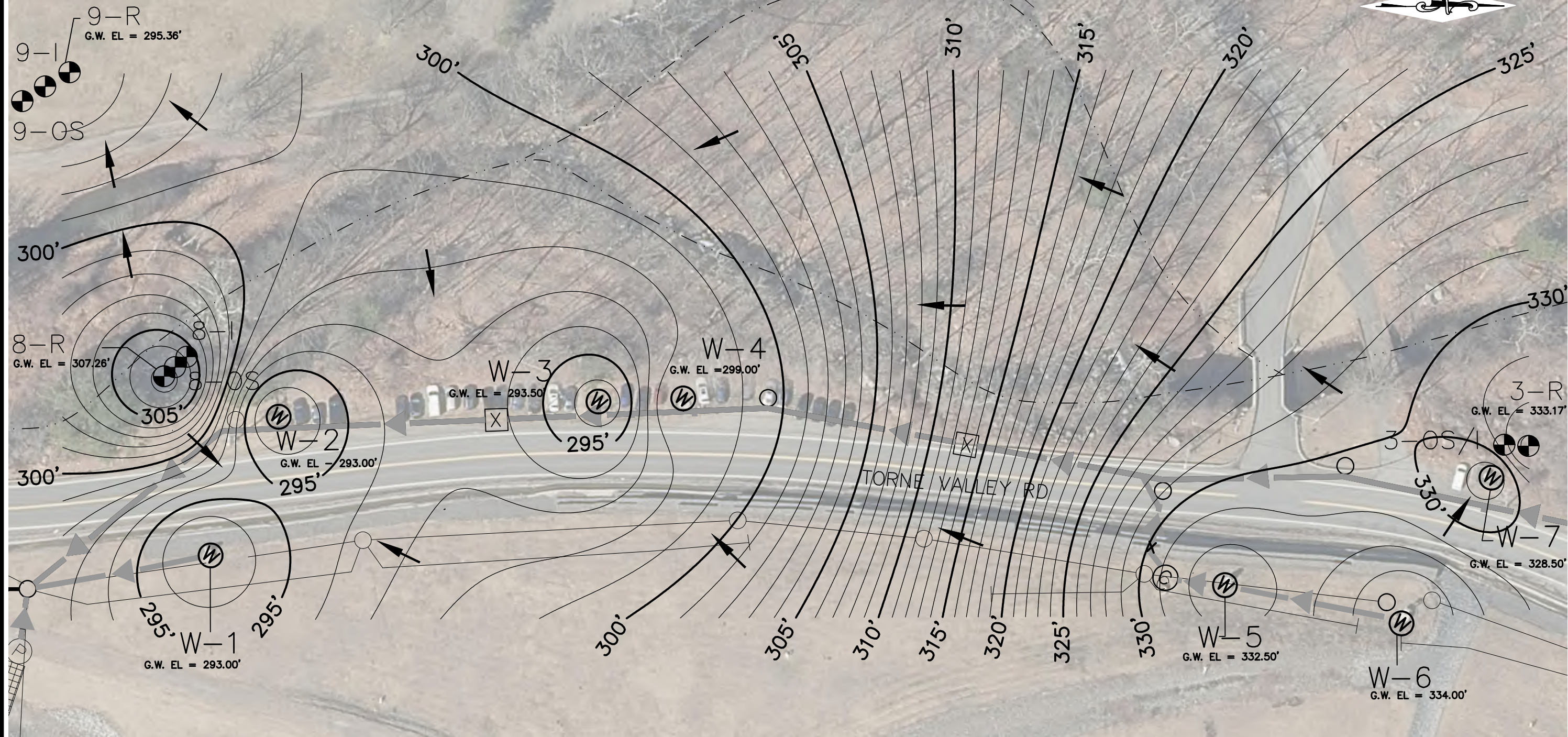
Sterling Environmental Engineering, P.C.
24 Wade Road • Latham, New York 12110

BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS - DAR PUMP ON ELEVATIONS
TOWN OF RAMAPO LANDFILL

TOWN OF RAMAPO

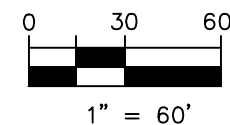
ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 01/22/2024 | SCALE: 1" = 60' | DWG. NO. 20010075 | FIGURE 20



LEGEND:

- 305'** ——— GROUNDWATER ELEVATION CONTOUR MAJOR (5' INTERVAL)
- GROUNDWATER ELEVATION CONTOUR MINOR (1' INTERVAL)
- EXTRACTION WELL PIPING AND FLOW DIRECTION TO LIFT STATION
- APPROXIMATE GROUNDWATER FLOW DIRECTION
- 9-R MONITORING WELL
- G.W. EL. = 298.00' GROUNDWATER ELEVATION
- W-1 RECOVERY WELL



MAP REFERENCE: DISCOVER GIS DATA NY ORTHOIMAGERY, 2021.

STERLING

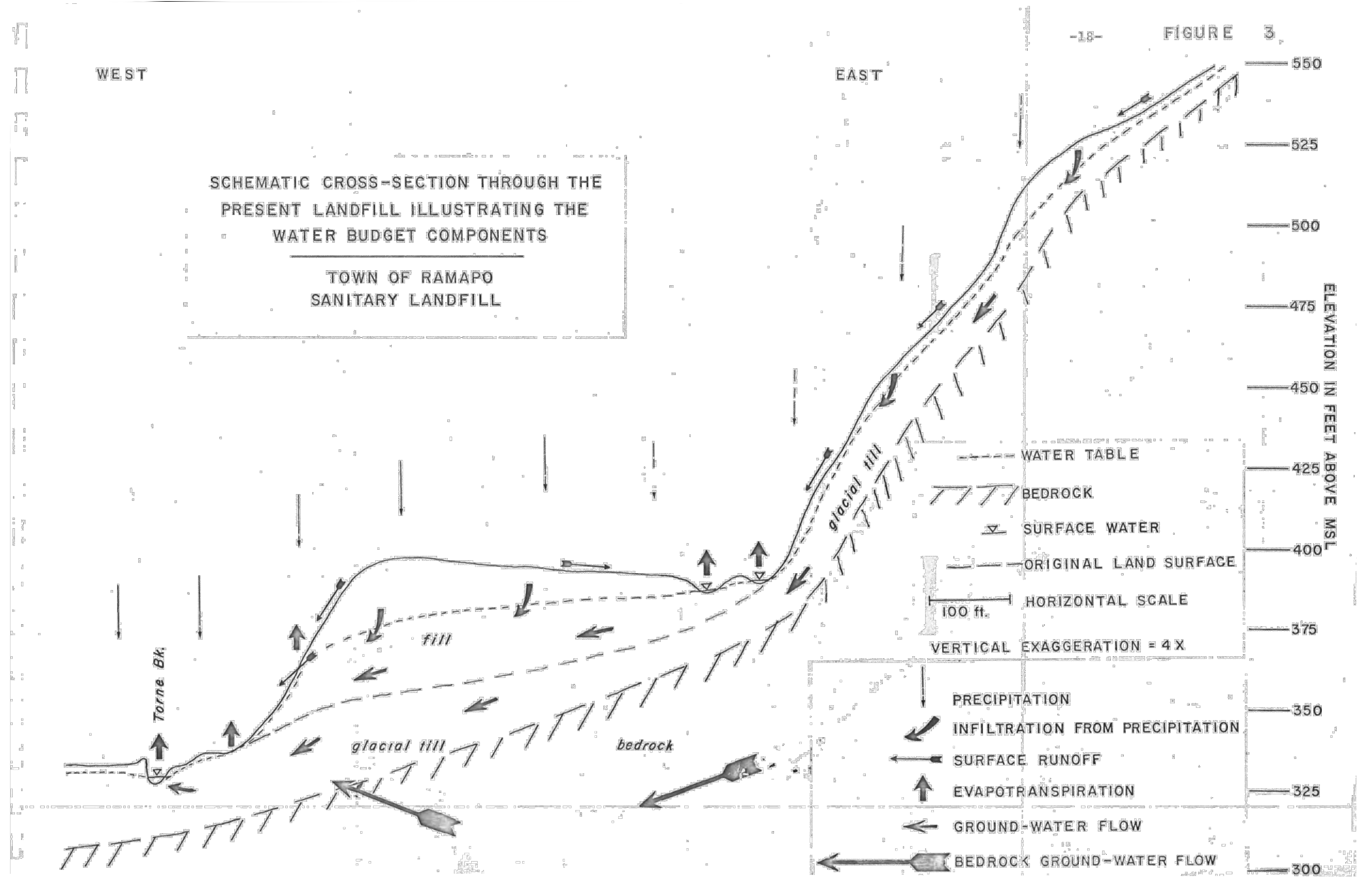
Sterling Environmental Engineering, P.C.
24 Wade Road • Latham, New York 12110

BEDROCK AQUIFER GROUNDWATER ELEVATION
CONTOURS — DAR PUMP OFF ELEVATIONS
TOWN OF RAMAPO LANDFILL

TOWN OF RAMAPO ROCKLAND CO., N.Y.

PROJ. No.: 20010 | DATE: 01/22/2024 | SCALE: 1" = 60' | DWG. NO. 20010077 | FIGURE 21

S:\Sterling\Projects\2000 Projects\Town of Ramapo - 20010\Drawings-Maps-Figures\ACAD\20010081_WATER BUDGET.dwg PAUL.SCHOLAR 1/22/2024 2:48 PM



NOTES: BASEMAP FROM HYDROGEOLOGIC INVESTIGATION PROGRESS REPORT BY LBG,
DATED OCTOBER 1989.

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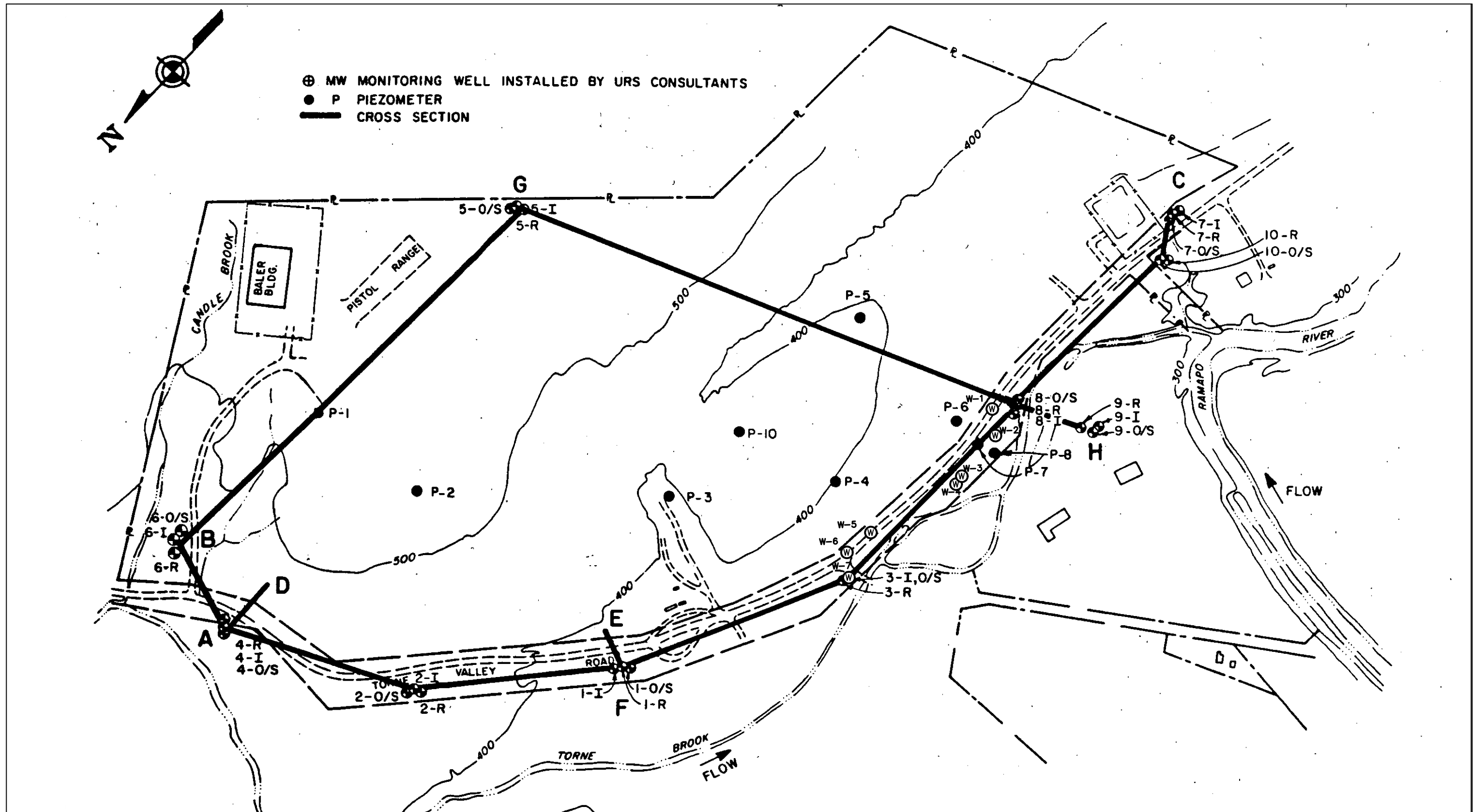
GENERAL WATER BUDGET
TOWN OF RAMAPO
LANDFILL

TOWN OF RAMAPO

ROCKLAND CO., NY

PROJ. No.: 20010 | DATE: 01/18/2023 | SCALE: NTS | DWG. NO. 20010081 | FIGURE 22

S:\Sterling\Projects\2000 Projects\Town of Ramapo\Drawings-Maps-Figures\ACAD\20010078_ Cross-Section Locations.dwg PAUL.SCHOLAR 1/23/2024 10:05 AM



NOTES: BASEMAP FROM REMEDIAL INVESTIGATION AND FEASIBILITY STUDY AT THE RAMAPO LANDFILL BY URS, DATED SEPTEMBER 1991.

LEGEND:

- W-4 (W) GROUNDWATER EXTRACTION WELL
3-R (P) MONITORING WELL

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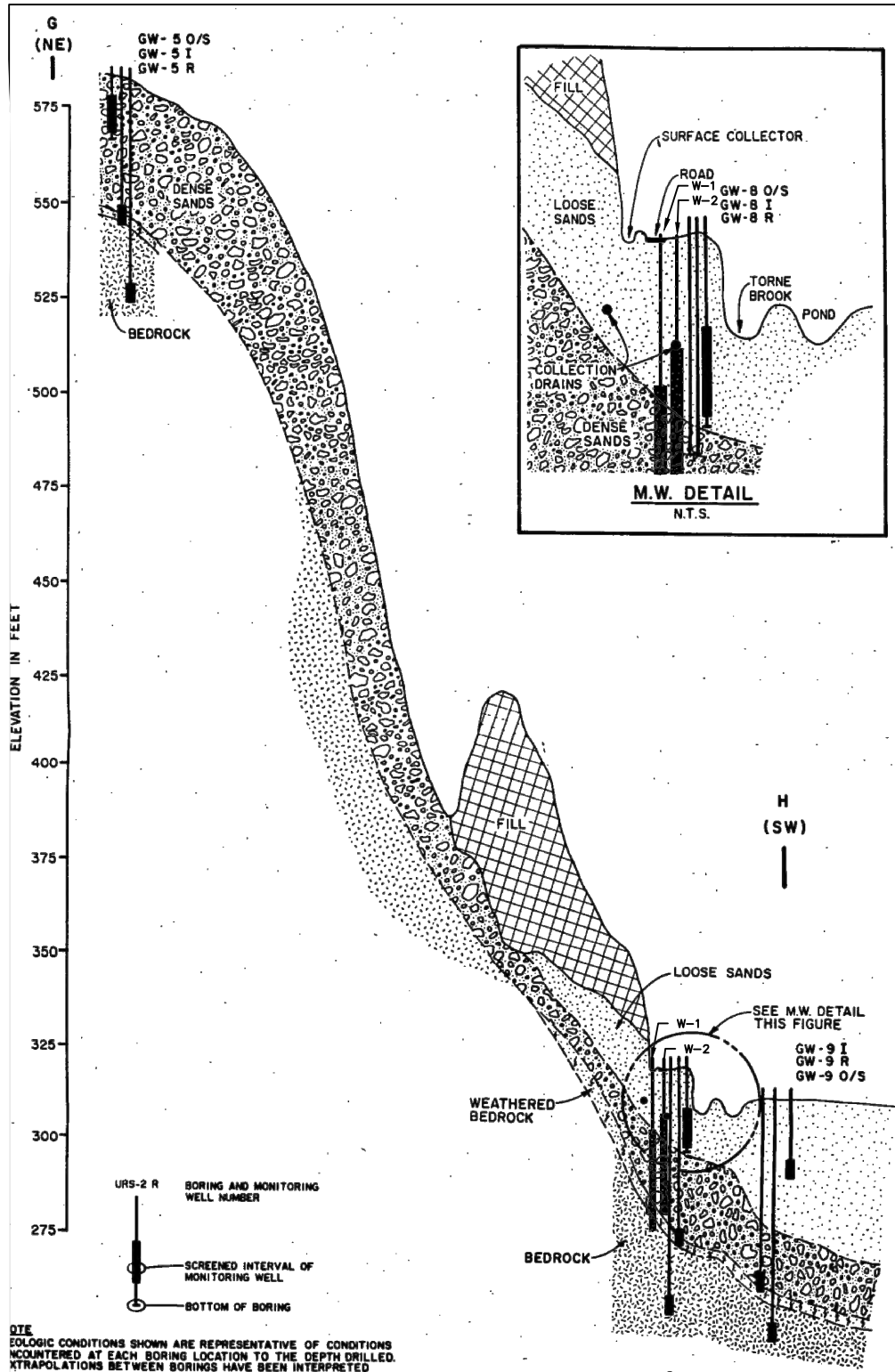
24 Wade Road • Latham, New York 12110

CROSS-SECTION LOCATIONS
TOWN OF RAMAPO
LANDFILL

TOWN OF RAMAPO

ROCKLAND CO., NY

PROJ. No.: 20010 | DATE: 01/18/2023 | SCALE: 1" = 200' | DWG. NO. 20010078 | FIGURE 23



NOTES: BASEMAP FROM REMEDIAL INVESTIGATION AND FEASIBILITY STUDY AT THE RAMAPO LANDFILL BY URS, DATED SEPTEMBER 1991.

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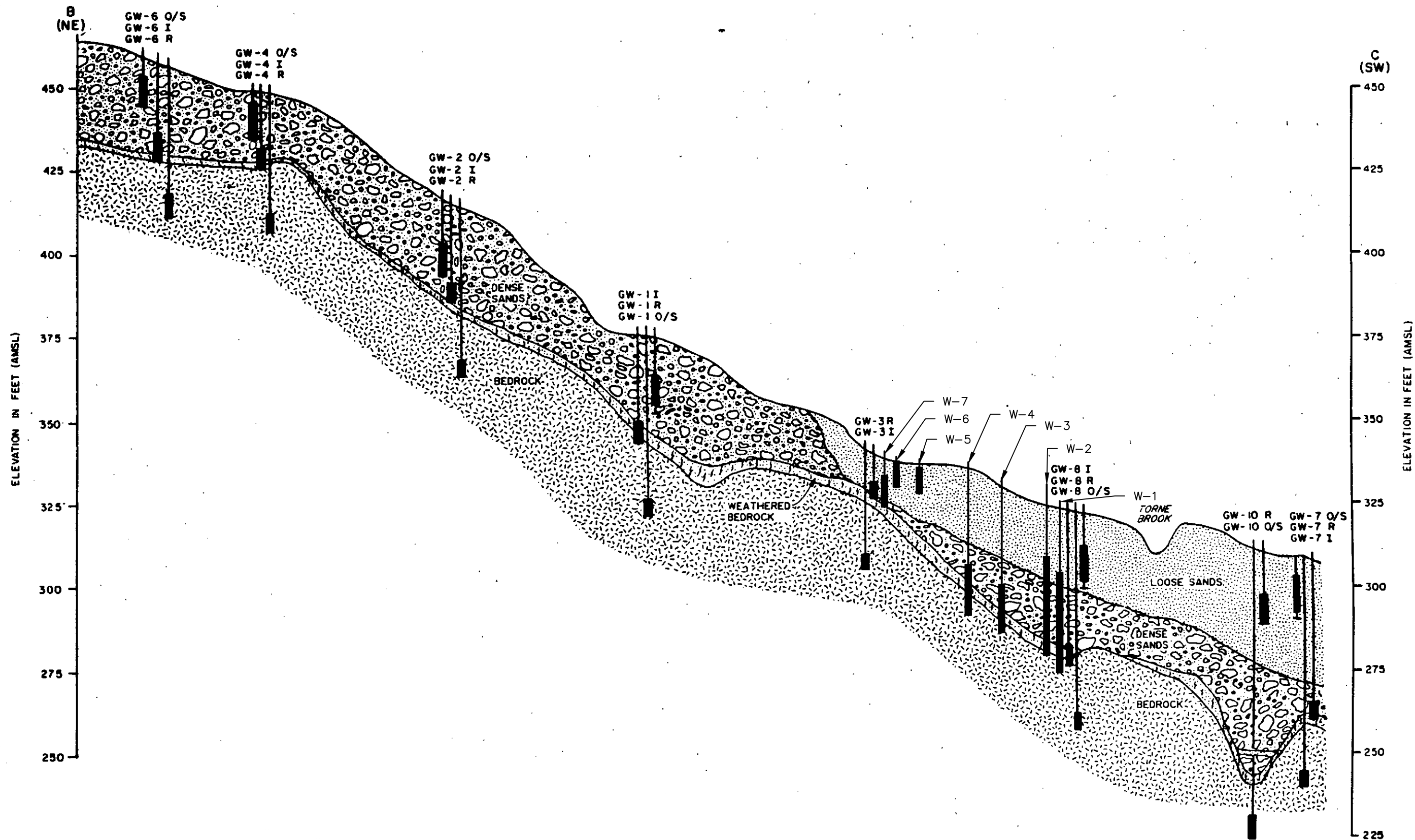
GEOLOGIC CROSS-SECTION G-H TOWN OF RAMAPO LANDFILL

TOWN OF RAMAPO

ROCKLAND CO., NY

PROJ. No.: 20010	DATE: 01/18/2023	SCALE: 1' = 350'	DWG. NO. 20010079	FIGURE 24
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S:\Sterling\Projects\2000 Projects\Town of Ramapo - 20010\Drawings-Maps-Figures\ACAD\20010077_Cross-Section.dwg Section.dwg PAUL SCHOLAR 1/18/2024 1:43 PM



NOTES: BASEMAP FROM REMEDIAL INVESTIGATION AND FEASIBILITY STUDY AT THE RAMAPO LANDFILL BY URS, DATED SEPTEMBER 1991.

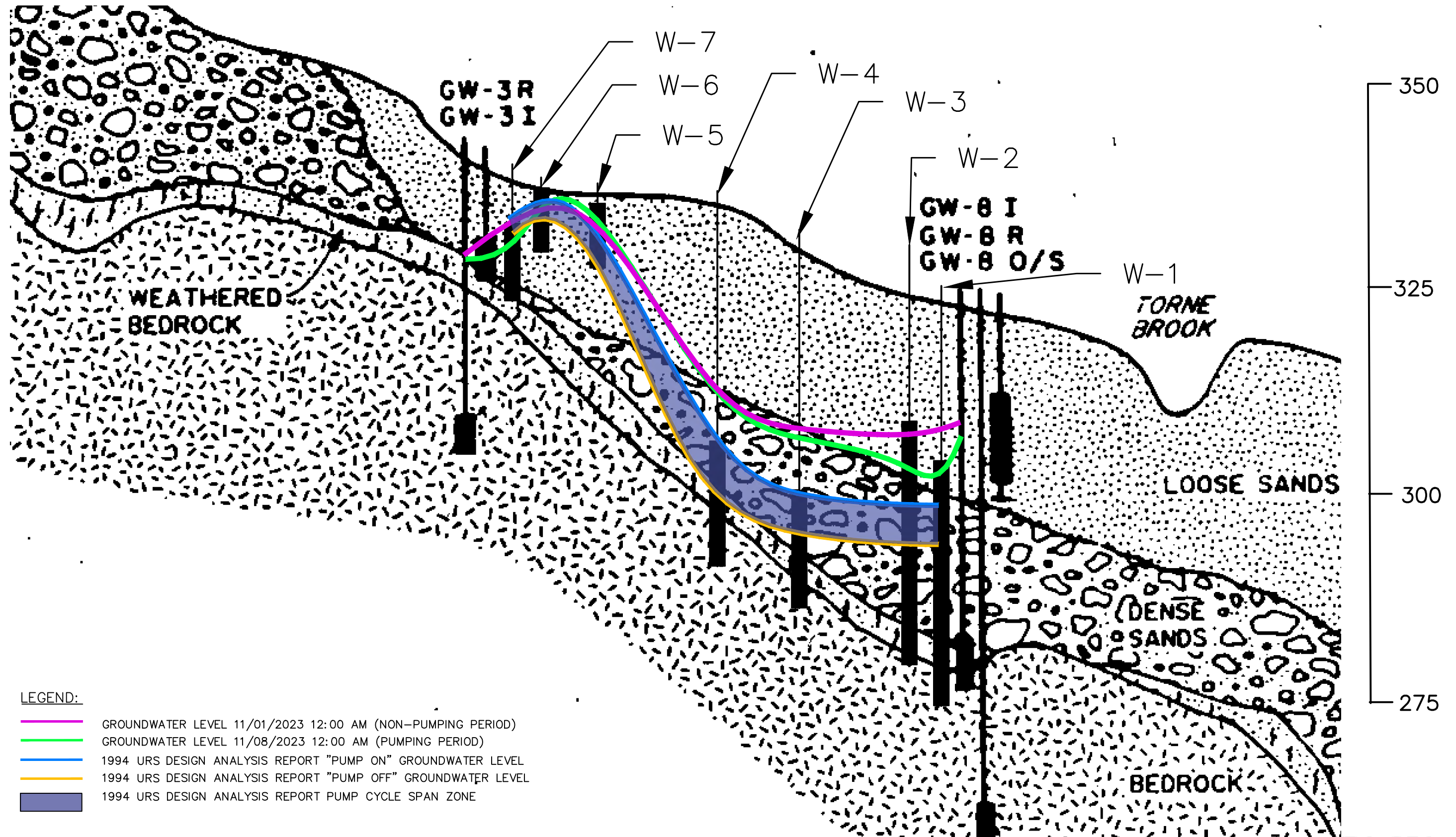
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GEOLOGIC CROSS-SECTION B-C
TOWN OF RAMAPO
LANDFILL

TOWN OF RAMAPOROCKLAND CO., NY

S:\Sterling\Projects\2000 Projects\Town of Ramapo - 20010\Drawings-Maps-Figures\ACAD\20010080_Cross-Section 3--&dwg PAUL SCHOLAR 1/23/2024 10:08 AM



LEGEND:

- GROUNDWATER LEVEL 11/01/2023 12:00 AM (NON-PUMPING PERIOD)
- GROUNDWATER LEVEL 11/08/2023 12:00 AM (PUMPING PERIOD)
- 1994 URS DESIGN ANALYSIS REPORT "PUMP ON" GROUNDWATER LEVEL
- 1994 URS DESIGN ANALYSIS REPORT "PUMP OFF" GROUNDWATER LEVEL
- 1994 URS DESIGN ANALYSIS REPORT PUMP CYCLE SPAN ZONE

NOTES: BASEMAP FROM REMEDIAL INVESTIGATION AND FEASIBILITY STUDY AT THE RAMAPO LANDFILL BY URS, DATED SEPTEMBER 1991.

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PUMPING ANALYSIS CROSS SECTION
TOWN OF RAMAPO
LANDFILL

TOWN OF RAMAPO

ROCKLAND CO., NY

PROJ. No.: 20010 | DATE: 01/18/2023 | SCALE: 1" = 80' | DWG. NO. 20010080 | FIGURE 26

TABLES

Date	Days	W-20			W-1			W-2			W-3			W-4			W-5			W-6			W-7		
		Reading	Gallons	GPD	Reading	Gallons	GPD	Reading	Gallons	GPD	Reading	Gallons	GPD	Reading	Gallons	GPD	Reading	Gallons	GPD	Reading	Gallons	GPD	Reading	Gallons	GPD
1/3/2023	7	3,989,087	9,288	1,327	2,095,014	16,789	2,398	4,108,610	0	0	66,382	0	0	753	0	0	10,045	0	0	--	--	--	142,795	474	68
1/9/2023	6	3,998,298	9,211	1,535	2,109,789	14,775	2,463	4,108,610	0	0	66,382	0	0	755	2	0	10,045	0	0	--	--	--	143,196	401	67
1/18/2023	9	4,010,699	12,401	1,378	2,130,645	20,856	2,317	4,108,616	6	1	66,383	1	0	770	15	2	10,045	0	0	--	--	--	143,764	568	63
1/23/2023	5	4,017,722	7,023	1,405	2,142,903	12,258	2,452	4,108,618	2	0	66,386	3	1	770	0	0	10,045	0	0	26,344	--	--	144,190	426	85
1/30/2023	7	4,028,250	10,528	1,504	2,160,504	17,601	2,514	--	--	--	66,386	0	0	770	0	0	10,045	0	0	26,344	0	0	145,217	1,027	147
2/13/2023	14	4,047,851	19,601	1,400	2,199,092	38,588	2,756	4,108,619	--	--	66,387	1	0	785	15	1	10,057	12	1	26,344	0	0	146,083	866	62
2/23/2023	10	4,060,999	13,148	1,315	2,216,868	17,776	1,778	4,108,678	59	6	66,441	54	5	831	46	5	10,062	5	1	26,344	0	0	146,231	148	15
3/1/2023	6	4,068,529	7,530	1,255	2,230,874	14,006	2,334	4,108,678	0	0	66,441	0	0	831	0	0	--	--	--	--	--	--	146,231	0	0
3/7/2023	6	4,076,565	8,036	1,339	2,245,300	14,426	2,404	4,108,690	12	2	66,452	11	2	855	24	4	--	--	--	--	--	--	146,231	0	0
3/13/2023	6	4,083,647	7,082	1,180	2,259,356	14,056	2,343	4,108,690	0	0	66,452	0	0	855	0	0	--	--	--	--	--	--	146,567	336	56
3/20/2023	7	4,094,775	11,128	1,590	2,277,110	17,754	2,536	4,108,710	20	3	66,475	23	3	900	45	6	10,068	--	--	26,344	--	--	147,027	460	66
3/28/2023	8	4,104,833	10,058	1,257	2,295,745	18,635	2,329	4,108,710	0	0	66,475	0	0	900	0	0	--	--	--	--	--	--	147,479	452	57
4/3/2023	6	4,112,889	8,056	1,343	2,309,938	14,193	2,366	4,108,710	0	0	66,484	9	2	912	12	2	--	--	--	--	--	--	147,557	78	13
4/10/2023	7	4,121,961	9,072	1,296	2,326,514	16,576	2,368	4,108,731	21	3	66,500	16	2	940	28	4	10,072	--	--	26,344	--	--	147,574	17	2
4/17/2023	7	4,131,100	9,139	1,306	2,342,545	16,031	2,290	4,108,736	5	1	66,501	1	0	942	2	0	10,073	1	0	26,344	0	0	147,597	23	3
5/4/2023	17	4,153,335	22,235	1,308	2,382,835	40,290	2,370	4,292,197	183,461	10,792	77,707	11,206	659	960	18	1	--	--	--	26,344	0	0	148,490	893	53
5/10/2023	6	4,160,871	7,536	1,256	2,394,513	11,678	1,946	4,417,369	125,172	20,862	80,243	2,536	423	960	0	0	--	--	--	26,344	0	0	148,635	145	24
5/19/2023	9	4,171,388	10,517	1,169	2,413,734	19,221	2,136	4,584,187	166,818	18,535	80,268	25	3	1,133	173	19	--	--	--	26,344	0	0	148,637	2	0
5/22/2023	3	--	--	--	2,420,003	6,269	2,090	4,657,495	73,308	24,436	80,268	0	0	1,133	0	0	--	--	--	--	--	--	148,637	0	0
5/24/2023	2	--	--	--	2,424,157	4,154	2,077	4,699,366	41,871	20,936	80,268	0	0	1,133	0	0	--	--	--	--	--	--	--	--	--
5/30/2023	6	4,184,406	--	--	2,436,006	11,849	1,975	4,824,036	124,670	20,778	80,269	1	0	1,134	1	0	10,095	--	--	26,344	--	--	148,639	--	--
6/7/2023	8	--	--	--	2,451,011	15,005	1,876	4,984,185	160,149	20,019	80,269	0	0	1,136	2	0	--	--	--	--	--	--	148,639	0	0
6/9/2023	2	--	--	--	2,454,954	3,943	1,972	5,025,564	41,379	20,690	80,269	0	0	1,136	0	0	--	--	--	--	--	--	148,639	0	0
6/12/2023	3	--	--	--	2,460,483	5,529	1,843	5,084,729	59,165	19,722	80,269	0	0	1,136	0	0	--	--	--	--	--	--	148,639	0	0
6/14/2023	2	--	--	--	2,464,355	3,872	1,936	5,126,482	41,753	20,877	80,269	0	0	1,136	0	0	--	--	--	--	--	--	148,639	0	0
6/16/2023	2	--	--	--	2,467,677	3,322	1,661	--	--	--	80,269	0	0	1,136	0	0	--	--	--	--	--	--	148,639	0	0
6/20/2023	4	4,205,383	--	--	2,474,927	7,250	1,813	5,241,952	--	--	80,269	0	0	1,136	0	0	10,095	--	--	26,344	--	--	148,639	0	0
6/26/2023	6	4,210,377	4,994	832	2,486,106	11,179	1,863	--	--	--	80,269	0	0	1,136	0	0	10,095	0	0	26,344	0	0	148,639	0	0
6/30/2023	4	--	--	--	2,495,937	9,831	2,458	5,434,281	--	--	80,269	0	0	1,136	0	0	--	--	--	--	--	--	148,803	164	41
7/6/2023	6	4,219,891	--	--	2,510,910	14,973	2,496	5,547,381	113,100	18,850	81,161	892	149	1,136	0	0	10,095	--	--	26,344	--	--	148,824	21	4
7/14/2023	8	4,231,660	11,769	1,471	2,537,486	26,576	3,322	5,690,344	142,963	17,870	96,274	15,113	1,889	1,136	0	0	10,095	0	0	26,344	0	0	149,280	456	57
7/19/2023	5	4,238,765	7,105	1,421	--	--	--	5,776,345	86,001	17,200	109,723	13,449	2,690	1,136	0	0	10,095	0	0	26,344	0	0	149,508	228	46
7/28/2023	9	4,249,375	10,610	1,179	2,578,947	--	--	5,924,236	147,891	16,432	132,420	22,697	2,522	1,136	0	0	--	--	--	--	--	--	149,888	380	42
7/31/2023	3	4,252,879	3,504	1,168	2,578,947	0	0	5,972,722	48,486	16,162	134,759	2,339	780	1,136	0	0	10,095	--	--	26,344	--	--	149,888	0	0
8/8/2023	8	4,261,390	8,511	1,064	2,591,360	12,413	1,552	6,100,254	127,532	15,942	135,714	955	119	1,136	0	0	--	--	--	--	--	--	149,888	0	0
8/14/2023	6	4,267,913	6,523	1,087	2,605,341	13,981	2,330	6,197,823	97,569	16,262	136,611	897	150	1,136	0	0	--	--	--	--	--	--	149,901	13	2
8/30/2023	16	4,287,109	19,196	1,200	--	--	--	6,355,276	157,453	9,841	--	--	--	--	--	--	--	--	--	--	--	--	150,225	324	20
9/6/2023	7	4,294,076	6,967	995	2,644,863	--	--	6,462,726	107,450	15,350	--	--	--	1,138	--	--	--	--	--	--	--	--	150,232	7	1
9/12/2023	6	4,299,743	5,667	945	2,659,137	14,274	2,379	6,548,729	86,003	14,334	--	--	--	1,145	7	1	--	--	--	--	--	--	150,240	8	1
9/18/2023	6	4,306,443	6,700	1,117	2,675,156	16,019	2,670	6,633,082	84,353	14,059	--	--	--	1,158	13	2	--	--	--	--	--	--	150,376	136	23
9/26/2023	8	4,315,804	9,361	1,170	2,698,726	23,570	2,946	6,740,050	106,968	13,371	--	--	--	1,167	9	1	--	--	--	--	--	--	150,757	381	48
10/6/2023	10	4,328,203	12,399	1,240	2,728,185	29,459	2,946	6,863,860	123,810	12,381	206,941	--	--	1,177	10	1	--	--	--	--	--	--	151,434	677	68
10/11/2023	5	4,335,017	6,814	1,363	2,743,473	15,288	3,058	6,917,027	53,167	10,633	230,860	23,919	4,784	1,177	0	0	--	--	--	--	--	--	151,705	271	54
10/16/2023	5	4,341,220	6,203	1,241	2,758,252	14,779	2,956	6,964,367	47,340	9,468	249,802	18,942	3,788	1,185	8	2	--	--	--	--	--	--	151,759	54	11
10/23/2023	7	4,349,525	8,305	1,186	2,777,758	19,506	2,787	--	--	--	273,050	23,248	3,321	1,193	8	1	--	--	--	--	--	--	151,842	83	12
10/30/2023	7	4,357,781	8,256	1,179	2,796,693	18,935	2,705	7,085,283	--	--	293,991	20,941	2,992	1,193	0	0	--	--	--	--	--	--	151,884	42	6
10/31/2023	1	4,359,330	1,549	1,549	--	--	--	7,097,522	12,239	12,239	295,057	1,066	1,066	1,193	0	0	--	--	--	--	--	--	151,884	0	0
11/14/2023	14	4,375,446	16,116	1,151	2,834,465	--	--	7,176,726	79,204	5,657	335,929	40,872	2,919	1,220	27	2	--	--	--	--	--	--	151,942	58	4
11/22/2023	8	4,384,877	9,431	1,179	2,859,378	24,913	3,114	7,236,486	59,760	7,470	354,983	19,054	2,382	1,237	17	2	--	--	--	--	--	--	151,961	19	2
12/8/2023	16	4,403,644	18,767	1,173	2,911,163	51,785	3,237	7,341,263	104,777	6,549	421,247	66,264	4,142	1,247	10	1	--	--	--	--	--	--	152,482	521	33
12/12/2023	4	4,408,856	5,212	1,303	2,924,985	13,822	3,456	7,366,609	25,346	6,337	440,168	18,921	4,730	1,256	9	2	--	--	--	--	--	--	152,699	217	54
12/18/2023	6	4,419,793	10,937	1,823	2,944,149	19,164	3,194	--	--	--	471,321	31,153	5,192	1,261	5	1	--	--	--	--	--	--	152,993	294	49
12/26/2023	8	4,429,655																							

Table 2
Groundwater Analytical Results October 24 and 30, 2023
Town of Ramapo Landfill
Capature Zone Analysis

ANALYTE	TOGS 1.1.1.	W-1	W-2	W-3	W-4	W-5	W-6	W-7	A-5	W-20
		10/24/2023	10/24/2023	10/24/2023	10/24/2023	10/24/2023	10/24/2023	10/24/2023	10/30/2023	10/30/2023
TOTAL METALS, mg/L										
Aluminum, Total	---	1.89	0.45	0.00376 J	0.0112	0.0554	0.0353	0.0102	0.00518 J	0.00336 J
Antimony, Total	0.003	0.00042 U	0.00042 U	0.00042 U	0.00042 U	0.00042 U	0.00042 U	0.00042 U	0.00042 U	0.00042 U
Arsenic, Total	0.025	0.01816	0.00142	0.00178	0.00055	0.00873	0.00256	0.00018 J	0.00168	0.00024 J
Barium, Total	1	0.3466	0.01592	0.01984	0.0196	0.09761	0.01856	0.03929	0.0293	0.01074
Beryllium, Total	0.003	0.00038 J	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U
Cadmium, Total	0.005	0.00018 J	0.00008 J	0.00005 U	0.00005 U	0.00007 J	0.00005 U	0.00005 U	0.00005 U	0.00005 U
Calcium, Total	---	75.6	12.7	44.5	45.1	129	60.9	86.8	73	70.8
Chromium, Hexavalent	0.05	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U	0.003 U
Chromium, Total	0.05	0.00767	0.2043	0.00025 J	0.00141	0.00137	0.00211	0.00149	0.00036 J	0.00026 J
Cobalt, Total	---	0.01025	0.0017	0.00203	0.00113	0.01218	0.00041 J	0.00016 U	0.00096	0.00049 J
Copper, Total	0.2	0.00642	0.00939	0.00061 J	0.00127	0.00812	0.0025	0.0015	0.0018	0.00096 J
Iron, Total	0.3	106	3.51	2.97	1.16	26.1	4.55	0.0364 J	2.12	0.476
Lead, Total	0.025	0.00943	0.00147	0.00034 U	0.00034 U	0.00035 J	0.00034 U	0.00034 U	0.00034 U	0.00034 U
Magnesium, Total	35	26.7	3.08	10.8	12	33.5	8.46	17.7	15.4	17.3
Manganese, Total	0.3	4.343	0.2378	1.122	0.2642	2.122	0.3676	0.2507	0.5542	0.7531
Mercury, Total	0.0007	0.00009 U	0.00009 U	0.00009 U	0.00009 U	0.00009 U	0.00009 U	0.00009 U	0.00009 U	0.00009 U
Nickel, Total	0.1	0.0172	0.00935	0.00141 J	0.00693	0.01417	0.00133 J	0.00514	0.00193 J	0.00055 U
Potassium, Total	---	12	0.961	3.51	2.2	29.3	13.9	2.25	3.77	2.39
Selenium, Total	0.01	0.00335 J	0.00173 U	0.00173 U	0.00173 U	0.00173 U	0.00173 U	0.00173 U	0.00173 U	0.00173 U
Silver, Total	0.05	0.00016 U	0.00016 U	0.00016 U	0.00016 U	0.00016 U	0.00016 U	0.00016 U	0.00016 U	0.00016 U
Sodium, Total	20	31.2	11.4	68.1	65	71.8	28	17.3	76.5	6.01
Thallium, Total	0.0005	0.00022 J	0.00014 U	0.00014 U	0.00014 J	0.00014 U	0.00014 U	0.00014 U	0.00014 U	0.00014 U
Vanadium, Total	---	0.00273 J	0.00478 J	0.00157 U	0.00157 U	0.00157 J	0.0016 J	0.00157 U	0.00157 U	0.00157 U
Zinc, Total	2	0.5833	0.02276	0.00386 J	0.00722 J	0.1146	0.01171	0.00341 U	0.00341 U	0.00341 U

Notes:
Reg 1 - NYS TOGs 1.1.1: Water Quality Standards & Guidance Values: GA Water Class for Standard and Guidance Values; Eff. June 2004
Bold = Value indicates reported concentration exceeds applicable water quality standard.
U = Not Detected (ND). The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
J = Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

Table 2
Groundwater Analytical Results October 24 and 30, 2023
Town of Ramapo Landfill
Capature Zone Analysis

ANALYTE	TOGS 1.1.1.	3-OS/I	3-R	8-OS	8-I	8-R	9-OS	9-I	9-R	10-OS	10-I	10-R
		10/30/2023	10/30/2023	10/30/2023	10/30/2023	10/30/2023	10/30/2023	10/30/2023	10/30/2023	10/30/2023	10/30/2023	10/30/2023
TOTAL METALS, mg/L												
Aluminum, Total	---	0.0469	0.0155	0.00327 U	0.00327 U	0.00629 J	0.0193	0.00617 J	0.00327 U	0.416	0.0051 J	0.0153
Antimony, Total	0.003	0.00042 U	0.00042 U	0.00042 U	0.00042 U	0.00042 U	0.00136 J	0.00042 U	0.00042 U	0.00042 U	0.00042 U	0.00042 U
Arsenic, Total	0.025	0.00016 U	0.00021 J	0.00016 U	0.00031 J	0.00037 J	0.00019 J	0.00016 U	0.00024 J	0.00021 J	0.00016 U	0.00016 U
Barium, Total	1	0.01126	0.03781	0.00525	0.01477	0.00595	0.00552	0.0079	0.00668	0.01092	0.00109	0.00314
Beryllium, Total	0.003	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.0001 U	0.00017 J	0.0001 U	0.0001 U
Cadmium, Total	0.005	0.00005 U	0.00043	0.00005 U	0.00005 U	0.00006 J	0.00007 J	0.00005 U	0.0006	0.00008 J	0.00005 U	0.00005 U
Calcium, Total	---	83.8	50.4	16.6	23.7	160	7.15	8.02	44.5	3.17	10.6	10.1
Chromium, Hexavalent	0.05	0.07	0.003 U	0.007 J	0.003 U	0.14	0.003 U	0.003 U	0.004 J	0.003 J	0.003 U	0.003 U
Chromium, Total	0.05	0.2209	0.1683	0.01255	0.00019 J	0.143	0.00314	0.00618	0.00589	0.00036 J	0.00036 J	0.00266
Cobalt, Total	---	0.00046 J	0.00403	0.00016 J	0.00084	0.00163	0.00016 U	0.00016 U	0.00023 J	0.0004 J	0.00016 U	0.00016 U
Copper, Total	0.2	0.00168	0.00746	0.00042 J	0.00038 U	0.00174	0.00061 J	0.00039 J	0.00131	0.00093 J	0.00044 J	0.00063 J
Iron, Total	0.3	1.28	3.19	0.0483 J	0.73	0.299	0.0668	0.0416 J	0.101	0.231	0.0191 U	0.0241 J
Lead, Total	0.025	0.00034 U	0.00034 U	0.00034 U	0.00034 U	0.00034 U	0.00034 U	0.00034 U	0.00034 U	0.00034 U	0.00034 U	0.00034 U
Magnesium, Total	35	12.1	14.3	3.64	4.35	43.7	1.86	1.93	11.1	0.524	2.9	1.93
Manganese, Total	0.3	0.05334	15.02	0.01083	5.592	0.1144	0.00301	0.1622	0.5287	0.02941	0.00044 U	0.00344
Mercury, Total	0.0007	0.00009 U	0.00009 U	0.00009 U	0.00009 U	0.00009 U	0.00009 U	0.00009 U	0.00009 U	0.0001 J	0.00009 U	0.00009 U
Nickel, Total	0.1	0.1056	0.1185	0.02178	0.00173 J	0.01726	0.00055 U	0.00055 U	0.1132	0.00065 J	0.00055 U	0.00221
Potassium, Total	---	2.59	1.97	1.15	1.83	3.18	0.872	0.96	9.33	0.383	0.854	0.641
Selenium, Total	0.01	0.00173 U	0.00173 U	0.00173 U	0.00173 U	0.00173 U	0.00173 U	0.00173 U	0.00173 U	0.00173 U	0.00173 U	0.00173 U
Silver, Total	0.05	0.00016 U	0.00016 U	0.00016 U	0.00016 U	0.00016 U	0.00016 U	0.00016 U	0.00016 U	0.00016 U	0.00016 U	0.00016 U
Sodium, Total	20	19.7	91.7	12.2	18.4	42.3	5.05	14.8	55.1	2.43	3.87	3.74
Thallium, Total	0.0005	0.00014 U	0.00014 U	0.00014 U	0.00014 U	0.00014 U	0.00014 U	0.00014 U	0.00014 U	0.00014 U	0.00014 U	0.00014 U
Vanadium, Total	---	0.00157 U	0.00157 U	0.00157 U	0.00157 U	0.00157 U	0.00157 U	0.00157 U	0.00157 U	0.00157 U	0.00157 U	0.00157 U
Zinc, Total	2	0.00341 U	0.00635 J	0.00341 U	0.00341 U	0.00341 U	0.00341 U	0.00341 U	0.00341 U	0.00341 U	0.00341 U	0.00341 U

Notes:
Reg 1 - NYS TOGs 1.1.1: Water Quality Standards & Guidance Values: GA Water Class for Standard and Guidance Values; Eff. June 2004
Bold = Value indicates reported concentration exceeds applicable water quality standard.
U = Not Detected (ND). The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
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Table 3
Summary of Groundwater Elevations
Ramapo Landfill October 25 - November 8, 2023

Date/Time	Groundwater Elevation (ft)									
	Extraction Wells							Monitoring Wells (Deep)		
	W-1	W-2	W-3	W-4	W-5	W-6	W-7	3-R	8-R	9-R
10/25/2023 0:00	301.24	304.26	305.87	307.98	329.45	334.85	332.42	333.22	307.40	295.55
10/26/2023 0:00	300.68	304.12	305.98	307.84	329.51	334.87	333.00	333.19	307.33	295.44
10/27/2023 0:00	302.18	304.10	306.03	307.79	329.49	334.87	332.99	333.16	307.28	295.42
10/28/2023 0:00	301.40	304.08	306.00	307.75	329.40	334.93	333.06	333.14	307.26	295.36
10/29/2023 0:00	302.64	304.08	305.90	307.75	329.41	335.04	332.92	333.08	307.23	295.32
10/30/2023 0:00	301.23	304.22	305.99	307.74	329.47	335.08	332.83	333.16	307.32	295.37
10/31/2023 0:00	307.20	305.55	306.75	308.06	329.54	334.87	333.46	333.37	307.65	295.73
11/1/2023 0:00	307.33	305.73	307.20	308.50	329.57	334.82	333.72	333.45	307.79	295.88
11/2/2023 0:00	307.31	305.77	307.34	308.67	329.50	334.79	333.74	333.37	307.76	295.90
11/3/2023 0:00	307.32	305.78	307.41	308.77	329.59	334.79	333.73	333.37	307.71	295.83
11/4/2023 0:00	302.38	304.58	306.02	308.20	329.63	334.78	332.76	333.31	307.45	295.65
11/5/2023 0:00	300.66	304.38	305.91	307.97	329.71	334.79	332.95	333.28	307.36	295.58
11/6/2023 0:00	302.35	304.27	305.33	307.89	329.61	334.78	332.88	333.21	307.30	295.47
11/7/2023 0:00	300.68	304.19	306.04	307.86	329.62	334.77	333.03	333.23	307.25	295.38
11/8/2023 0:00	300.68	304.23	305.96	397.81	329.55	334.74	332.95	333.17	307.26	295.36

Summary of Historical Groundwater Quality Results - Benzene (ug/L)
Town of Ramapo Landfill

Well ID	1-OS/I	2-OS	3-OS/I	4-OS	5-OS	5-I	7-OS	8-OS	8-I	8-R
Location	Downgradient	Downgradient	Downgradient	Crossgradient	Upgradient	Upgradient	Crossgradient	Downgradient	Downgradient	Downgradient
Jan-90	ND	ND	ND	ND	2.0	NA	ND	2.0	2.0	3.0
Sep-90	ND	ND	ND	0.3	ND	NA	ND	0.3	2.9	0.4
Jan-93	ND	NA	ND	ND	ND	NA	ND	ND	NA	ND
Apr-93	ND	ND	ND	ND	ND	NA	ND	ND	ND	0.9
Sep-93	ND	ND	ND	ND	NA	NA	ND	ND	ND	ND
Dec-93	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND
Mar-94	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND
Jun-94	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Sep-94	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND
Dec-94	ND	ND	ND	ND	NA	ND	ND	ND	2.0	ND
Mar-95	ND	ND	ND	ND	NA	ND	ND	ND	ND	2.0
Jun-95	ND	ND	ND	ND	ND	NA	NA	ND	ND	0.9
Sep-95	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND
Dec-95	ND	ND	ND	ND	NA	ND	ND	ND	1.2	0.7
Mar-96	ND	ND	ND	ND	ND	NA	ND	ND	1.0	ND
Jun-96	NA	NA	NA	NA	NA	NA	NA	ND	2.0	ND
Sep-96	ND	NA	ND	ND	NA	ND	ND	ND	2.0	ND
Dec-96	NA	NA	NA	NA	NA	NA	NA	ND	3.0	ND
Mar-97	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND
Jun-97	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND
Sep-97	ND	ND	ND	ND	NA	ND	ND	ND	2.0	ND
Dec-97	NA	NA	NA	NA	NA	NA	NA	ND	ND	2.0
Mar-98	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND
Jun-98	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND
Sep-98	ND	ND	ND	ND	NA	ND	ND	ND	ND	ND
Mar-99	ND	ND	ND	ND	ND	NA	ND	ND	NA	ND
Jun-99	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND
Sep-99	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Mar-00	ND	ND	ND	ND	ND	NA	ND	ND	0.5 J	ND
Sep-00	NA	NA	NA	NA	NA	NA	NA	ND	ND	ND
Dec-00	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND
Mar-01	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND
Oct-03	NA	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U
Mar-04	NA	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	0.6 J	1.0 U
Jun-05	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U
Sep-06	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U
Oct-07	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U
Mar-09	0.5 U	0.5 U	0.5 U	0.5 U	0.5 U	NA	0.5 U	0.5 U	0.5 U	0.5 U
May-10	1.0 U	1.0 U	1.0 U	1.0 U	1.0 U	NA	1.0 U	1.0 U	1.0 U	1.0 U
Sep-11	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND
Nov-12	ND	ND	ND	ND	NA	NA	ND	ND	ND	ND
Mar-14	ND	ND	ND	ND	ND	NA	ND	ND	ND	ND
Jul-15	0.31 U	0.31 U	0.31 U	0.31 U	0.3 U	NA	0.31 U	0.31 U	0.31 U	0.31 U
Jan-17	0.23 U	0.23 U	0.23 U	0.23 U	NA	NA	0.23 U	0.23 U	0.23 U	0.23 U
May-18	0.00 U	0.00 U	0.00 U	0.00 U	NA	NA	0.0025 U	0.0025 U	0.0025 U	0.0025 U
Jul-19	0.16 U	0.16 U	0.16 U	0.16 U	NA	NA	0.16 U	0.16 U	0.16 U	0.16 U
Oct-20	0.16 U	0.16 U	0.16 U	0.16 U	NA	NA	0.16 U	0.16 U	0.16 U	0.16 U
Jan-22	0.16 U	0.16 U	0.16 U	0.16 U	NA	NA	0.16 U	0.16 U	0.16 U	0.16 U
May-23	0.16 U	0.16 U	0.16 U	0.16 U	NA	NA	0.16 U	0.16 U	0.16 U	0.16 U

Statistics Summary										
Count	49	49	49	49	49	49	49	49	24	49
Minimum	0.00	0.00	0.00	0.00	0.31	1.00	0.0025	0.0025	0.0025	0.0025
Maximum	1	1	1	1	2	1	1	2	3	3
Mean	0.390	0.477	0.477	0.466	0.830	1.000	0.477	0.561	1.037	0.787
St. Dev.	0.327	0.373	0.373	0.363	0.581	0.000	0.373	0.520	0.901	0.748
10-Prcntl	0.16	0.16	0.16	0.16	0.42	1.00	0.16	0.16	0.16	0.16
Median	0.3	0.4	0.4	0.3	0.5	1.0	0.4	0.4	0.8	0.5
90-Prcntl	1.0	1.0	1.0	1.0	1.4	1.0	1.0	1.0	2.0	2.0

Notes:

Value in **BOLD** indicates an exceedance of the applicable water quality standard or guidance value.

U = Not detected (ND). The analyte was analyzed for, but was not detected above the reported method detection limit.

J = Result is less than reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.

ND = Not Detected. Non-detect concentrations and not analyzed events are not represented in statistics summary.

NA = Not Analyzed

Summary of Historical Groundwater Quality Results - Benzene (ug/L)
Town of Ramapo Landfill

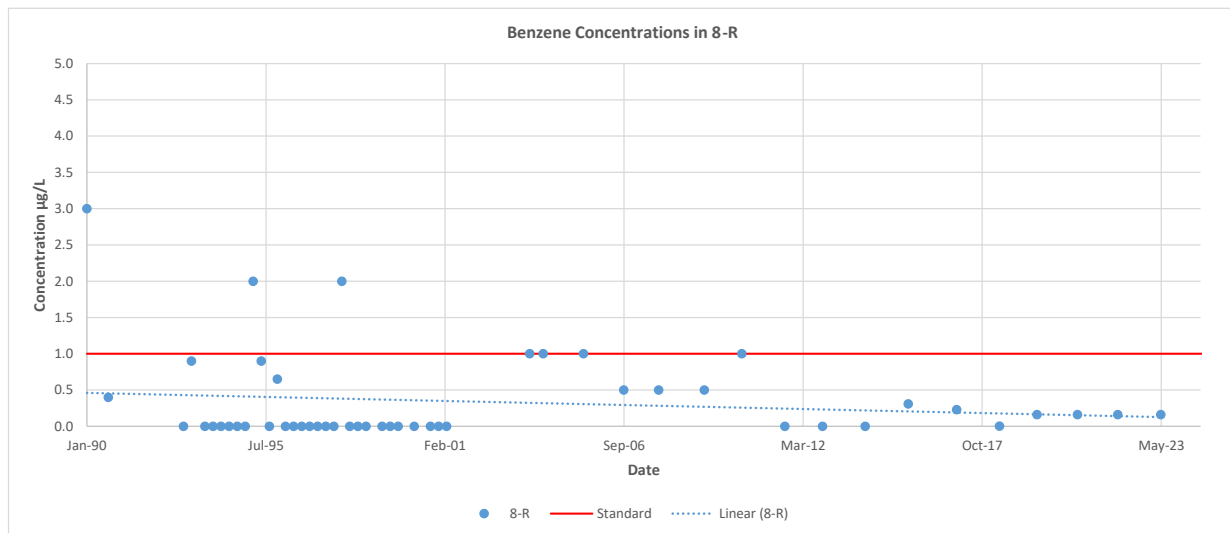
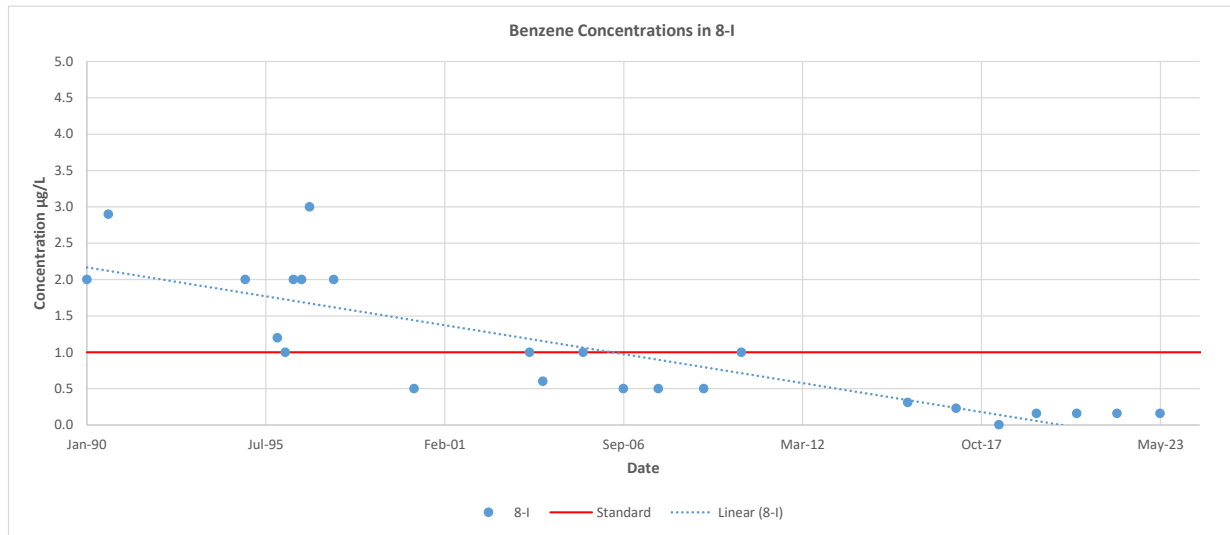


Table 5

Summary of Historical Groundwater Quality Results - Chromium (mg/L)
Town of Ramapo Landfill

Well ID DATE	Well 1-OS	Well 1-R	Well 2-OS	Well 2-R	Well 3-OS/I	Well 3-R	Well 4-OS	Well 4-R	Well 5-OS	Well 5-I	Well 5-R	Well 7-OS	Well 7-R	Well 8-OS	Well 8-I	Well 8-R	Well 9-OS	Well 9-I	Well 9-R	Well 10-OS	Well 10-I	Well 10-R	Well UP-OS	Well UP-I	Well UP-R	PW-1	PW-2	SVWC-93	SVWC-94	SVWC-95	SVWC-96	
Jan-90	0.1530	0.0397	0.1800	0.0161	0.5870	0.0280	0.1390	0.1350	0.0900	0.1430	0.0274	0.0335	0.0162	0.0348	0.2150	0.0200	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sep-90	0.0573	0.0175	0.1410	0.0055	1.2900	0.0114	0.0401	0.0706	0.0356	0.0488	0.0293	0.0401	0.0168	0.0167	0.0325	0.0231	0.0068	0.0081	0.0088	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA
Jan-93	0.0080	ND	ND		0.8070	ND	0.0058	NA	0.0488	NA	0.0068	0.0242	ND	ND	NA	0.0099	ND	NA	0.0039	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Apr-93	ND	ND	ND		0.0404	ND	ND	NA	ND	NA	ND	0.0130	ND	ND	NA	ND	ND	NA	0.0164	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	ND	ND
Sep-93	0.0600	0.0849	0.0502	0.0148	1.3500	ND	0.0108	NA	NA	NA	ND	1.8900	ND	ND	NA	0.0177	ND	NA	0.0167	NA	NA	NA	NA	NA	ND	ND	ND	NA	NA	ND	NA	NA
Dec-93	0.2570	0.0468	0.0959	0.0061	1.1000	0.0147	0.0112	NA	NA	0.0800	0.0086	0.2180	ND	0.0076	NA	0.0182	ND	NA	0.0116	NA	NA	NA	NA	NA	ND	0.0049	ND	NA	NA	NA	ND	
Jun-99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0202	0.0568	0.0020	0.0011	0.0068	0.0150	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	
Sep-99	1.8500	0.0734	0.2850	ND	0.3210	0.0757	0.0877	ND	NA	0.0106	0.0027	0.0592	ND	0.0310	ND	ND	ND	ND	0.0473	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	NA
May-00	2.1000	0.0586	0.4150	0.0040 B	0.6870	0.0512	0.0368	0.0005 U	0.0693	NA	0.0147	0.2000	0.0005 U	0.0301	0.0100	0.0011 B	0.0345	0.0108	0.0030 B	NA	NA	NA	NA	NA	NA	0.0008 B	0.0005 U	0.0005 U	0.0005 B	0.0005 U	0.0005 U	
Sep-00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0169 B	0.0173	0.0022 B	0.0074 B	0.0050 B	0.0016 B	NA	NA	NA	NA	NA	NA	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	
Dec-00	0.4050	0.0098 B	0.1200	0.0047 B	0.4530	0.2130	0.0179	0.0009 U	0.1650	NA	0.0072 B	0.0347	0.0009 U	0.0088 B	0.0229	0.0036 B	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0009 U	0.0014 B	0.0009 U	0.0009 U	0.0009 U	0.0009 U
Jan-01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0201	0.0041 B	0.0024 B	NA	NA	NA	NA	NA	NA	0.0009 U	NA	NA	NA	NA	NA	NA
Mar-01	0.2530	0.1190	0.1280	0.0009 U	0.5220	0.1240	0.0132	0.0009 U	0.0386	NA	0.0039 B	0.0519	0.0009 U	0.0258	0.0499	0.0077 B	0.0170	0.0288	0.0041 B	NA	NA	NA	NA	NA	NA	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	
Jul-01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0066 B	0.0199	0.0056 B	0.0009 U	0.0024 B	0.0011 B	NA	NA	NA	NA	NA	NA	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	0.0009 U	
Oct-01	0.0206	0.0471	0.0871	0.0039 B	0.4670	0.0127	0.0040 B	0.0022 B	NA	0.0033 B	0.0033 B	0.0484	0.0023 B	0.0206	0.0023 B	0.0039 B	0.0174	0.0012 B	0.0019 B	NA	NA	NA	NA	NA	NA	0.0012 B	0.0018 B	NA	NA	NA	NA	
Mar-02	0.0601	0.0102	0.0356	0.0096 B	0.2570	0.0335	0.0087 B	0.0008 U	NA	0.0105	0.0246	0.0221	0.0008 U	0.0164	0.0048 B	0.0012 B	0.0125	0.0024 B	0.0008 U	NA	NA	NA	NA	NA	NA	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.0008 U	
Jul-02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0057 B	0.0095 B	0.0017 B	0.0052 B	0.0038 B	0.0008 U	NA	NA	NA	NA	NA	NA	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.0008 U	
Oct-02	0.3860 E	0.0829 E	2.0400 E	0.0046 B, E	1.4000 E	0.0312 E	0.0350 E	0.0013 B, E	NA	0.0012 B, E	0.0099 B, E	0.1080 E	NA	0.0338 E	0.0095 B, E	0.0061 B, E	0.0097 B, E	0.0008 U	0.0008 U	NA	NA	NA	NA	NA	NA	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.0008 U	
Apr-03	NA	0.0008 U	0.0898	0.0048 B	4.2500	0.0868	0.0179	0.0008 U	NA	0.0056 B	0.0056 B	0.0360	NA	0.0104	0.0155	0.0008 U	0.0192	0.0042 B	0.0008 U	NA	NA	NA	NA	NA	NA	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.0008 U	0.0008 U	
Mar-04	NA	NA	0.0871	NA	0.8160	NA	0.0094 B	NA	0.2370	NA	NA	0.1330	NA	0.0103	0.0194	0.0020 B	0.0104	0.0028 B	0.0026 B	NA	NA	NA	NA	NA	NA	NA	0.0013 B	0.0015 B	0.0014 B	0.0019 B	0.0015 B	0.0012 B
Jun-05	0.0314	NA	0.1010	NA	2.0200	NA	0.0567	NA	NA	0.0056 B	NA	0.0057 B	NA	0.0296	0.0033 B	0.0025 B	0.0024 B	0.0014 B	0.0019 B	NA	NA	NA	NA	NA	NA	0.0009 U	0.0009 U	0.0009 U	0.0009 B	0.0009 U	0.0009 B	
Sep-06	2.4000	NA	0.1200	NA	7.2000	NA	1.3000	NA	0.6900	NA	NA	0.0870	NA	0.1400	0.0300	0.0420	0.0550	0.0360	0.0041 J	NA	NA	NA	NA	NA	NA	0.0027 J	0.0028 J	0.0032 J	0.0020 J	0.0100 U	0.0100 U	
Oct-07	0.5300	NA	0.2500	NA	3.4000	NA	0.2700	NA	0.0320	NA	NA	0.0960	NA	0.0850	0.0410	0.0110	0.3300	0.1500	0.0043 J	NA	NA	NA	NA	NA	NA	0.0100 U	0.0100 U	0.0100 U	0.0100 U	0.0100 U	0.0100 U	
Mar-09	0.1400	NA	0.4800	NA	3.9000	NA	0.2300	NA	0.1700	NA	NA	0.0610	NA	0.6800	0.0270	0.0110	0.3000	0.0380	0.0100 U	NA	NA	NA	NA	NA	NA	0.0100 U	0.0100 U	0.0100 U	NA	0.0100 U	0.0100 U	
May-10	1.9900	NA	0.7220	NA	2.5700	NA	0.5220	NA	0.2780	NA	NA	0.1580	NA	0.1520	0.0140	0.0040 U	0.1760	0.0539	0.0025 J	NA	NA	NA	NA	NA	NA	0.0040 U	0.0040 U	0.0040 U	NA	0.0040 U	0.0040 U	
Sep-11	11.1000	0.9700	1.0000	0.0027 J	29.7000	2.6000	0.2900	NA	0.1200	0.0110	0.0930	0.4800	NA	1.5000	0.0040 U	0.0040 U	0.4300	0.3800	0.0040 U	NA	NA	NA	NA	NA	NA	0.0040 U	0.0040 U	0.0040 U	0.0040 U	NA	NA	
Nov-12	2.4000	NA	0.2800	NA	4.1000	NA	1.7000	NA	0.1300	NA	NA	0.2300	NA	0.1400	0.0029 J	0.0040 U	0.1000	0.0026 J	0.0040 U	NA	NA	NA	NA	NA	NA	0.0040 U	0.0040 U	0.0040 U	0.0040 U	0.0040 U	NA	
Mar-14	5.2000	NA	1.1000	NA	2.8000	NA	0.5400	NA	0.0960	NA	NA	0.3000	NA	0.0850	0.0037 J	ND	0.2900	0.0110	ND	NA	NA	NA	NA	NA	NA	ND	ND	ND	ND	ND	ND	
Nov-14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0020 U	0.0020 U	0.0033 J	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Jul-15	6.6040	NA	0.0622	NA	0.2288	NA	0.1329	NA	0.0406	NA	NA	0.2542	NA	0.2304	0.0028	0.0024	0.0567	0.0025	0.0024	0.0024	0.0015 J	0.0079	NA	NA	NA	0.0003 J	0.0002 J	0.0002 J	0.0005 J	0.0020 U	0.0002 J	
Jan-17	1.2590	NA	0.2292	NA	0.5949	NA	0.2100	NA	NA	NA	NA	0.1315	NA	0.2967	0.0027	0.0192	0.0037	0.0368	0.0130	0.0004 J	0.0019	0.0052	0.0020	0.0020	0.0033	0.0004 J	0.0003 J	0.0013	0.0013	0.0004 J	0.0004 J	
May-18	0.0602	NA	0.0103	NA	3.3750	NA	0.1566	NA	NA	NA	NA	0.0187	NA	0.0038	0.0009 J	0.0010	0.0040	0.0447	0.0460	0.0004 J	0.0007 J	0.1811	0.0006 J	0.0114	0.0012	0.0003 J	0.0002 J	0.0003 J	0.0002 J	0.0003 J	0.0004 J	
Jul-19	0.3083	NA	0.0023	NA	8.5800	NA	0.0735	NA	NA	NA	NA	0.0164	NA	0.0127	0.0006 J	0.0457	0.0120	0.0154	0.0055	0.0002 U	0.0003 J	0.0114	0.0025	0.0019	0.0073	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 U	0.0002 J	
Oct-20	0.3180	NA	0.0940	NA	3.1900	NA	0.1060	NA	NA	NA	NA	0.5730	NA	0.0612	0.0010	0.0524	0.0008 J	0.0468	0.0036	0.0003 J	0.0003 J	0.0290	0.0013	0.0260	0.0020	0.0004 J	0.0002 U	0.0002 J	0.0002 U	0.0003 J	0.0004 J	
Jan-22	0.0544	NA	0.0335	NA	0.1541	NA	0.9992	NA	NA	NA	NA	0.0044	NA	0.3624	0.0032	0.0169	0.0159	0.0122	0.0016	0.0016	0.0005 J	0.0080	0.0014	0.0043	NA	0.0003 J	0.0002 U	0.0005 J	0.0002 U	0.0002 J	0.0002 U	
May-23	0.0231	NA	0.0131	NA	0.0847	0.3767	0.0296	NA	NA	NA	NA	0.0343	NA	0.0709	0.0006 J	0.0025	0.0007 J	0.0226	0.0130	0.0004 J	0.0004 J	0.0043	0.0033	0.0544	0.0014	0.0004 J	0.0002 J	0.0002 U	0.0004 J	0.0003 J		

Notes:

ARAR Standard = 0.05 mg/L; USEPA MCL = 0.1 mg/L; and, Part 5 MCL = 0.1 mg/L.
ARAR = Applicable or Relevant and Appropriate Requirement: NYSDEC T.O.G.S. 1.1.1 Ambient Water-Quality Standards and Guidance Values and Groundwater Effluent Limitations (June 2004).
MCL = Maximum Contaminant Level: USEPA National Primary Drinking Water Regulations.
Values in **BOLD** indicate the reported concentration is greater than the ARAR for the groundwater monitoring wells or MCL for the private and municipal drinking water wells water quality standard.
NA = Not Analyzed

Laboratory Qualifier Definitions

ND or U = Not Detected
B = The analyte was detected above the reporting limit in the associated method blank.
J = Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
N = Spiked sample recovery not within control limits.

Table 5
Summary of Historical Groundwater Quality Results - Chromium (mg/L)
Town of Ramapo Landfill

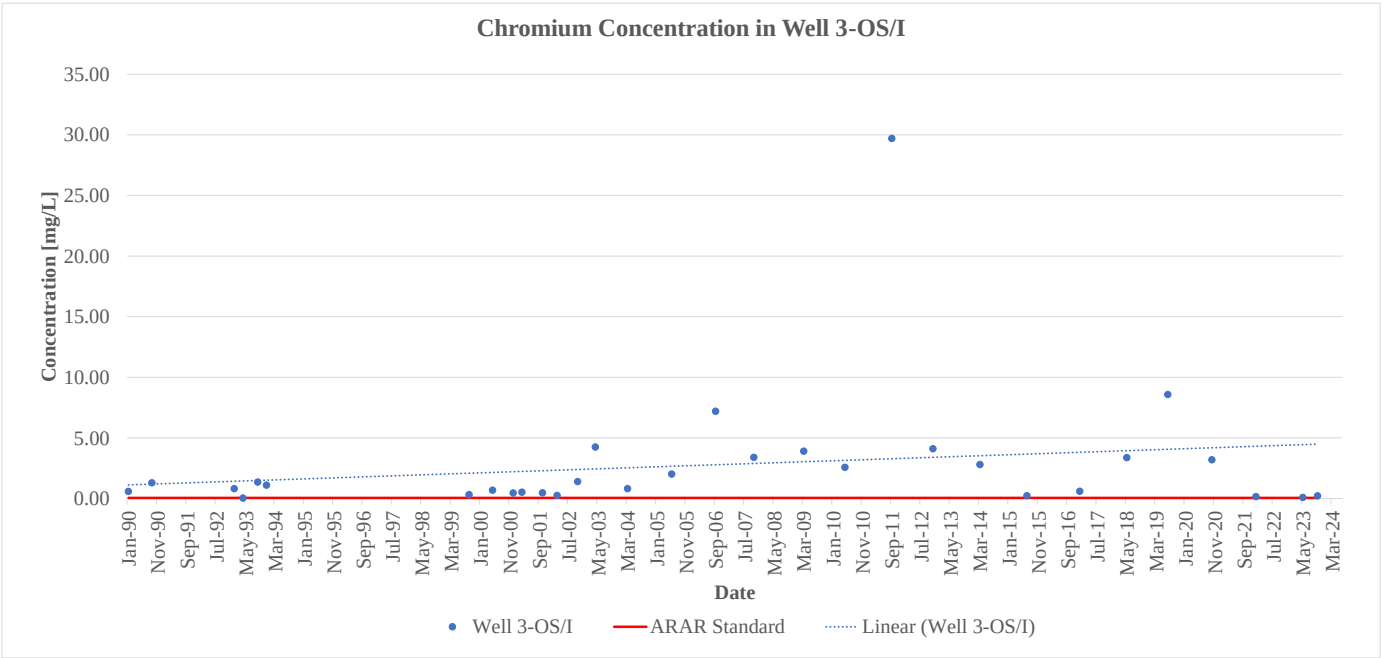
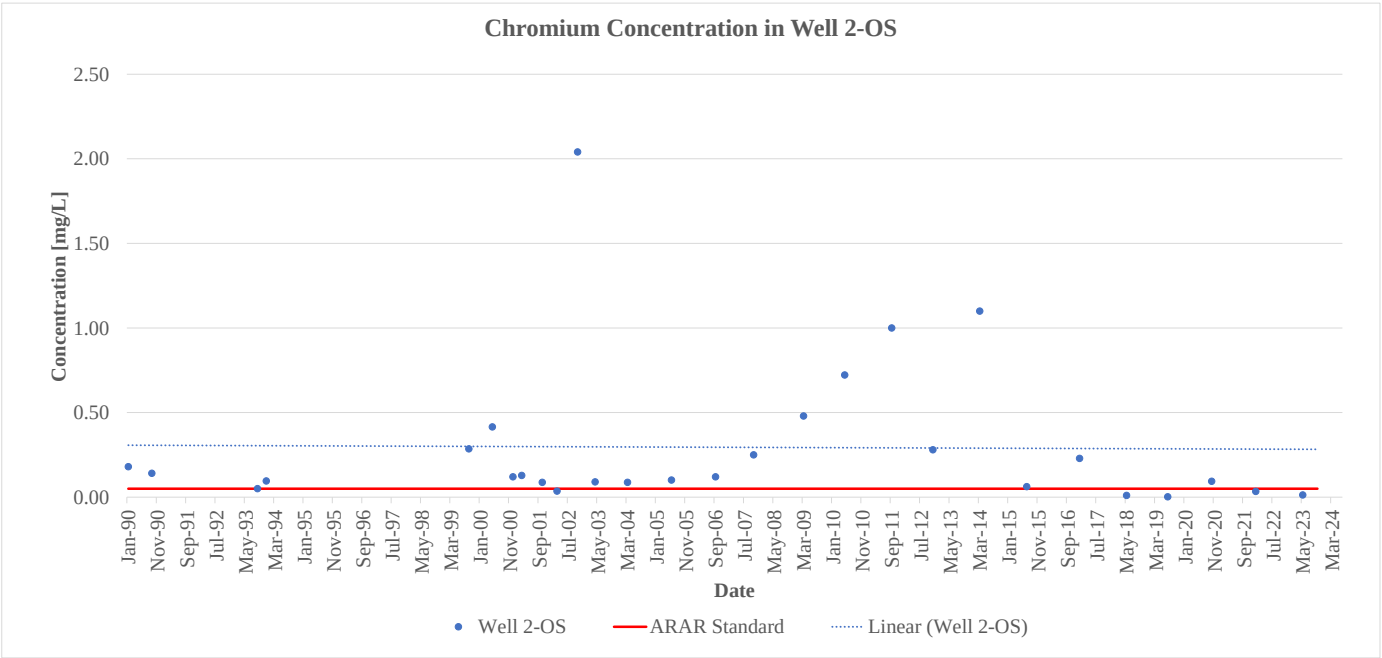
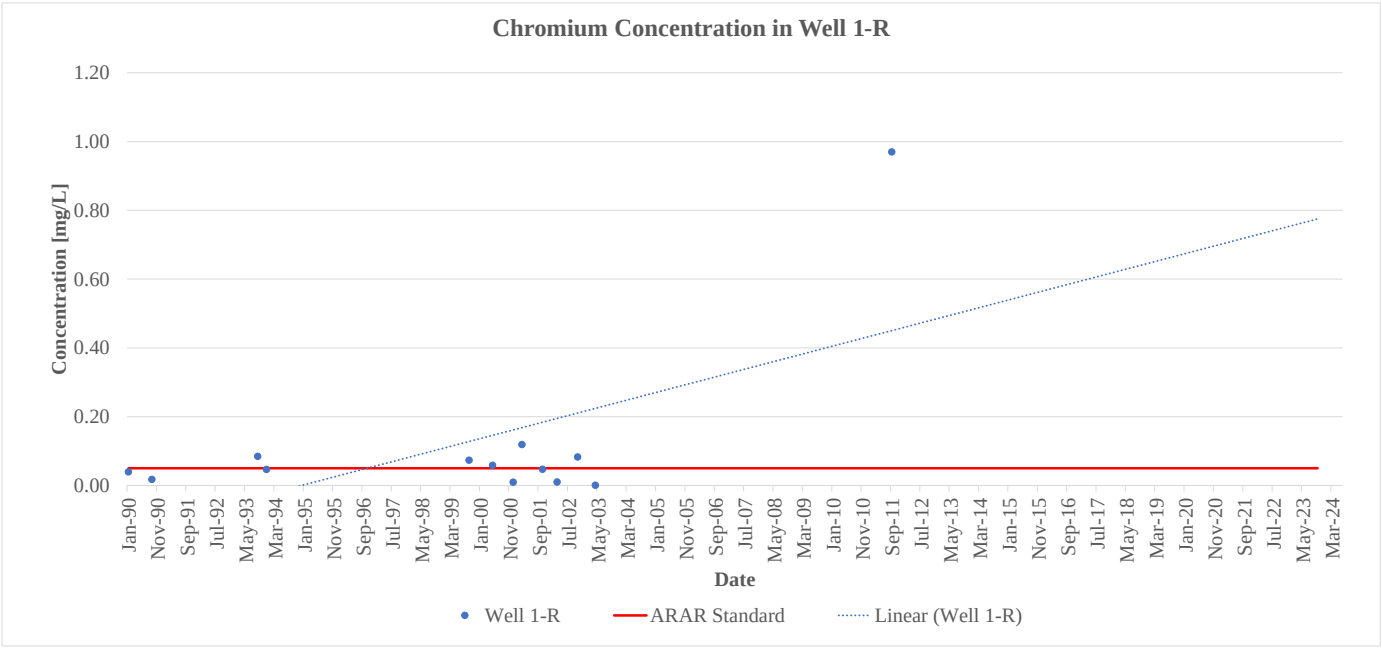
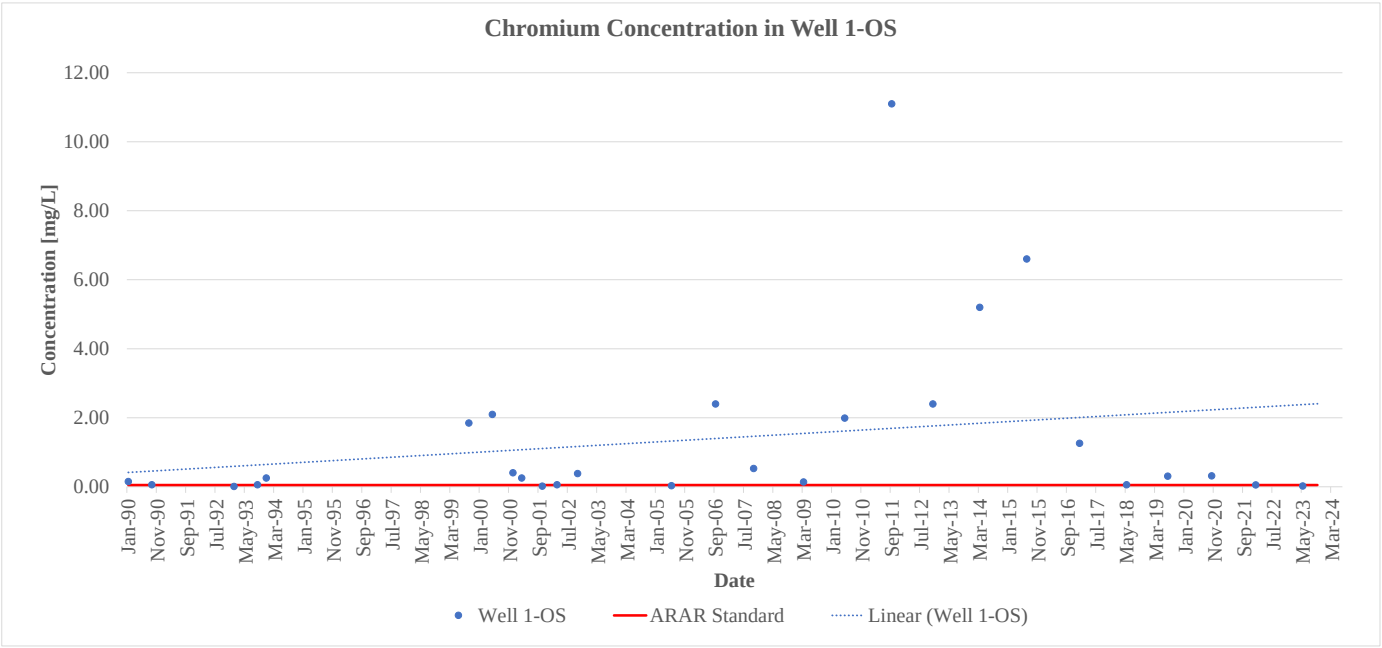


Table 5
Summary of Historical Groundwater Quality Results - Chromium (mg/L)
Town of Ramapo Landfill

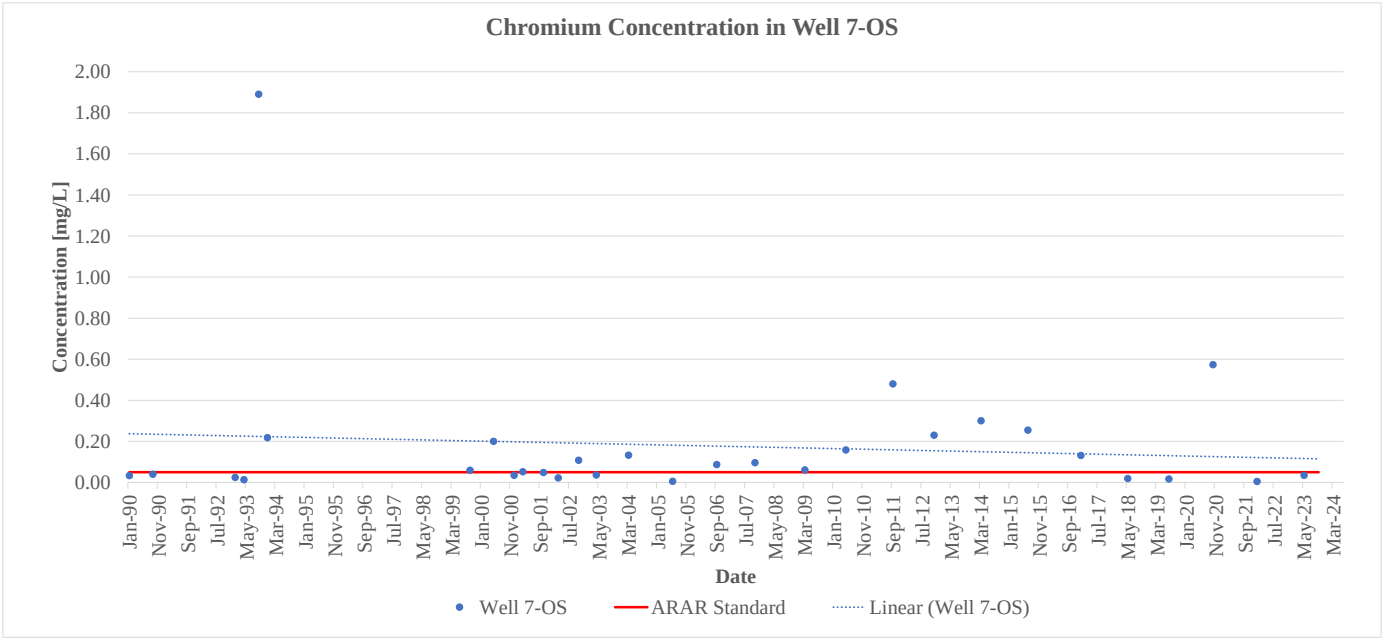
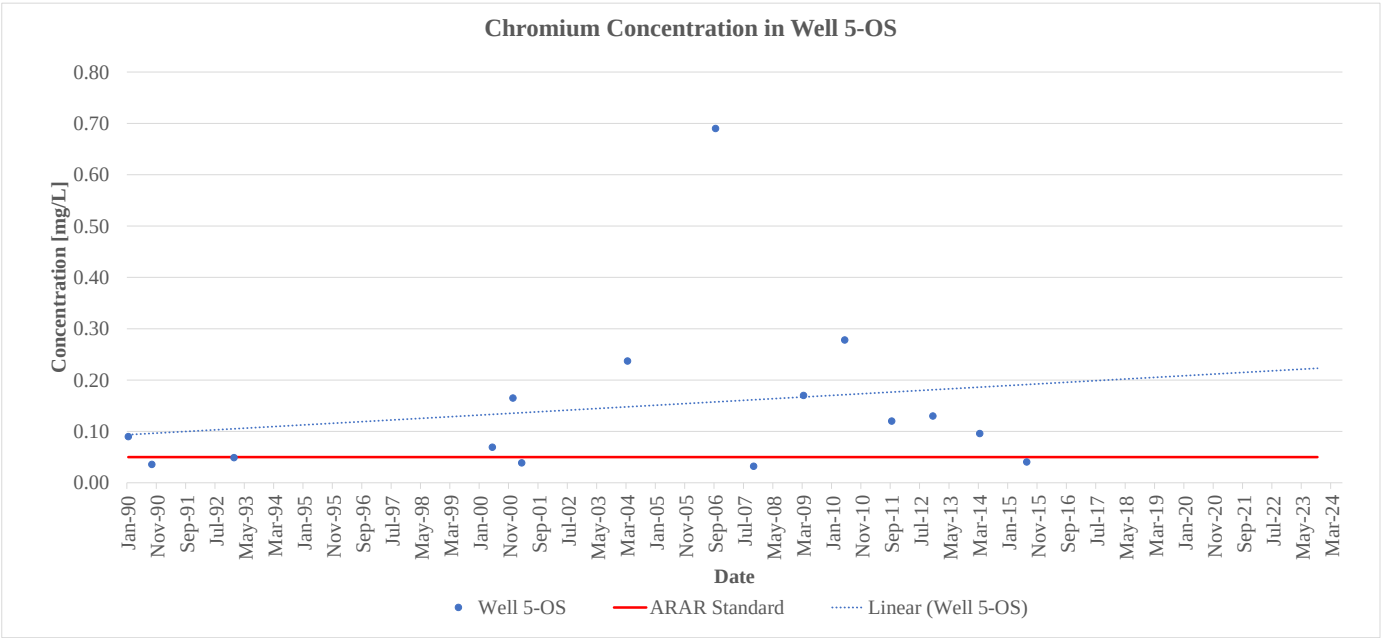
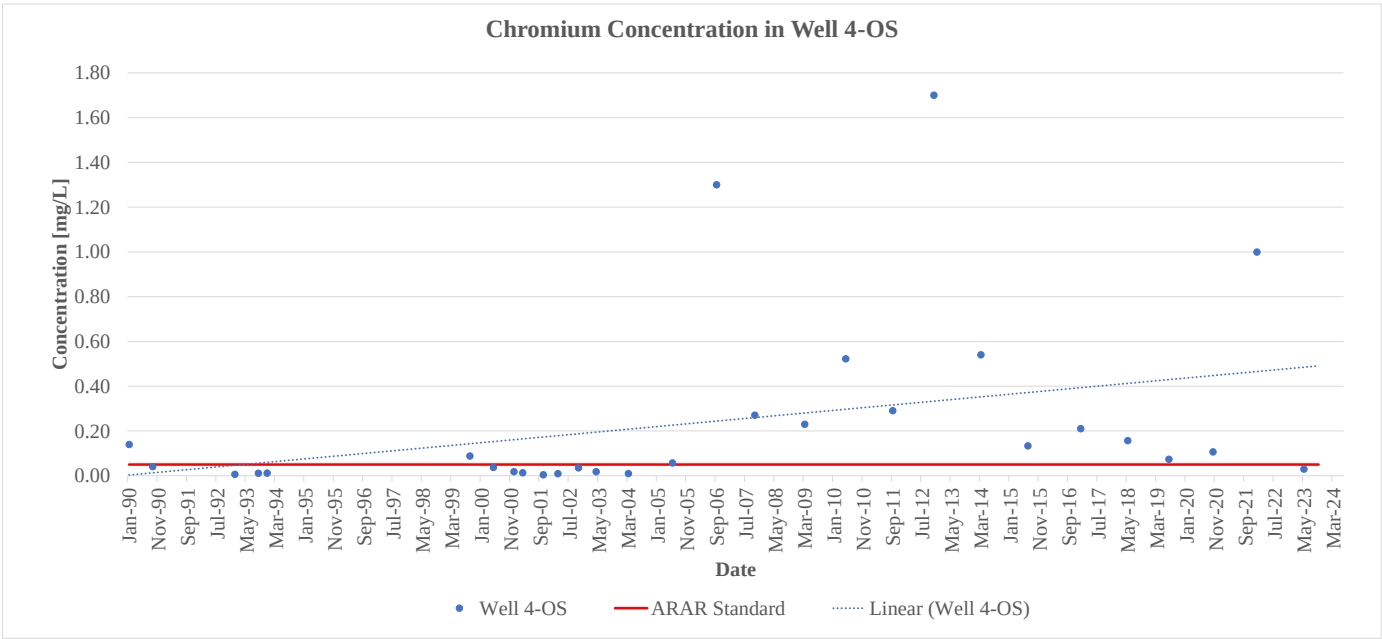
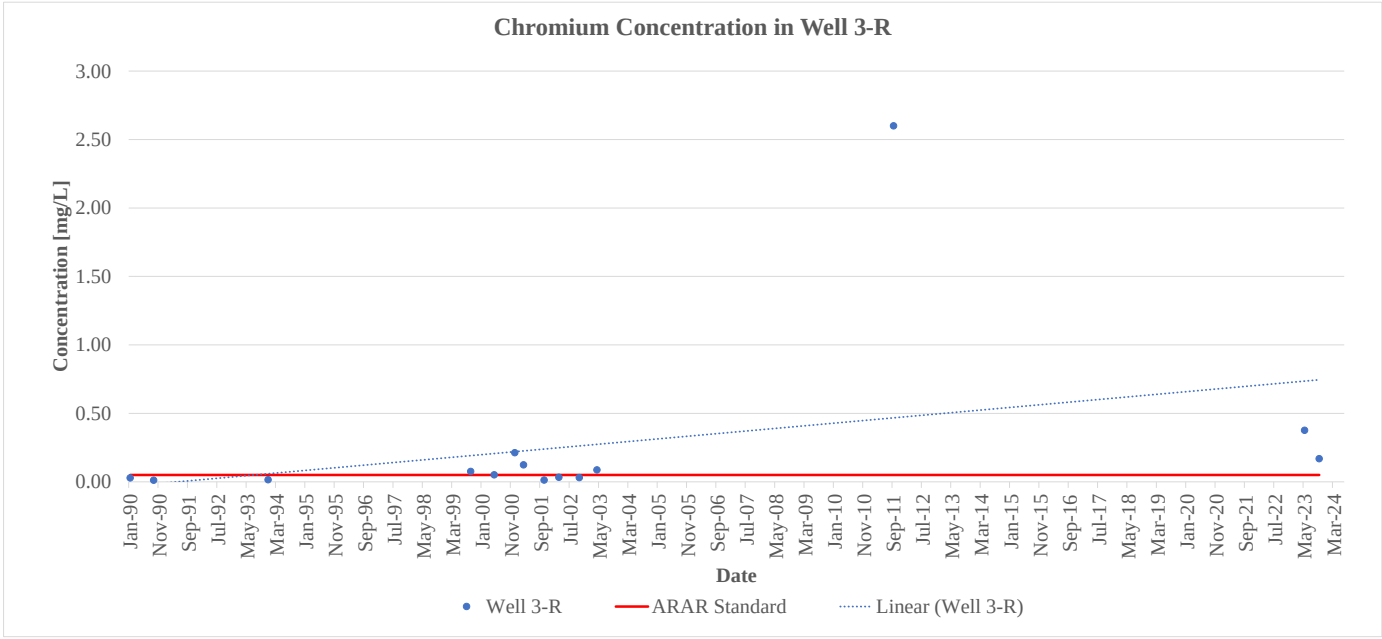


Table 5
Summary of Historical Groundwater Quality Results - Chromium (mg/L)
Town of Ramapo Landfill

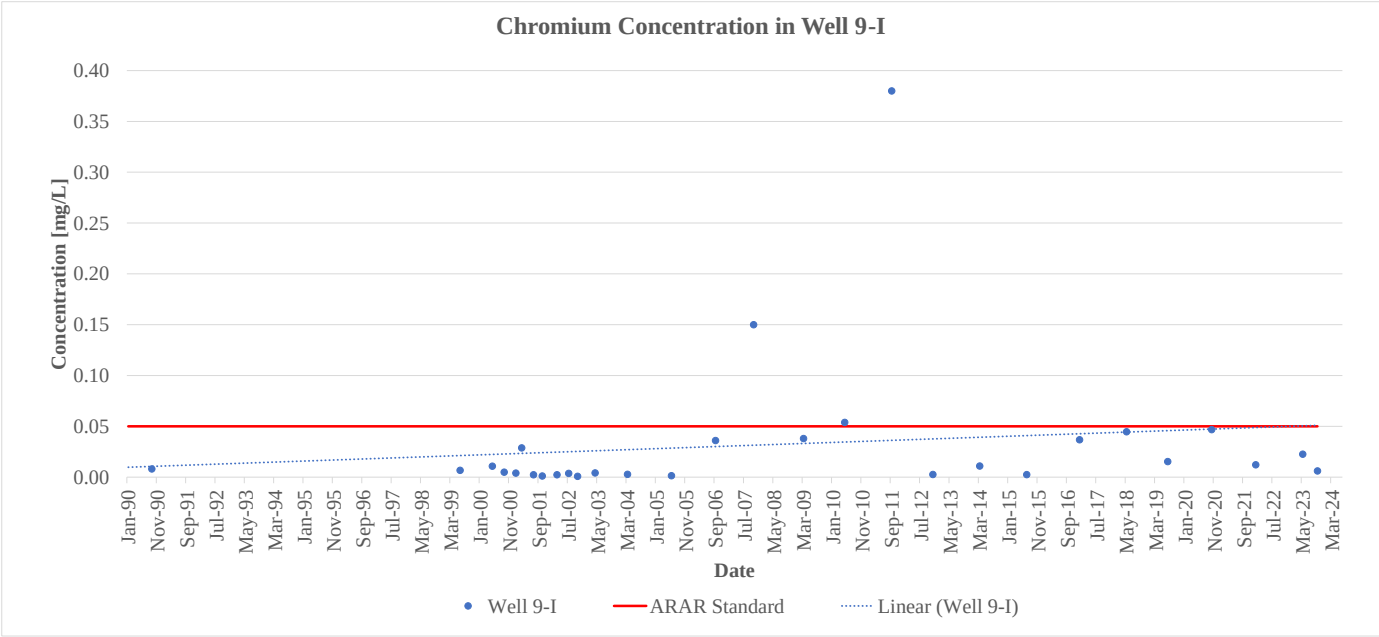
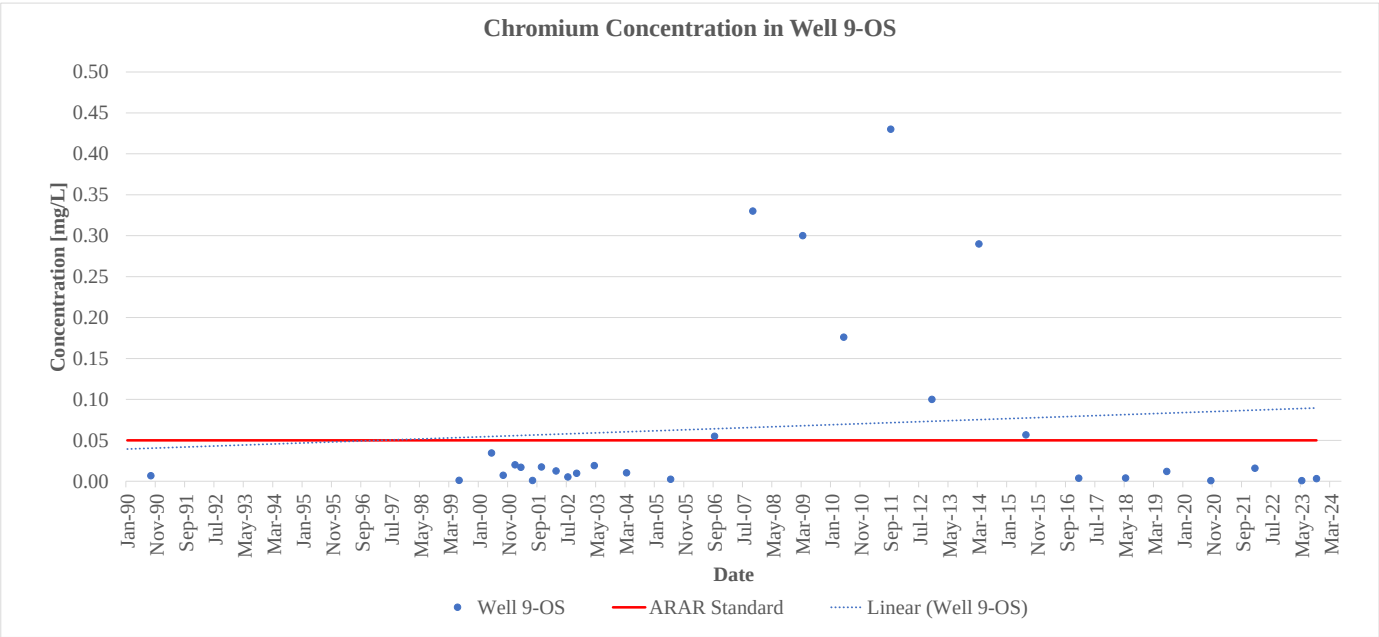
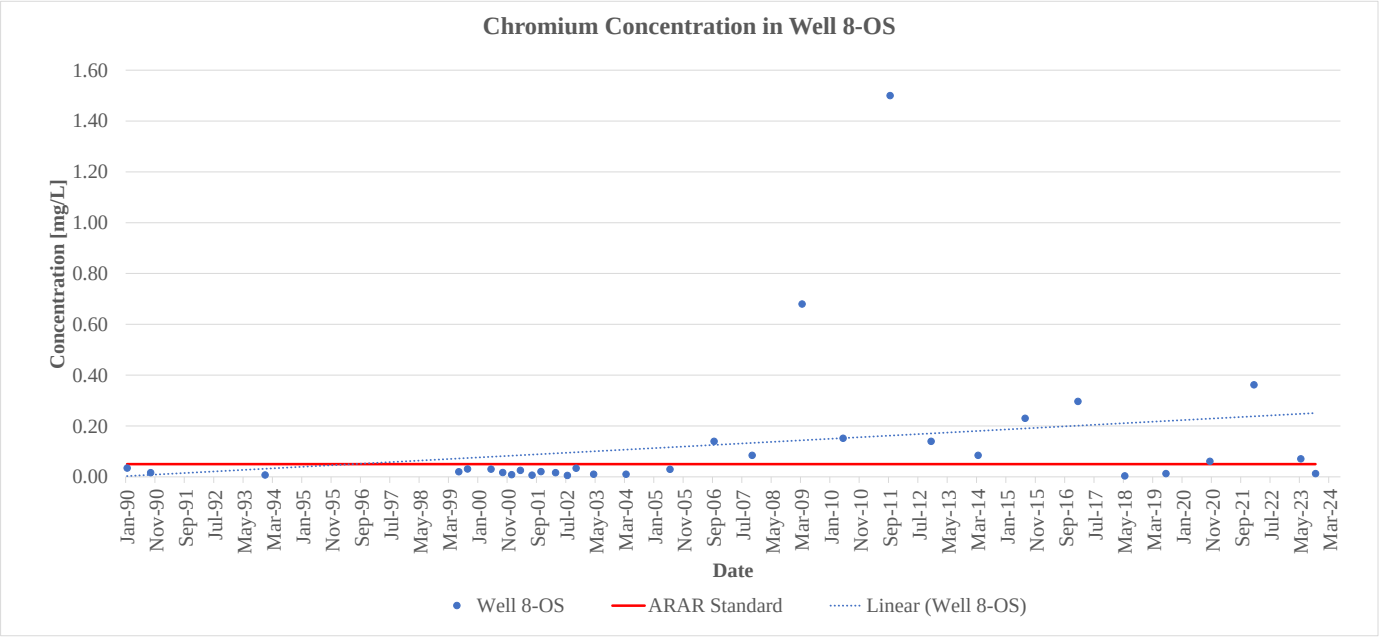


Table 6

Summary of Historical Groundwater Quality Results - Iron (mg/L)
Town of Ramapo Landfill

Well ID DATE	Well 1-OS	Well 1-R	Well 2-OS	Well 2-R	Well 3-OS/I	Well 3-R	Well 4-OS	Well 4-R	Well 5-OS	Well 5-I	Well 5-R	Well 7-OS	Well 7-R	Well 8-OS	Well 8-I	Well 8-R	Well 9-OS	Well 9-I	Well 9-R	Well 10-OS	Well 10-I	Well 10-R	Well UP-OS	Well UP-I	Well UP-R	PW-1	PW-2	SVWC-93	SVWC-94	SVWC-95	SVWC-96	
Jan-90	45.000	11.800	0.912	0.409	6.830	1.930	15.600	8.230	27.000	0.973	0.658	0.981	31.500	229.000	15.700	1.360	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sep-90	17.500	2.650	41.800	0.602	9.750	1.370	12.400	5.290	11.200	23.300	0.368	24.500	1.940	43.800	30.500	2.940	0.249	0.145	20.200	NA	NA	NA	NA	NA	NA	0.064	0.011	NA	NA	NA	NA	
Jan-93	1.870	0.395	NA	NA	5.110	11.500	0.529	3.520	11.100	NA	0.620	1.250	ND	3.230	NA	11.600	0.051	NA	2.680	NA	NA	NA	NA	NA	NA	0.186	0.042	0.033	0.040	0.052	0.022	
Apr-93	0.884	0.197	0.186	0.674	0.333	2.940	0.520	4.920	4.700	NA	2.310	0.521	0.057	2.080	NA	2.590	1.200	NA	8.250	NA	NA	NA	NA	NA	NA	0.130	0.050	0.011	0.019	0.074	0.173	
Sep-93	32.300	1.940	11.800	1.120	21.300	3.280	5.560	3.100	NA	NA	0.751	619.000	0.989	6.180	NA	9.160	0.383	NA	11.500	NA	NA	NA	NA	NA	NA	1.260	NA	NA	NA	ND	NA	
Dec-93	162.000	1.210	9.800	1.450	37.900	4.800	10.600	5.290	NA	2.030	0.243	2.200	0.600	12.000	NA	4.710	0.393	NA	10.800	NA	NA	NA	NA	NA	NA	0.916	0.023	0.553	NA	NA	0.023	
Jun-99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.473	19.100	1.140	0.515	0.949	4.360	NA	NA	NA	NA	NA	NA	0.163	0.114	0.169	0.083	0.090	0.068	
Sep-99	76.200	1.420	6.910	2.640	1.990	8.770	50.200	7.500	NA	0.700	0.040	11.300	ND	0.747	4.270	5.260	0.198	ND	3.110	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	
May-00	40.500	0.867	32.900	1.790	3.310	1.610	16.300	5.900	41.500	NA	5.000	4.300	0.128	1.200	9.870	1.180	1.880	2.820	1.340	NA	NA	NA	NA	NA	NA	0.018 B	0.059 B	0.009 B	0.004 B	0.023 B	0.005 B	
Sep-00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	8.900	22.900	2.230	2.230	3.920	9.110	NA	NA	NA	NA	NA	NA	0.003 U	0.037 B	0.004 B	0.003 U	0.003 U	0.003 U	
Dec-00	43.800 E	0.990 E	32.800 E	1.440 E	3.620 E	3.020 E	11.300 E	7.240 E	101.000 E	NA	2.370 E	12.400 E	0.310 E	4.450 E	26.400 E	2.580 E	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.062 B,E	0.037 B,E	0.021 B,E	0.014 B,E	0.053 B,E	
Jan-01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.640	2.570	8.280	NA	NA	NA	NA	NA	NA	0.005 B	NA	NA	NA	NA	NA	
Mar-01	54.100	15.700	37.700	0.337	5.810	4.400	7.690	4.220	22.800	NA	0.826	4.170 N	0.213	6.020 N	47.600 N	2.500 N	3.660 N	24.000 N	8.080 E	NA	NA	NA	NA	NA	NA	0.015 B	0.011 B	0.062 B	0.022 B	0.025 B	0.028 B	
Jul-01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2.460	27.600	1.680	0.003 U	2.350	8.320	NA	NA	NA	NA	NA	NA	0.561	0.026 B	0.029 B	0.007 B	0.103	0.019 B	
Oct-01	16.400 E	6.260 E	24.500 E	0.299	4.090 E	1.140 E	1.760 E	3.850 E	NA	0.186 E	0.096 E	10.400 E	0.022 B,E	4.600 E	6.560 E	1.770 E	3.780 E	0.145 E	8.150 E	NA	NA	NA	NA	NA	NA	0.016 B	0.059 B,E	NA	NA	NA	NA	
Mar-02	35.200	1.330	10.500	6.830	1.810	2.020	4.310	3.250	NA	5.490	10.300	6.790	0.073	3.060	16.700	2.110	0.896	2.000	5.980	NA	NA	NA	NA	NA	NA	0.008 B	0.036 B	0.005 U	0.011 B	0.013 B	0.005 U	
Jul-02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.540 *	16.700 *	1.580 *	0.789 *	3.290 *	7.110 *	NA	NA	NA	NA	NA	NA	0.008 *B	0.017 *B	0.019 B	0.007 U	0.009 B	0.007 U	
Oct-02	127.000 E	41.600 E	48.200 E	1.760 E	30.800 E	13.300 E	32.800 E	4.520 E	NA	0.061 E	1.230 E	21.200 E	NA	6.600 E	17.600 E	1.490 E	0.500 E	0.040 B,E	6.140 E	NA	NA	NA	NA	NA	NA	0.024 B,E	0.033 B,E	0.939 E	0.053 B,E	0.091 E	0.011 B,E	
Apr-03	NA	0.374	40.700	2.550	31.800	4.830	14.100	6.250	NA	1.910	1.760	1.850	NA	2.490	21.400	0.969	1.600	3.710	5.720	NA	NA	NA	NA	NA	NA	0.009 B	0.025 B	0.024 B	0.020 B	0.056 B	0.007 B	
Mar-04	NA	NA	14.700	NA	12.900	NA	3.050	NA	150.000	NA	NA	38.500	NA	1.030	29.700	1.160	0.506	1.630	4.890	NA	NA	NA	NA	NA	NA	0.020 B	0.028 B	0.203	0.030 B	0.157	0.017 U	
Jun-05	54.200 N	NA	0.144 N	NA	60.500 N	NA	1.230	NA	NA	0.124 N	NA	1.310	NA	3.150	13.900	0.751	0.453	0.318	6.430	NA	NA	NA	NA	NA	NA	0.019 B	0.115	0.014 B	0.008	0.017 B	0.008 U	
Sep-06	120.000	NA	12.000	NA	77.000	NA	12.000	NA	410.000	NA	NA	17.000	NA	1.200	43.000	4.700	1.600	24.000	7.000	NA	NA	NA	NA	NA	NA	0.015 J	0.034 J	0.021 J	0.050 U	0.260	0.050 U	
Oct-07	160.000	NA	31.000	NA	25.000	NA	24.000	NA	0.850	NA	NA	13.000	NA	0.780	39.000	1.300	6.300	41.000	8.500	NA	NA	NA	NA	NA	NA	0.017 J	0.130	0.046 J	0.012 J	0.076	0.050 U	
Mar-09	38.000	NA	12.000	NA	30.000	NA	10.000	NA	110.000	NA	NA	5.800	NA	3.800	33.000	1.300	7.800	23.000	9.400	NA	NA	NA	NA	NA	NA	0.012 J	0.140	0.029 J	NA	0.033 J	0.016 J	
May-10	44.100 B	NA	22.700	NA	24.000 B	NA	6.830	NA	176.000	NA	NA	19.300 B	NA	1.070 B	27.000 B	0.563 B	4.640 B	30.300 B	12.500 B	NA	NA	NA	NA	NA	NA	0.023 B,J	0.071 B	0.050 U	NA	0.030 B,J	0.598 B	
Sep-11	82.000	8.600 B	16.000	0.260	158.000	18.000	3.500	NA	66.500	1.300	28.100 B	19.300	NA	6.500	12.600 B	0.350 B	7.500 B	40.100 B	7.300 B	NA	NA	NA	NA	NA	NA	0.028 B,J	0.080 B	0.140 B	0.090 B	NA	NA	
Nov-12	45.200	NA	6.600	NA	34.800	NA	18.500	NA	68.500	NA	NA	14.300	NA	0.950	15.800	0.300	1.300	0.075	5.400	NA	NA	NA	NA	NA	NA	0.055	0.250	0.050 U	0.050 U	0.050 U	NA	
Mar-14	66.000	NA	17.900	NA	16.600	NA	8.900	NA	53.500	NA	NA	24.500	NA	0.540	14.400	0.210	3.700	0.100	6.800	NA	NA	NA	NA	NA	NA	0.034 J	0.110	ND	ND	ND	ND	
Nov-14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.114	0.997	2.010	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Jul-15	53.600	NA	2.310	NA	2.750	NA	2.500	NA	7.800	NA	NA	5.570	NA	1.280	11.600	0.311	1.760	0.023 J	9.270	0.273	0.331	0.085	NA	NA	NA	0.030 J	0.090	0.020 U	0.020 U	0.480	0.020 U	
Jan-17	10.400	NA	3.670	NA	8.560	NA	1.160	NA	NA	NA	NA	0.806	NA	2.140	9.520	0.373	0.042 J	0.241	0.968	0.186	0.022 J	0.111	0.219	0.165	0.463	0.048 J	0.066	0.034 J	0.047 J	0.104	0.076	
May-18	0.533	NA	0.324	NA	25.200	NA	1.140	NA	NA	NA	NA	0.265	NA	0.056	10.200	0.294	0.067	0.347	22.800	0.275	0.133	0.765	0.435	3.230	0.055	0.193	0.148	0.036 J	0.050 U	0.022 J	0.020 J	
Jul-19	7.150	NA	3.710	NA	37.600	NA	0.633	NA	NA	NA	NA	0.348	NA	0.240	8.930	0.195	0.270	0.113	1.650	0.019 J	0.095	0.078	1.150	0.106	0.200	0.021 J	0.032 J	0.019 U	0.054	0.054	0.019 U	
Oct-20	9.660	NA	1.050	NA	13.600	NA	1.180	NA	NA	NA	NA	5.310	NA	0.552	9.630	1.560	0.026 J	0.305	0.533	0.181	0.039 J	0.151	0.062	0.266	0.025 J	0.029 J	0.047 J	0.019 U	0.019 U	0.019 U	0.030 J	
Jan-22	0.450	NA	0.849	NA	1.210	NA	6.580	NA	NA	NA	NA	0.045 J	NA	2.190	7.520	2.460	0.102	0.229	0.569	1.960	0.027 J	0.070	0.167	0.233	NA	0.010 J	0.104	0.019 U	0.019 U	0.019 U	0.019 U	
May-23	0.377	NA	0.207	NA	0.409	3.360	0.765	NA	NA	NA	NA	0.220	NA	0.504	5.100	0.345	0.019 U	0.168	5.620	0.270	0.0191 U	0.0381 J	1.620	2.220	0.0357 J	0.009 U	0.024 J	0.009 U	0.0363 J	0.0289 J	0.009 U	
Oct-23	NA	NA	NA	NA	1.280	3.190	NA	NA	NA	NA	NA	NA	NA	0.0483 J	0.730	0.299	0.067	0.042 J	0.101	0.231	0.0191 U	0.0241 J	NA	NA	NA	NA						

Notes:

ARAR Standard = 0.3 mg/L; USEPA Secondary MCL = Not Available; and, Part 5 MCL = 0.3 mg/L
ARAR = Applicable or Relevant and Appropriate Requirement: NYSDEC T.O.G.S. 1.1.1 Ambient Water-Quality Standards and Guidance Values and Groundwater Effluent Limitations (June 2004).
MCL = Maximum Contaminant Level: USEPA National Primary Drinking Water Regulations.
Values in **BOLD** indicate the reported concentration is greater than the ARAR for the groundwater monitoring wells or MCL for the private and municipal drinking water wells water quality standard.
NA = Not Analyzed

Laboratory Qualifier Definitions

ND or U = Not Detected
B = The analyte was detected above the reporting limit in the associated method blank.
J = Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
N = Spiked sample recovery not within control limits.

Table 6
Summary of Historical Groundwater Quality Results - Iron (mg/L)
Town of Ramapo Landfill

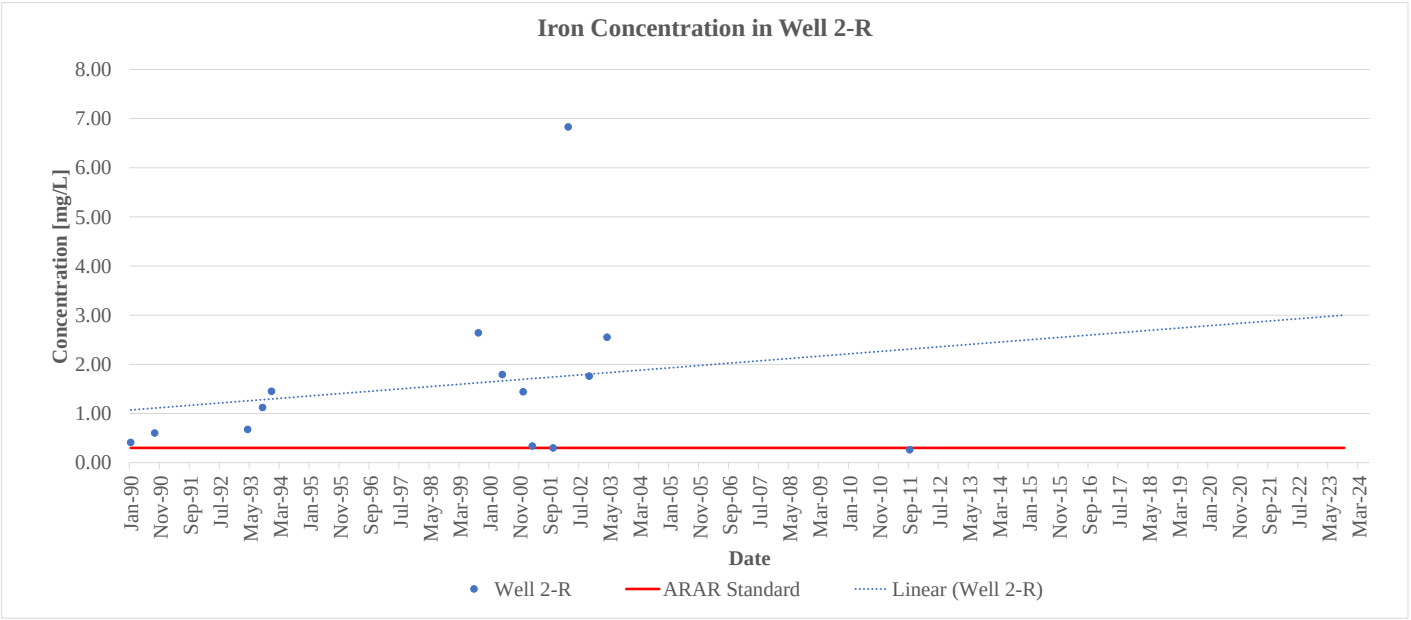
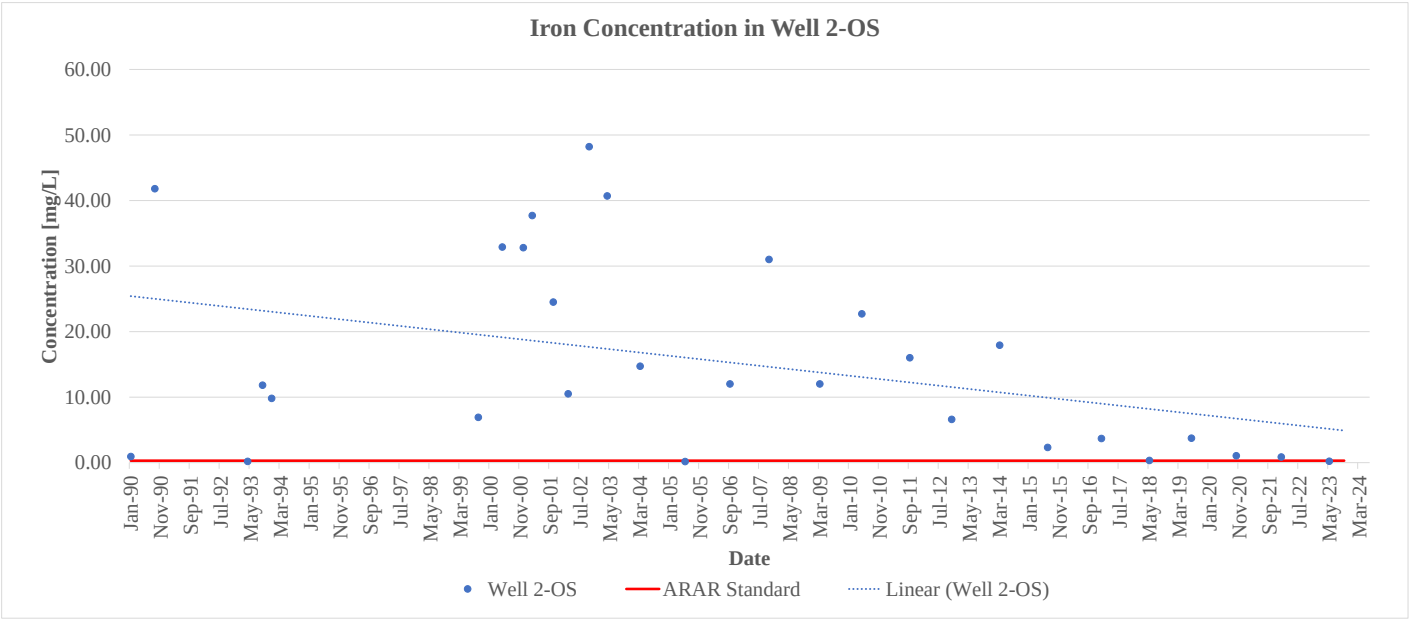
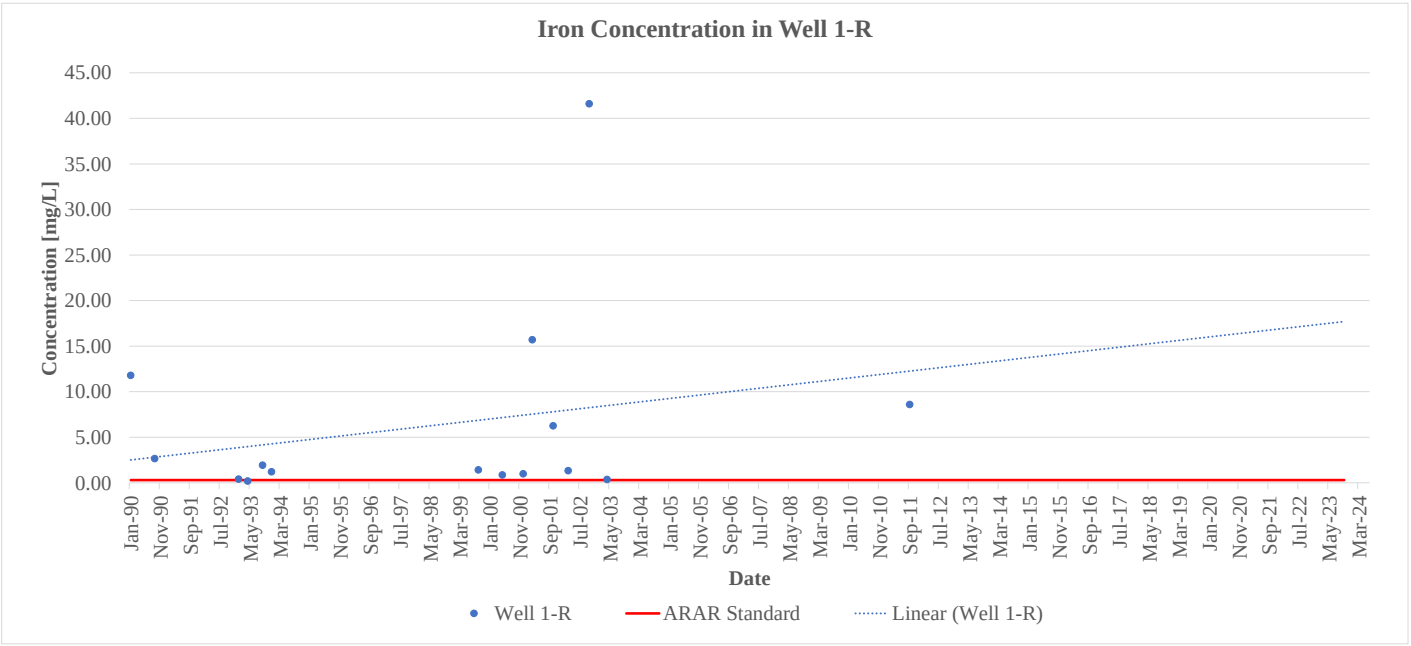
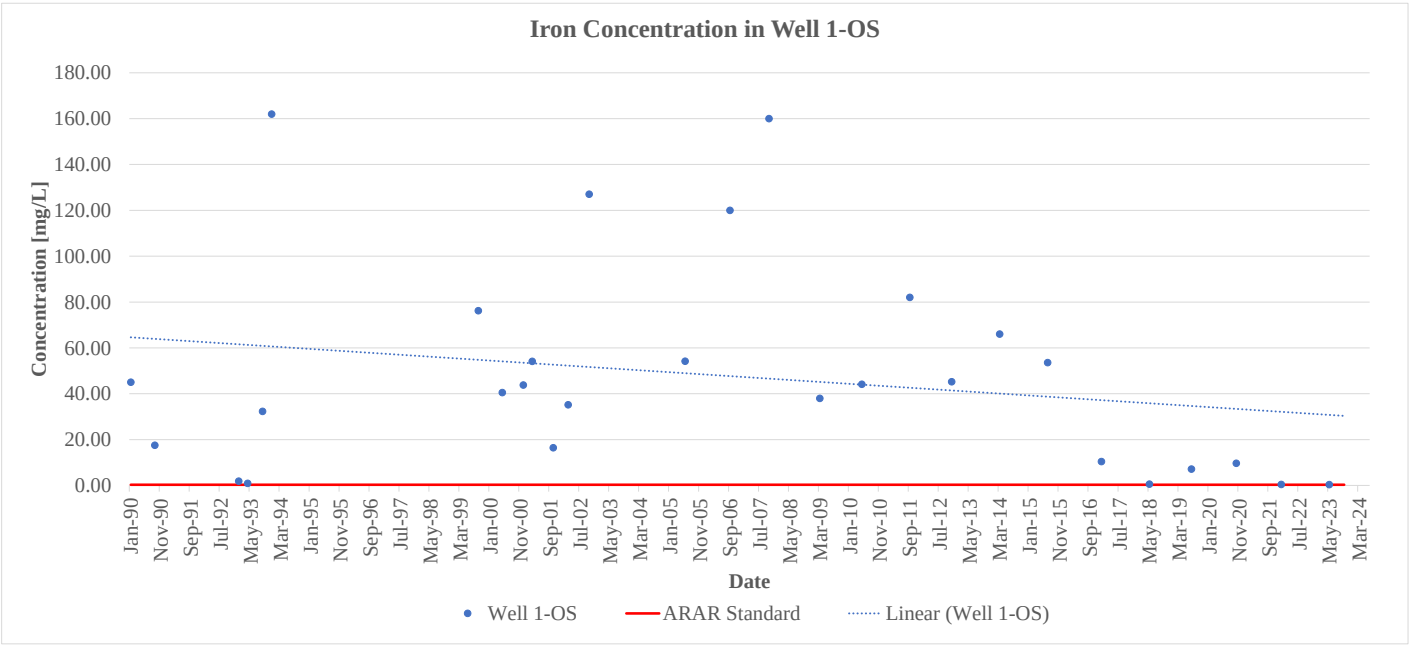


Table 6
Summary of Historical Groundwater Quality Results - Iron (mg/L)
Town of Ramapo Landfill

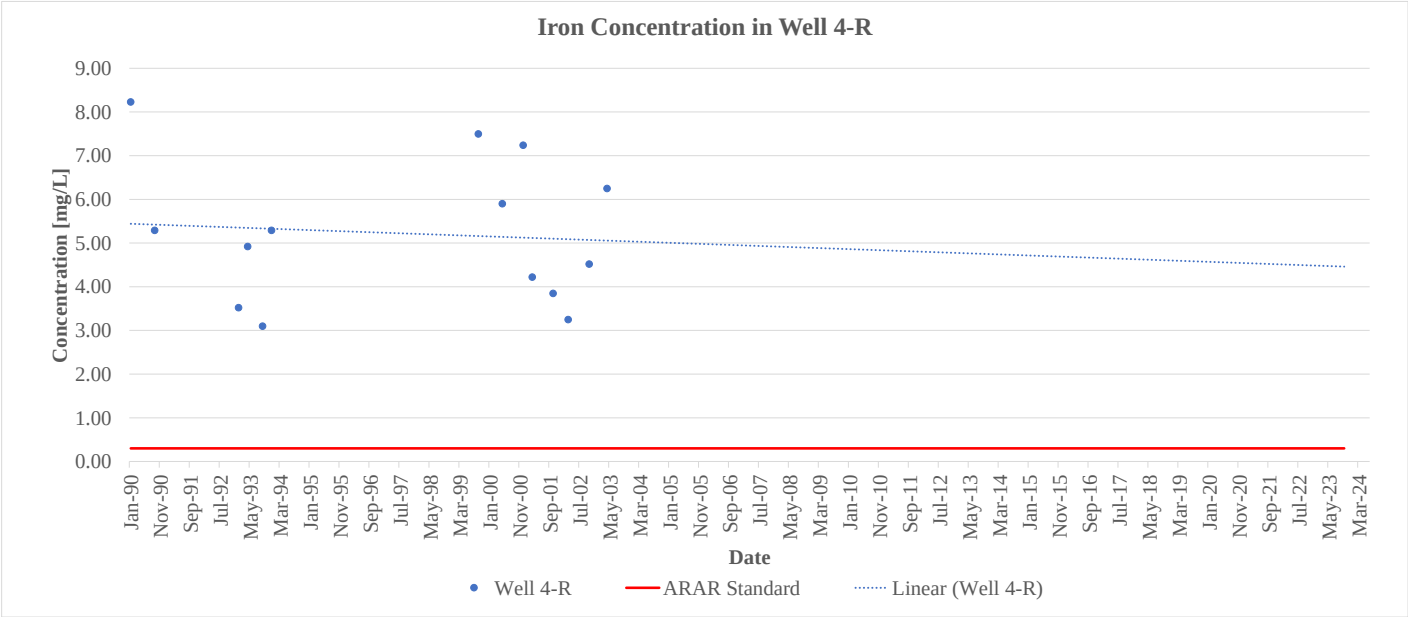
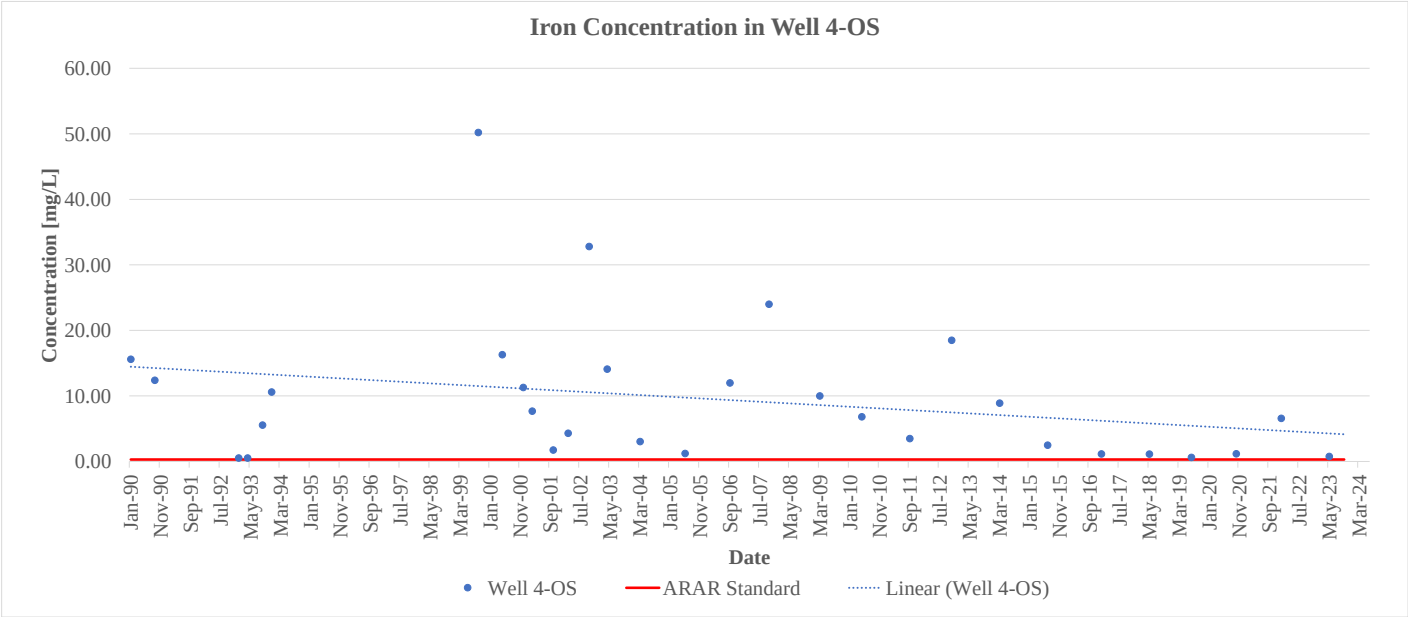
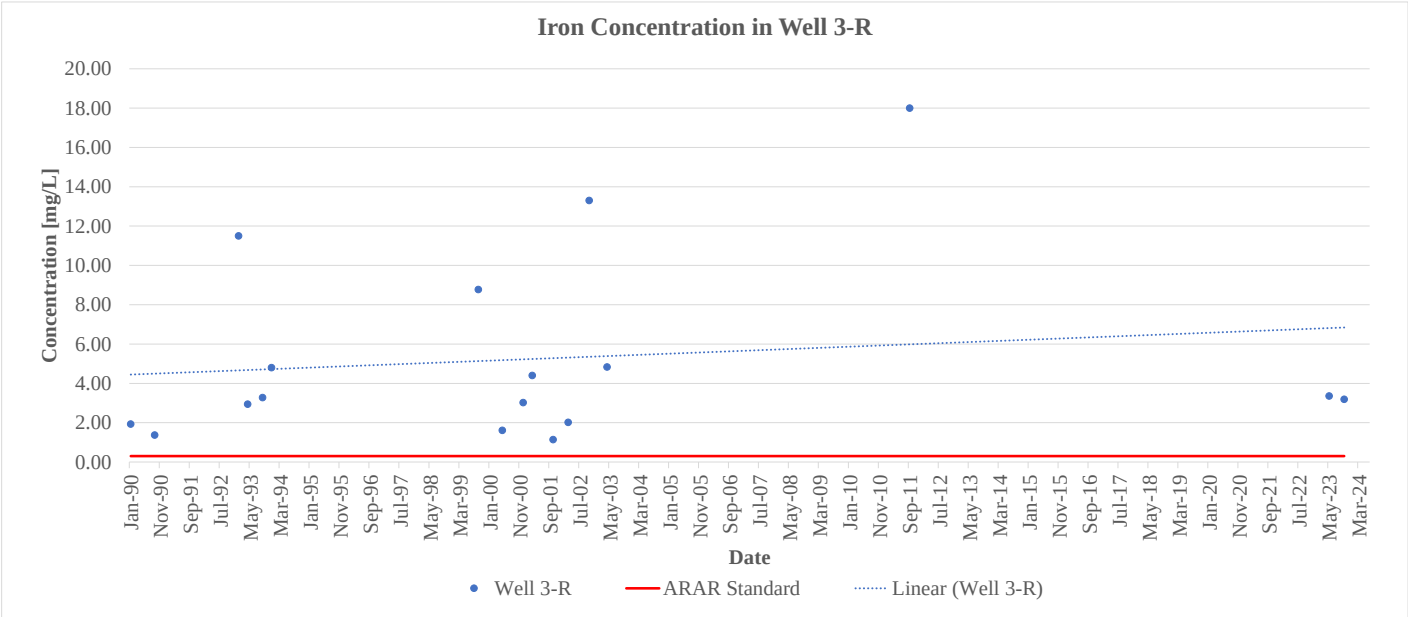
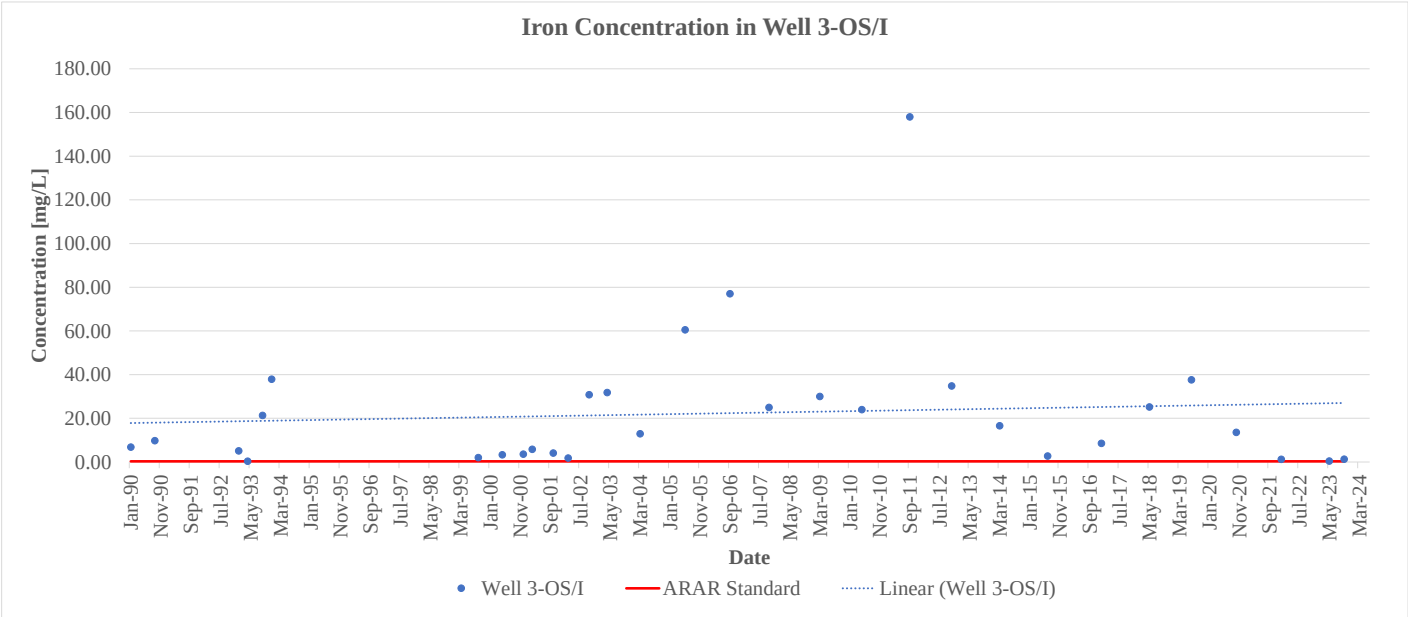


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Summary of Historical Groundwater Quality Results - Iron (mg/L)
Town of Ramapo Landfill

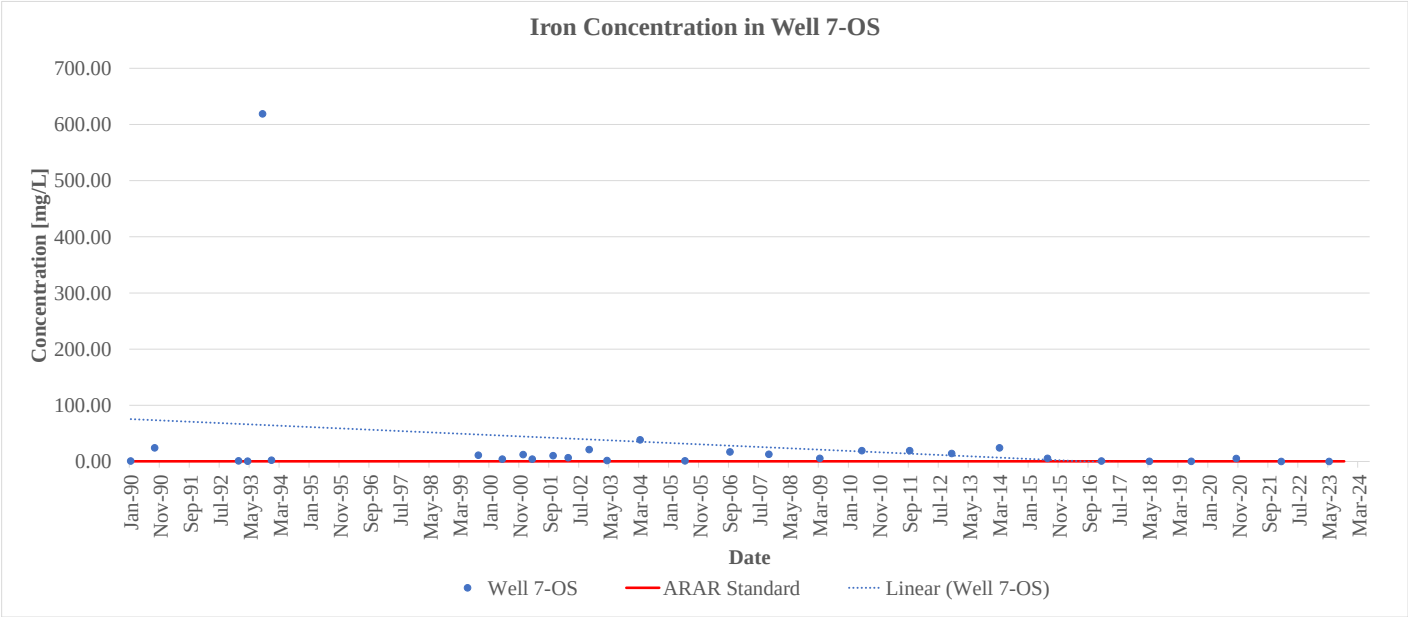
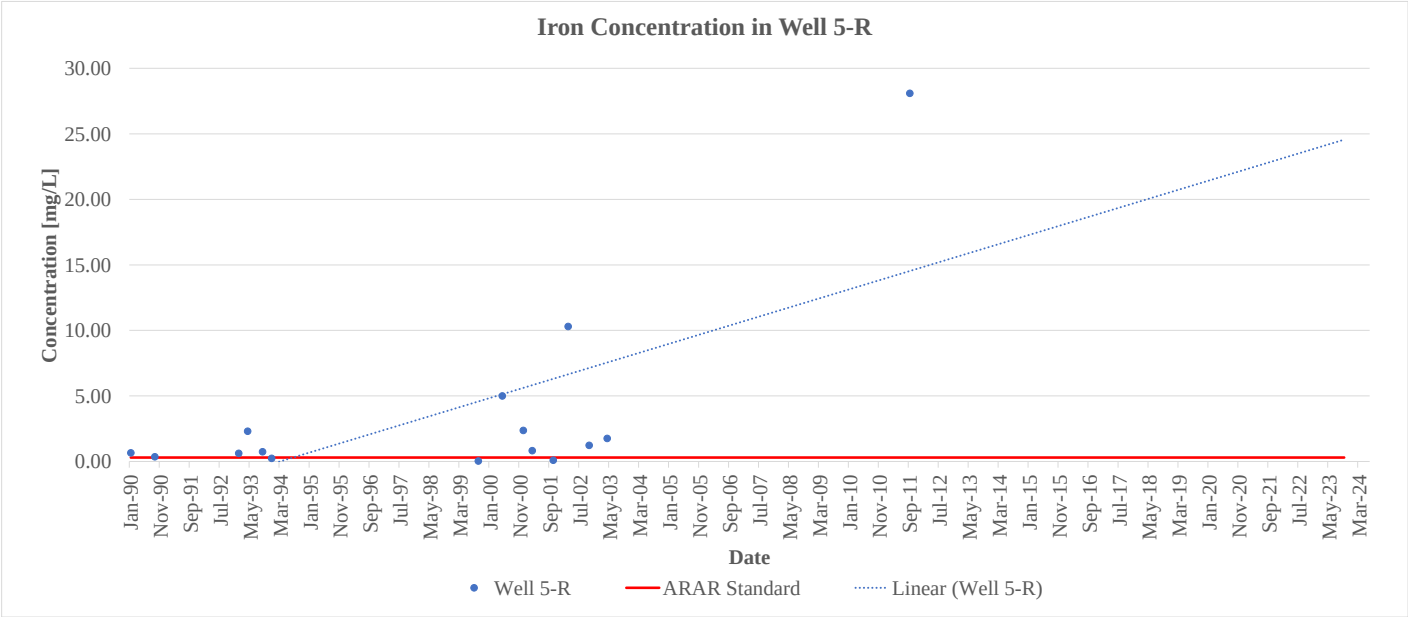
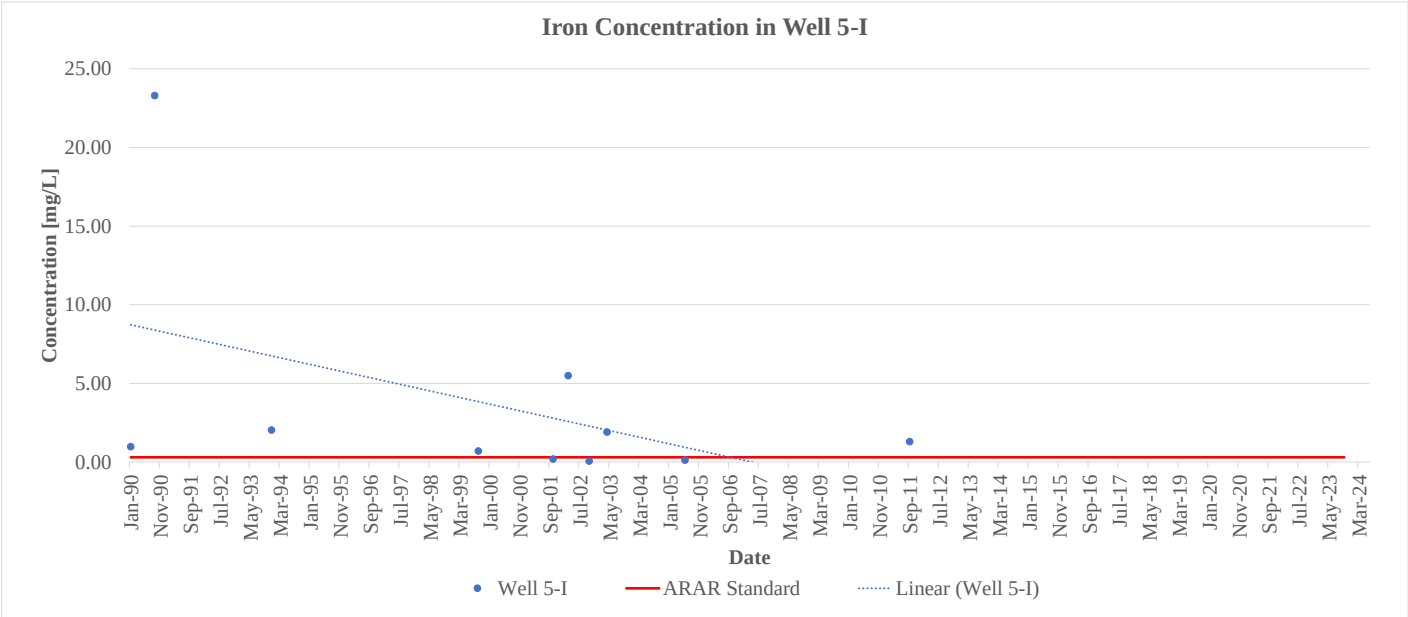
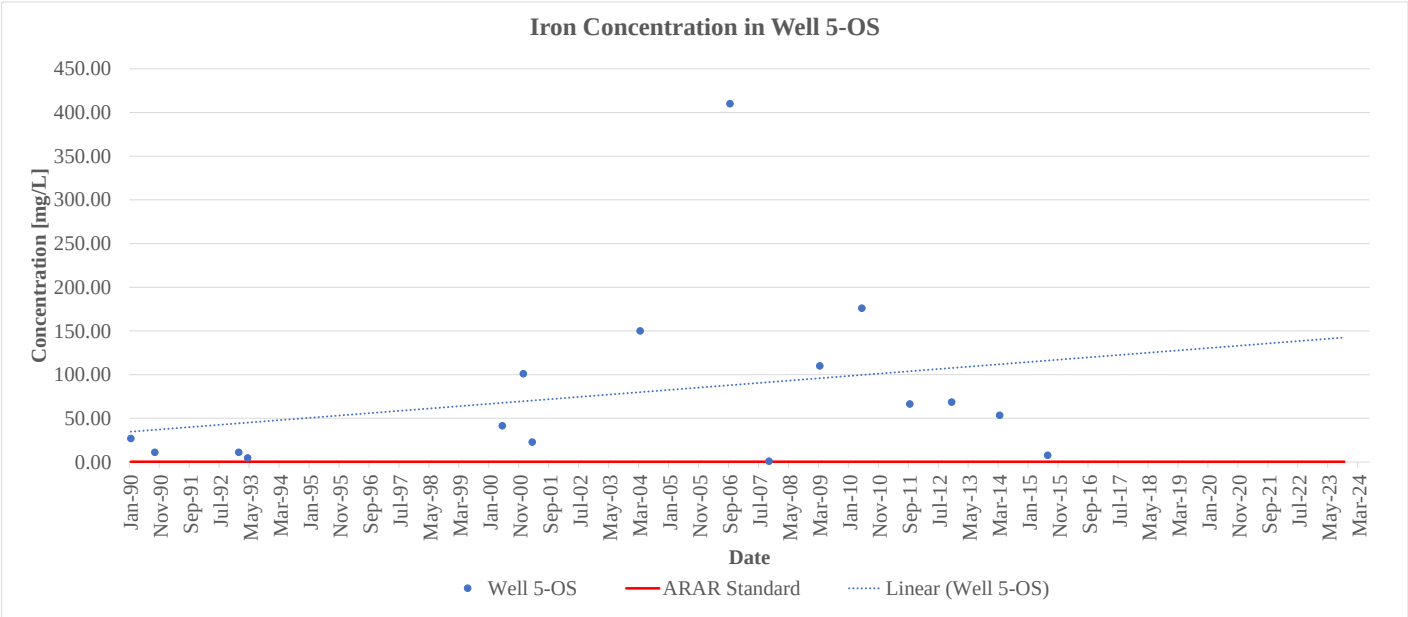


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Summary of Historical Groundwater Quality Results - Iron (mg/L)
Town of Ramapo Landfill

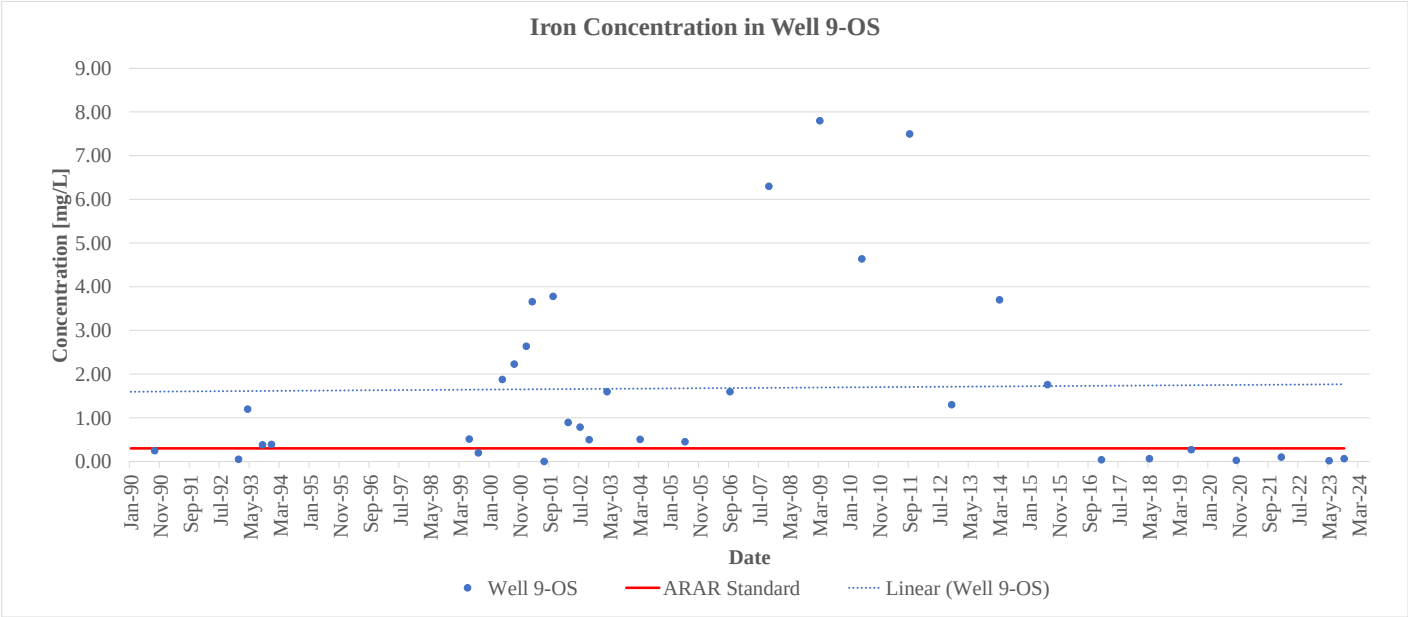
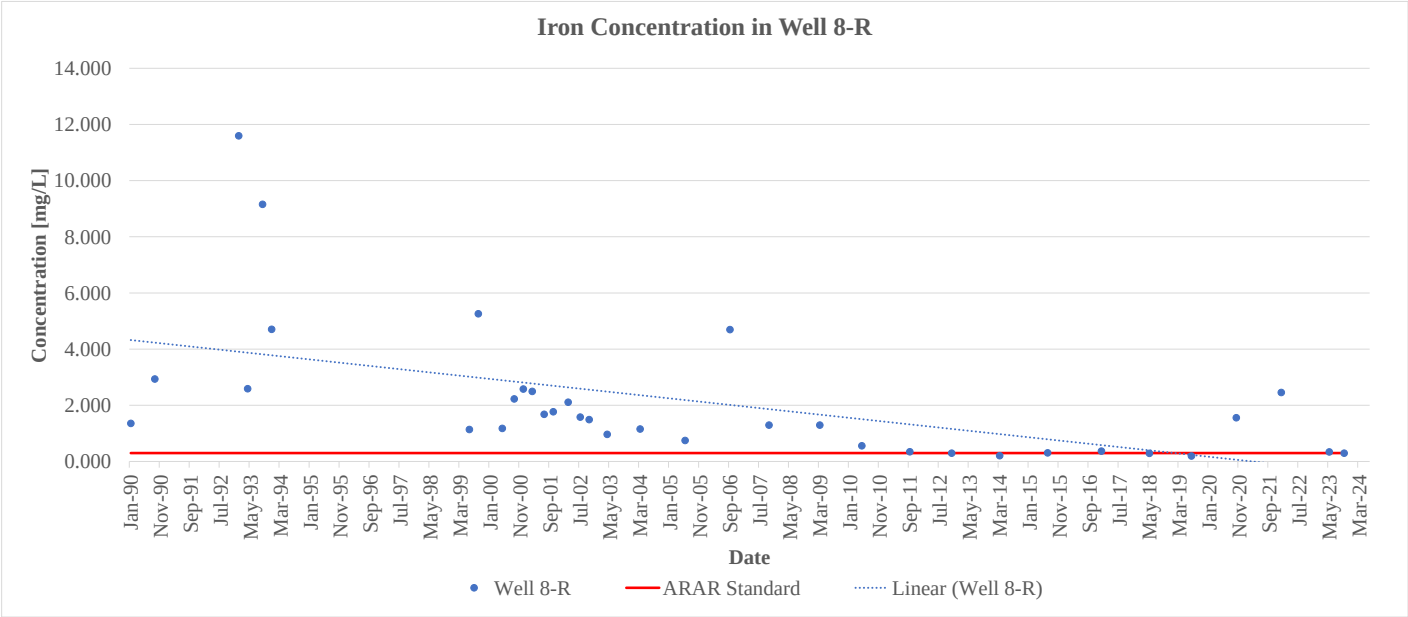
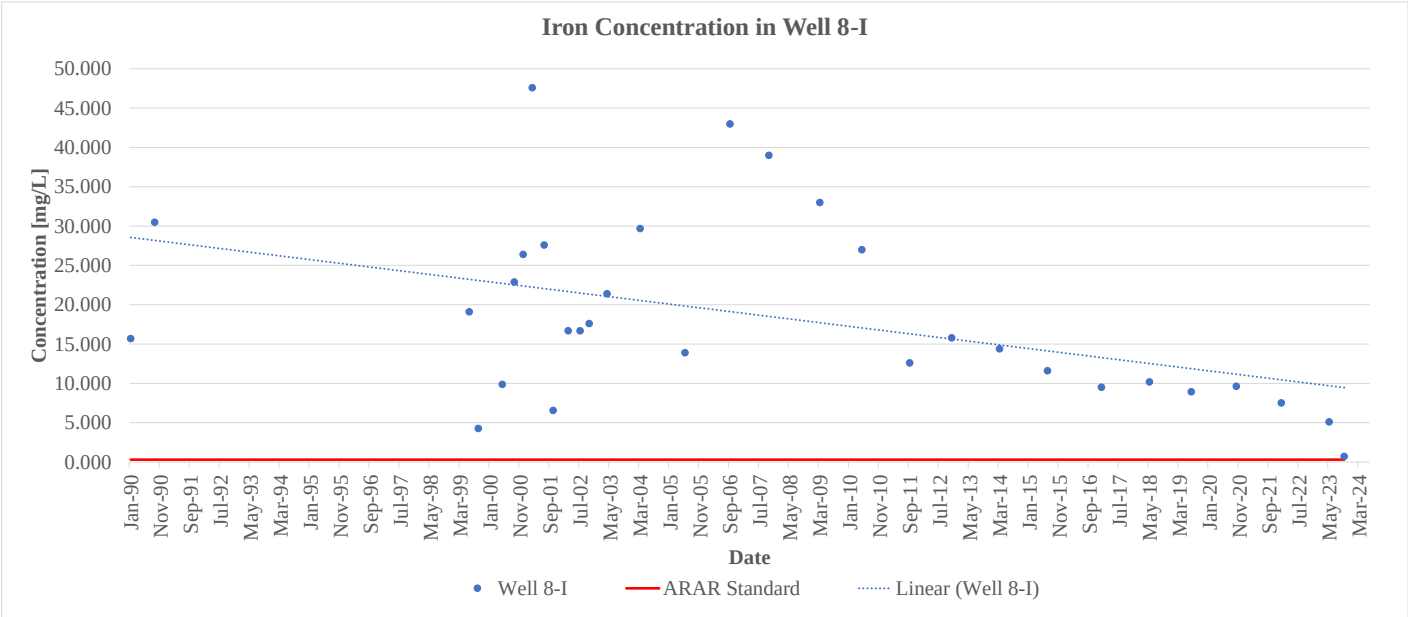
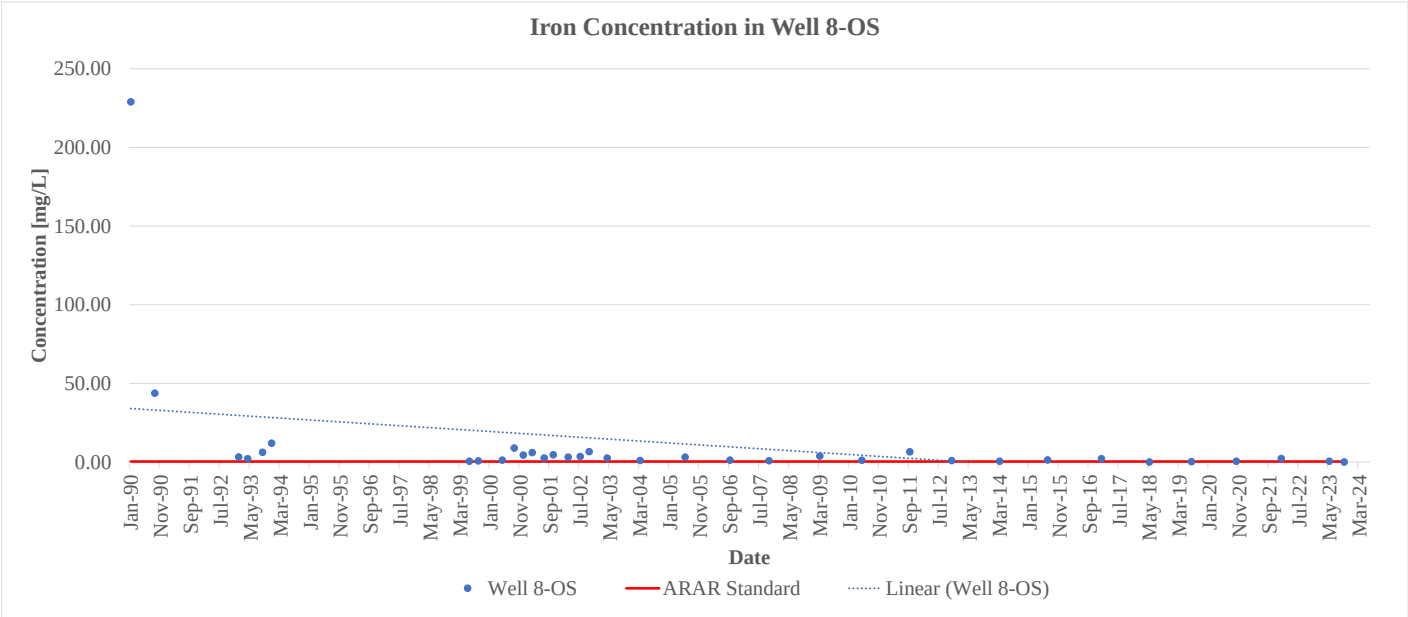


Table 6
Summary of Historical Groundwater Quality Results - Iron (mg/L)
Town of Ramapo Landfill

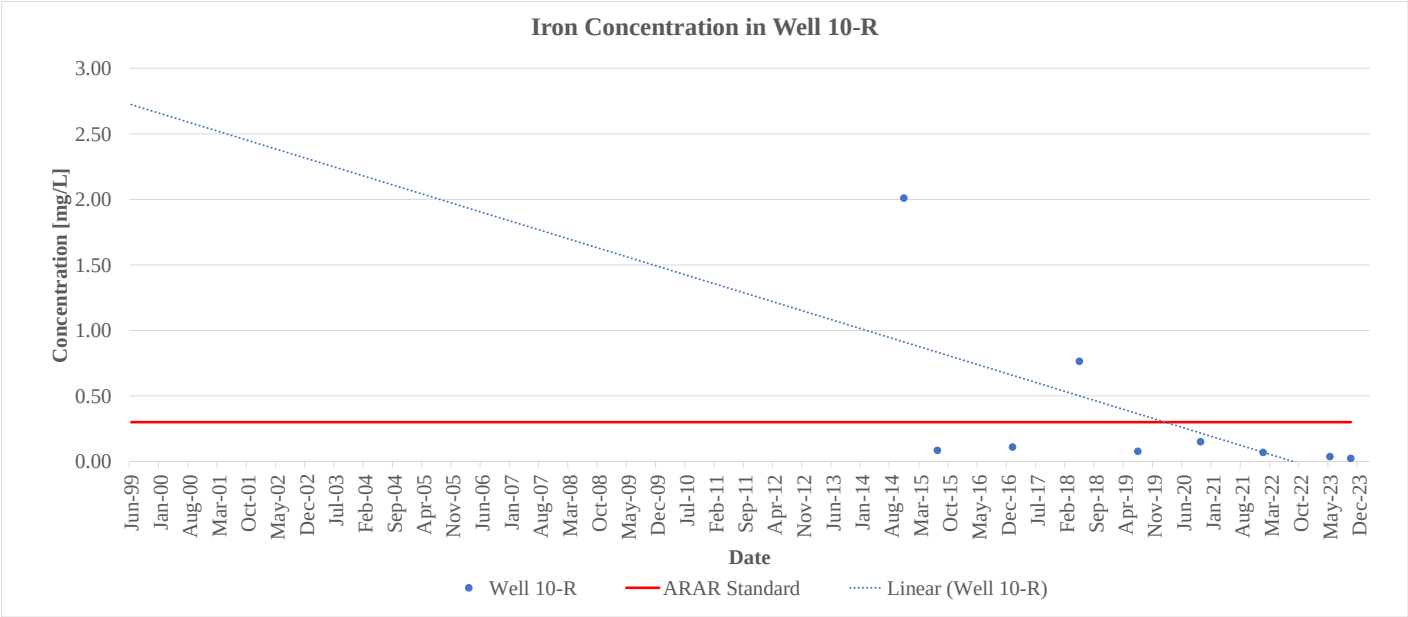
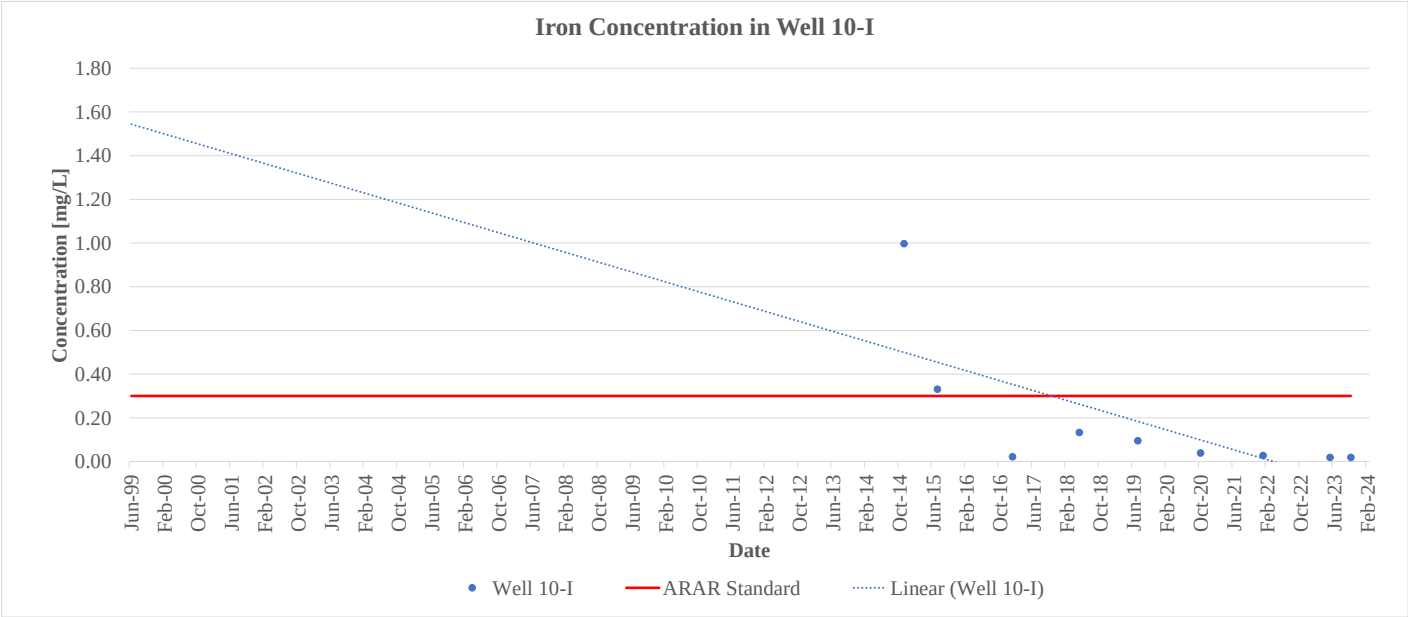
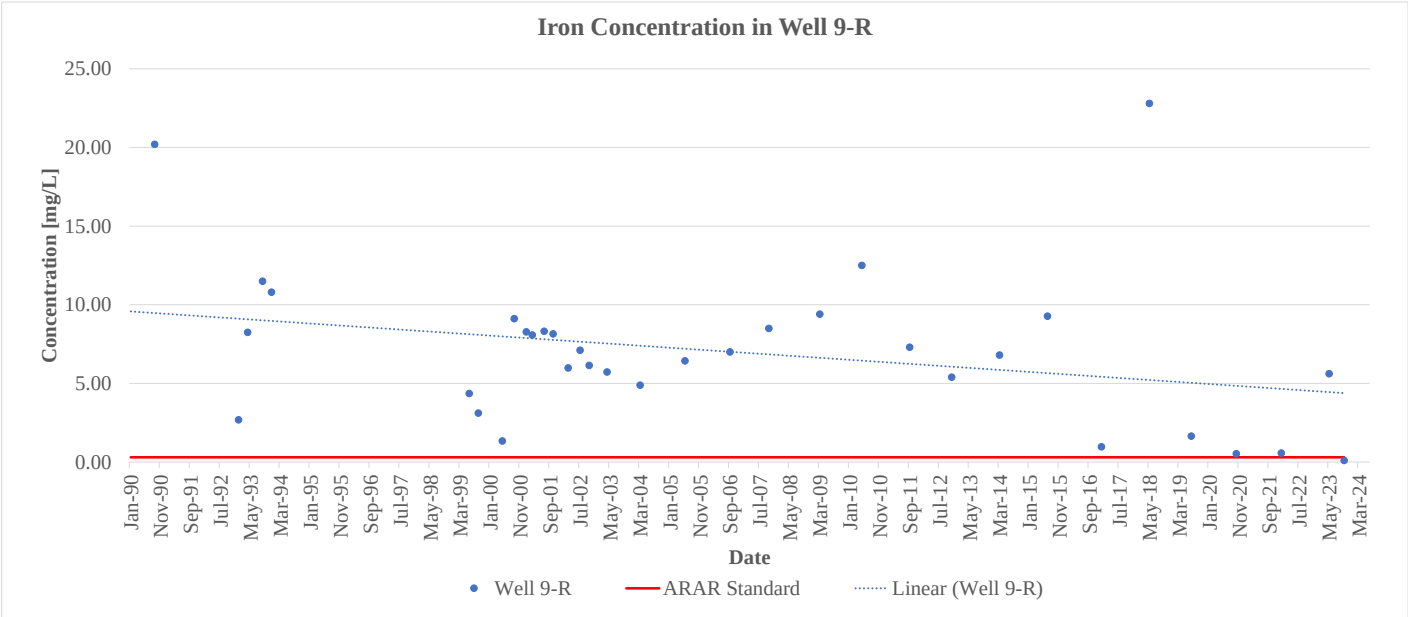
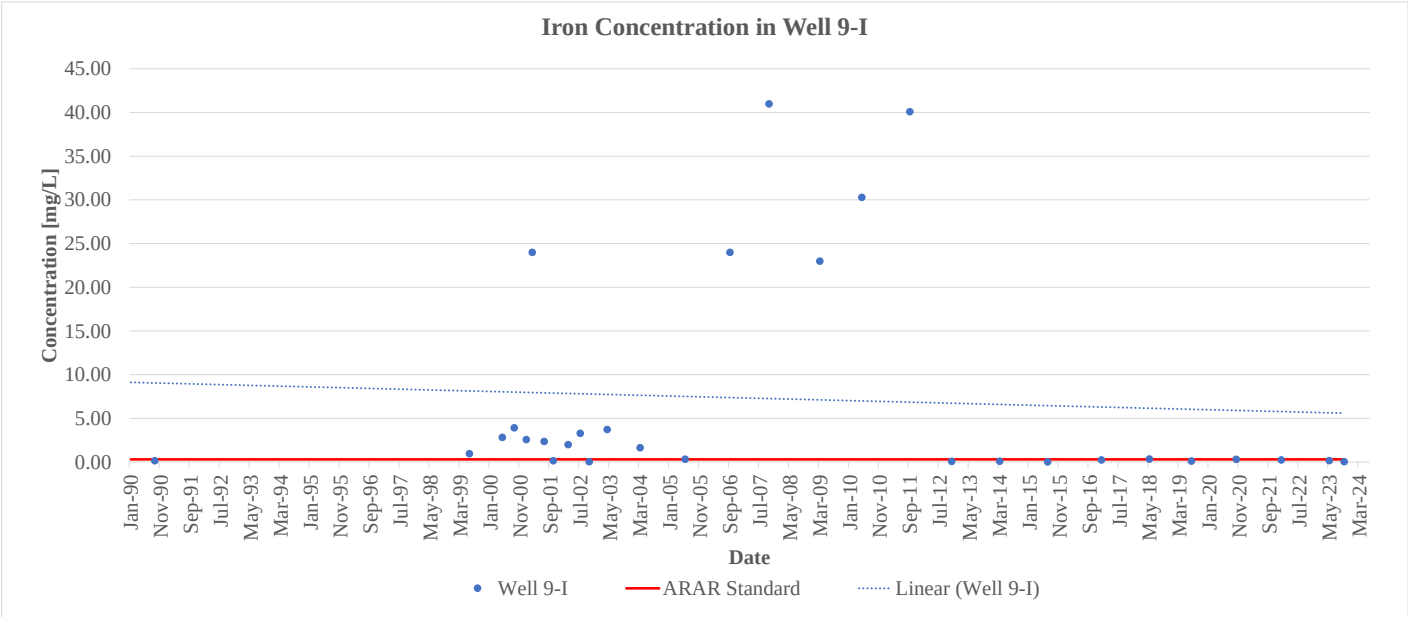


Table 6
Summary of Historical Groundwater Quality Results - Iron (mg/L)
Town of Ramapo Landfill

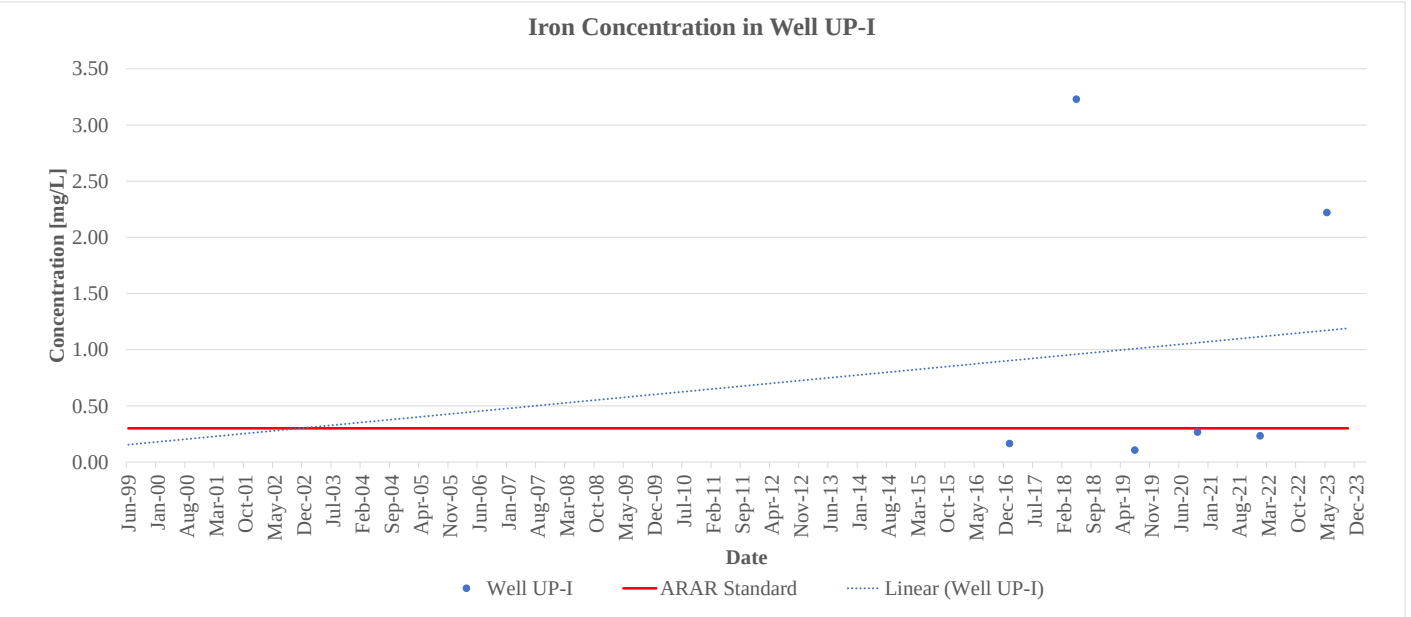
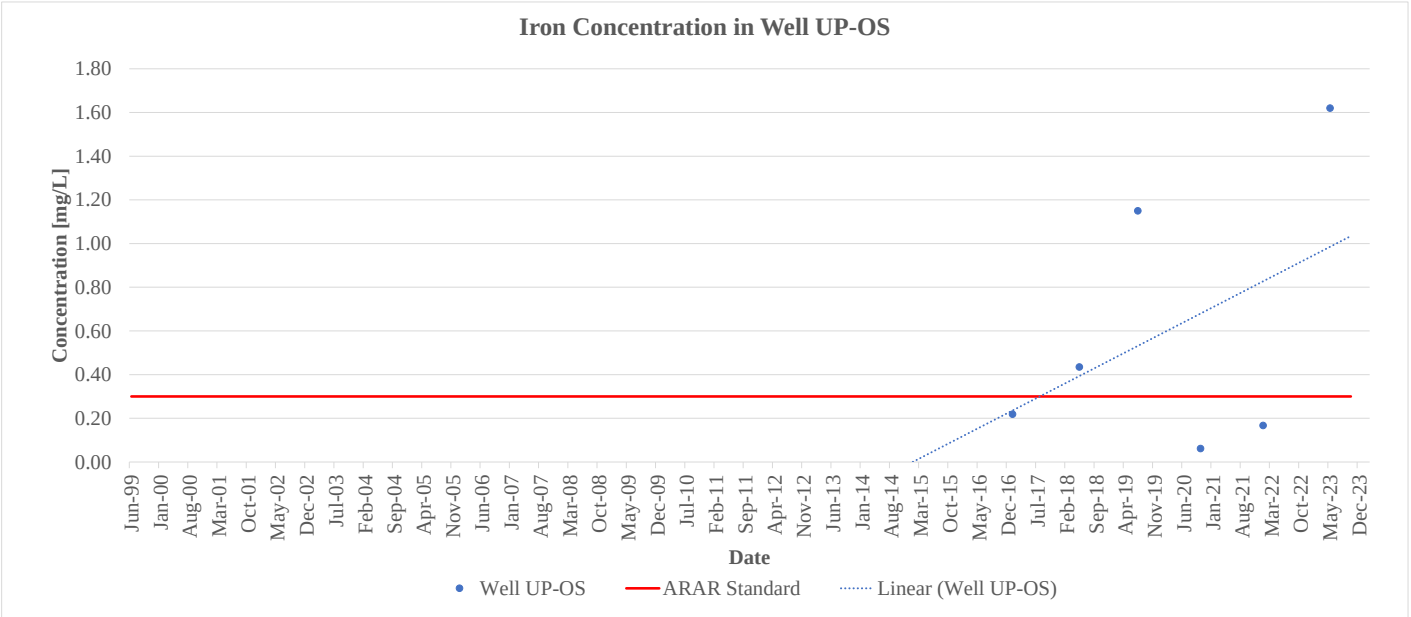


Table 7

Summary of Historical Groundwater Quality Results - Manganese (mg/L)
Town of Ramapo Landfill

Well ID DATE	Well 1-OS	Well 1-R	Well 2-OS	Well 2-R	Well 3-OS/I	Well 3-R	Well 4-OS	Well 4-R	Well 5-OS	Well 5-I	Well 5-R	Well 7-OS	Well 7-R	Well 8-OS	Well 8-I	Well 8-R	Well 9-OS	Well 9-I	Well 9-R	Well 10-OS	Well 10-I	Well 10-R	Well UP-OS	Well UP-I	Well UP-R	PW-1	PW-2	SVWC-93	SVWC-94	SVWC-95	SVWC-96	
Jan-90	3.790	0.144	0.298	0.197	8.700	7.230	4.210	1.730	0.981	0.034	0.022	1.240	0.052	2.830	4.230	0.872	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Sep-90	3.700	0.099	4.770	0.135	18.100	12.400	5.020	1.520	0.530	0.276	0.009	3.260	0.102	2.750	1.110	0.181	0.015	0.377	3.270	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	
Jan-93	0.809	0.061	NA	NA	3.450	10.700	0.547	1.660	0.192	NA	0.010	0.048	0.046	1.680	NA	1.660	ND	NA	2.320	NA	NA	NA	NA	NA	NA	0.0012	0.0047	ND	0.0073	0.0564	ND	
Apr-93	1.410	0.039	0.027	0.118	1.690	12.900	0.506	1.890	0.043	NA	0.022	0.046	0.052	1.640	NA	2.600	0.021	NA	2.280	NA	NA	NA	NA	NA	NA	0.0018	0.0075	0.0017	ND	0.0018	ND	
Sep-93	4.010	0.143	4.850	0.126	9.590	11.000	2.080	1.160	NA	NA	0.011	45.100	0.114	3.330	NA	2.440	0.010	NA	2.540	NA	NA	NA	NA	NA	NA	ND	0.0063	NA	NA	ND	NA	
Dec-93	5.590	0.062	1.580	0.116	8.780	12.000	0.995	1.230	NA	0.053	0.008	0.122	0.082	NA	NA	1.910	0.009	NA	1.890	NA	NA	NA	NA	NA	NA	0.0036	0.0066	0.0722	NA	NA	ND	
Jun-99	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.400	1.050	1.900	0.015	0.018	1.620	NA	NA	NA	NA	NA	NA	0.0019	0.0066	0.0025	0.0043	0.0406	0.0016	
Sep-99	9.830	0.599	0.936	0.744	0.577	15.100	1.720	1.180	NA	0.027	0.001	0.755	0.099	0.860	1.570	2.780	0.012	0.005	1.320	NA	NA	NA	NA	NA	NA	ND	ND	NA	NA	NA	NA	
May-00	5.740	0.236	4.110	0.497	5.720	14.200	1.340	1.320	0.533	NA	0.069	0.305	0.257	0.525	0.789	2.640	0.040	0.109	1.500	NA	NA	NA	NA	NA	NA	0.0008 B	0.0018 B	0.0005 B	0.0036 B	0.0404	0.0002 U	
Sep-00	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.820	2.810	2.390	0.055	0.067	3.020	NA	NA	NA	NA	NA	NA	0.0007 B	0.0025 B	0.0021 B	0.0071 B	0.0497	0.0007 U	
Dec-00	5.810	0.158	3.370	0.247	5.070	13.100	1.930	1.240	1.080	NA	0.033	1.270	0.360	2.410	2.560	2.120	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.0039 B	0.0007 U	0.0096 B	0.0475	0.0007 U	
Jan-01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.059	0.049	3.100	NA	NA	NA	NA	NA	NA	0.0014 B	NA	NA	NA	NA	NA	
Mar-01	4.940	2.070	3.450	0.142	3.750	10.400	0.440	1.040	0.323	NA	0.013 B	0.638 N	0.379 N	6.760 N	3.430	2.250 N	0.093 N	0.561 N	2.860 N	NA	NA	NA	NA	NA	NA	0.0136 B	0.0060 B	0.0022 B	0.0047 B	0.0498	0.0006 U	
Jul-01	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	5.800	2.990 N	2.640	0.001 U	0.038	2.960	NA	NA	NA	NA	NA	NA	0.0044 B	0.0020 B	0.0006 U	0.0027 B	0.1430	0.0006 U	
Oct-01	5.310	0.909	3.830	0.106	2.040	12.700	0.839	1.070	NA	0.003 B	0.002 U	0.668	0.375	6.340	1.760	2.060	0.078	0.005 B	3.080	NA	NA	NA	NA	NA	NA	0.0022 U	0.0047 B	NA	NA	NA	NA	
Mar-02	6.240	0.104	2.300	0.616	2.800	9.950	0.759	1.110	NA	0.132	0.154	0.592	0.292	1.620	3.670	1.930	0.025	0.045	2.490	NA	NA	NA	NA	NA	NA	0.0014 U	0.0060 B	0.0014 U	0.0069 B	0.0682	0.0014 U	
Jul-02	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	3.390	2.390	2.160	0.019	0.076	2.740	NA	NA	NA	NA	NA	NA	0.0019 U	0.0069 B	0.0019 U	0.0046 B	0.0774	0.0019 U	
Oct-02	8.160 E	1.650 E	6.940 E	0.404 E	13.400 E	19.400 E	3.790 E	0.953 E	NA	0.004 B,E	0.022 E	1.730 E	NA	6.950 E	2.980 E	1.980 E	0.011 E	0.004 B,E	2.880 E	NA	NA	NA	NA	NA	NA	0.0021 B,E	0.0033 B,E	0.0074 B	0.0019 U	0.0617	0.0034 B	
Apr-03	NA	0.177	3.100	0.157	24.800	12.100	0.620	1.180	NA	0.064	0.030	0.124	NA	0.894	3.140	2.050	0.036	0.052	2.630	NA	NA	NA	NA	NA	NA	0.0008 U	0.0039 B	0.0008 U	0.0061 B	0.0800	0.0008 U	
Mar-04	NA	NA	2.300	NA	7.200	NA	0.338	NA	2.040	NA	NA	2.140	NA	1.590	4.650	2.150	0.004 B	0.019	1.980	NA	NA	NA	NA	NA	NA	0.0009 U	0.0009 U	0.0009 U	0.0033 B	0.0880	0.0009 U	
Jun-05	4.720	NA	0.778	NA	6.450	NA	0.700	NA	NA	0.014	NA	0.222	NA	0.691	3.090	2.190	0.028	0.012	2.730	NA	NA	NA	NA	NA	NA	0.0021 U	0.0021 U	0.0021 U	0.0065 B	0.0860	0.0021 U	
Sep-06	2.800	NA	1.900	NA	9.200	NA	0.860	NA	5.100	NA	NA	1.300	NA	0.110	1.900	2.200	0.051	0.290	2.800	NA	NA	NA	NA	NA	NA	0.0008 J	0.0014 J	0.0006 J	0.0032 J	0.0250 J	0.0500 U	
Oct-07	5.100	NA	3.500	NA	4.400	NA	2.700	NA	0.014 J	NA	NA	0.920	NA	2.000	2.200	1.900	0.140	0.560	2.900	NA	NA	NA	NA	NA	NA	0.0500 U	0.0056 J	0.0500 U	0.0038 J	0.0960	0.0500 U	
Mar-09	9.000	NA	2.200	NA	14.000	NA	0.400	NA	1.000	NA	NA	0.450	NA	0.610	3.100	1.900	0.150	0.290	3.700	NA	NA	NA	NA	NA	NA	0.0500 U	0.0018 J	0.0500 U	NA	0.1400	0.0500 U	
May-10	14.800 B	NA	1.680	NA	2.460 B	NA	0.223	NA	2.230	NA	NA	1.710 B	NA	0.399 B	4.590 B	1.960 B	0.090 B	0.392 B	4.030 B	NA	NA	NA	NA	NA	NA	NA	0.0012 J,B	0.0031 B	0.0003 J,B	NA	0.1100 B	0.0220 B
Sep-11	8.300 B	1.500 B	0.780 B	0.530 B	4.500 B	41.400 B	0.160 B	NA	0.830 B	0.026 B	0.640 B	1.200 B	NA	0.700 B	3.500 B	2.100 B	0.110 B	0.590 B	2.700 B	NA	NA	NA	NA	NA	NA	0.0021 J,B	0.0024 J,B	0.0018 J,B	0.0015 J,B	NA	NA	
Nov-12	11.600 B	NA	0.980 B	NA	2.800 B	NA	0.560 B	NA	0.660 B	NA	NA	1.400 B	NA	0.280 B	3.500 B	2.000 B	0.019 B	0.004 B	2.300 B	NA	NA	NA	NA	NA	NA	0.0013 J,B	0.0026 J,B	0.0009 J,B	0.0008 J,B	0.2000 B	NA	
Mar-14	16.900 B	NA	1.900 B	NA	2.900 B	NA	0.740 B	NA	0.620 B	NA	NA	1.500	NA	0.100 B	3.300 B	1.900 B	0.051	0.004	3.100	NA	NA	NA	NA	NA	NA	0.0016 J	0.0410	ND	ND	0.1300	ND	
Nov-14	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	0.026	0.0289	0.1900	NA	NA	NA	NA	NA	NA	NA	NA	NA	
Jul-15	12.550	NA	0.363	NA	0.271	NA	0.276	NA	0.065	NA	NA	0.173	NA	0.178	2.560	2.162	0.047	0.032	4.458	0.033	0.0083	0.0158	NA	NA	NA	0.0020 U	0.0020 U	0.0020 U	0.0020 U	1.8100	0.0020 U	
Jan-17	2.479	NA	0.087	NA	0.520	NA	0.024	NA	NA	NA	NA	0.019	NA	0.066	1.558	0.263	0.002	0.002	1.659	0.022	0.0013	0.0162	0.0154	0.0109	0.0045	0.0011	0.0010 J	0.0010	0.0005 J	0.0675	0.0004 U	
May-18	0.199	NA	0.009	NA	1.121	NA	0.034	NA	NA	NA	NA	0.042	NA	0.001	3.720	2.422	0.001	0.026	2.948	0.029	0.0030	0.0361	0.0805	0.1597	0.0010 J	0.0024	0.0023	0.0008 J	0.0010 U	0.0421	0.0010 U	
Jul-19	0.772	NA	0.454	NA	3.728	NA	0.212	NA	NA	NA	NA	0.075	NA	2.318	3.198	0.127	0.009	0.033	1.450	0.025	0.0011	0.0181	0.0392	0.0034	0.0070	0.0010	0.0017	0.0006 J	0.0012	0.0431	0.0005 J	
Oct-20	13.000	NA	0.026	NA	1.500	NA	0.463	NA	NA	NA	NA	0.586	NA	0.184	3.479	0.577	0.001 J	0.006	1.137	0.021	0.0005 J	0.0226	0.0016	0.0056	0.0008 J	0.0005 J	0.0005 J	0.0004 U	0.0008 J	0.0627	0.0004 U	
Jan-22	2.215	NA	0.055	NA	0.107	NA	0.074	NA	NA	NA	NA	0.010	NA	0.227	3.129	4.152	0.002	0.005	2.019	0.052	0.0004 U	0.0059	0.0043	0.0037	NA	0.0020 U	0.0050 J	0.0004 U	0.0004 U	0.0335	0.0004 U	
May-23	0.890	NA	0.007	NA	0.049	12.190 NA	0.038	NA	NA	NA	NA	0.003	NA	0.017	2.557	2.294	0.001 J	0.120	3.850	0.026	0.0004 J	0.0039	0.0272	0.0336	0.0010	0.0016 U	0.0016 U	0.0016 U	0.0121	0.0342	0.0016 U	
Oct-23	NA	NA	NA	NA	0.053	15.020	NA	NA	NA	NA	NA	NA	NA	0.011	5.592	0.114	0.003	0.162	0.529	0.029												

Notes:

ARAR Standard = 0.3 mg/L; USEPA Secondary MCL = Not Available; and, Part 5 MCL = 0.3 mg/L
ARAR = Applicable or Relevant and Appropriate Requirement: NYSDEC T.O.G.S. 1.1.1 Ambient Water-Quality Standards and Guidance Values and Groundwater Effluent Limitations (June 2004).
MCL = Maximum Contaminant Level: USEPA National Primary Drinking Water Regulations.
Values in **BOLD** indicate the reported concentration is greater than the ARAR for the groundwater monitoring wells or MCL for the private and municipal drinking water wells water quality standard.
NA = Not Analyzed

Laboratory Qualifier Definitions

ND or U = Not Detected
B = The analyte was detected above the reporting limit in the associated method blank.
E = Indicates an estimated value because of the possible presence of interference.
J = Result is less than the reporting limit but greater than or equal to the method detection limit and the concentration is an approximate value.
N = Spiked sample recovery not within control limits.

Table 7

Summary of Historical Groundwater Quality Results - Manganese (mg/L)
Town of Ramapo Landfill

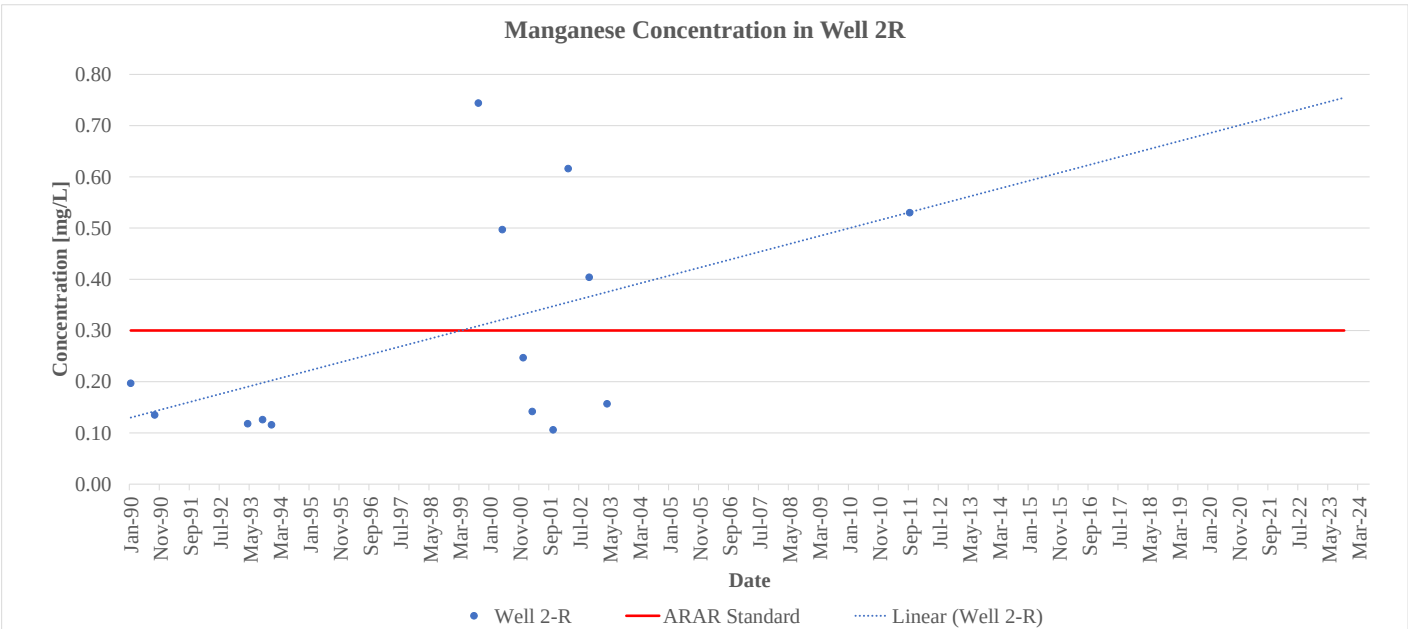
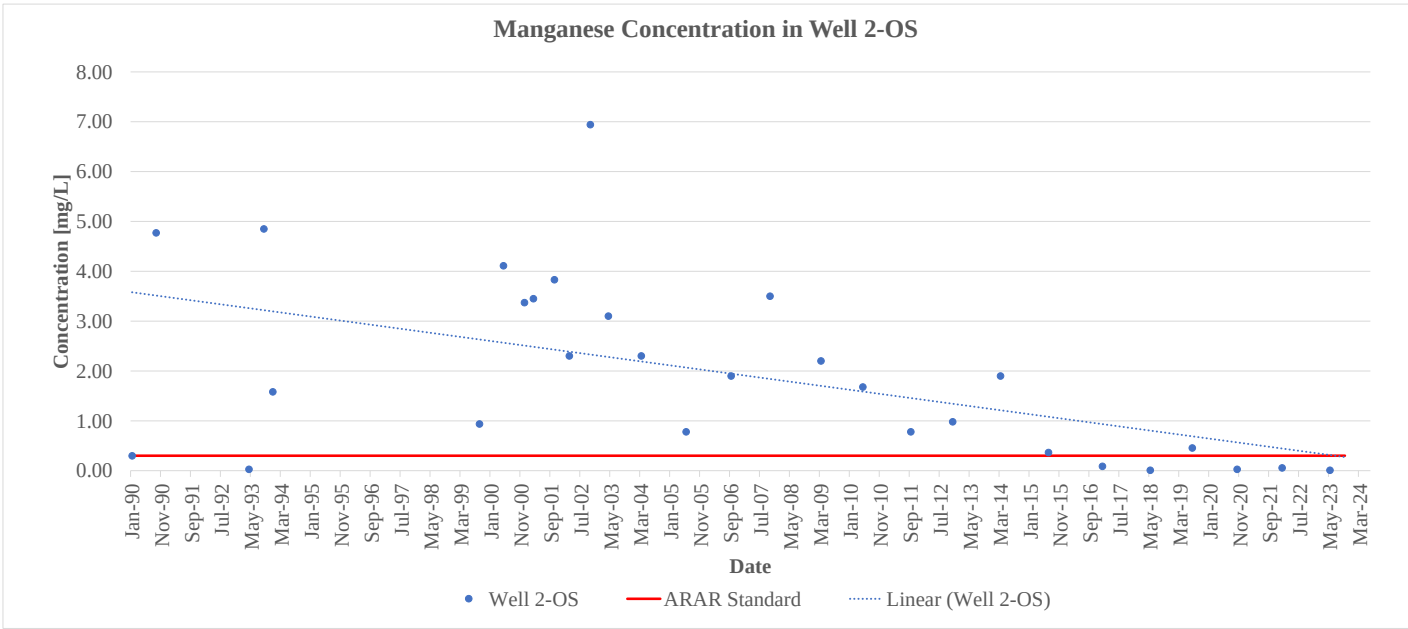
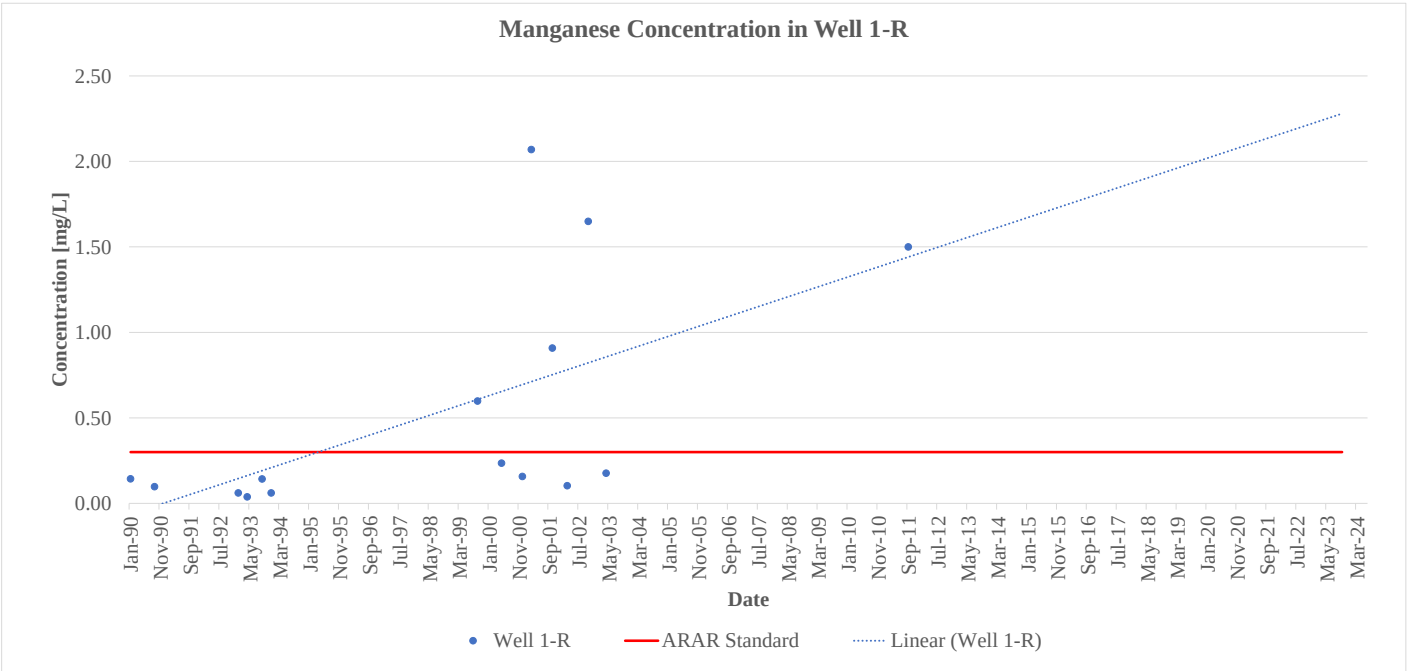
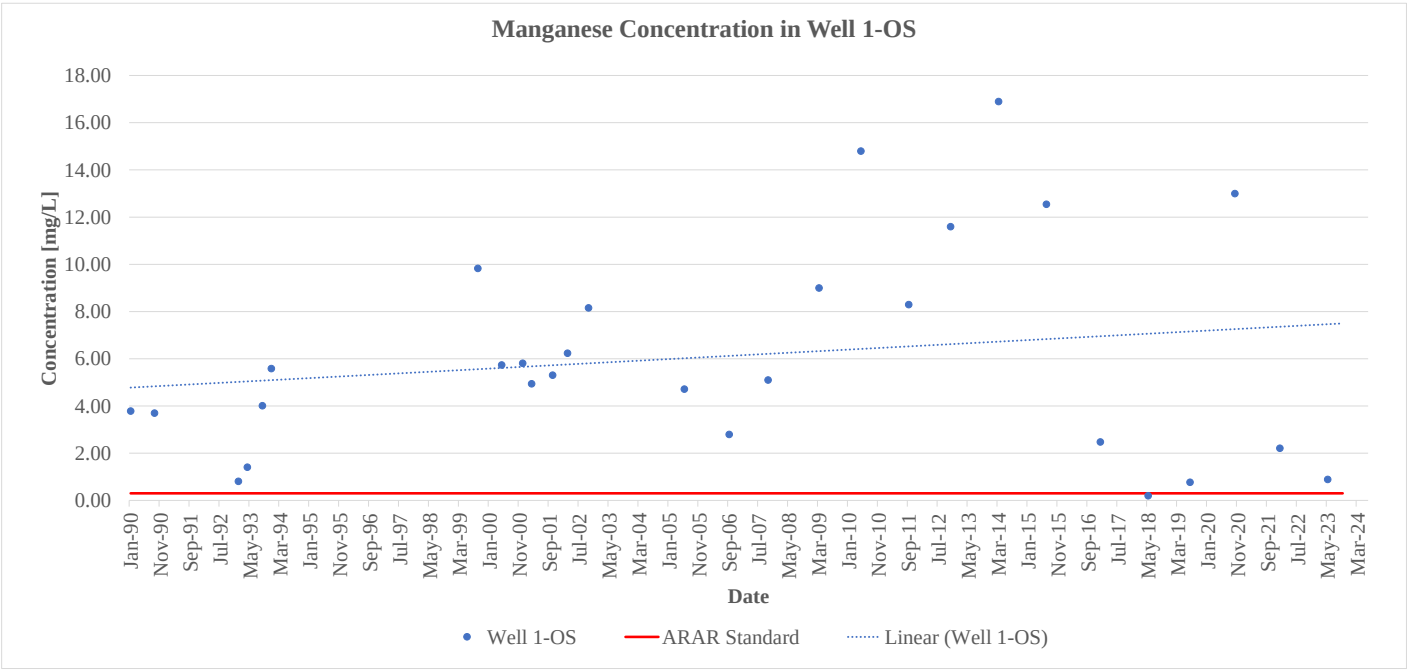


Table 7

Summary of Historical Groundwater Quality Results - Manganese (mg/L)
Town of Ramapo Landfill

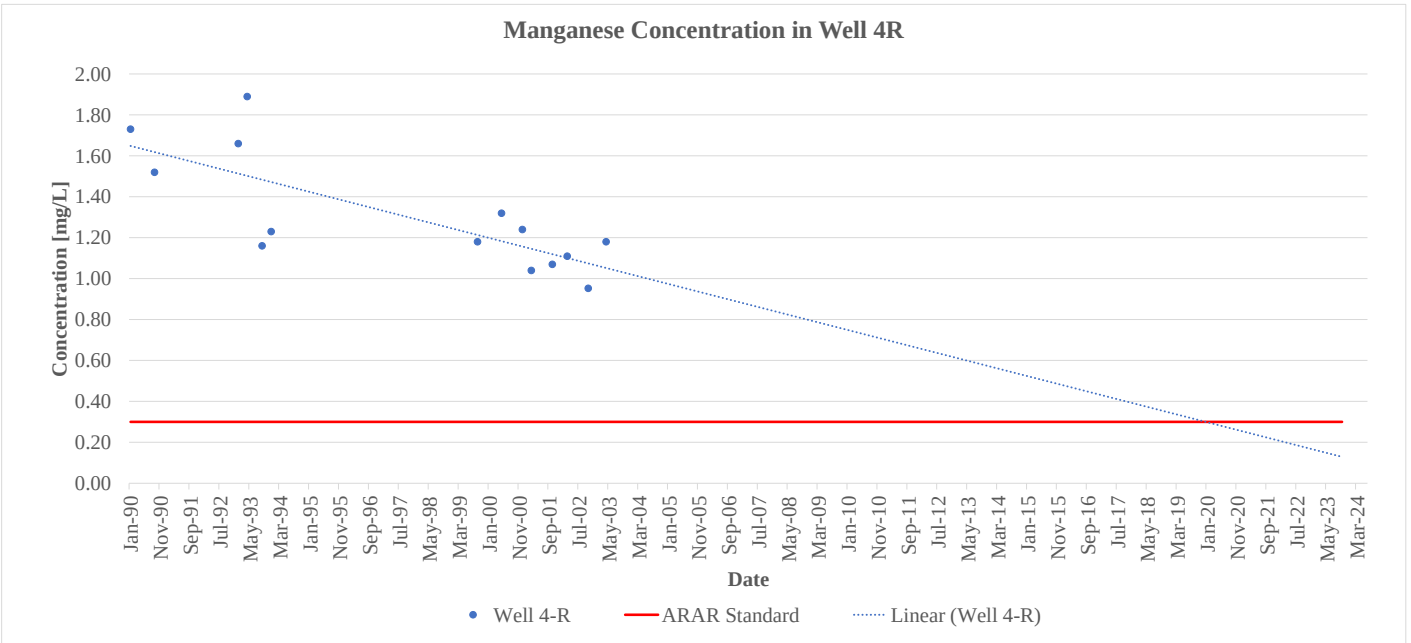
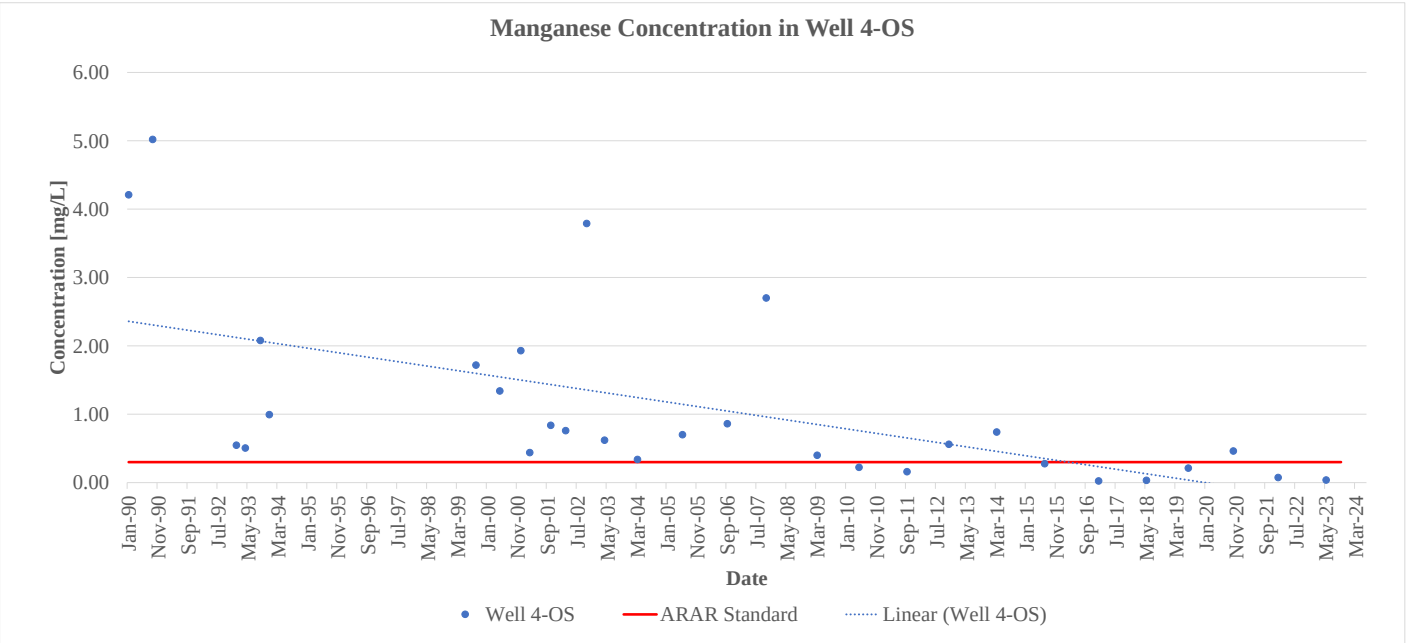
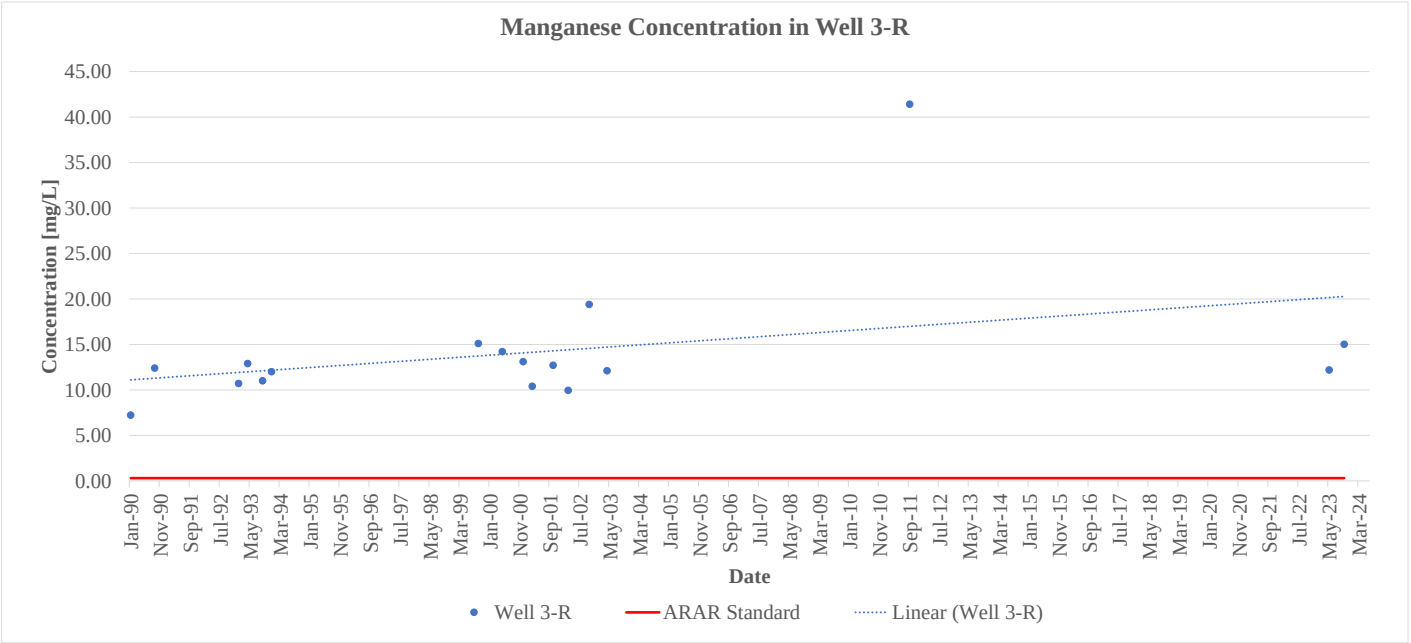
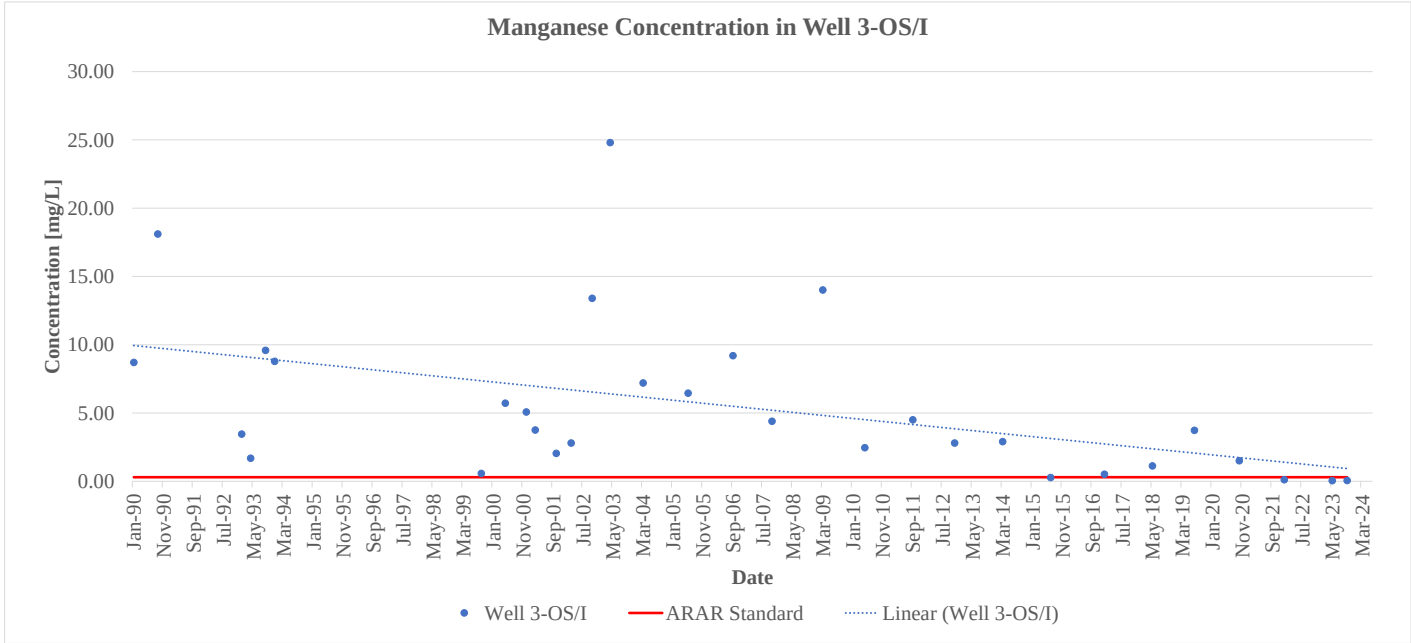


Table 7

Summary of Historical Groundwater Quality Results - Manganese (mg/L)
Town of Ramapo Landfill

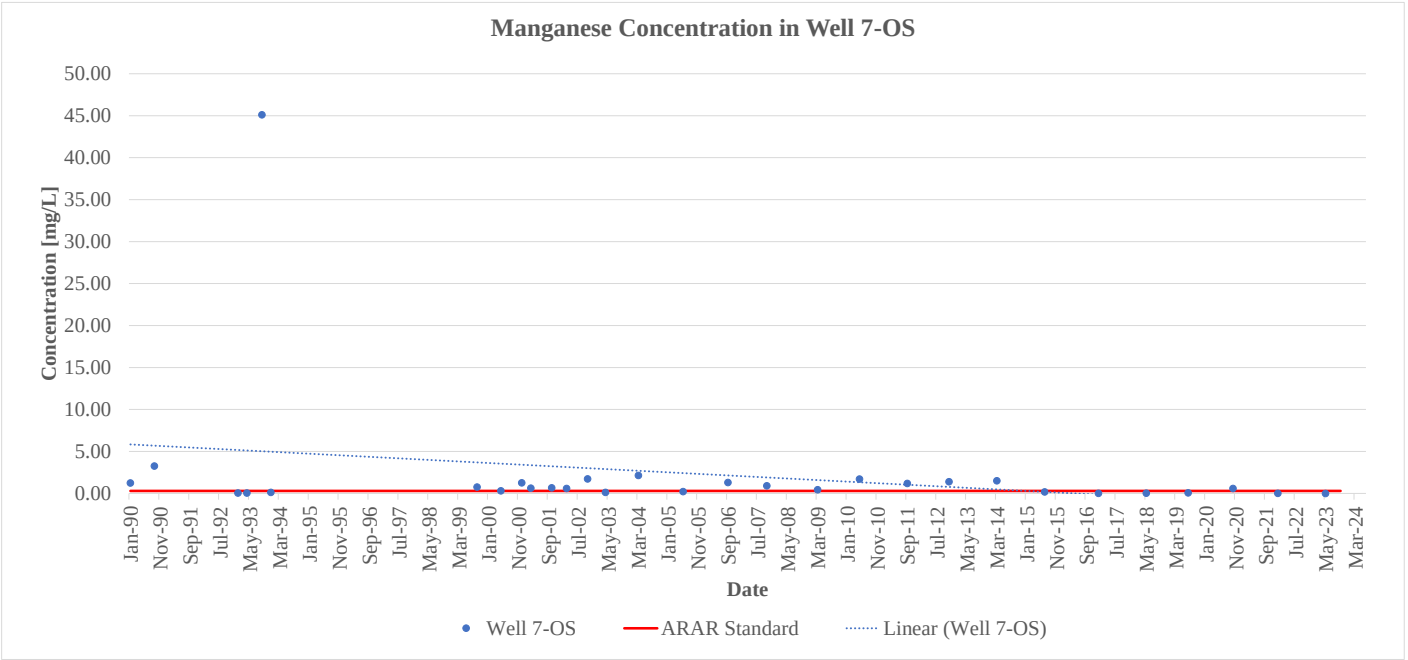
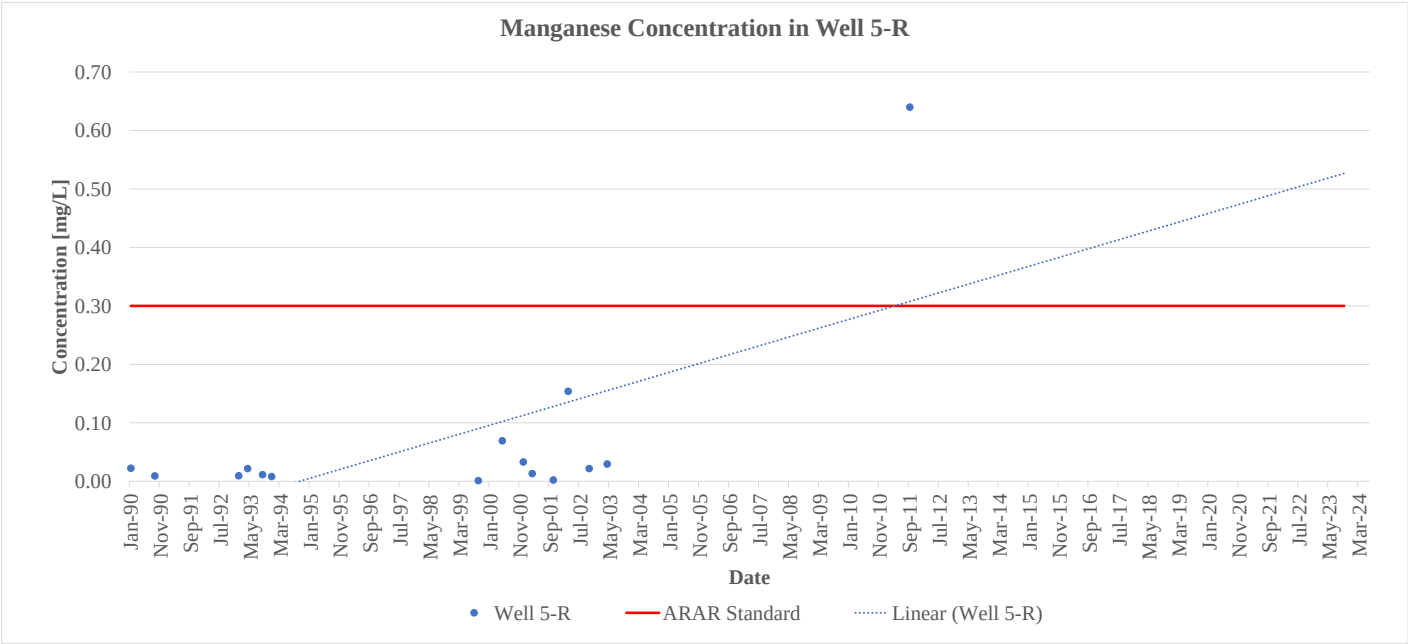
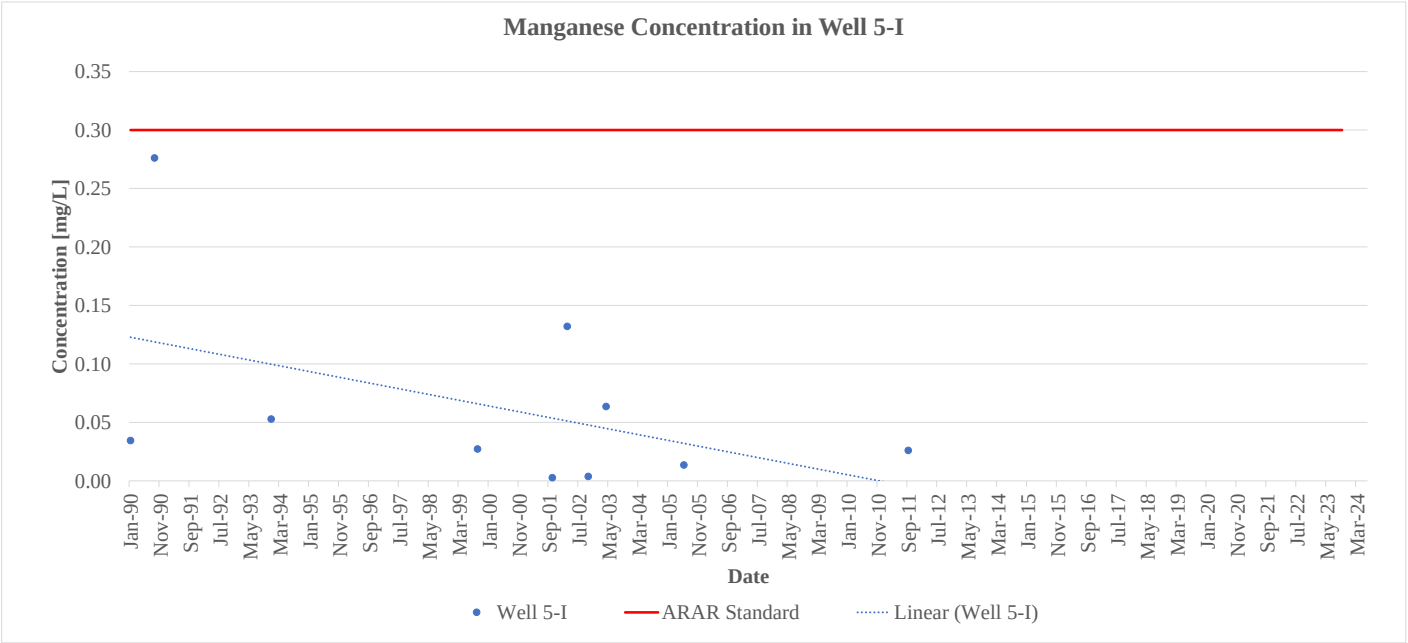
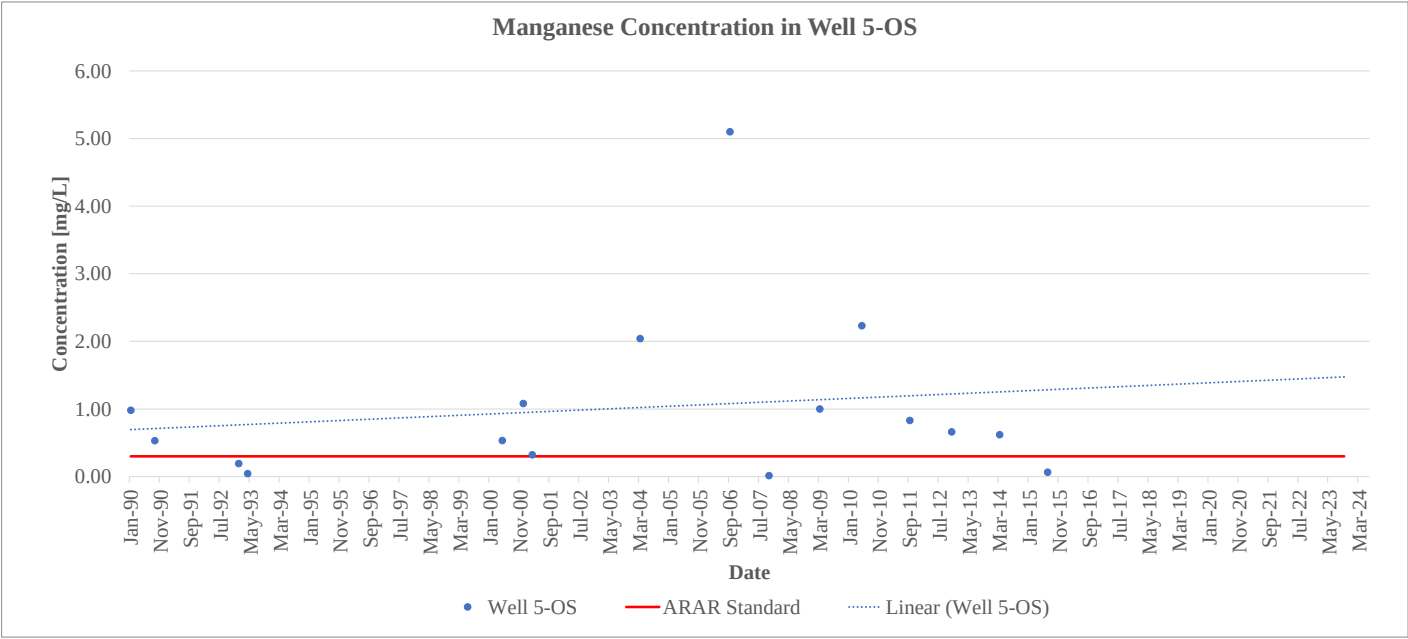


Table 7

Summary of Historical Groundwater Quality Results - Manganese (mg/L)
Town of Ramapo Landfill

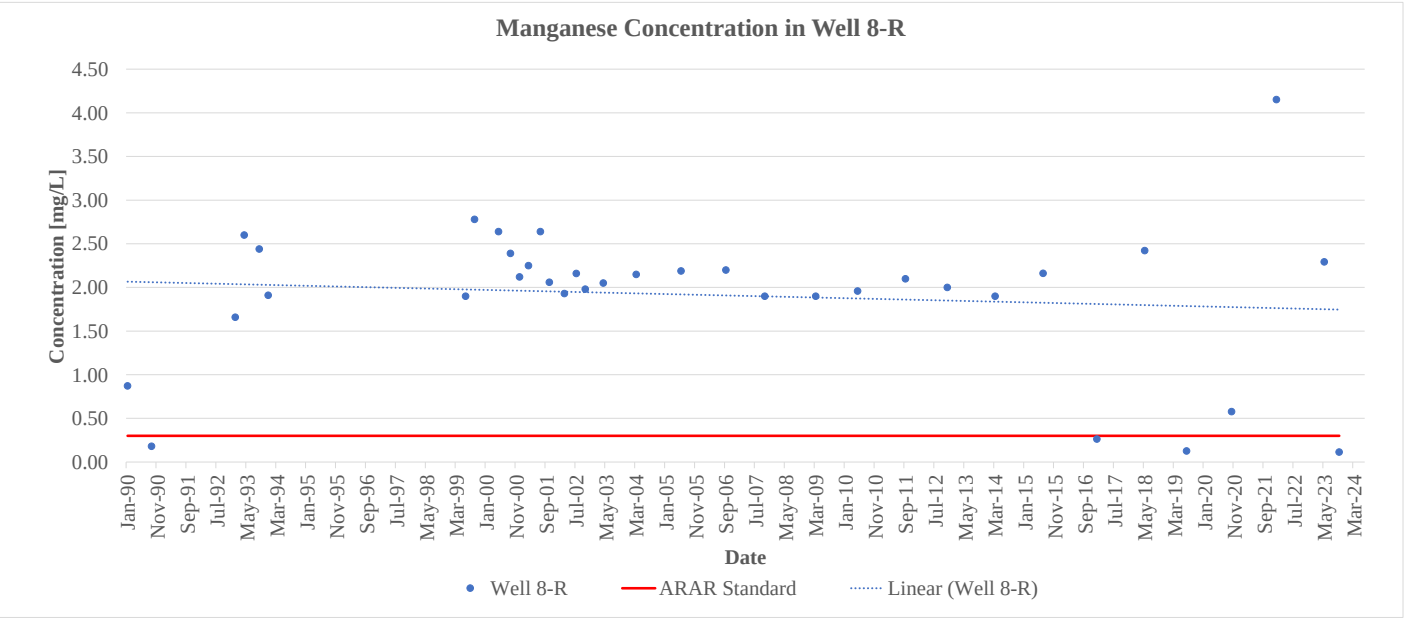
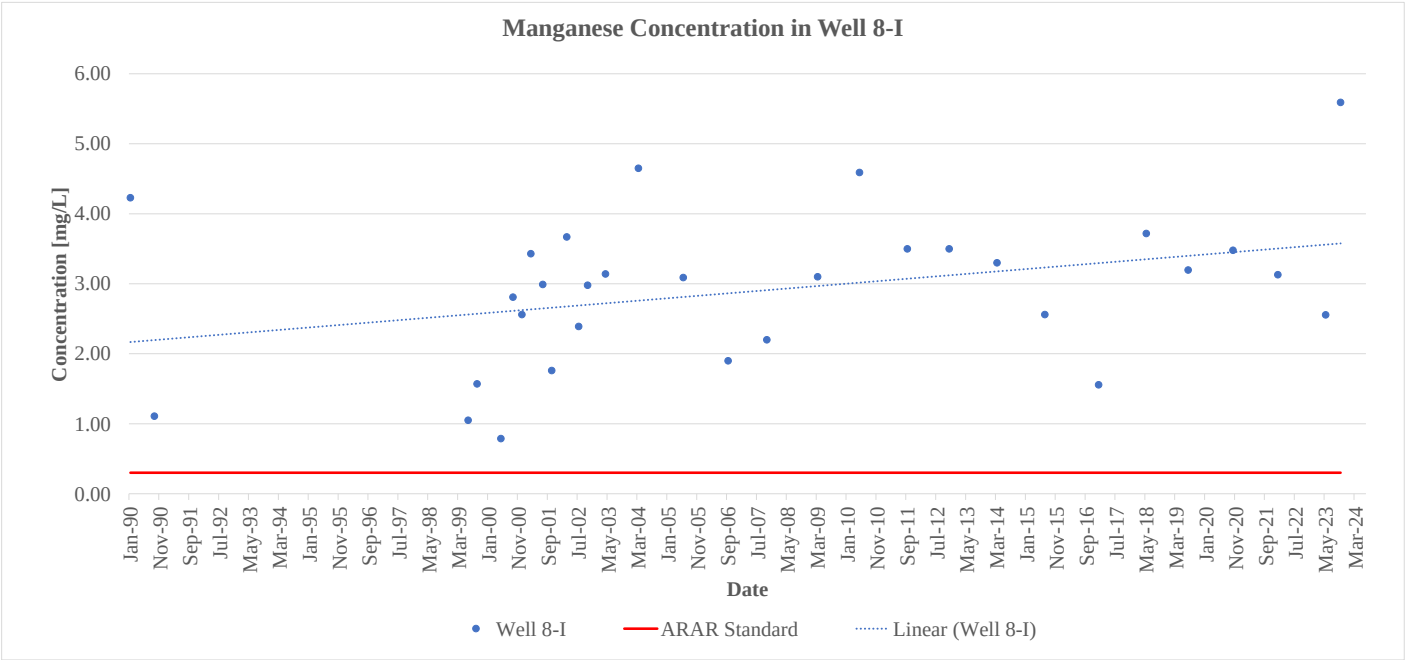
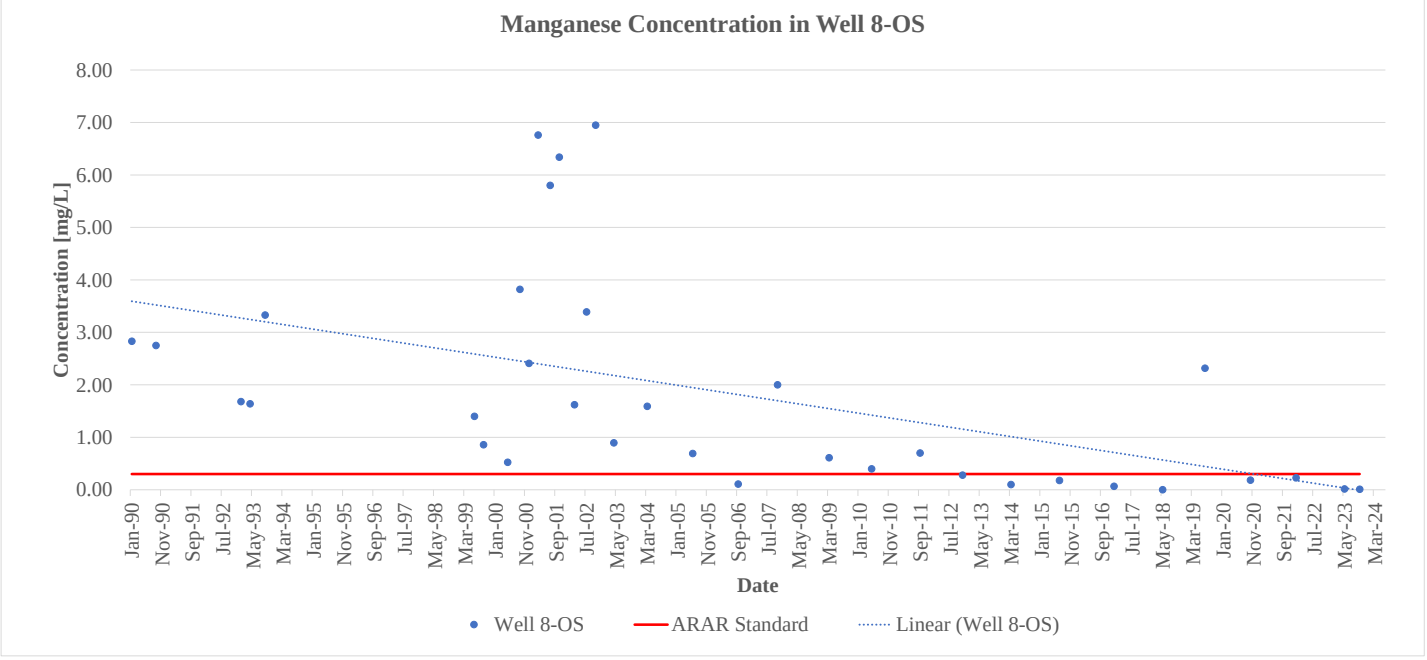
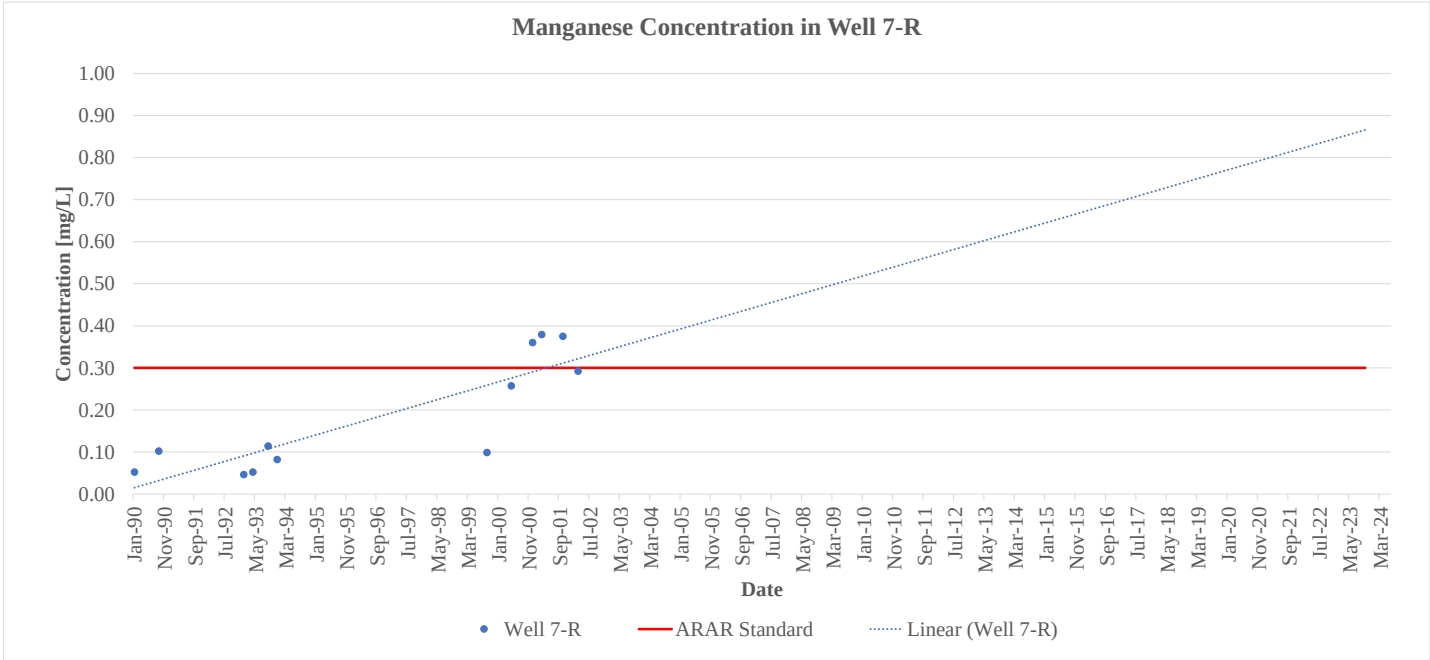
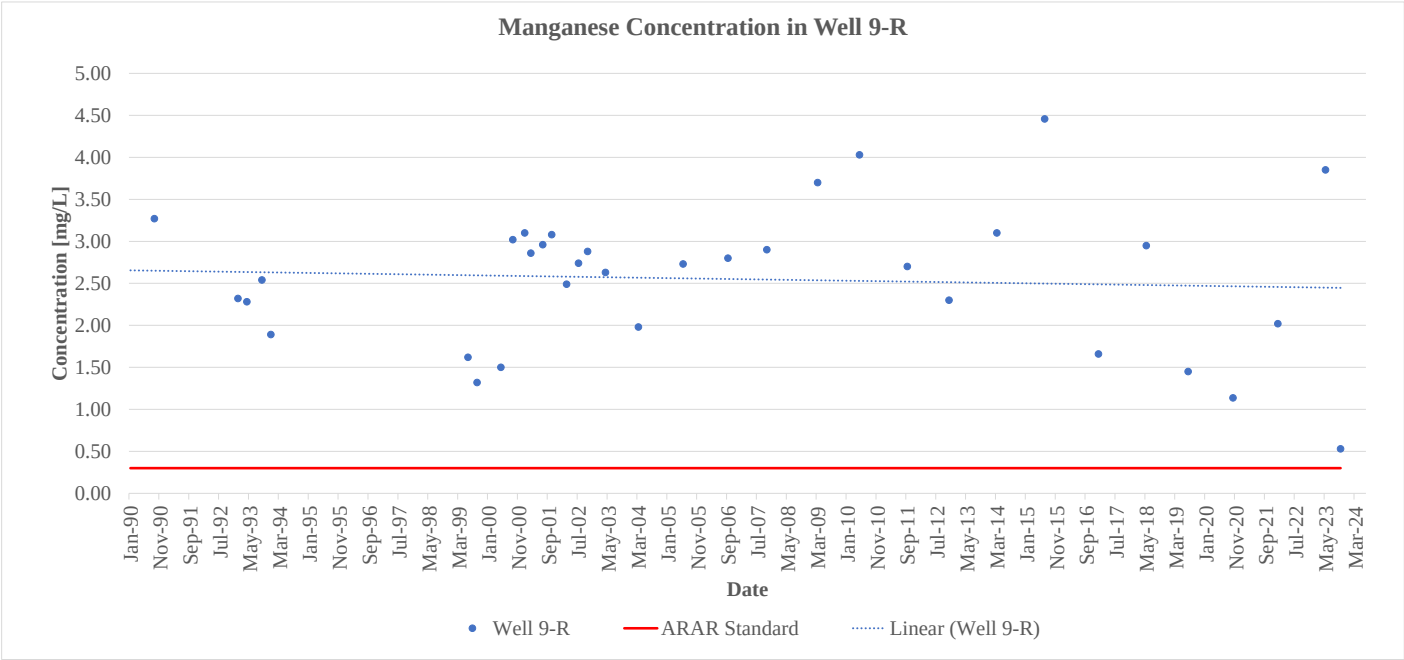
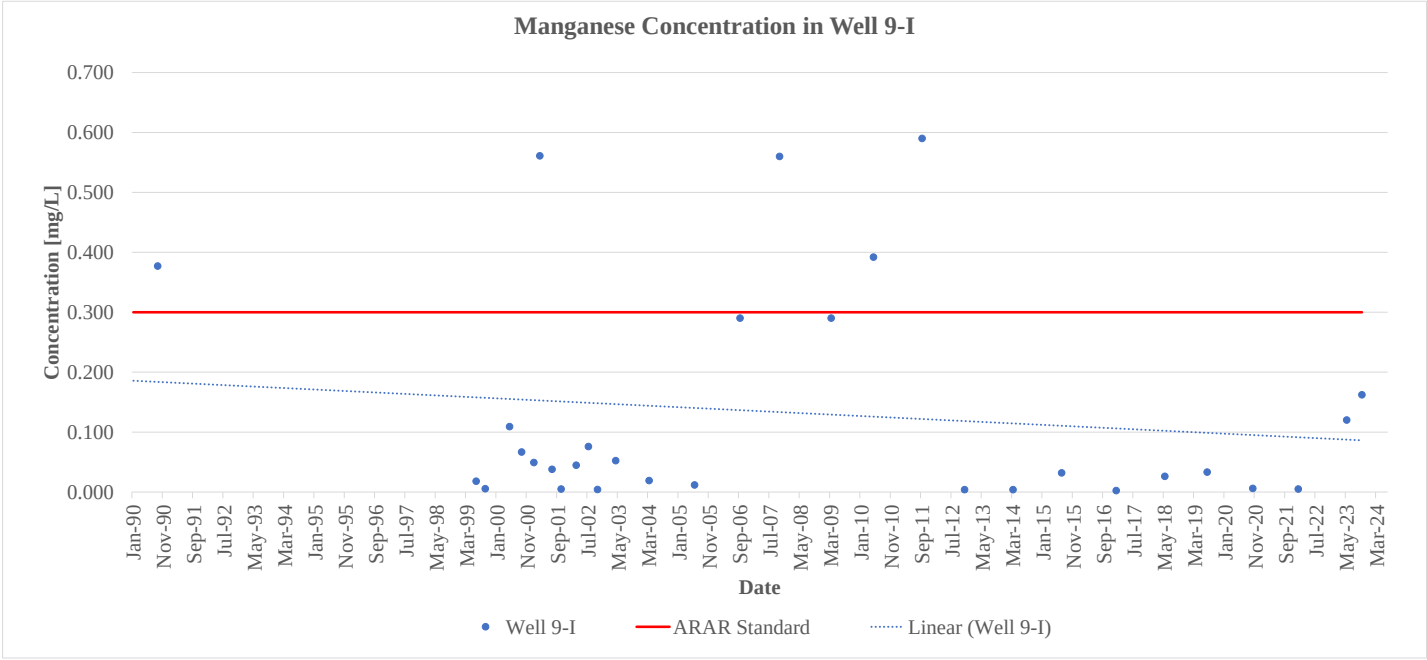


Table 7

Summary of Historical Groundwater Quality Results - Manganese (mg/L)
Town of Ramapo Landfill



APPENDIX A

EXTRACTION WELL DRILLING LOGS



JAMES C. ANDERSON ASSOCIATES, INC.
Drilling Contractor

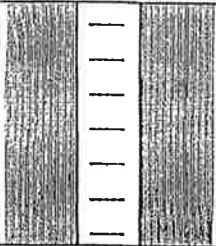
907 Pleasant Valley Avenue

Mount Laurel, New Jersey 08054

(609)-722-6700

PROJECT		Ramapo Landfill Remediation Site			Sheet 1 of 2	
CLIENT		GEO-CON Inc.			Job No. D94DRE-463	
GROUNDWATER			DRILLING METHOD		DEPTH	
Date	Time	Depth	12" Air Rotary		0' To 44'	
2/16/95		17.86 ft				
WELL CONSTRUCTION			COORDINATE NO.	STATE PERMIT NO.	SPOON SIZE	
					2' X 3"	
					Elevation TOC: 321.88	
					Inspector: URS	

grade	SAMPLE				CLASSIFICATION
	No.	Depth	Blows	N	
	1	0-2	12-18-18-23	36	brown fine to med SAND some Silt, trace fine Gravel
	2	3-5	10-12-14-17	26	S.A.A.
6	3	5-7	5-6-9-3	15	dark brown fine to med SAND trace Silt
	4	8-10	0-3-2-6	5	dark brown fine to med Clayey SAND trace fine Gravel
10.3	5	10-12	7-18-14-15	32	green, gray fine to coarse SAND some fine Gravel
12.3					
14.3	6	13-15	5-9-10-100/2	19	S.A.A. wet wet at 13 ft
	7	15-17			no sample
	8	18-20	13-15-18-20	33	green, gray fine to coarse SAND some fine Gravel, trace Clay wet
	9	20-22	9-11-15-18	26	S.A.A. wet
	10	23-25	12-12-14-14	26	S.A.A. wet
	11	25-27	11-10-15-16	25	S.A.A. wet
	12	28-30	8-9-8-15	17	S.A.A. wet
	13	30-32	4-10-11-9	21	green, gray fine to coarse Clayey SAND some med Gravel wet
	14	33-35	8-9-8-14	17	S.A.A. wet
	15	35-37	56-100/2		green fine to coarse Clayey SAND some fine to med Gravel wet

		SAMPLE			CLASSIFICATION
		No.	Depth	Blows	
		16	38-40	100/6	tan fine to coarse Clayey SAND some fine to med Gravel
		17	40-42	100/1	refusal at 40' 1" - gneiss fragments in tip of spoon
	44.3				

Well Depth
44ft 4inches

LEGEND.



Cement/Bentonite Grout



Bentonite Pellet Seal



Gravel Pack



8" SCH 40 Type 304 Flush Joint Threaded Stainless Steel Casing



8" 304 0.035 Slot Stainless Steel Screen



Stainless Steel Centralizer

Notes:

1. Bore hole diameter was 12 inches.
2. Bore hole was flushed with air and water before casing and screen was set. Bore hole flushing was accomplished by introducing air and water through the drilling rods.
3. Filter pack was poured around the well casing from the bottom of the bore hole up.
4. Depth to top of filter pack was determined using a weighted measuring tape.
5. Bentonite pellets were slowly poured around the well casing and allowed to settle.
6. Bentonite seal hydrated for 14 hours.
7. Annular grout was placed via tremie method.
8. Cement/bentonite grout mix - 5lbs bentonite, 94lbs cement, and 8 gallons water.
9. Gravel pack - Ricel Bros. Sand Co., Inc., #1 Well Gravel, 20 100lb bags used.
10. Bentonite pellets - Rocktest, Inc., Peltonite (Wyoming Bentonite Sealing Agent), 1 50lb bucket used.
11. Bentonite - Baroid Drilling Fluids, Inc., 1/2 55lb bag used.
12. Cement - Allentown Cement Company, Inc., 5 94lb bags used.
13. Well Casing - Cook Screen Technology, Inc., 1x10ft and 1x5ft section used.
14. Well Screen - Cook Screen Technology, Inc., 3x10ft sections used.
15. Well was developed 26 hours after grouting.
16. Well was developed for 2 hours and 40 minutes at 2 gpm.
17. Well was developed using a submersible pump.
18. Development water was cloudy at first, then it cleared up after 2 hours of pumping.
19. Elevation of top-of-casing is 321.88.
20. The interval between annular grout and surface grade was left open.



JAMES C. ANDERSON ASSOCIATES, INC.
Drilling Contractor

907 Pleasant Valley Avenue

Mount Laurel, New Jersey 08054

(609)-722-6700

PROJECT		Ramapo Landfill Remediation Site			Sheet 1 of 2	
CLIENT		GEO-CON Inc.			Job No. D94DRE-463	
GROUNDWATER			DRILLING METHOD		DEPTH	
Date	Time	Depth	12" Air Rotary		0' To 43'	
6/13/95		20.38 ft			Borehole No. W-2	
					Date Started : 6/6/95	
					Date Finished : 6/13/95	
					Driller : UNI-TECH	
WELL CONSTRUCTION		COORDINATE NO.	STATE PERMIT NO.		SPOON SIZE	Elevation TOC: 323.64
					2' X 3"	Inspector : URS

grade	SAMPLE				CLASSIFICATION
	No.	Depth	Blows	N	
	1	0-2	7-12-12-11	24	dark brown, brown fine to med SAND some med Gravel
6	2	5-7	7-6-3-2	9	brown fine to med SAND some small Gravel
8.5					
10.5					
12.5	3	10-12	5-2-2-2	4	brown fine SAND trace Silt moist
	4	15-17	11-14-16-16	30	brown fine SAND trace Silt wet
	5	18-20	36-52-40-21	92	black, gray fine to coarse SAND and med GRAVEL wet
	6	23-25	7-18-50/4		gray, brown fine to coarse SAND with small Gravel wet
	7	27-29	27-29		gray, brown fine to coarse SAND with med Gravel wet
	8	33-35	5-5-25-30	30	light green, gray fine to coarse SAND with med Gravel wet

SAMPLE				CLASSIFICATION
No.	Depth	Blows	N	
9	37-39	15-22-25-25	47	black, gray fine to med SAND wet
10	39-40	150/2		gneiss fragment (quartz, feldspar, and serpentine visible)

42.5

Well Depth
42ft 6inches

LEGEND



Cement/Bentonite Grout



Bentonite Perlet Seal



Gravel Pack



8" SCH 40 Type 304 Flush Joint Threaded Stainless Steel Casing



8" Type 304 0.035 Slot Stainless Steel Screen



< > Stainless Steel Centralizer

Notes:

1. Bore hole diameter was 12 inches.
2. Bore hole was flushed with air and water before casing and screen was set. Bore hole flushing was accomplished by introducing air and water through the drilling rods.
3. Filter pack was poured around the well casing from the bottom of the bore hole up.
4. Depth to top of filter pack was determined using a weighted measuring tape.
5. Bentonite pellets were slowly poured around the well casing and allowed to settle.
6. Bentonite seal hydrated for 14 hours.
7. Annular grout was placed via tremie method.
8. Cement/bentonite grout mix - 5lbs bentonite, 94lbs cement, and 8 gallons water.
9. Gravel pack - Ricci Bros. Sand Co., Inc., #1 Well Gravel, 61 100lb bags used.
10. Bentonite pellets - Rocktest, Inc., Peltonite (Wyoming Bentonite Sealing Agent), 1 50lb bucket used.
11. Bentonite - Baroid Drilling Fluids, Inc., 1 55lb bag used.
12. Cement - Allentown Cement Company, Inc., 11 94lb bags used.
13. Well Casing - Cook Screen Technology, Inc., 1x10ft and 1x5ft section used.
14. Well Screen - Cook Screen Technology, Inc., 3x10ft sections used.
15. Well was developed 24 hours after grouting.
16. Well was developed for 1 hour at 10 gpm.
17. Well was developed using a submersible pump.
18. Development water was cloudy at first, then it cleared up after 30 minutes of pumping.
19. Elevation of top-of-casing is 323.64.
20. The interval between annular grout and surface grade was left open.
21. A void was encountered during the placement of well gravel. The void required additional bags of well gravel to fill.



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Mount Laurel, New Jersey 08054

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PROJECT		Ramapo Landfill Remediation Site			Sheet 1 of 2	
CLIENT		GEO-CON Inc.			Job No. D94DRE-463	
GROUNDWATER			DRILLING METHOD		DEPTH	
Date	Time	Depth	12" Air Rotary		0' To 30'	
6/5/95		22.98 ft			Borehole No. W-3	
					Date Started : 6/2/95	
					Date Finished : 6/5/95	
					Driller : UNI-TECH	
WELL CONSTRUCTION		COORDINATE NO.	STATE PERMIT NO.		SPOON SIZE	Elevation TOC: 328.26
					2' X 3"	Inspector : URS

grade	SAMPLE				CLASSIFICATION
	No.	Depth	Blows	N	
	1	0-2	4-5-5-6	10	brown, orange topsoil over light brown fine SAND, trace Silt
	2	3-5	9-10-9-8	19	light brown fine to med SAND trace Silt and fine Gravel
6	3	5-7	2-4-10-13	14	brown fine SAND some Clay
	4	8-10	2-2-3-4	5	brown Clayey fine to med SAND
10.3	5	10-12	0-1-1-2	2	green SILT some fine Sand and fine Gravel
12.3					
14.3	6	13-15	0-0-0-5	0	green, brown Silty CLAY some fine Gravel
	7	15-17	8-24-25-40	49	green fine to coarse SAND some med Gravel, wet at 17 ft
	8	18-20	17-24-30-24	54	S.A.A.
	9	20-22	16-13-16-26	29	S.A.A.
	10	23-25	50-42-34-21	76	green fine to coarse SAND some med Gravel, trace Silt
	11	25-27	25-38-100/5		green fine to coarse Clayey SAND some fine Gravel
		27.5	100/2		Auger Refusal at 27.5 ft - gneiss fragments in tip of spoon
29.3		27.5			Air Hammered through rock
		31.5			stopped at 31.5 ft

Well Depth
29ft 4inches

SAMPLE				CLASSIFICATION
No.	Depth	Blows	N	

LEGEND



Cement/Bentonite Grout



Bentonite Pellet Seal



Gravel Pack



8" SCH 40 Type 304 Flush Joint Threaded Stainless Steel Casing



8" Type 304 0.035 Slot Stainless Steel Screen



Stainless Steel Centralizer

Notes:

1. Bore hole diameter was 12 inches.
2. Bore hole was flushed with air and water before casing and screen was set. Bore hole flushing was accomplished by introducing air and water through the drilling rods.
3. Filter pack was poured around the well casing from the bottom of the bore hole up.
4. Depth to top of filter pack was determined using a weighted measuring tape.
5. Bentonite pellets were slowly poured around the well casing and allowed to settle.
6. Bentonite seal hydrated for 14 hours.
7. Annular grout was placed via tremie method.
8. Cement/bentonite grout mix - 5lbs bentonite, 94lbs cement, and 8 gallons water.
9. Gravel pack - Ricel Bros. Sand Co., Inc., #1 Well Gravel, 19 100lb bags used.
10. Bentonite pellets - Rocktest, Inc., Peltonite (Wyoming Bentonite Sealing Agent), 1 50lb bucket used.
11. Bentonite - Baroid Drilling Fluids, Inc., 1/2 55lb bag used.
12. Cement - Allentown Cement Company, Inc., 5 94lb bags used.
13. Well Casing - Cook Screen Technology, Inc., 1x10ft and 1x5ft section used.
14. Well Screen - Cook Screen Technology, Inc., 1x10ft and 1x5ft section used.
15. Well was developed 24 hours after grouting.
16. Well was developed for 1 hour at 10 gpm.
17. Well was developed using a submersible pump.
18. Development water was cloudy at first, then cleared up after 25 minutes of pumping.
19. Elevation of top-of-casing is 328.26.
20. The interval between annular grout and surface grade was left open.

SAMPLE				CLASSIFICATION
No.	Depth	Blows	N	

LEGEND



Cement/Bentonite Grout



Bentonite Pellet Seal



Gravel Pack



8" SCH 40 Type 304 Flush Joint Threaded Stainless Steel Casing



8" Type 304 0.035 Slot Stainless Steel Screen



Stainless Steel Centralizer

Notes:

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4. Depth to top of filter pack was determined using a weighted measuring tape.
5. Bentonite pellets were slowly poured around the well casing and allowed to settle.
6. Bentonite seal hydrated for 14 hours.
7. Annular grout was placed via tremie method.
8. Cement/bentonite grout mix - 5lbs bentonite, 94lbs cement, and 8 gallons water.
9. Gravel pack - Ricci Bros. Sand Co., Inc., #1 Well Gravel, 16 100lb bags used.
10. Bentonite pellets - Rocktest, Inc., Peltonite (Wyoming Bentonite Sealing Agent), 1 50lb bucket used.
11. Bentonite - Baroid Drilling Fluids, Inc., 1/2 55lb bag used.
12. Cement - Allentown Cement Company, Inc., 6 94lb bags used.
13. Well Casing - Cook Screen Technology, Inc., 2x10ft sections used.
14. Well Screen - Cook Screen Technology, Inc., 1x10ft and 1x5ft section used.
15. Well was developed 26 hours after grouting.
16. Well was developed for 1 hour at 10 gpm.
17. Well was developed using a submersible pump.
18. Development water was cloudy at first, then it cleared up after 35 minutes of pumping.
19. Elevation of top-of-casing is 330.09.
20. The interval between annular grout and surface grade was left open.



JAMES C. ANDERSON ASSOCIATES, INC.
Drilling Contractor

907 Pleasant Valley Avenue

Mount Laurel, New Jersey 08054

(609)-722-6700

PROJECT		Ramapo Landfill Remediation Site			Sheet 1 of 2	
CLIENT		GEO-CON Inc.			Job No. D94DRE-463	
GROUNDWATER		DRILLING METHOD		DEPTH		
Date	Time	Depth	12" Air Rotary	0' To 20'		
5/24/95		dry				
WELL CONSTRUCTION		COORDINATE NO.	STATE PERMIT NO.	SPOON SIZE		
				2' X 3"		
				Inspector: URS		

grade	SAMPLE				CLASSIFICATION
	No.	Depth	Blows	N	
	1	0-2	5-2-5-5	7	brown med to coarse SAND trace med Gravel
	2	3-5	5-100/1		S.A.A. to 3.5 ft boulder at 3.5 ft
6	3	5-7			boulder to 7.5 ft
8					
10	4	8-10	18-76-17-11	93	gray, green fine to coarse SAND with med Gravel
	5	10-12	10-8-5-6	13	S.A.A.
	6	13-15	16-18-100/2		gray, green Clayey SAND to 14.5 ft gnelss at 14.5 ft
		14.5 to 18.5			Air Hammered through rock stopped at 18.5
20					

Well Depth 20ft	
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SAMPLE				CLASSIFICATION
No.	Depth	Blows	N	

LEGEND

 Bentonite Pellet Seal

 Gravel Pack

 8" SCH 40 Type 304 Flush Joint Threaded Stainless Steel Casing

 8" Type 304 0.035 Slot Stainless Steel Screen

 Stainless Steel Centralizer

Notes:

1. Bore hole diameter was 12 inches.
2. Bore hole was flushed with air and water before casing and screen was set. Bore hole flushing was accomplished by introducing air and water through the drilling rods.
3. Filter pack was poured around the well casing from the bottom of the bore hole up.
4. Depth to top of filter pack was determined using a weighted measuring tape.
5. Bentonite pellets were slowly poured around the well casing and allowed to settle.
6. Bentonite seal hydrated for 14 hours.
7. Gravel pack - Ricci Bros. Sand Co., Inc., #1 Well Gravel; 20 100lb bags used.
8. Bentonite pellets - Rocktest, Inc., Peltonite (Wyoming Bentonite Sealing Agent), 1 50lb bucket used.
9. Well Casing - Cook Screen Technology, Inc., 1x10ft section used.
10. Well Screen - Cook Screen Technology, Inc., 1x10ft section used.
11. Well was developed 26 hours after bentonite seal hydration.
12. Well was developed by bailing till dry at 15 minute intervals for 1 hour.
13. Well was developed using a hand bailer.
14. Development water cloudy at first, then cleared up after 30 minutes of bailing.
15. Elevation of top-of-casing is 345.82.
16. The annular space interval between the bentonite seal and surface grade was left open.



JAMES C. ANDERSON ASSOCIATES, INC.
Drilling Contractor

907 Pleasant Valley Avenue

Mount Laurel, New Jersey 08054

(609)-722-6700

PROJECT <i>Ramapo Landfill Remediation Site</i>						Sheet 1 of 2	
CLIENT <i>GEO-CON Inc.</i>						Job No. D94DRE-463	
GROUNDWATER			DRILLING METHOD		DEPTH		Borehole No. W-6
Date	Time	Depth	12" Air Rotary		0' To 19'		Date Started : 7/24/95
7/24/95		dry					Date Finished : 7/24/95
							Driller : UNI-TECH
WELL CONSTRUCTION		COORDINATE NO.	STATE PERMIT NO.		SPOON SIZE		Elevation TOC: 350.40
					2' X 3"		Inspector : URS

grade	SAMPLE				CLASSIFICATION
	No.	Depth	.Blows	N	
	1	0-2	4-5-5-6	10	brown, orange topsoil over light brown fine SAND, trace Silt
4.5	2	3-5	9-10-9-8	19	light brown fine to med SAND trace Silt and fine Gravel
6.5	3	5-7	2-4-10-13	14	brown fine SAND some Clay
8.5	4	8-10	2-2-3-4	5	brown Clayey fine to med SAND
		10-13			Air Hammered through boulder 10.8 to 13 ft 13 to 13.2 - green, gray fine to coarse SAND moist
		13.2			auger refusal at 13.2 ft - gneiss in tip of spoon
		13.2 to 17.2			Air Hammered through rock stopped at 17.2 ft
18.5					

Well Depth 18ft
6inches

SAMPLE				CLASSIFICATION
No.	Depth	Blows	N	

LEGEND



Bentonite Pellet Seal



Gravel Pack



8" SCH 40 Type 304 Flush Joint Threaded Stainless Steel Casing



8" Type 304 0.035 Slot Stainless Steel Screen



Stainless Steel Centralizer

Notes:

1. Bore hole diameter was 12 inches.
2. Bore hole was flushed with air and water before casing and screen was set. Bore hole flushing was accomplished by introducing air and water through the drilling rods.
4. Filter pack was poured around the well casing from the bottom of the bore hole up.
5. Depth to top of filter pack was determined using a weighted measuring tape.
6. Bentonite pellets were slowly poured around the well casing and allowed to settle.
7. Bentonite seal hydrated for 14 hours.
8. Gravel pack - Riccl Bros. Sand Co., Inc., #1 Well Gravel, 12 100lb bags used.
9. Bentonite pellets - Rocktest, Inc., Peltonite (Wyoming Bentonite Sealing Agent), 1 50lb bucket used.
10. Well Casing - Cook Screen Technology, Inc., 1x10ft section used.
10. Well Screen - Cook Screen Technology, Inc., 1x10ft section used.
11. Well was developed 26 hours after bentonite seal hydration.
12. Well was developed by bailing till dry at 15 minute intervals for 1 hour.
13. Well was developed using a hand bailer.
14. Development water cloudy at first, then cleared up after 30 minutes of bailing.
15. Elevation of top-of-casing is 350.40.
16. The annular space interval between the bentonite seal and surface grade was left open.



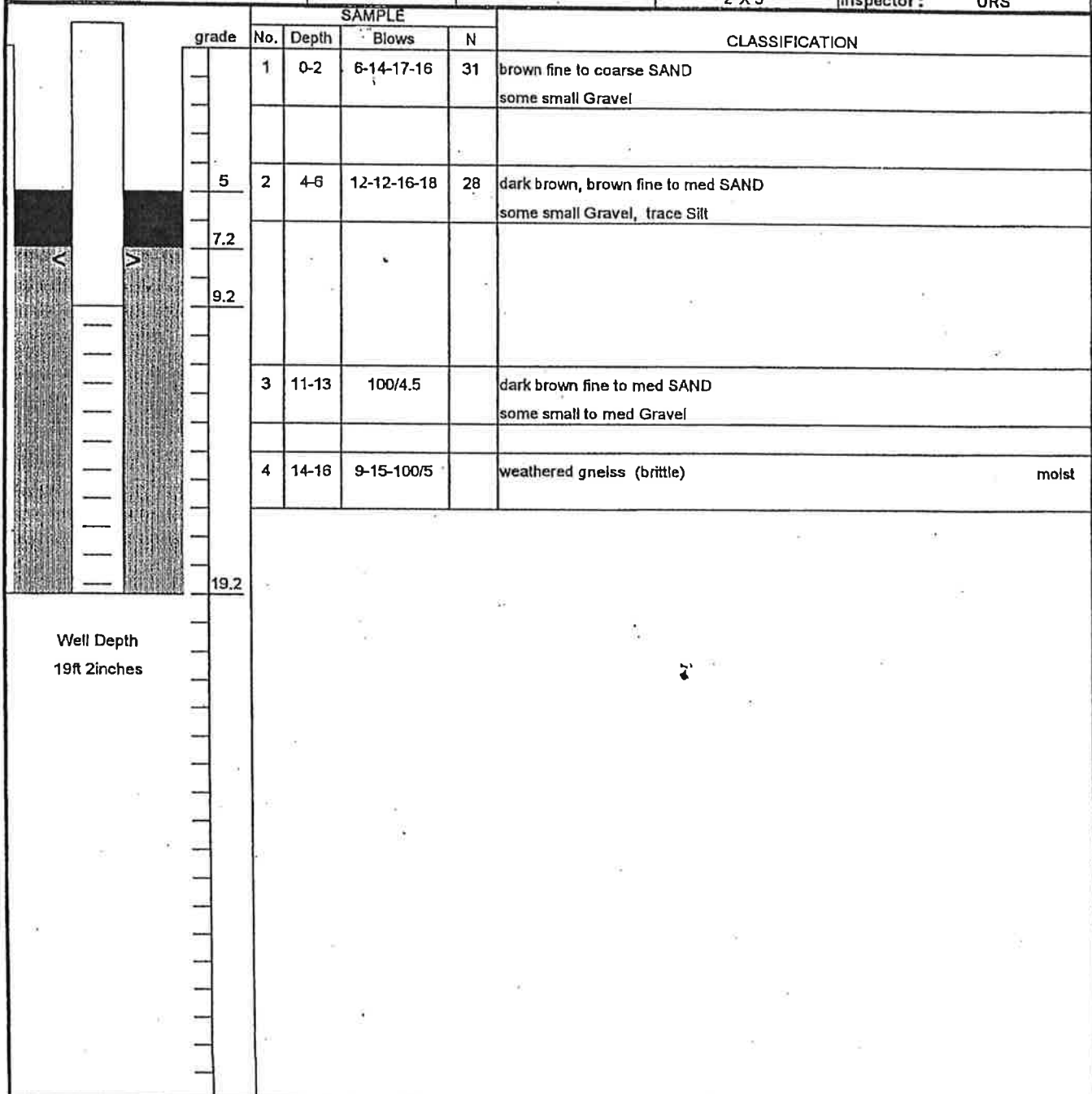
JAMES C. ANDERSON ASSOCIATES, INC.
Drilling Contractor

907 Pleasant Valley Avenue

Mount Laurel, New Jersey 08054

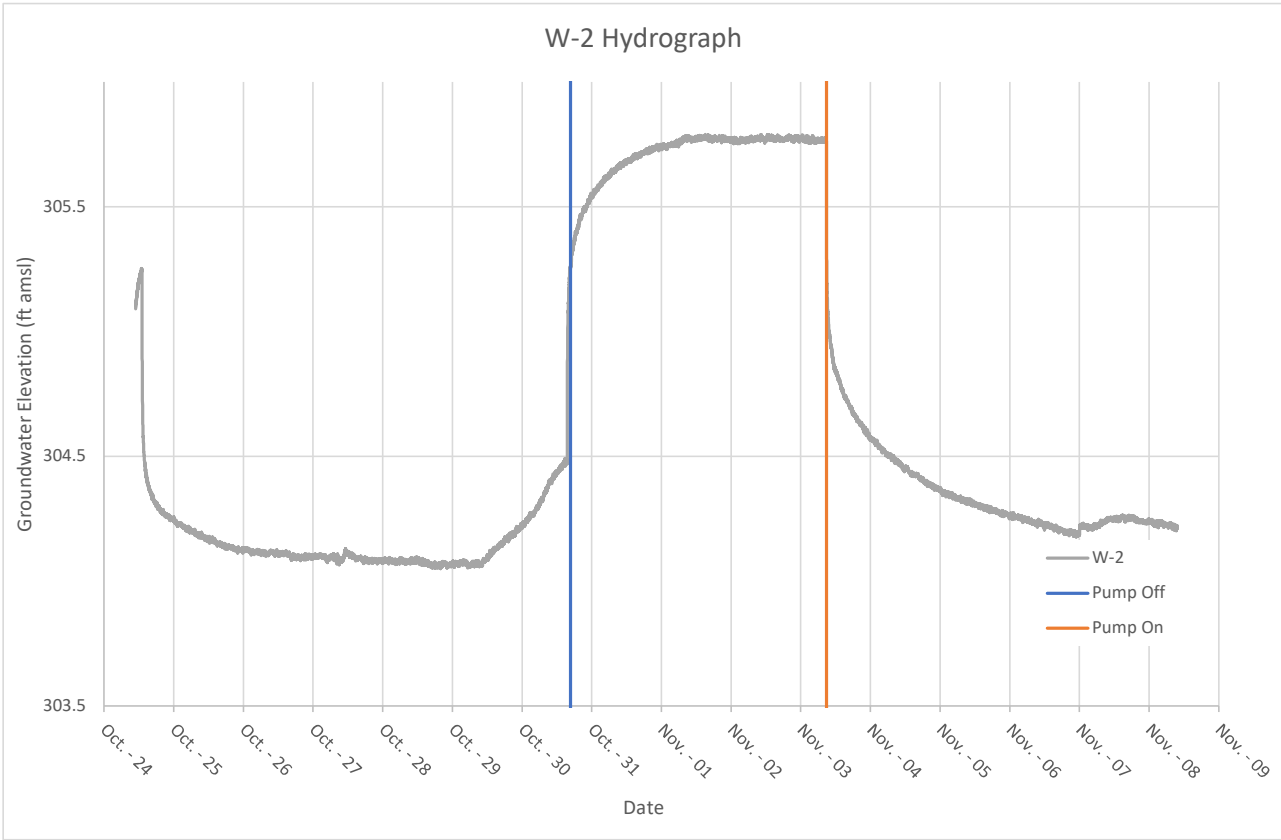
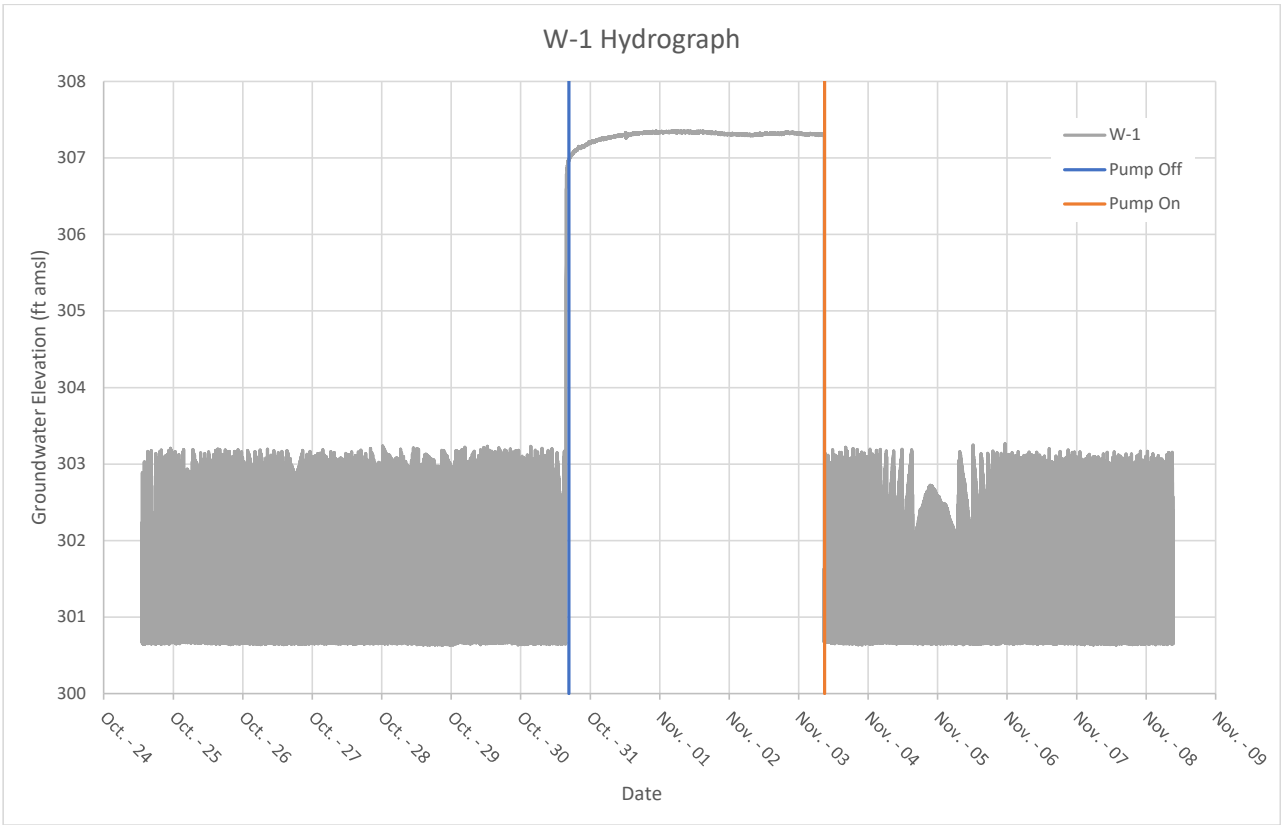
(609)-722-6700

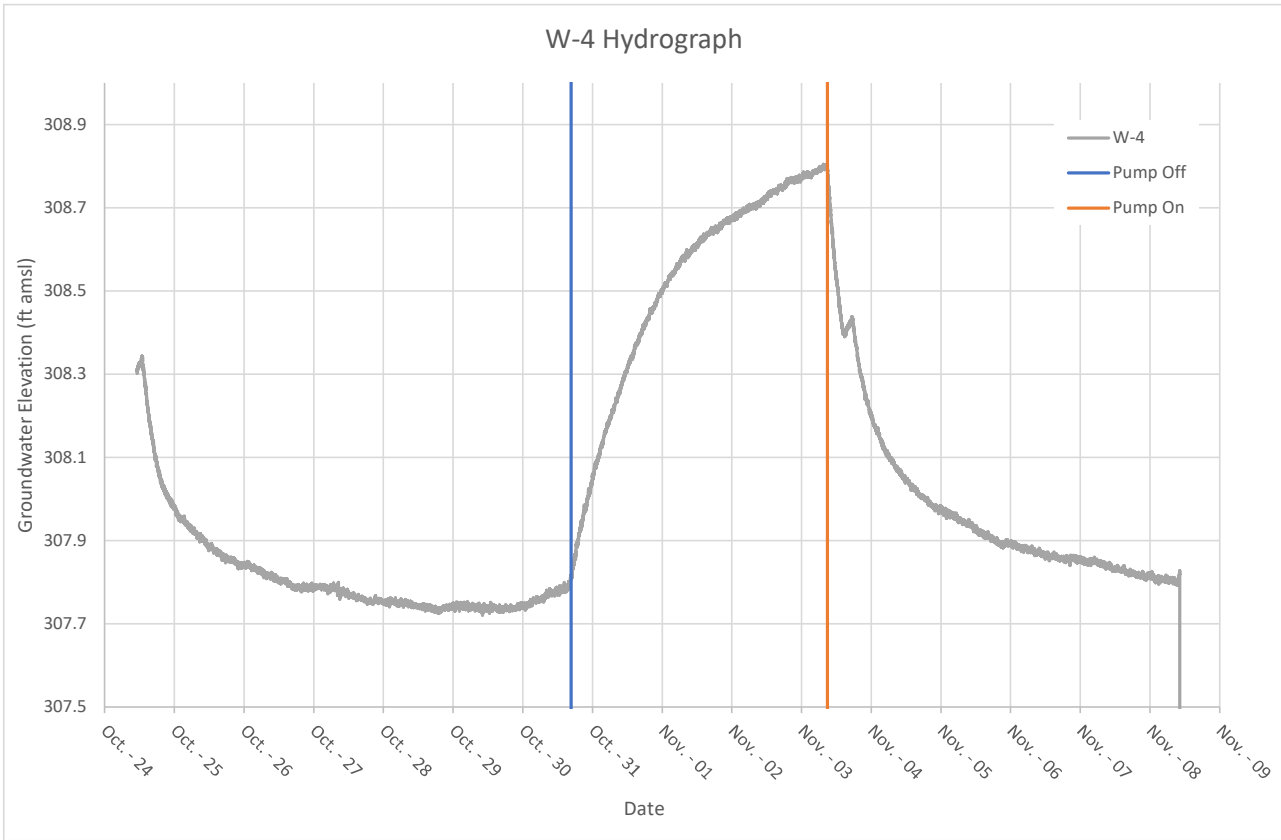
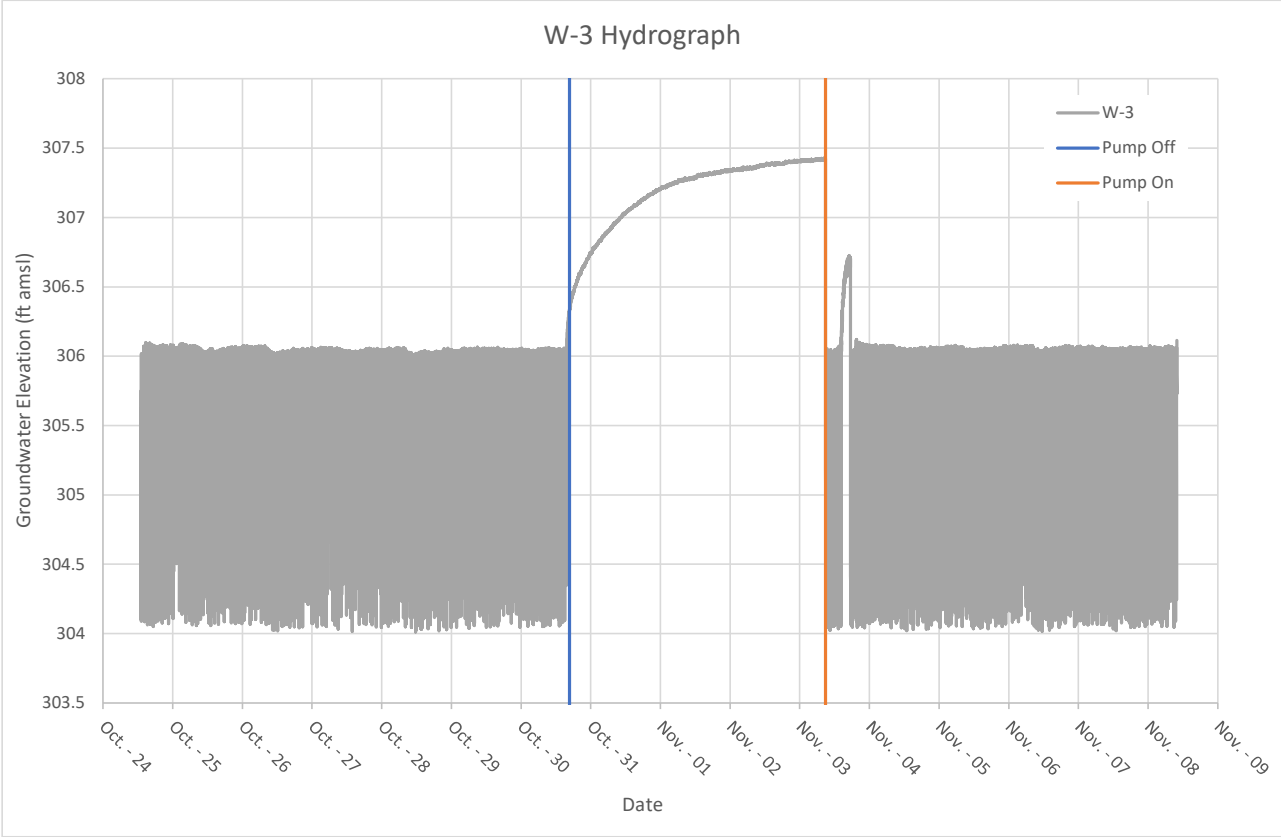
PROJECT		Ramapo Landfill Remediation Site			Sheet 1 of 1	
CLIENT		GEO-CON Inc.			Job No. D94DRE-463	
GROUNDWATER			DRILLING METHOD	DEPTH	Borehole No. W-7	
Date	Time	Depth	12" Air Rotary	0' To 20'	Date Started : 6/19/95	
6/19/95		17.91 ft			Date Finished : 6/19/95	
					Driller : UNI-TECH	
WELL CONSTRUCTION		COORDINATE NO.	STATE PERMIT NO.	SPOON SIZE	Elevation TOC: 343.47	
				2' X 3"	Inspector : URS	

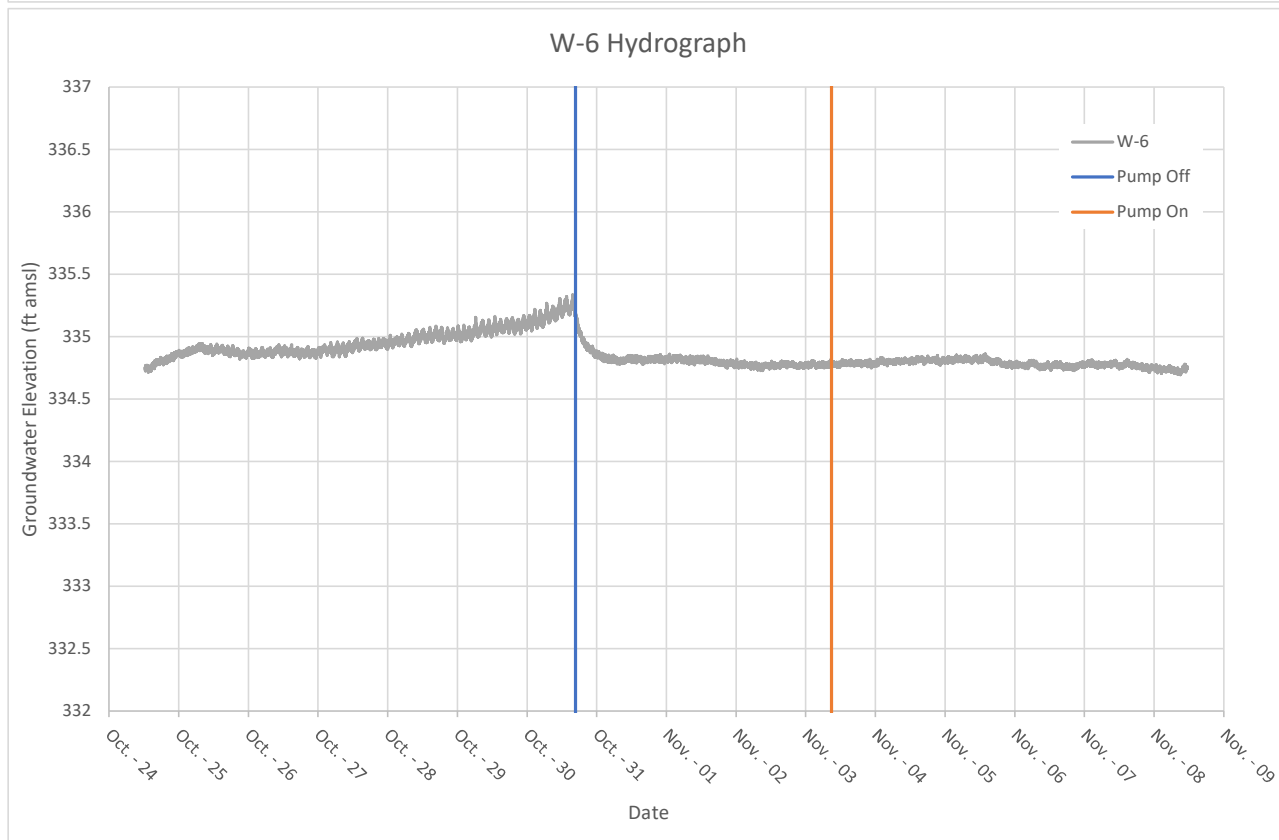
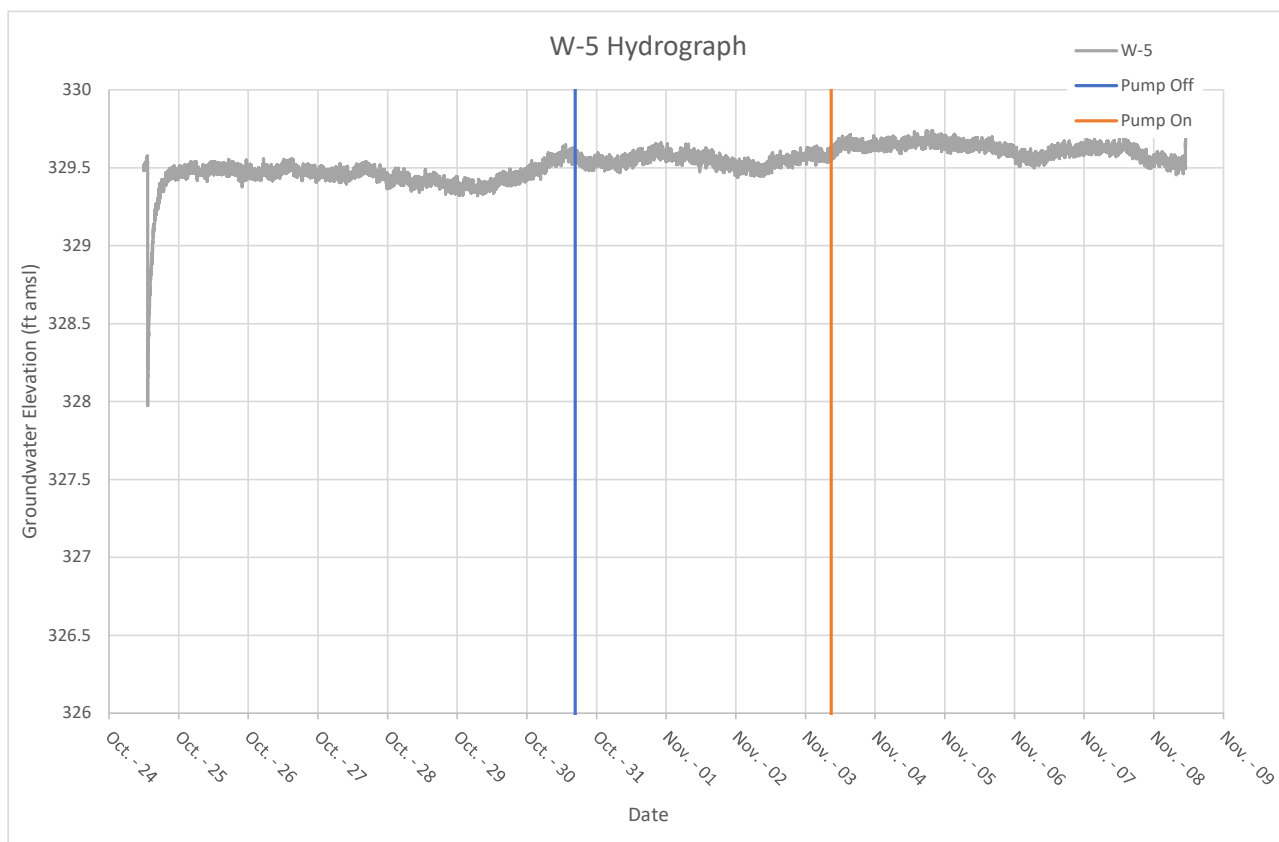


		SAMPLE			CLASSIFICATION
No.	Depth	Blows	N		
LEGEND  Bentonite Pellet Seal  Gravel Pack  8" SCH 40 Type 304 Flush Joint Threaded Stainless Steel Casing  8" SCH 40 Type 304 0.035 Slot Stainless Steel Screen  Stainless Steel Centralizer Notes: 1. Bore hole was flushed before casing and screen was set. 2. Filter pack was poured around the well casing from the bottom of the bore hole up. 3. Depth to top of filter pack was determined using a weighted measuring tape. 4. Bentonite pellets were slowly poured around the well casing and allowed to settle. 5. Bentonite seal hydrated for 14 hours. 6. Gravel pack - Ricci Bros. Sand Co., Inc., #1 Well Gravel, 12 100lb bags used. 7. Bentonite pellets - Rocktest, Inc., Peltonite (Wyoming Bentonite Sealing Agent), 1 50lb bucket used. 8. Well Casing - Cook Screen Technology, Inc., 1x10ft section used. 9. Well Screen - Cook Screen Technology, Inc., 1x10ft section used. 10. Well was developed 26 hours after bentonite seal hydration. 11. Well was developed by pumping till dry at 15 minute intervals for 1 hour. 12. Well was developed using a submersible pump. 13. Development water cloudy at first, then cleared up after 30 minutes of pumping. 14. Elevation of top-of-casing is 343.47. 15. The annular space interval between the bentonite seal and surface grade was left open.					

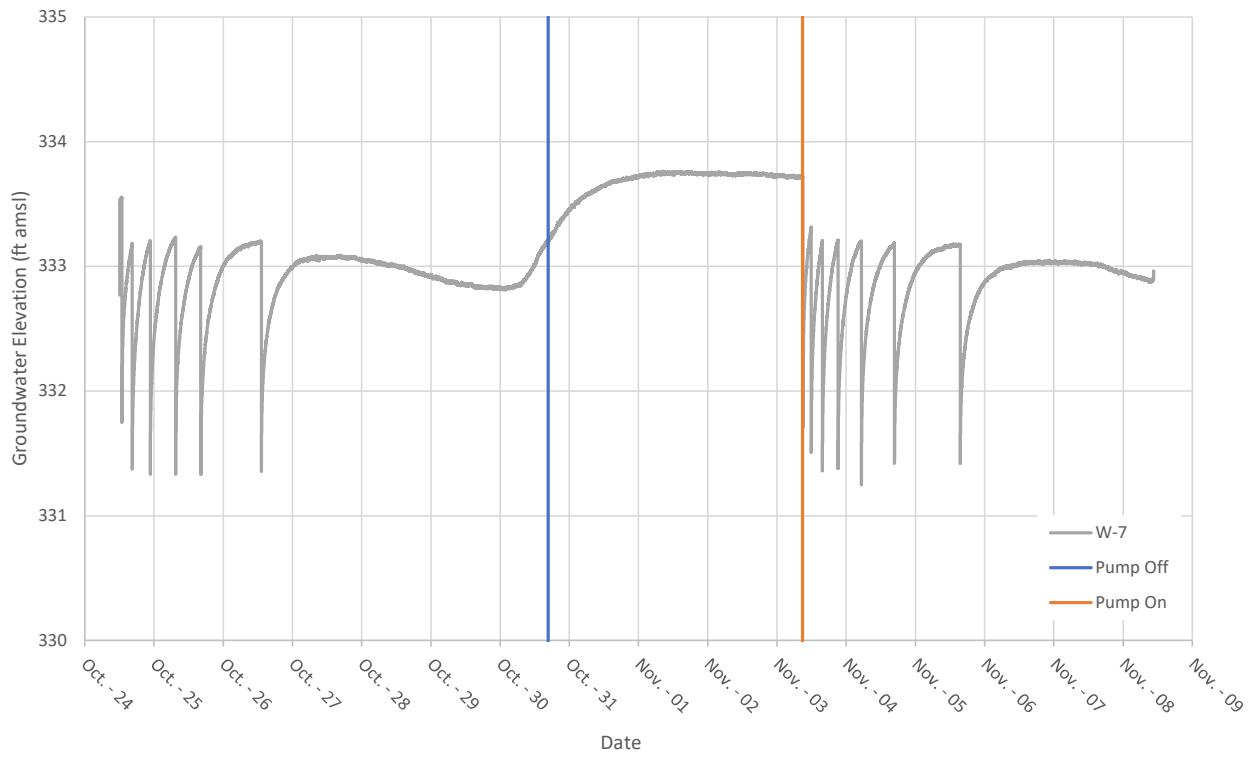
APPENDIX B
HYDROGRAPHS



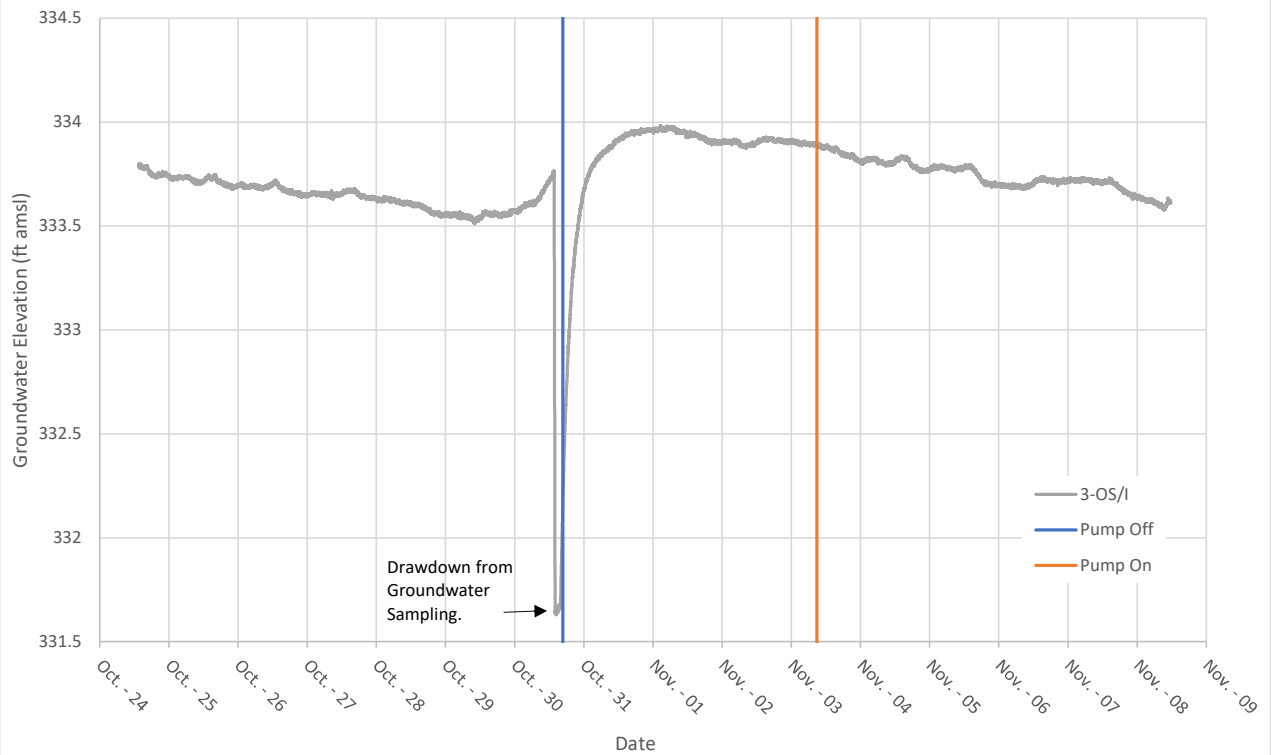


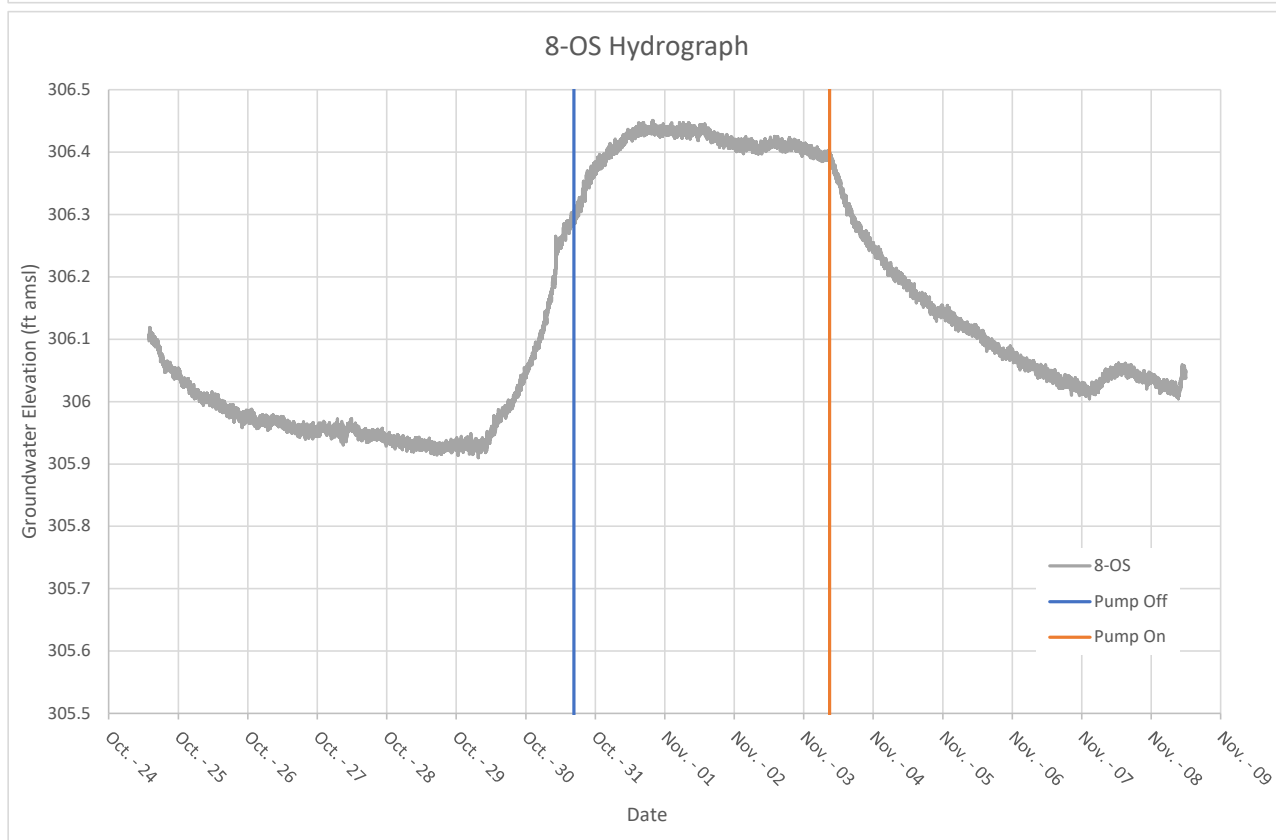
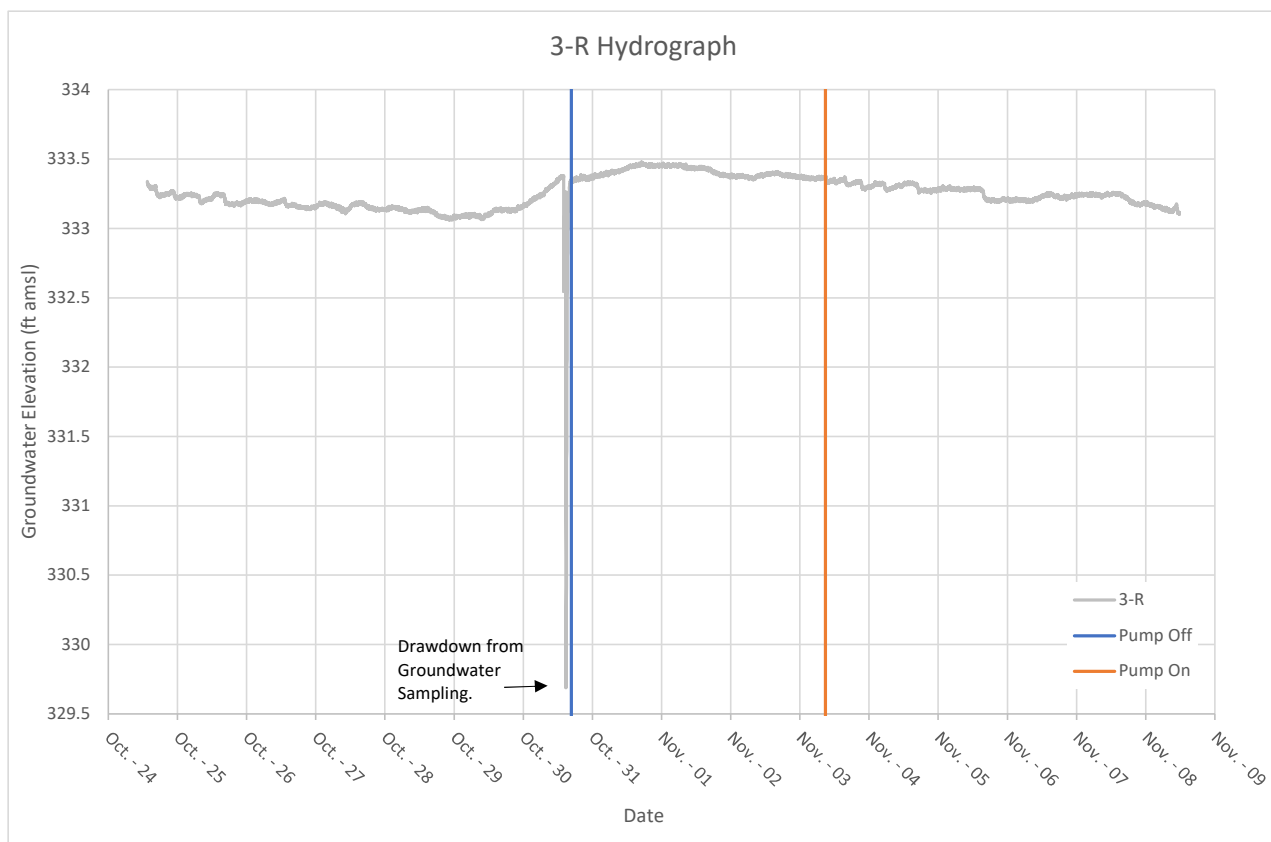


W-7 Hydrograph

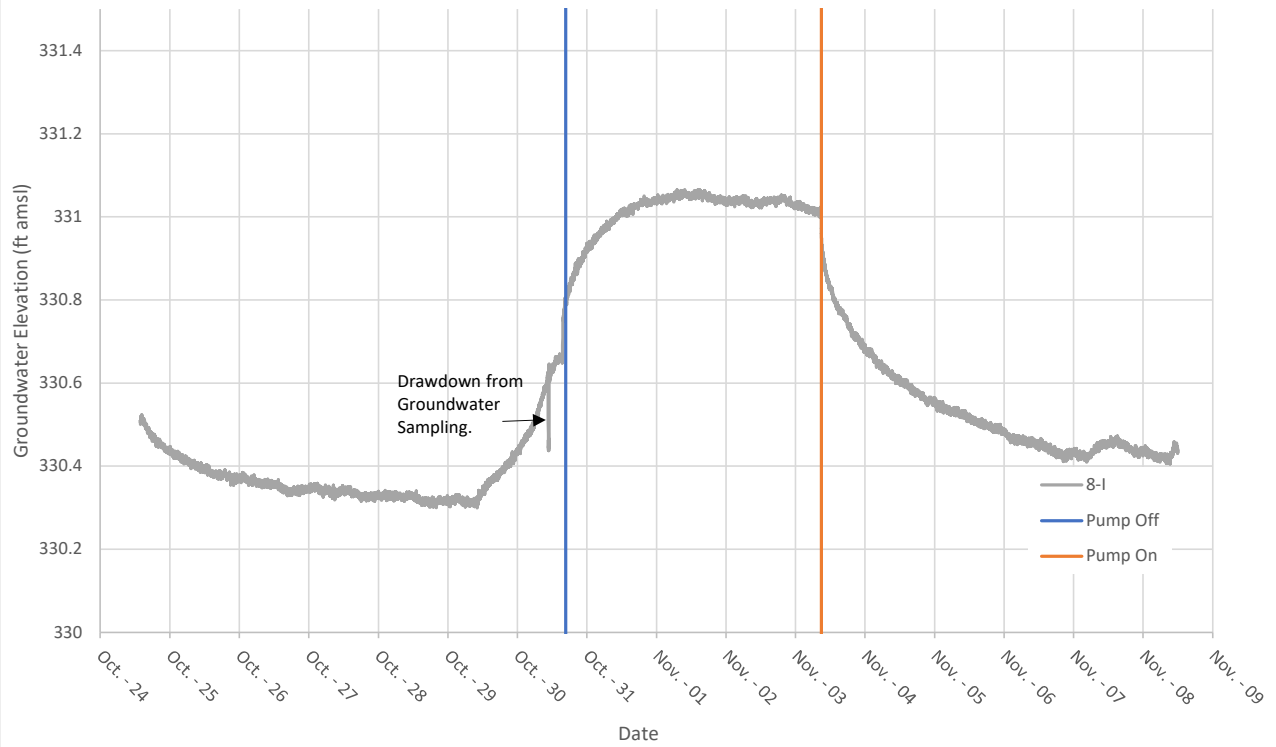


3-OS/I Hydrograph

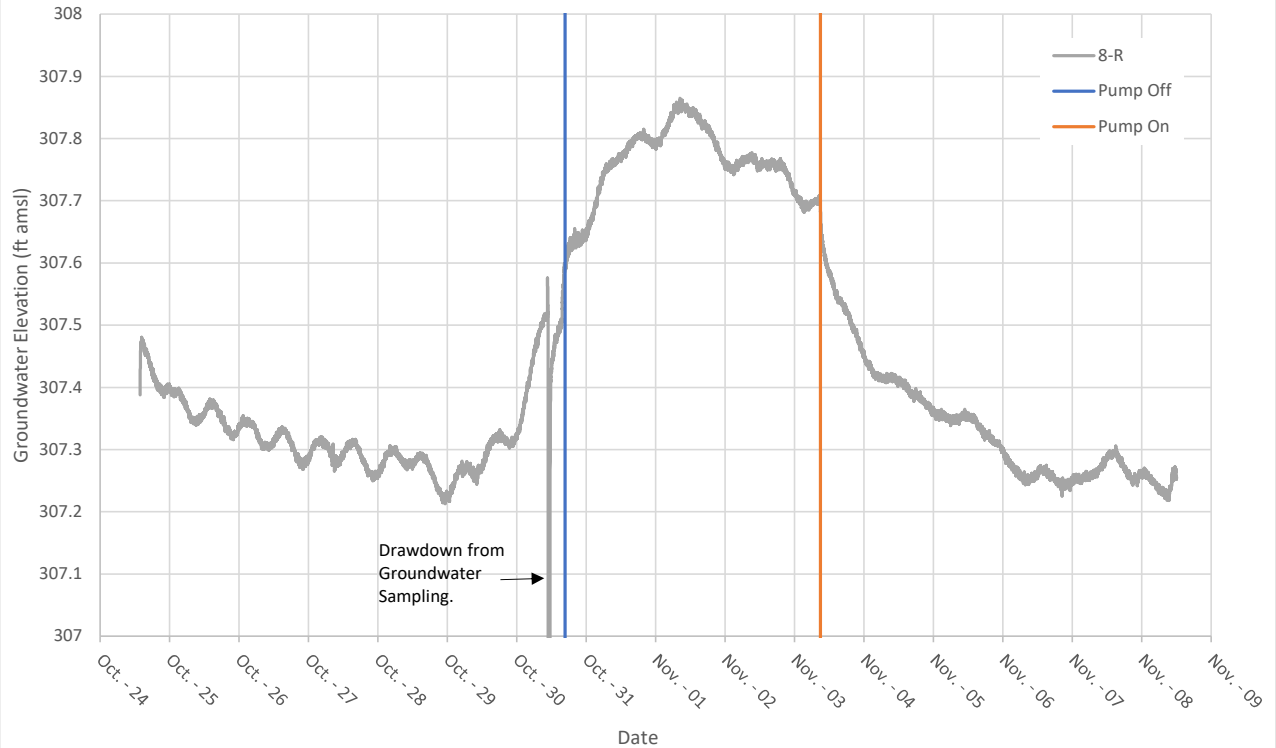




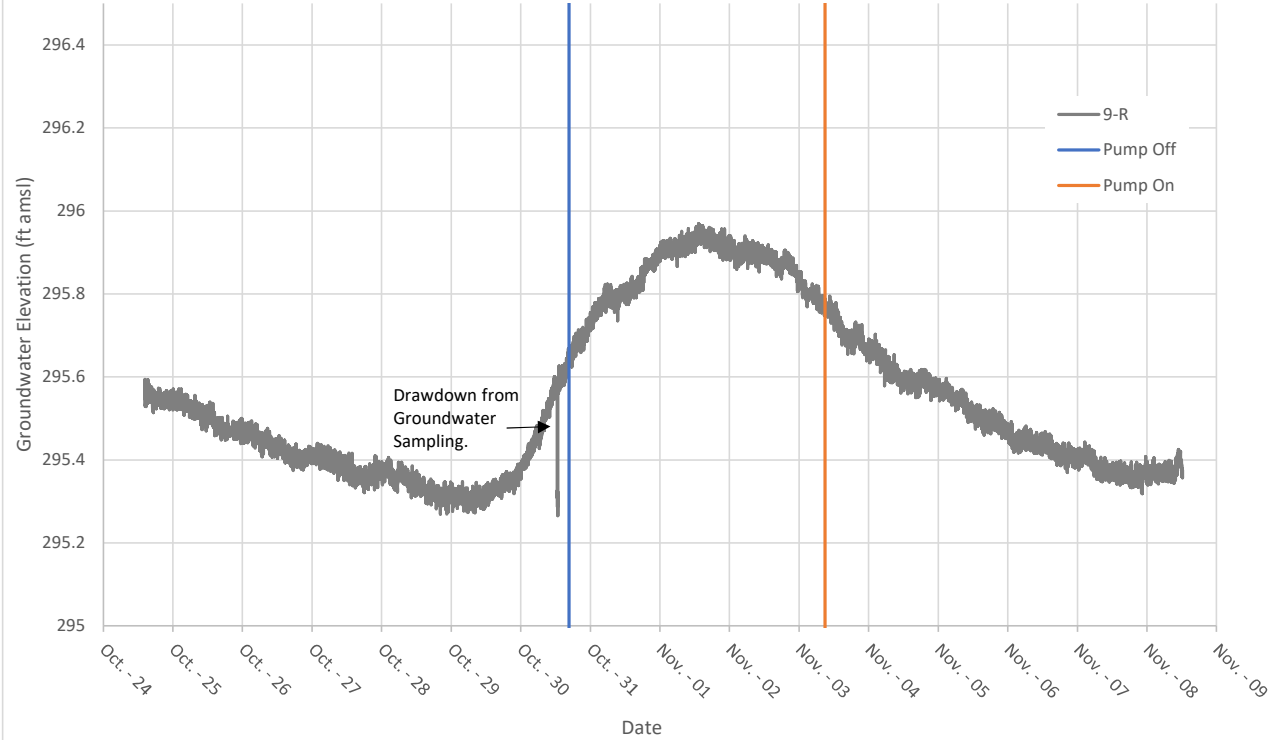
8-I Hydrograph



8-R Hydrograph



9-R Hydrograph

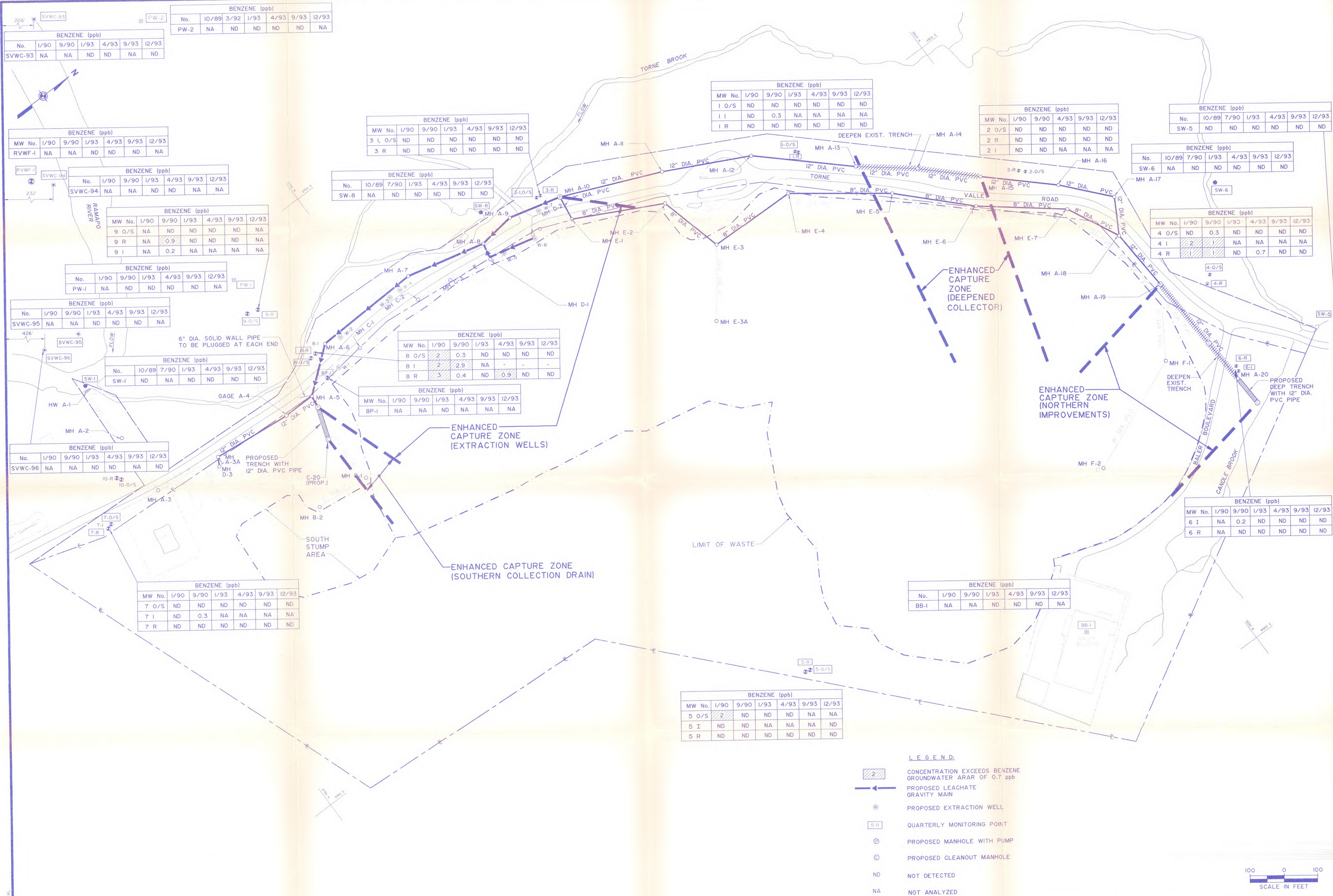


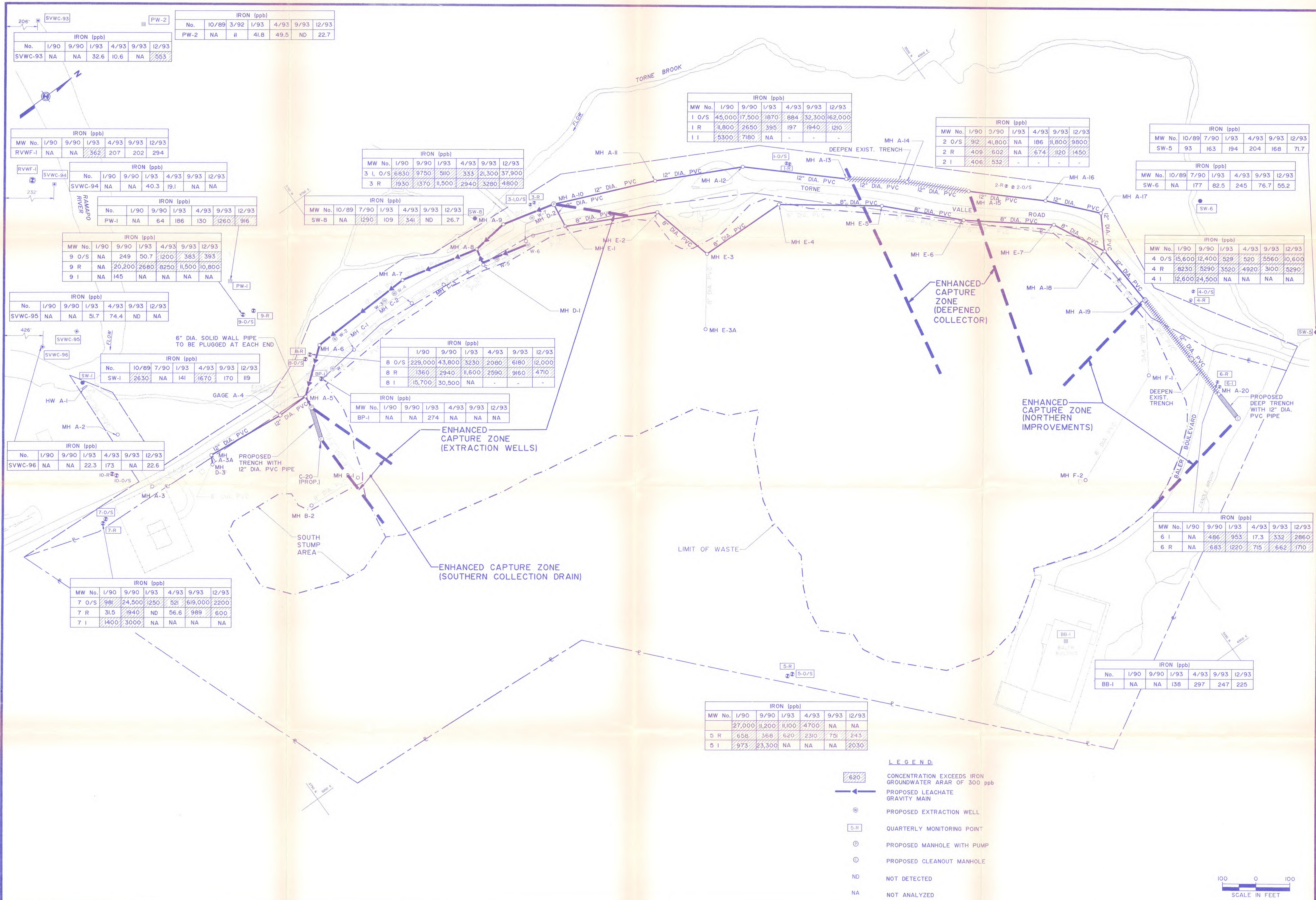
APPENDIX C

CZA PRESSURE TRANSDUCER DATA (ON FLASH DRIVE)

APPENDIX D

1994 DESIGN ANALYSIS REPORT CAPTURE ZONE DRAWINGS





NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION
REVISIONS					

URS URS Consultants, Inc.
CONSULTING ENGINEERS
BUFFALO NEW YORK

JOB No. 35314

RAMAPO LANDFILL

TOWN OF RAMAPO

NEW YORK

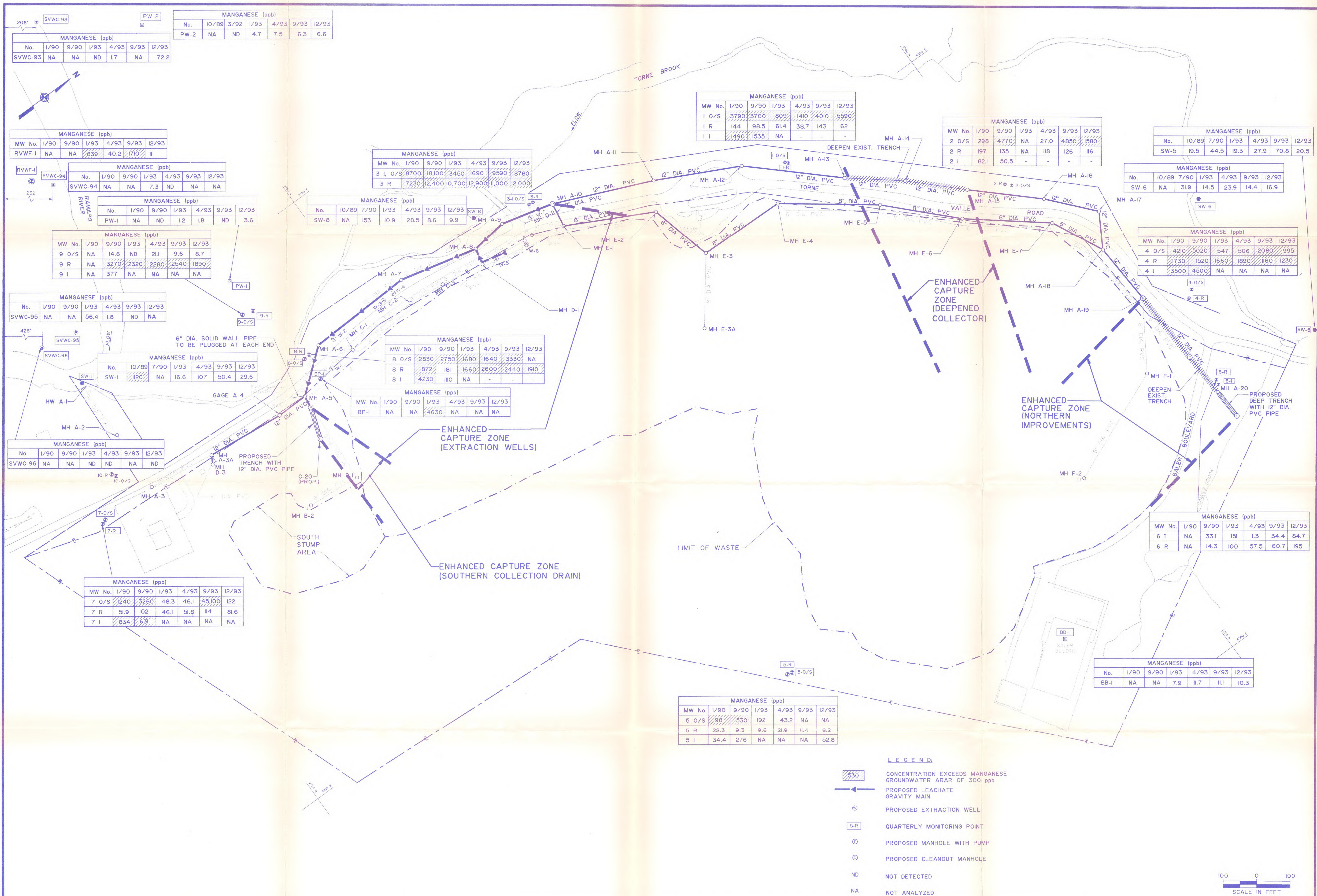
REMEDATION

CAPTURE ZONES FOLLOWING
REMEDIATION AND
IRON CONCENTRATIONS

Scale: 1"=100'

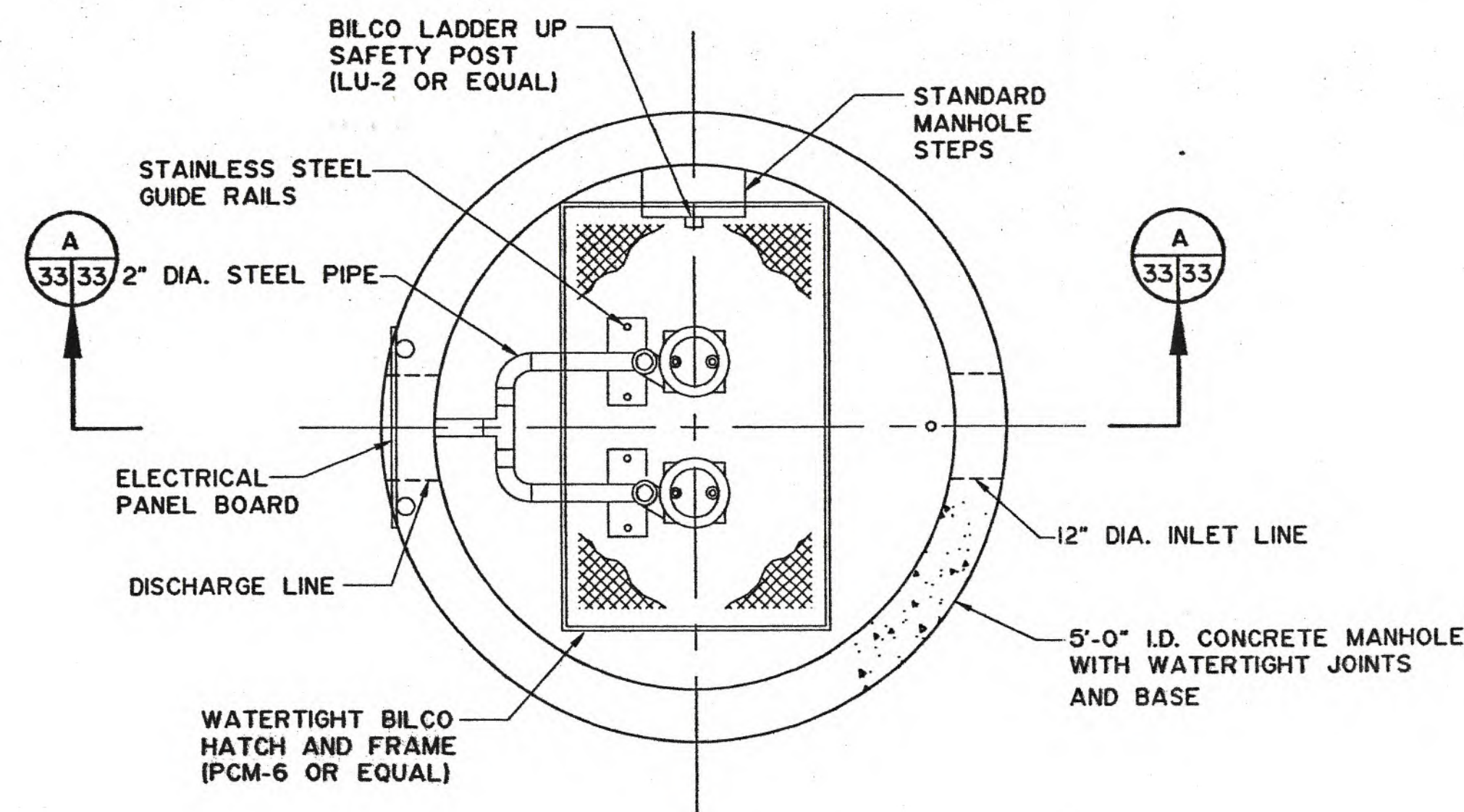
Date: MARCH 94

PLATE NO. 3

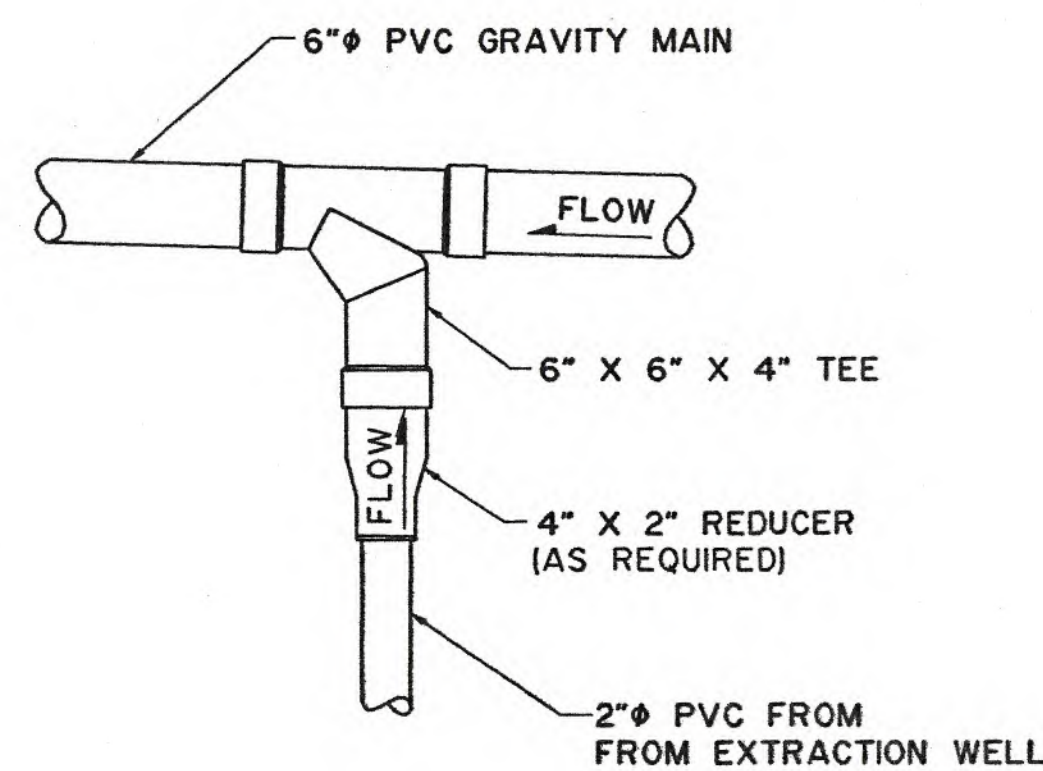


APPENDIX E

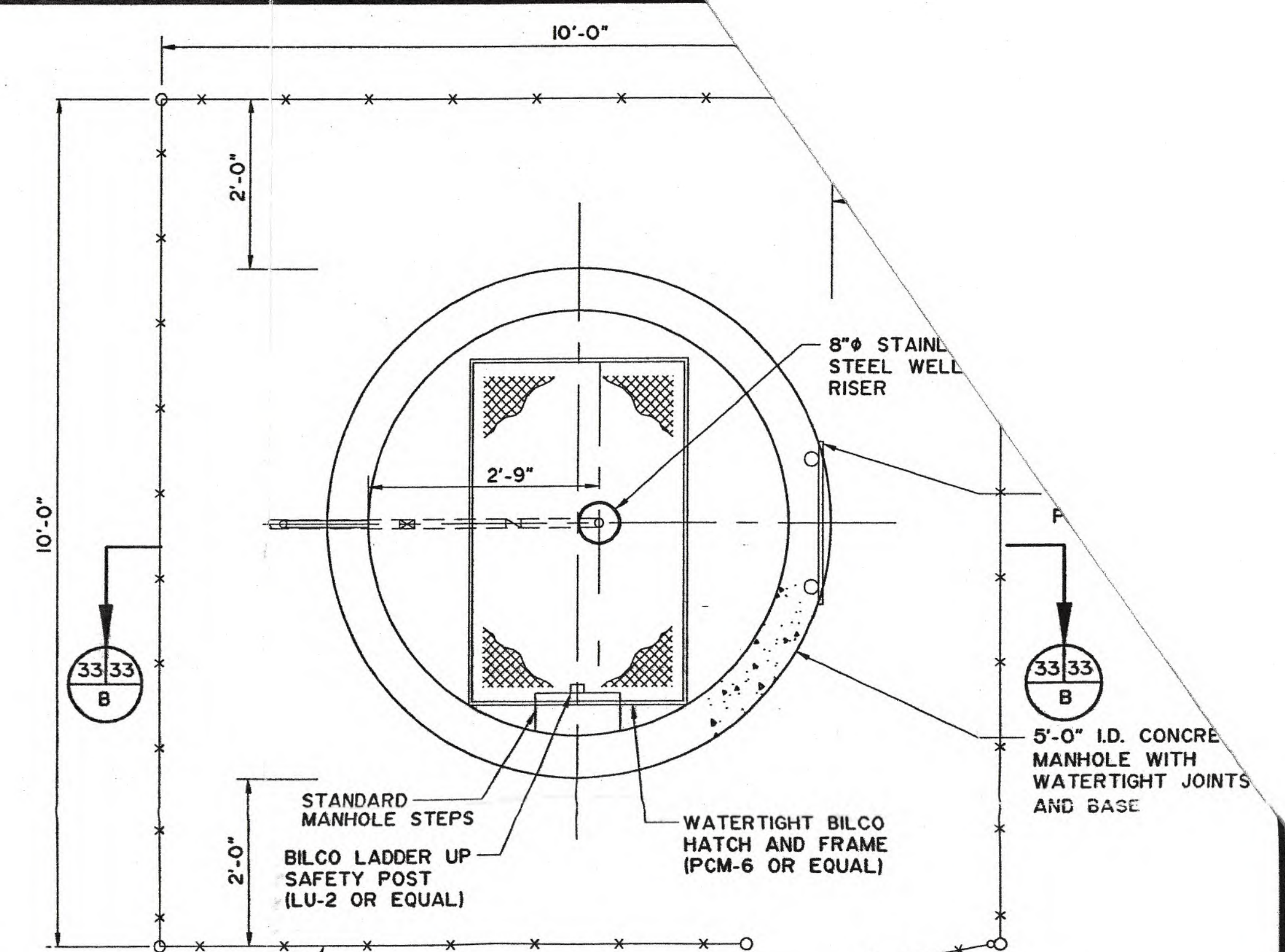
1998 LANDFILL REMEDIATION RECORD DRAWING SHEET 33



PLAN
SCALE: 3/4"=1'-0"



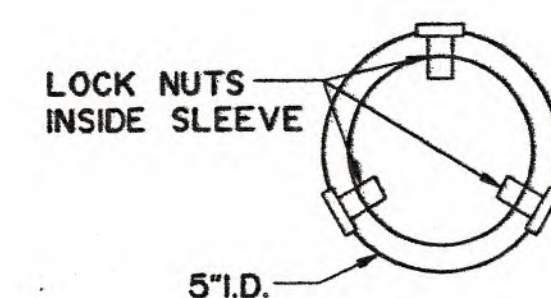
TYPICAL EXTRACTION WELL DISCHARGE
TO GRAVITY MAIN DETAIL
NOT TO SCALE



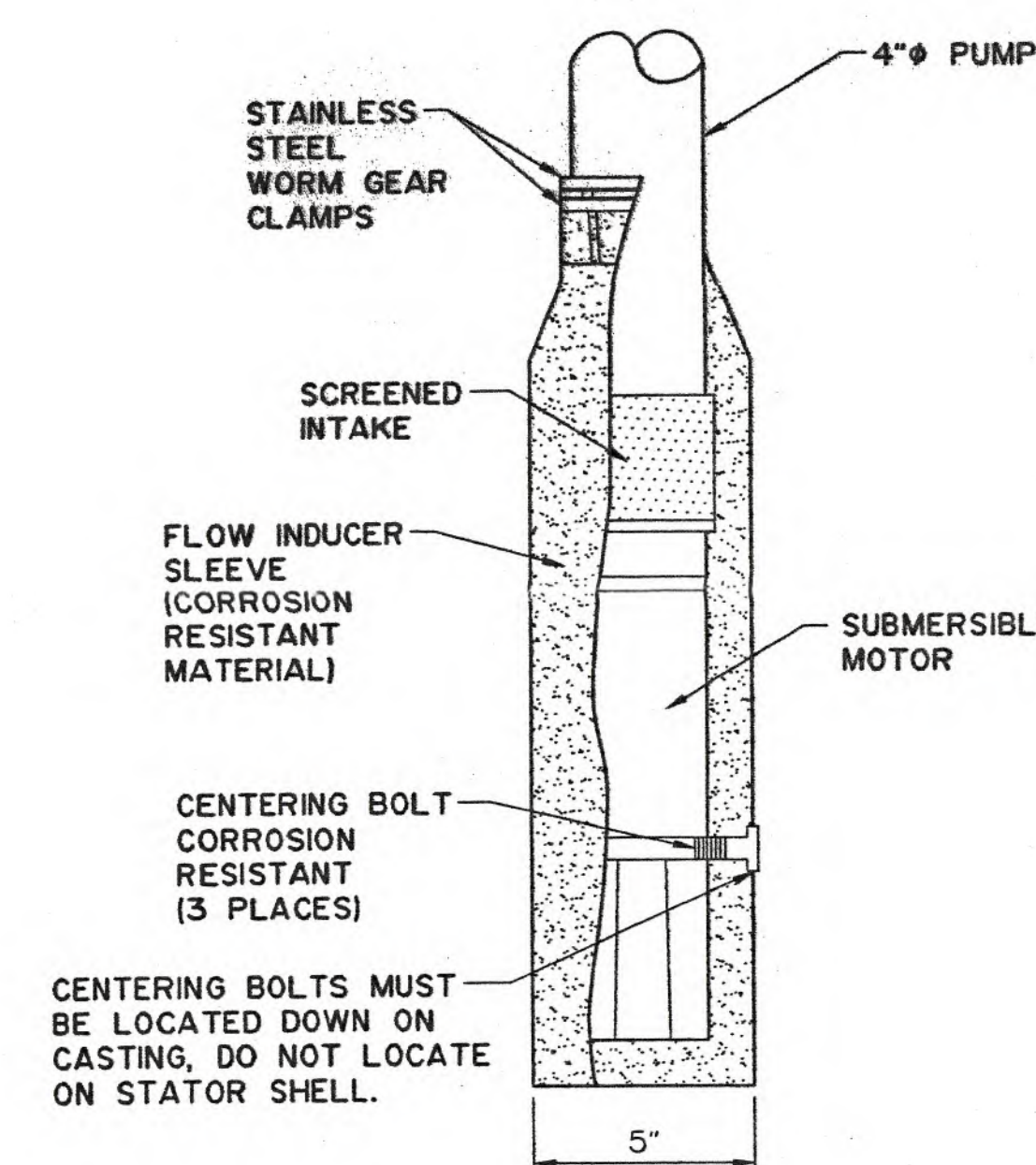
PLAN
SCALE: 3/4"=1'-0"

EXTRACTION WELL SCHEDULE						
EXTRACTION WELL NO.	ELEVATION OF BOTTOM OF WELL (FEET)	LIFT PUMP DESIGNATION	PUMP OFF ELEVATION (FEET)	PUMP ON ELEVATION (FEET)	ALARM ELEVATION (FEET)	APPROX. WATER ELEVATION JAN. '93 (FEET)
W-1	274.5	P-1	293.0	298.0	298.5	306.0
W-2	270.2	P-2	293.0	298.0	298.5	309.0
W-3	285.5	P-3	293.5	298.5	299.0	315.0
W-4	291.0	P-4	299.0	304.0	304.5	317.0
W-5	328.5	P-5	332.5	334.5	335.0	336.5
W-6	330.0	P-6	334.0	336.0	336.5	338.0
W-7	324.5	P-7	328.5	330.5	331.0	333.0

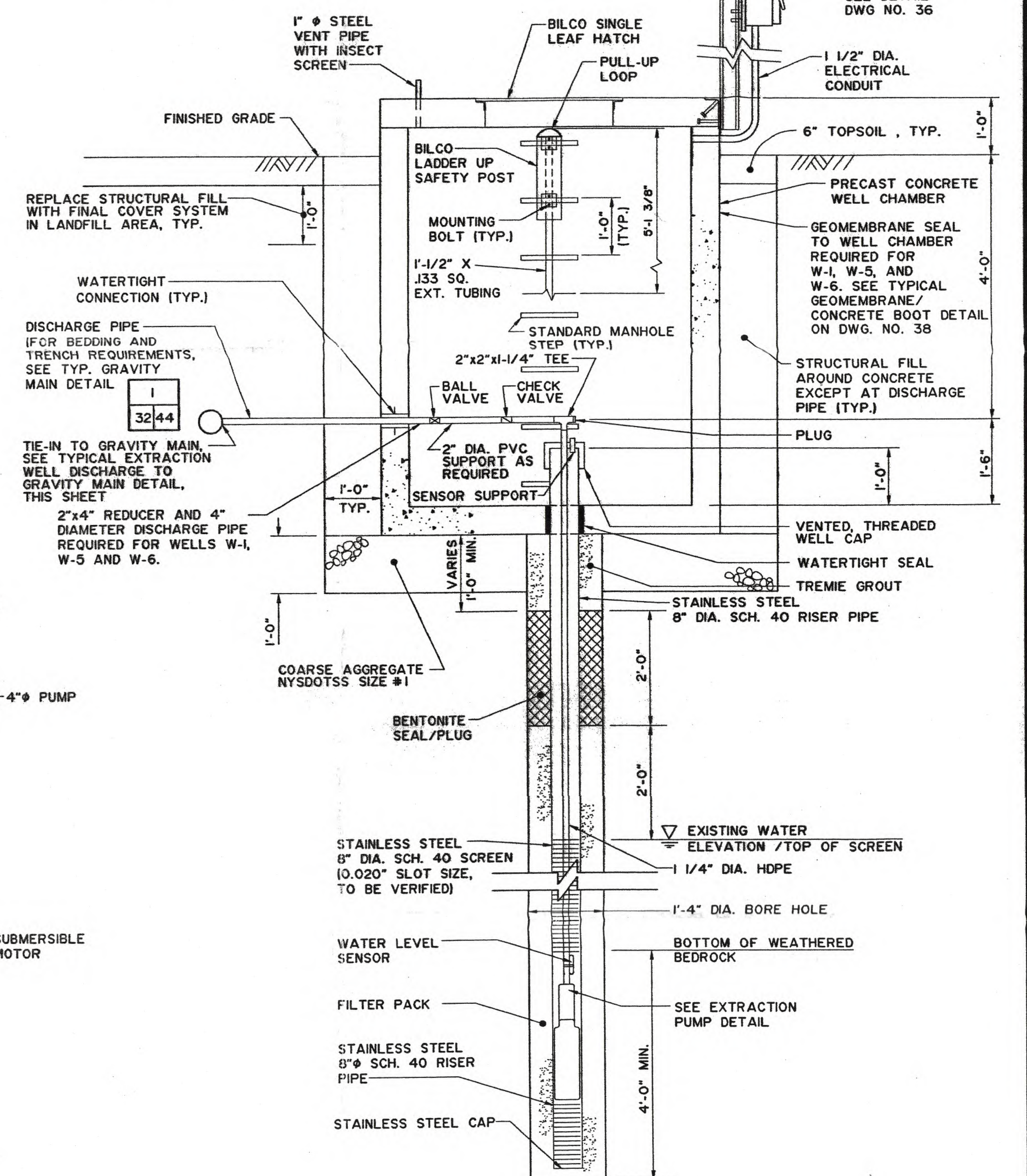
LIFT PUMP STATION SCHEDULE			
PUMP STATION FEATURE	LIFT STATION MH-A19	LIFT STATION MH-A10	LIFT STATION W-20 (SOUTHERN EXT.)
INV. A	417.00	333.18	302.50
INV. B	418.50	334.68	304.00
INV. C	428.97	342.30	313.00
LIFT PUMPS	LP-14, 42	LP-31, 32	LP-20, 21
BOTH PUMPS OFF	417.50	333.68	303.00
LEAD PUMP ON	418.50	334.68	304.00
LAG PUMP ON	419.00	335.18	304.50
ALARM	419.50	335.68	305.00
APPROX. WATER ELEV. (JAN '93)	443.00	336.00	314.00
FINISHED GRADE ELEV.	452.17	347.13	318.5



BOTTOM END VIEW
SCALE: 1/4"=1'-0"



EXTRACTION PUMP DETAIL
SCALE: 1/4"=1'-0"



SECTION B-B
SCALE: 3/4"=1'-0"

TYPICAL EXTRACTION WELL

RECORD DRAWING

WARNING
IT IS A VIOLATION OF SECTION 2209, SUBDIVISION 2, OF THE NEW YORK STATE EDUCATION LAW FOR ANY PERSON, OTHER THAN THOSE WHOSE SEAL APPEARS ON THIS DRAWING, TO ALTER IN ANY WAY AN ITEM ON THIS DRAWING IF AN ITEM IS ALTERED, THE ALTERING ENGINEER SHALL AFFIX TO THE ITEM HIS SEAL AND THE NOTATION, ALTERED BY FOLLOWED BY HIS SIGNATURE AND THE DATE OF SUCH ALTERATION, AND A SPECIFIC DESCRIPTION OF THE ALTERATION.

DESIGNED BY: D.A.M.	URS Consultants, Inc.	RAMAPO LANDFILL	REMEDATION	LEACHATE/GROUNDWATER WITHDRAWAL WELL AND GRAVITY MAIN DETAILS
DRAWN BY: R.A.L.	CONSULTING ENGINEERS			
CHECKED BY: R.R.C.	BUFFALO NEW YORK			
PROJ. ENGR. J.A.L.	JOB No. 35314	TOWN OF RAMAPO	NEW YORK	Scale: AS NOTED Date: JUNE 94 DWG. NO. 33
NO. DATE DESCRIPTION	NO. DATE DESCRIPTION			
1 12/98 RECORD DRAWING				

APPENDIX F

**RAMAPO RIVER AT RAMAPO, NY
01387400 GAUGING STATION HYDROGRAPH**

USGS 01387400 Ramapo River at Ramapo, NY Gauging Station

