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U.S. DEPARTMENT OF ENERGY

Groundwater Update

Highlights of Plume and Treatment Systems Status, Performance, Progress, and Recommendations

Bill Dorsch, Manager
Groundwater Protection Group
October 12, 2023

@BrookhavenLab

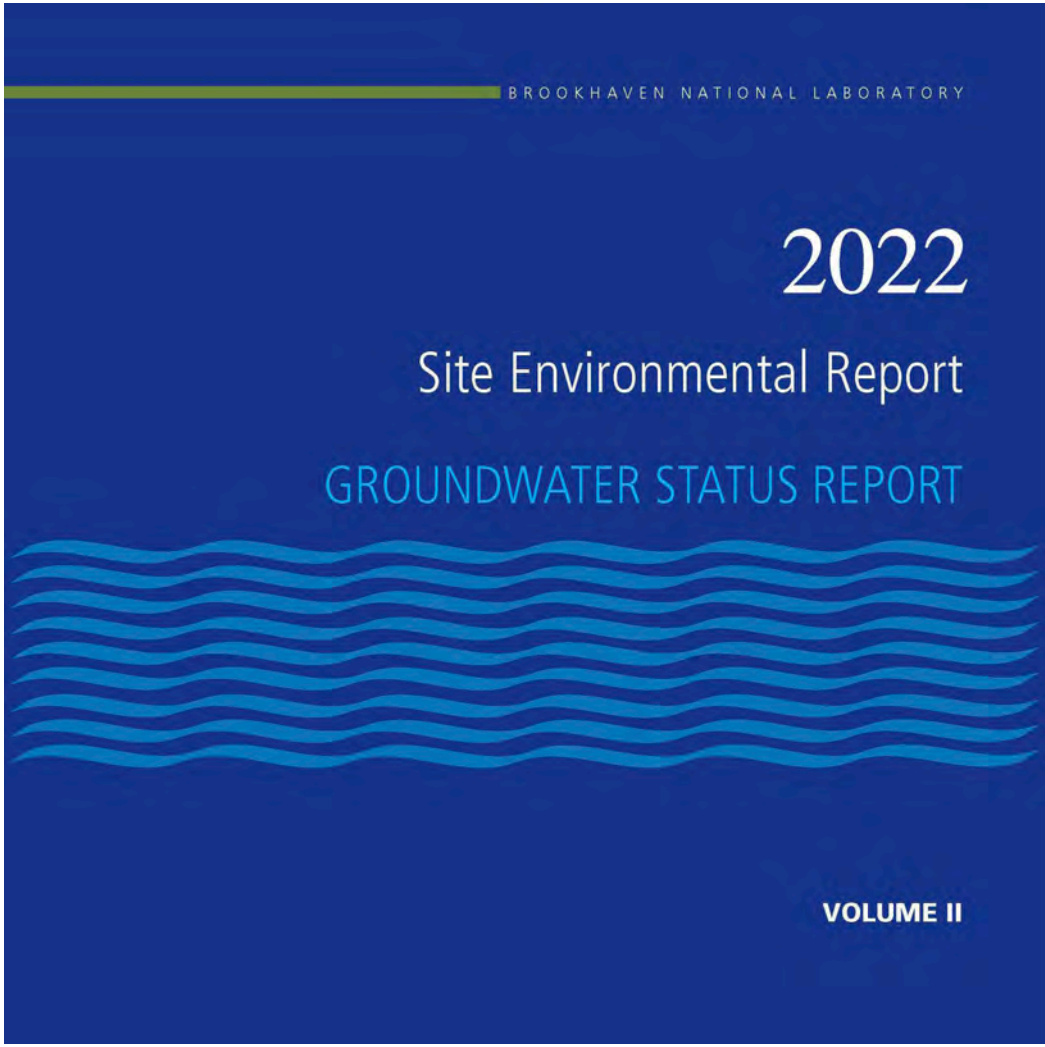
Agenda

- Overview of Remediation Systems
  - VOC plume remediation progress and issues
  - Sr-90 plume remediation progress
- PFAS Time Critical Removal Action (TCRA) and Operable Unit (OU) X Status

Groundwater Status Report (Volume 2 of Site Environmental Report)

- Groundwater Status Report (GSR) provides details on groundwater monitoring and remediation conducted during 2022
- Chapter 7 of SER Vol. I provides a high-level overview

Web link for 2022 Groundwater Status Report - https://www.bnl.gov/gpg/files/groundwater-reports/2022-groundwater-status-report.pdf.pdf



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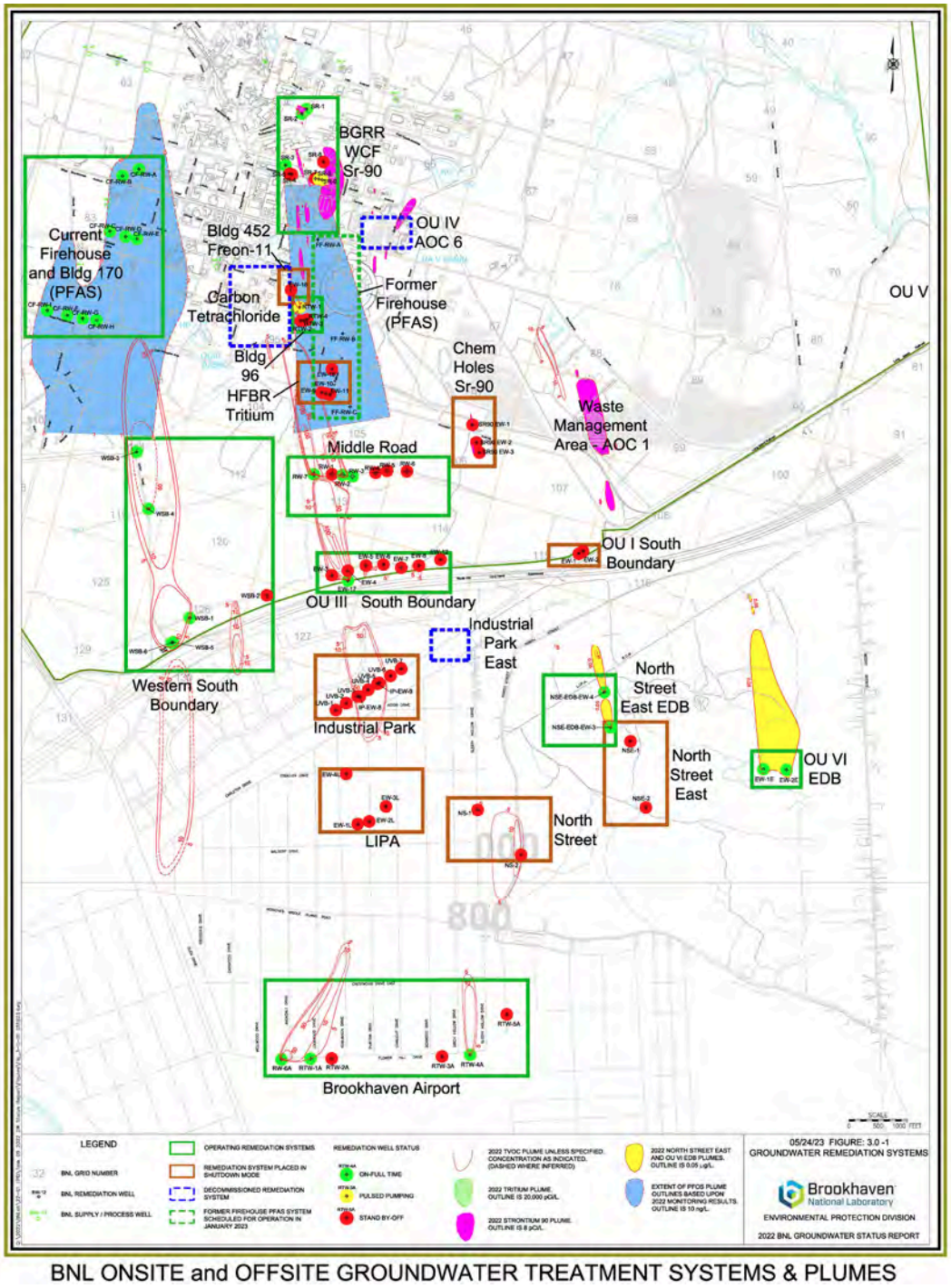
Remediation System Overview

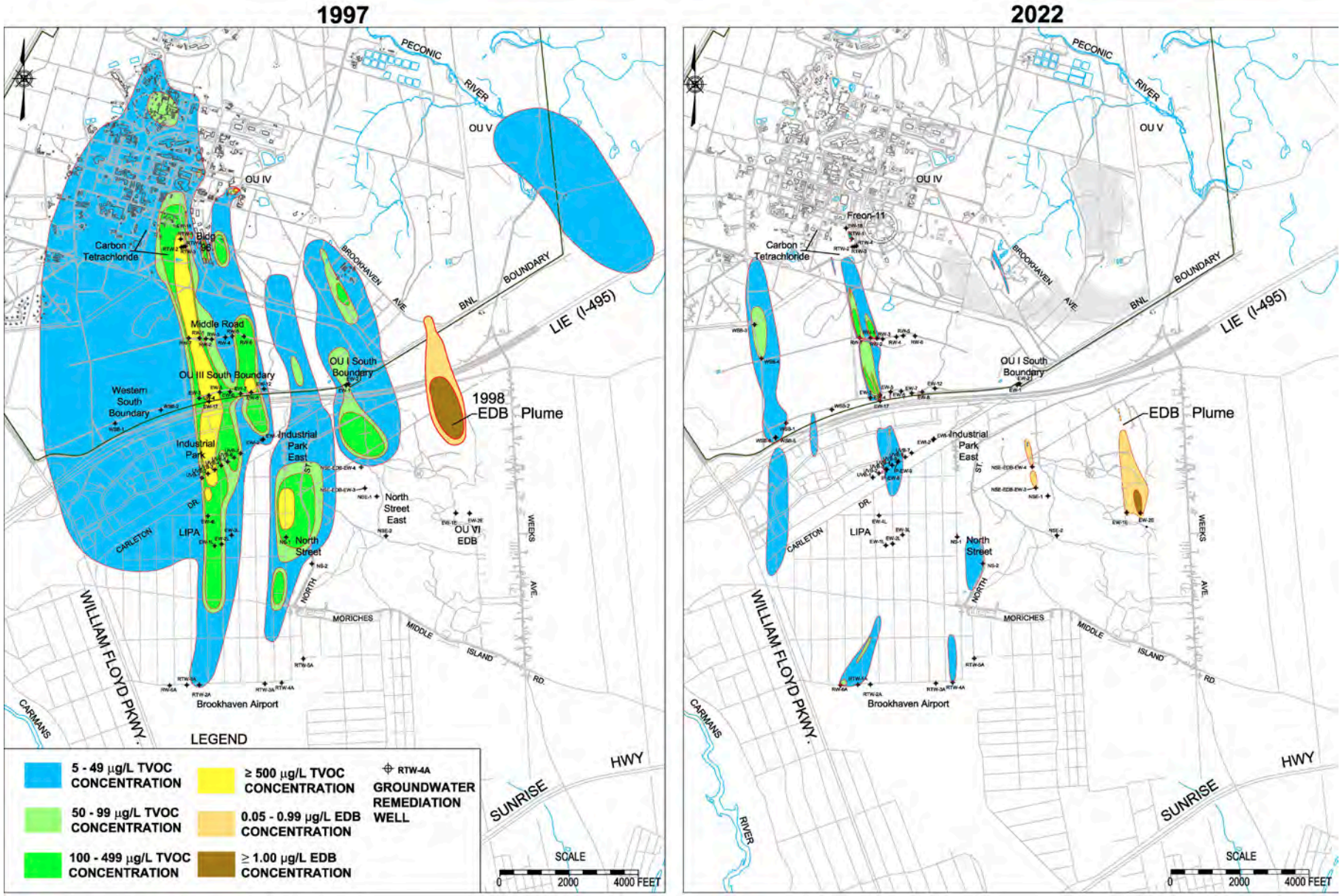
- Groundwater Remediation Systems operating*:
  - Seven VOC Systems
  - One PFAS System
  - One Sr-90 System
- 31 of 80 total extraction wells in operation
- 1 billion gallons groundwater treated in 2022
- 7,819 lbs. of VOC removed from groundwater to date and 35 mCi Sr-90

<u>Note*</u>: Above statistics and system status as of December 2022



BNL ONSITE and OFFSITE GROUNDWATER TREATMENT SYSTEMS & PLUMES

VOC Plume Comparison



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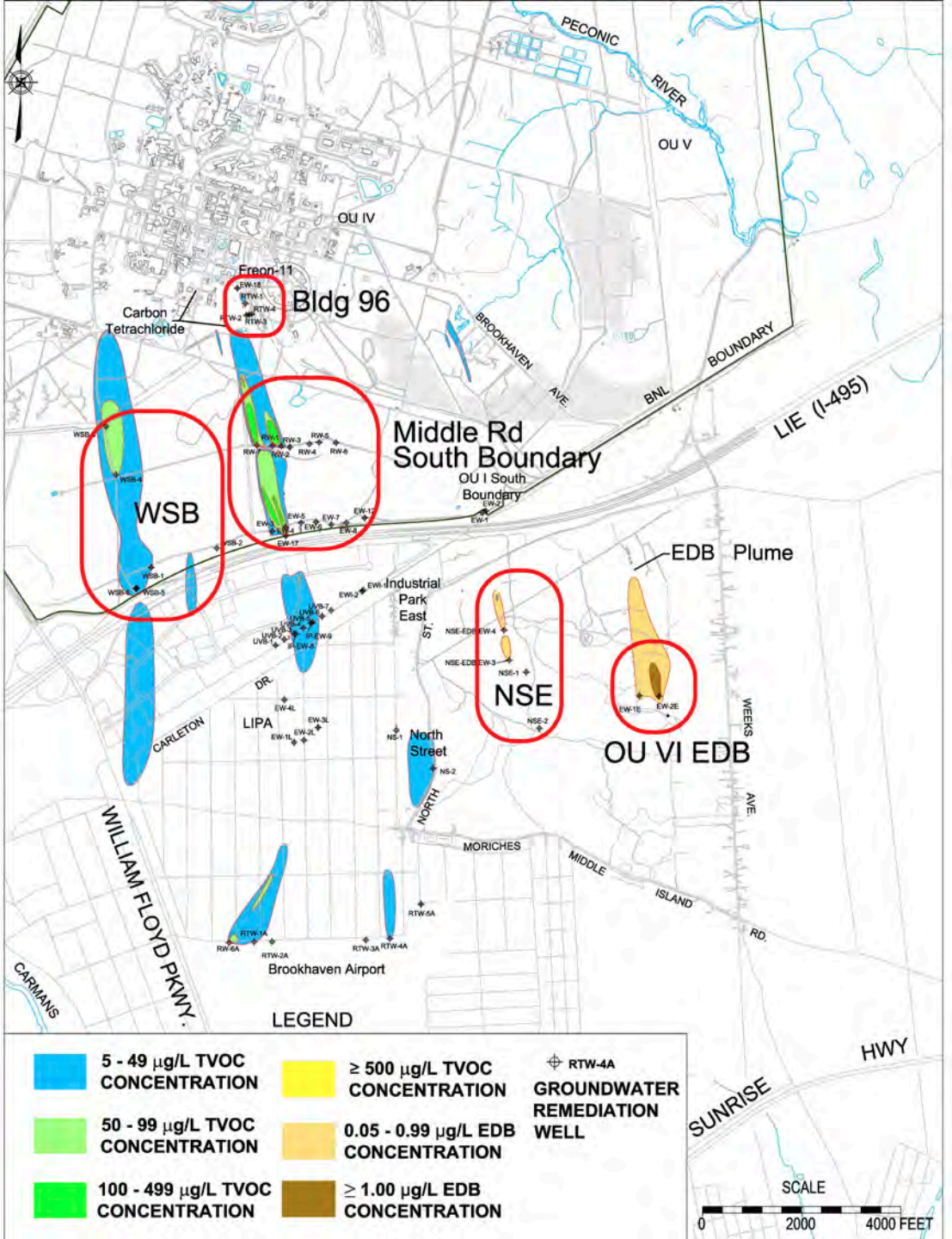
Groundwater Remediation – VOC System Progress and Current Issues

- Discuss details of status, progress, issues and ongoing work for highlighted areas



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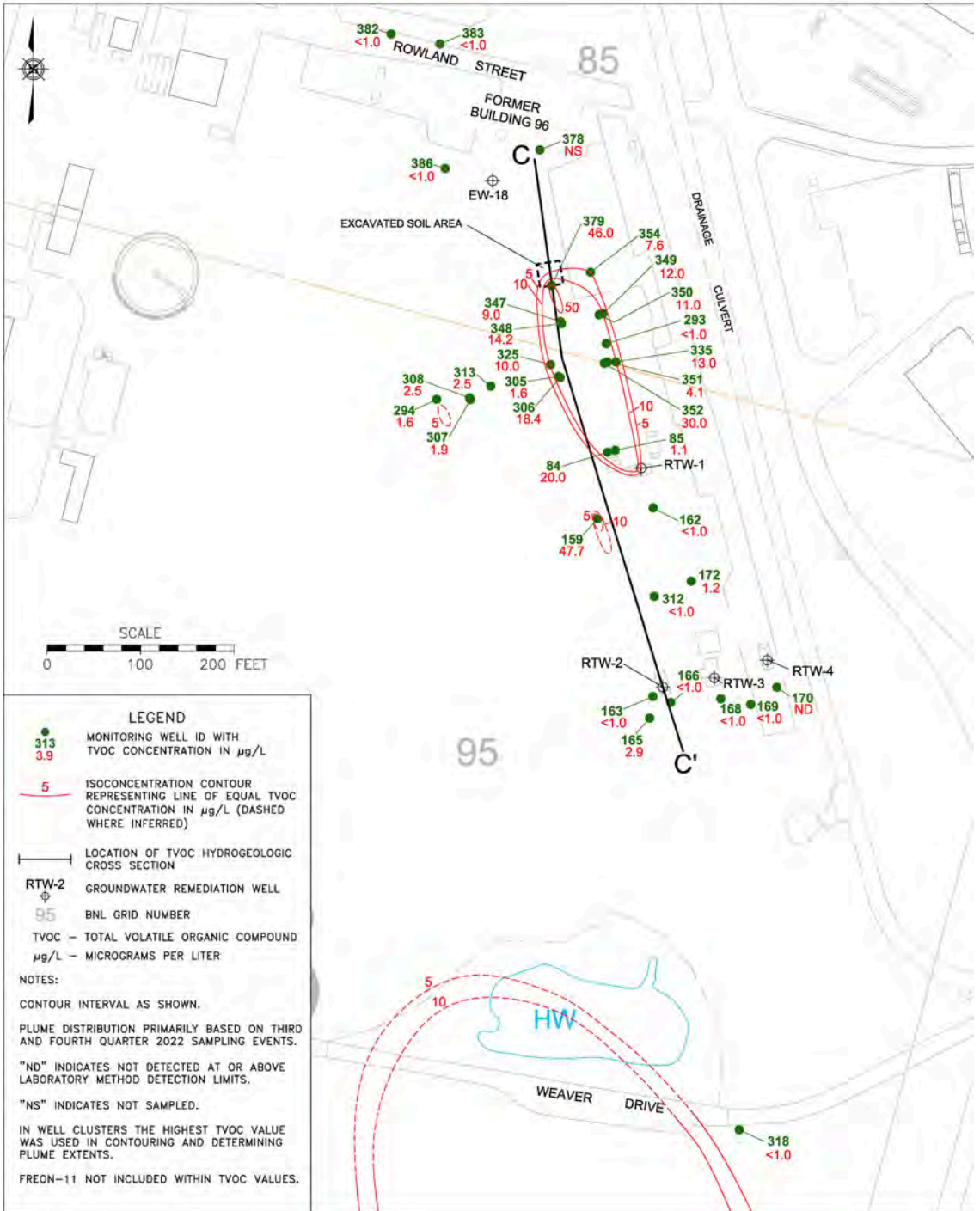
OU III Building 96

- Extraction well RTW-1:
  - TVOCs <50 µg/L (capture goal) since 2015
  - VOCs <MCLs since 2020

- RTW-1 placed in pulsed pumping mode (month on/month off) in May 2022

- Overall VOC plume cleanup complete with exception of immediate source area. Well 085-379 has been slow to improve

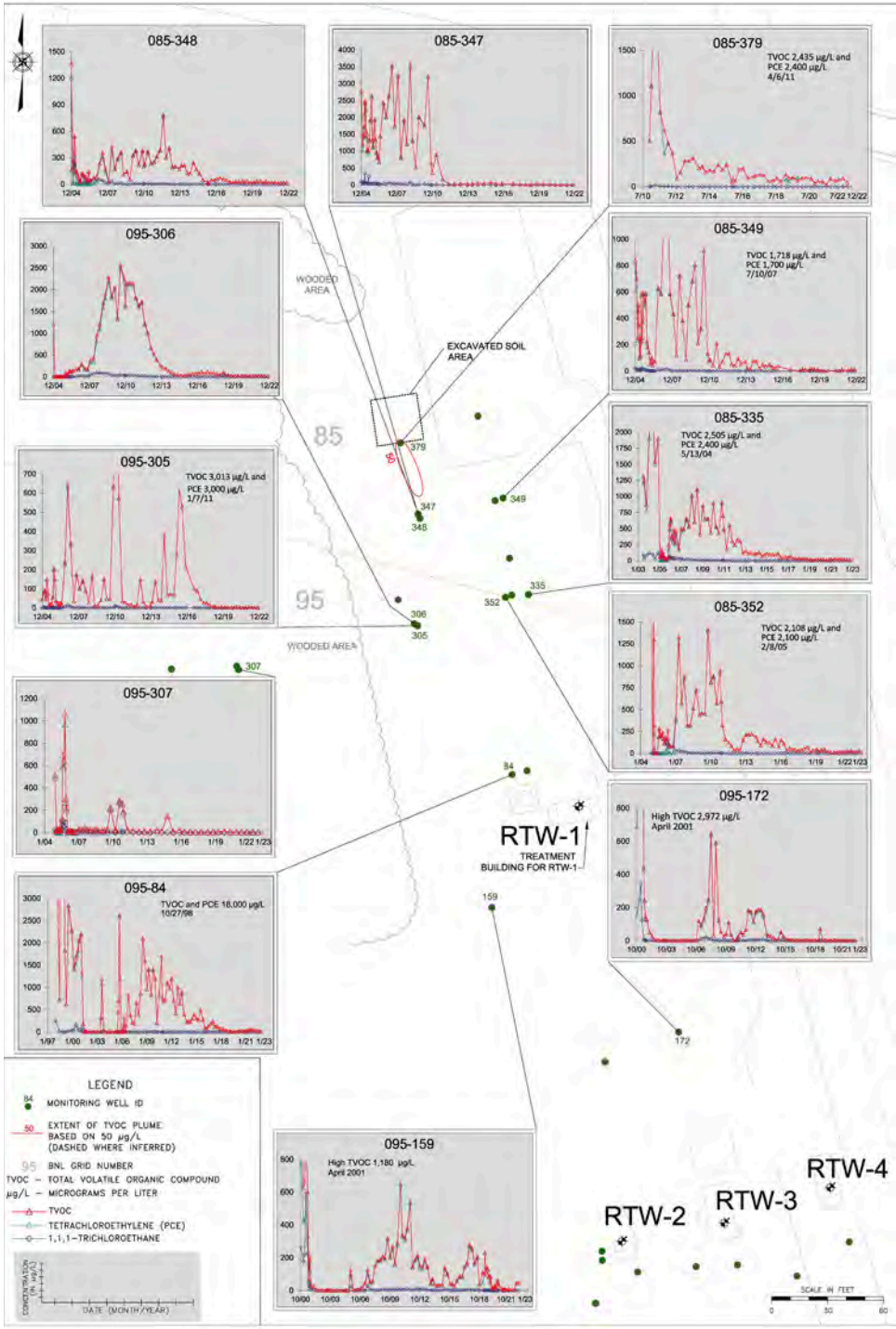


OU III Building 96

- Last 4 rounds of TVOC data for 085-379 through 7/23 show concentrations of 46 µg/L, 52 µg/L, 49 µg/L, and 76 µg/L (precipitation and water table low over that period)

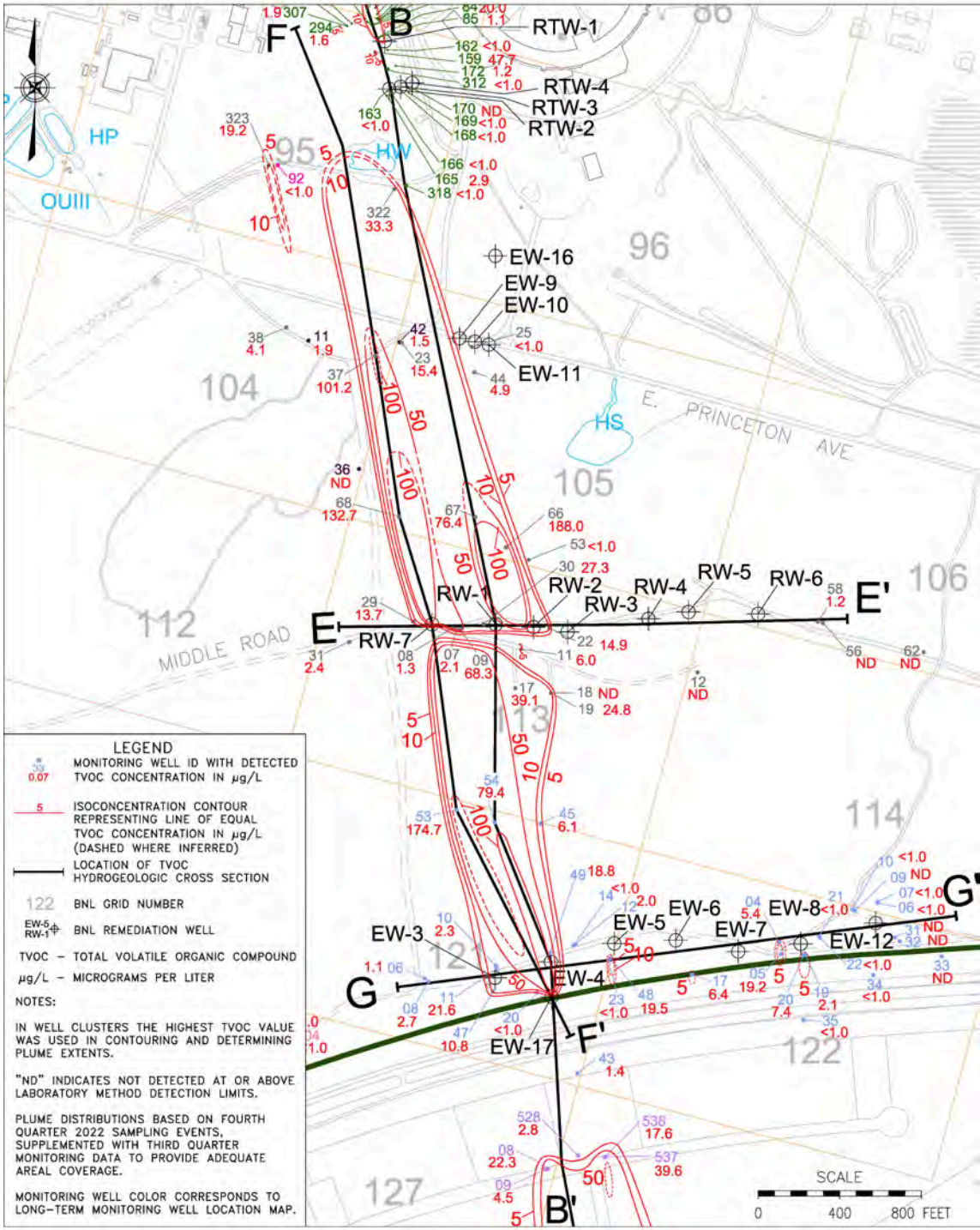
- 2021 Five-Year Review (FYR) recommendation to continue monitoring over next two years and evaluate/implement a liquid carbon with zero valent iron source area injection treatment if warranted

- 2022 GSR recommendation to reduce sampling frequency for 11 monitoring wells based on low VOC concentrations and historical data.



OU III Middle Rd./South Boundary

- Continue to operate Middle Rd. extraction wells (EWs) RW-2, RW-3, and RW-7 and South Boundary EW-17
- VOCs concentrations remain elevated in deep Upper Glacial



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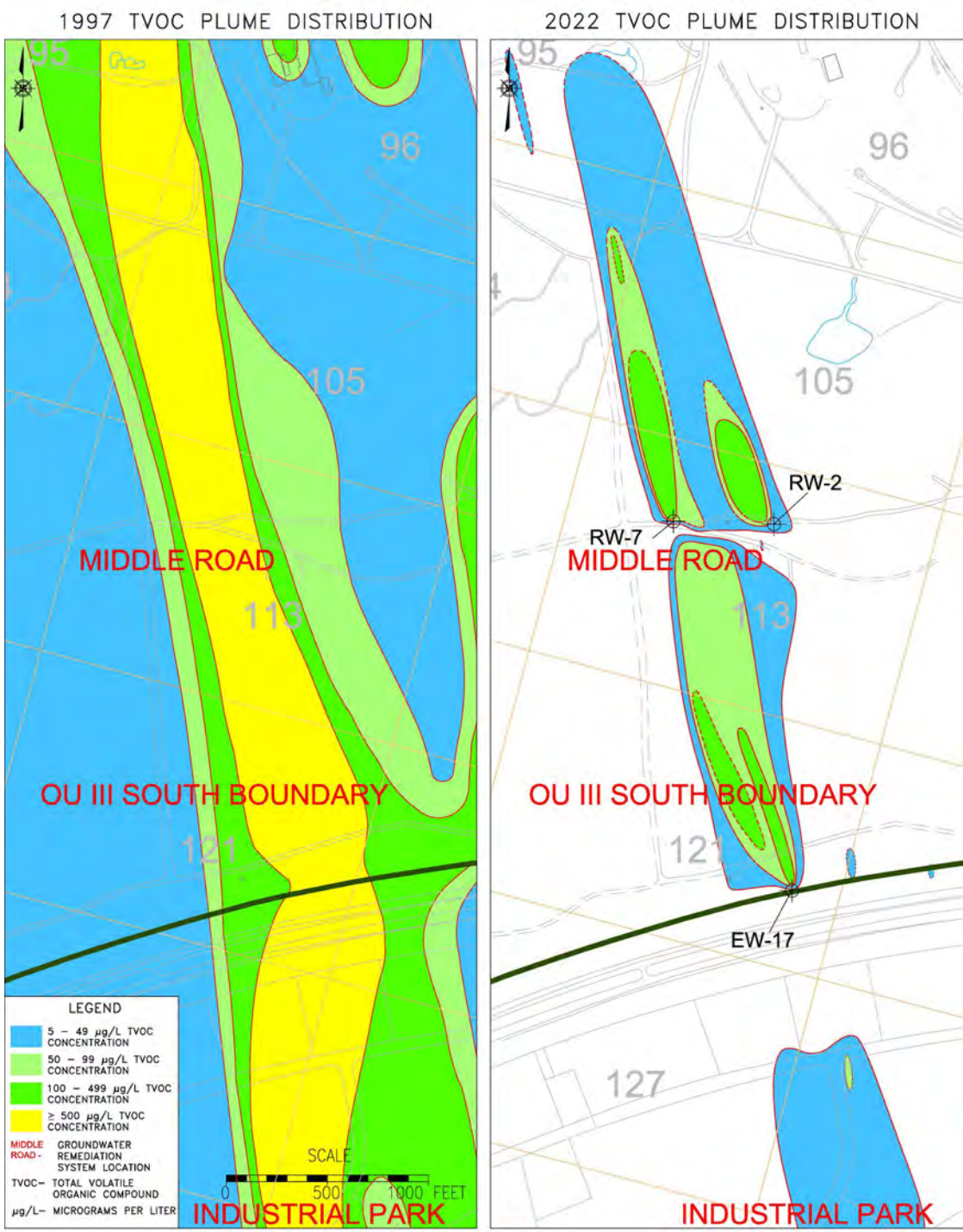

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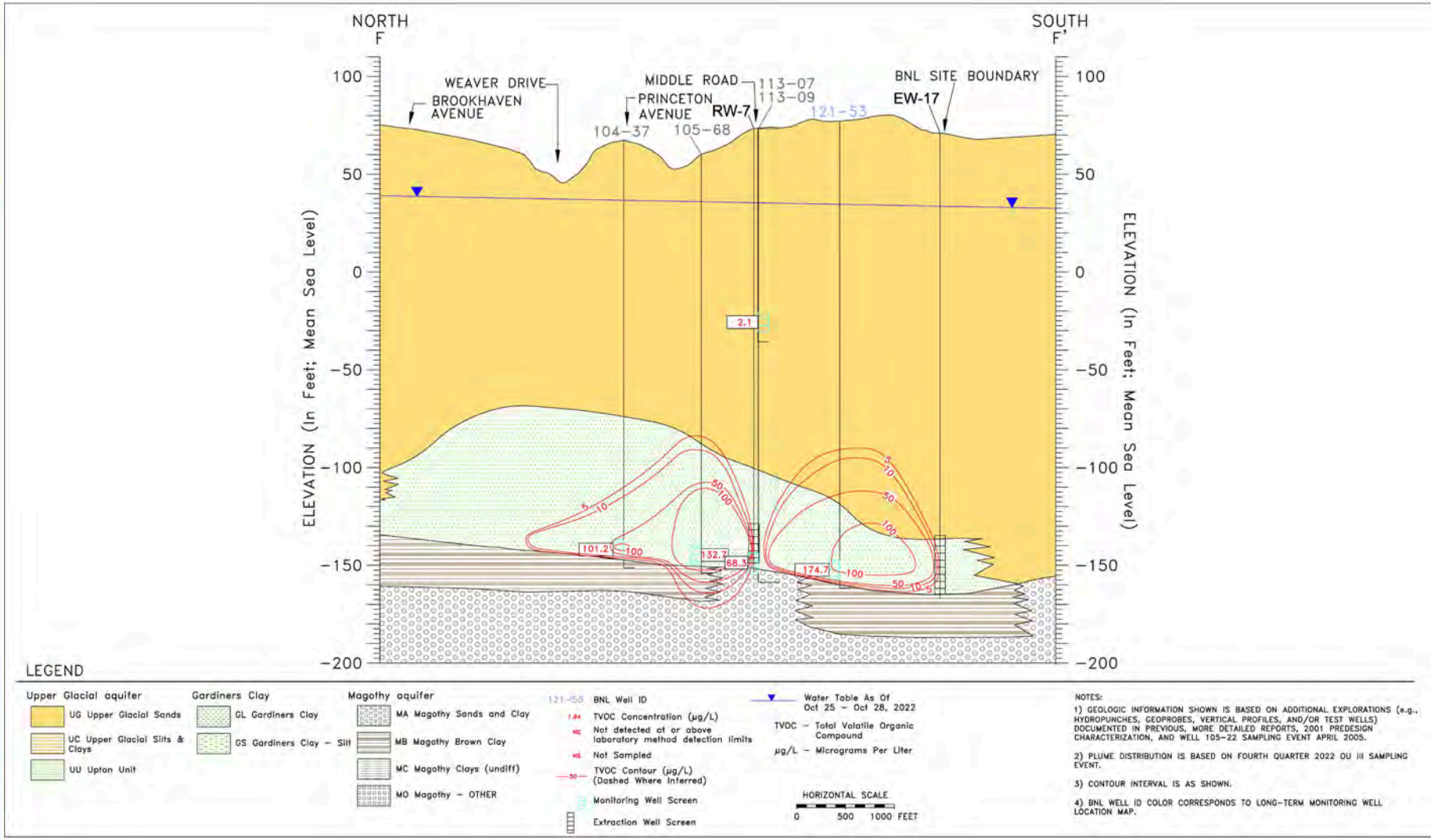
OU III Middle Rd./South Boundary



- VOCs concentrations remain elevated in deep Upper Glacial aquifer

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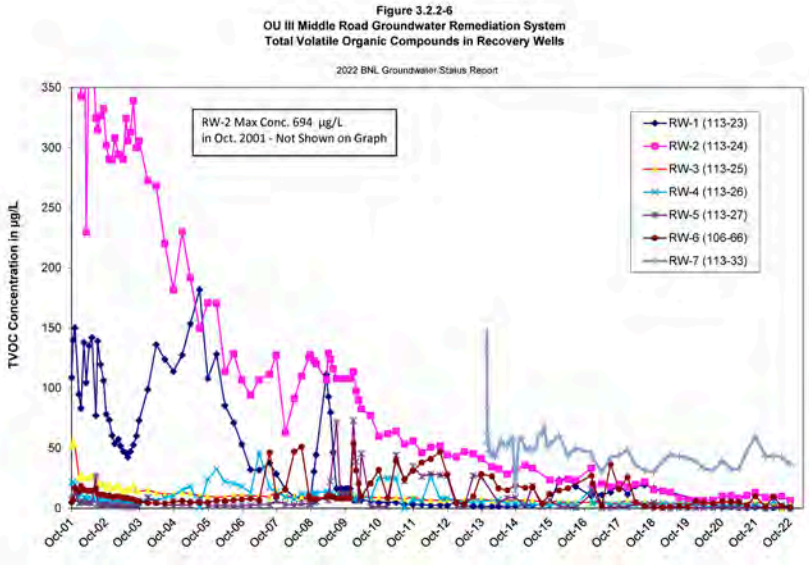
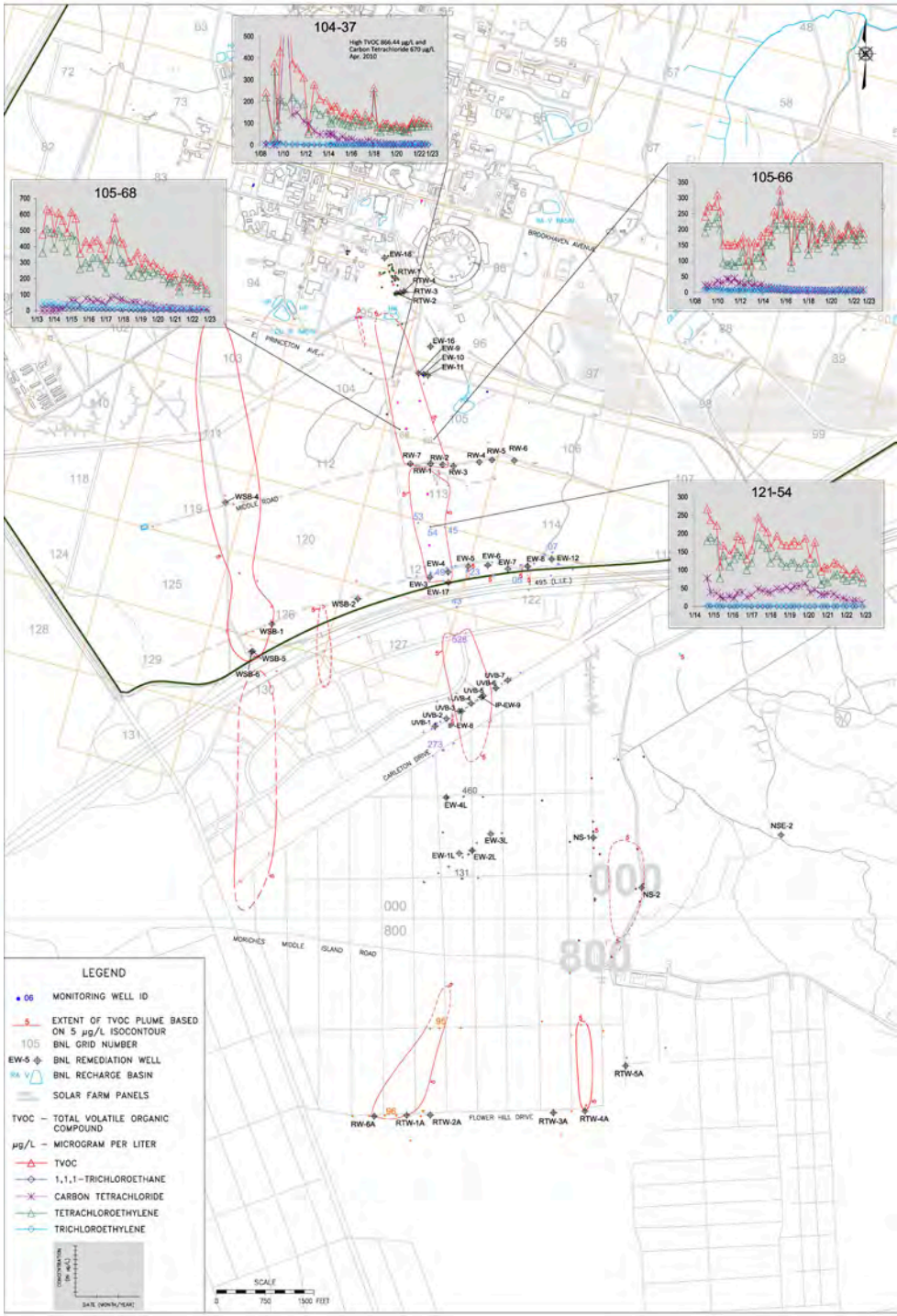
OU III Middle Rd./South Boundary





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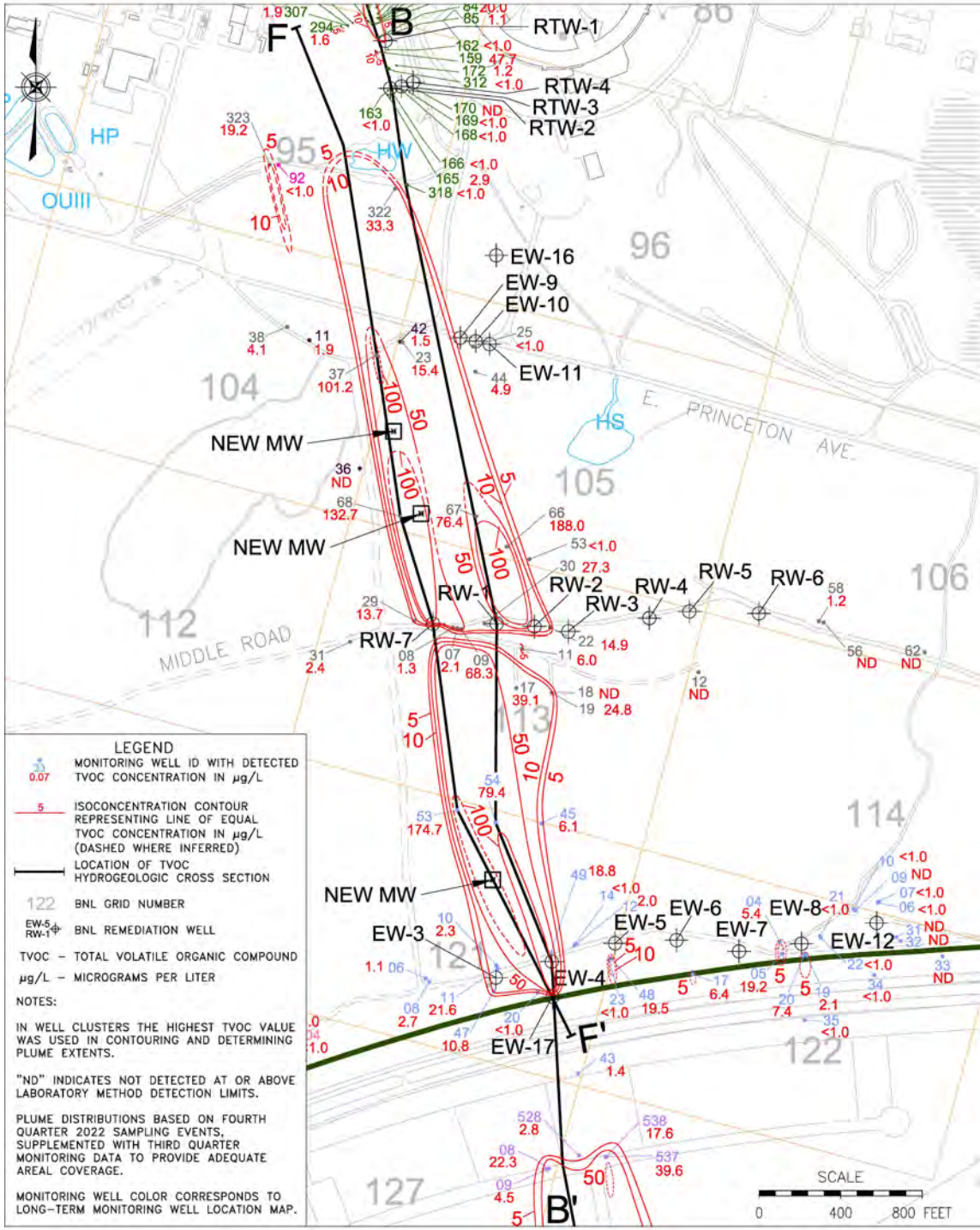
OU III Middle Rd./South Boundary

- Per 2021 FYR Recommendations
  - Update regional model as necessary and evaluate interaction of Upton Unit and Upper Magothy Clay on deep plume
  - Perform groundwater model simulations to evaluate the best locations, extraction rates, and number of extraction wells for a system modification design that will meet the 2030 ROD cleanup goal.
- Per 2022 GSR Recommendation:
  - Install three new monitoring wells to fill plume data gaps



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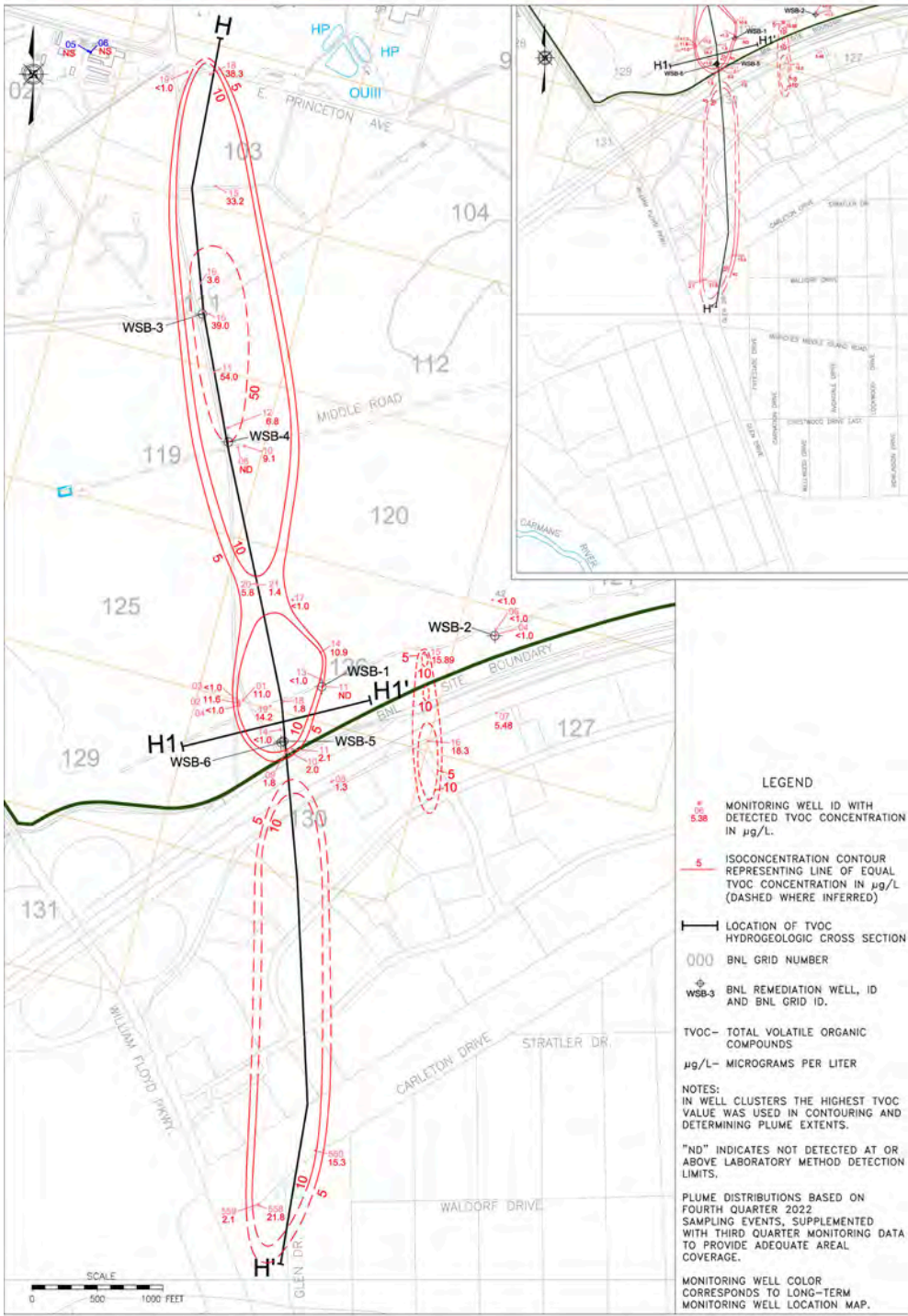
Western South Boundary

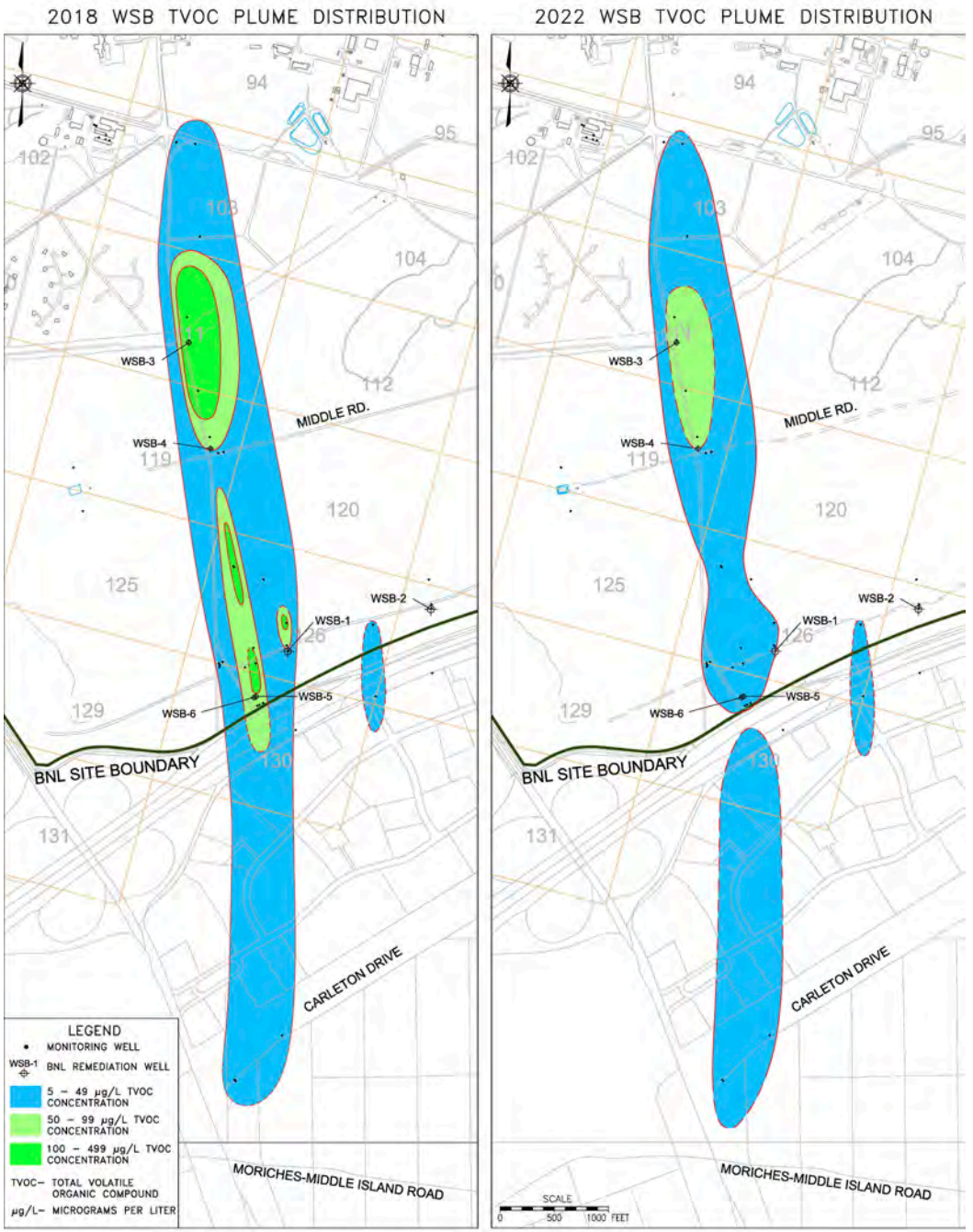
- Extraction well WSB-2 in stand-by since 2016 (< 20 µg/L system capture goal)
- The operation of four new extraction wells to pump and treat deeper VOCs was initiated in March 2019
- Off-site, leading plume edge wells continue to show low VOC concentrations



Western South Boundary

2022 GW status Report Recommendations:

- Based on significant reduction in deeper VOC contamination, place the four newer wells (WSB-3, WSB-4, WSB-5, and WSB-6) in pulsed pumping mode
- Place WSB-1 in pulsed pumping mode as TVOC concentrations in upgradient monitoring well 126-14 have decreased to at or below the capture goal of 20 µg/L for six consecutive sampling rounds.
- Based on the low TVOC concentrations below the capture goal, maintain extraction well WSB-2 in standby mode.



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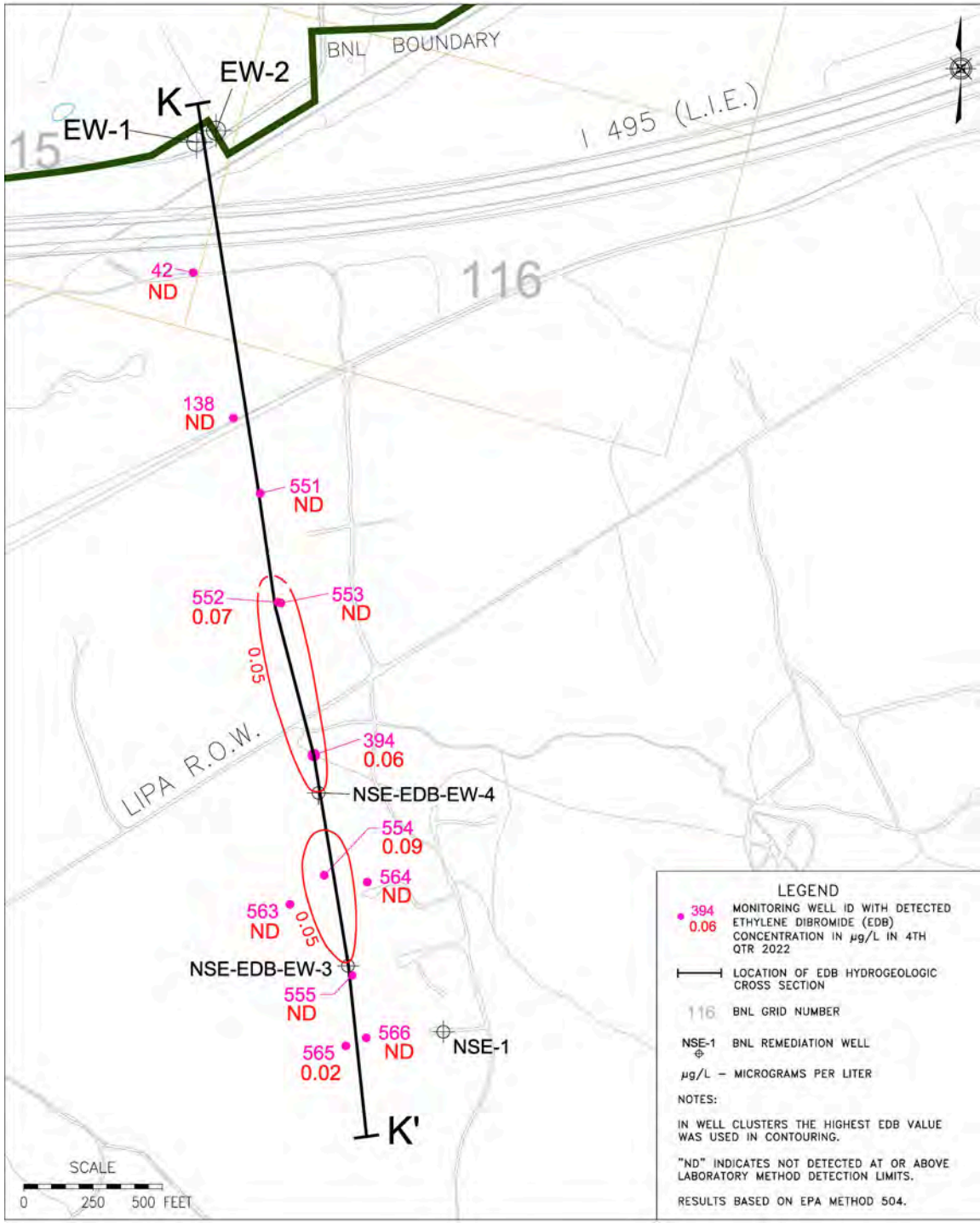
OU III North St. East

- VOC system was shut down in 2014.
- Identified EDB plume and characterized extent 2018-19
- EDB system began operation in 2020 and making progress in reducing plume concentrations.



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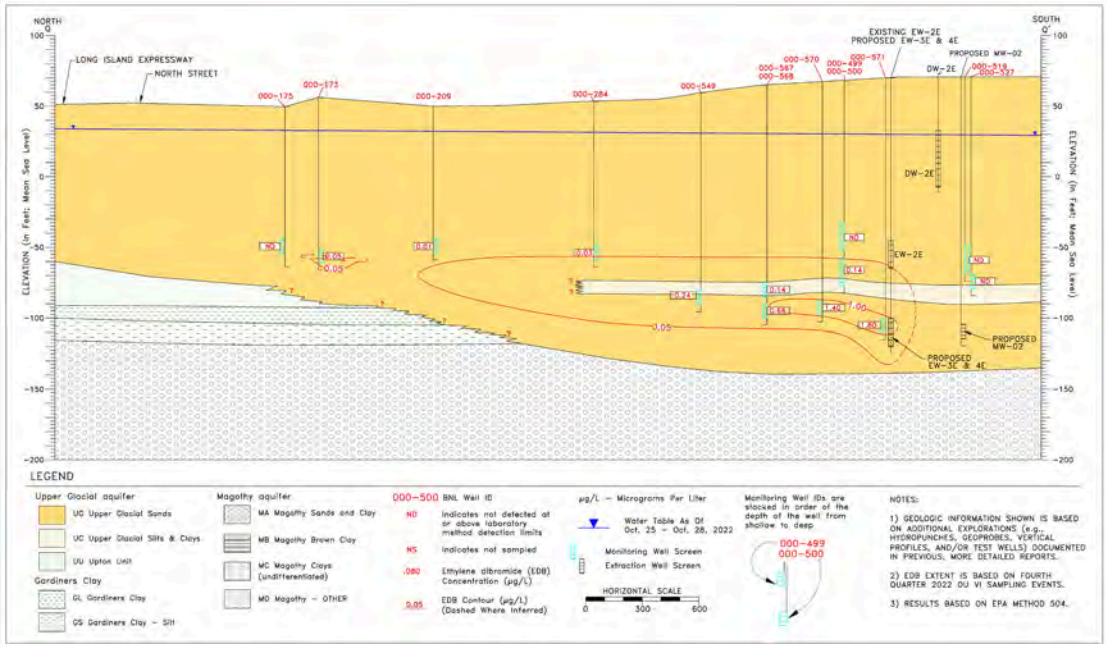
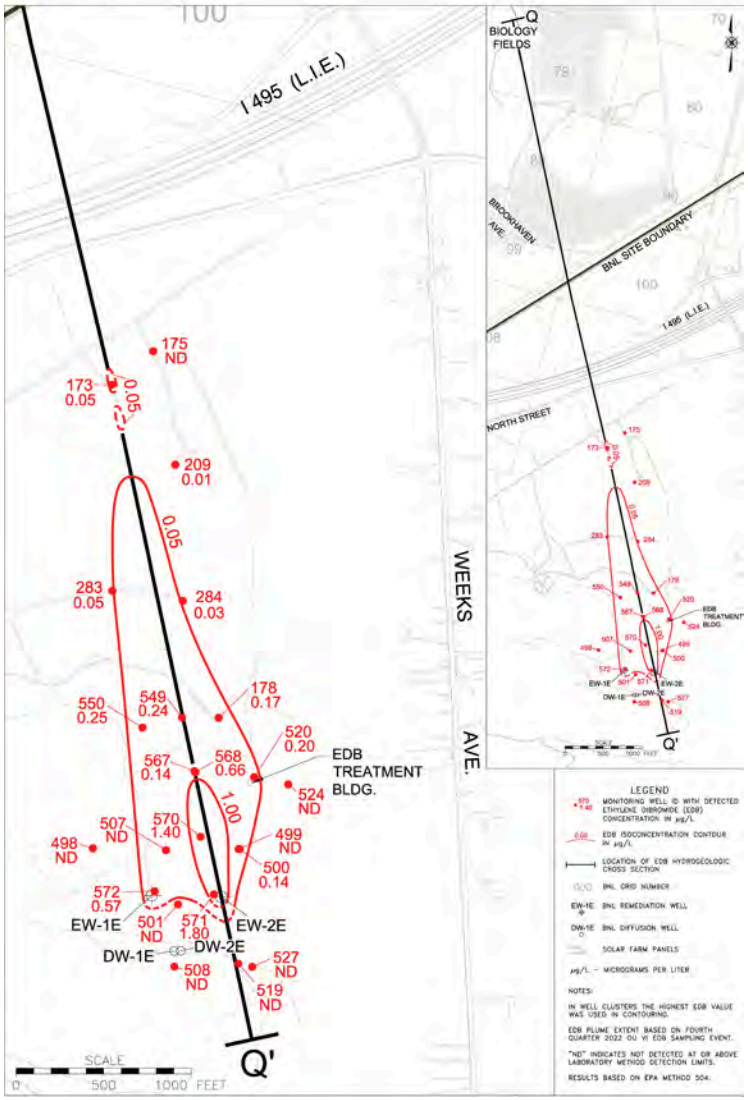
OU III North St. East

- Well 000-394 decreased to 0.04 µg/L in June 2023 (0.05 µg/L DWS)
- Continue full-time system operation.

OU VI EDB

- Completed design and groundwater modeling work for system modification as per FYR (recommendation to remediate deeper EDB currently bypassing extraction wells).
- Submitted design modification report to regulators August 2023
- Two new (deeper) extraction wells were installed in September 2023





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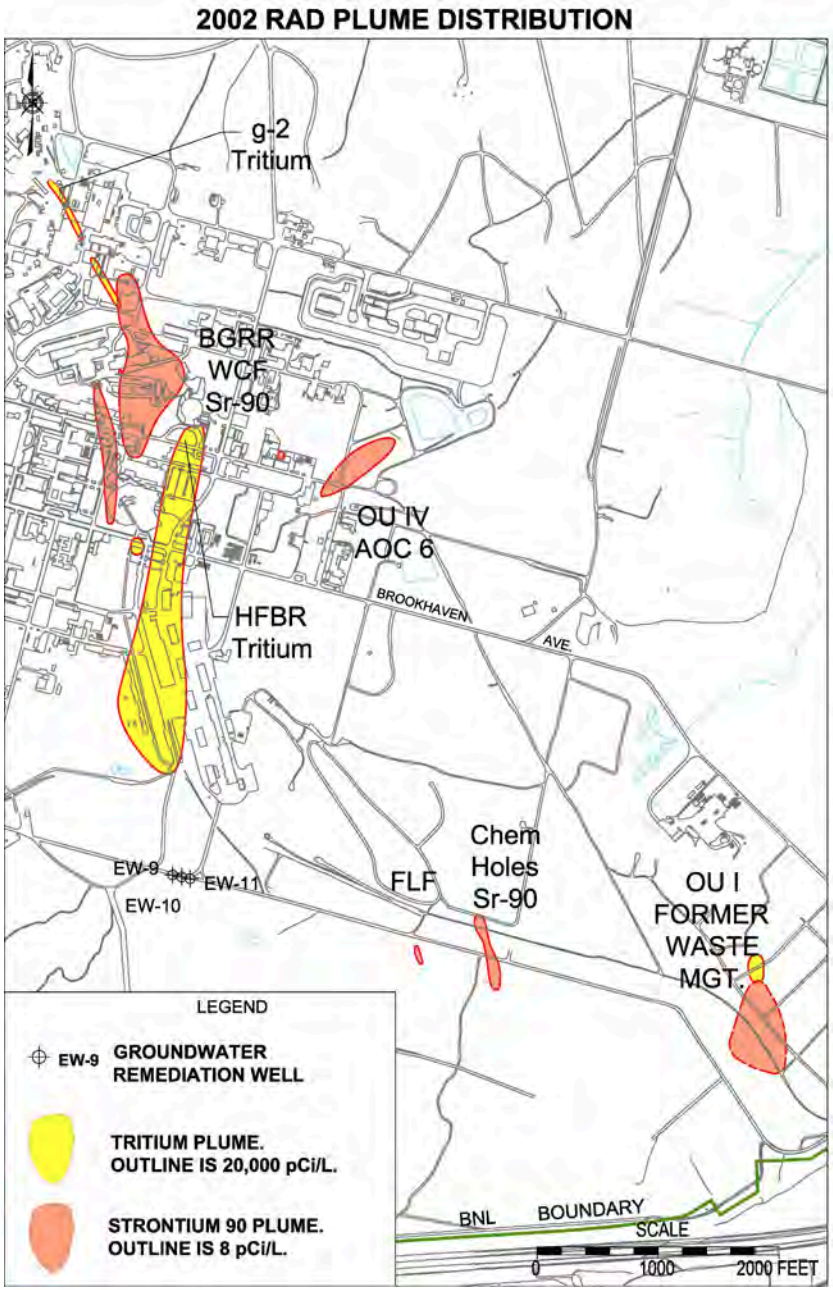
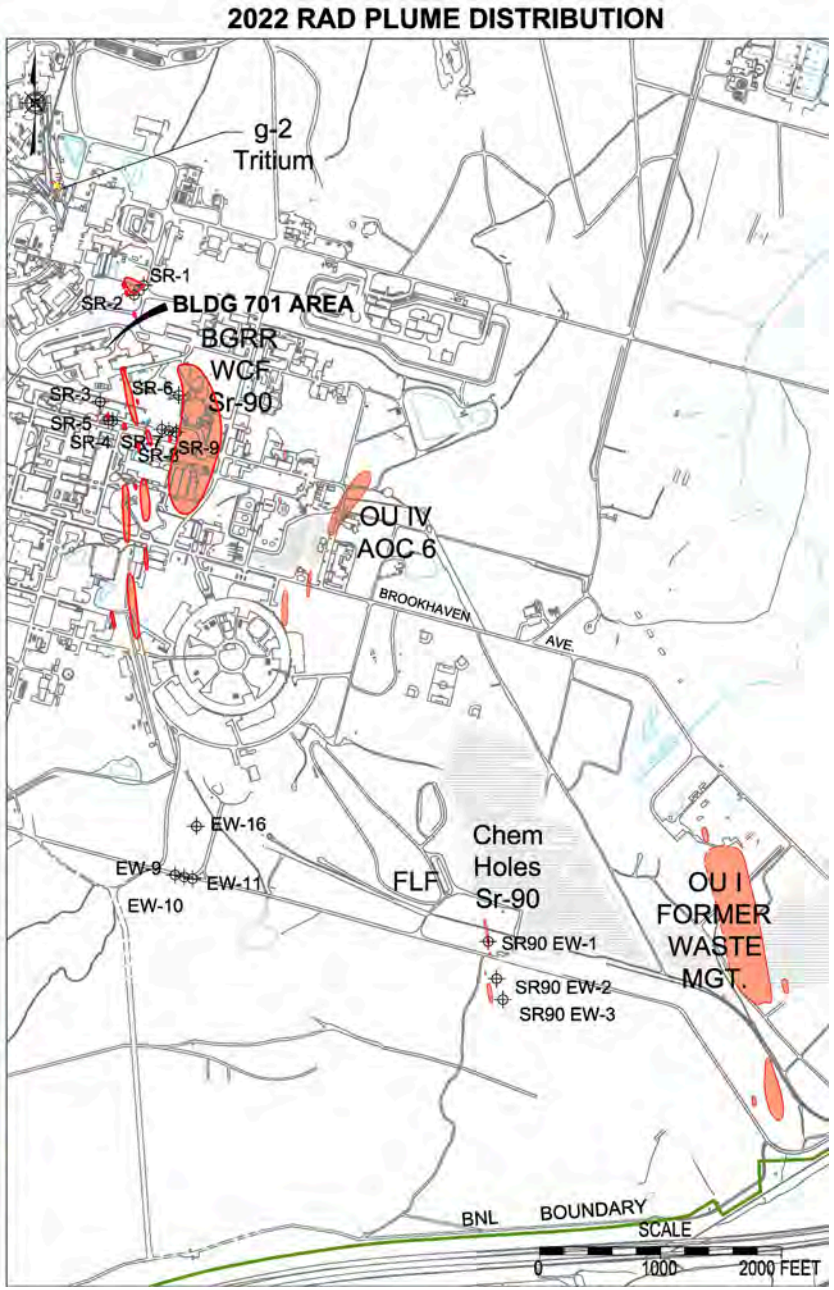
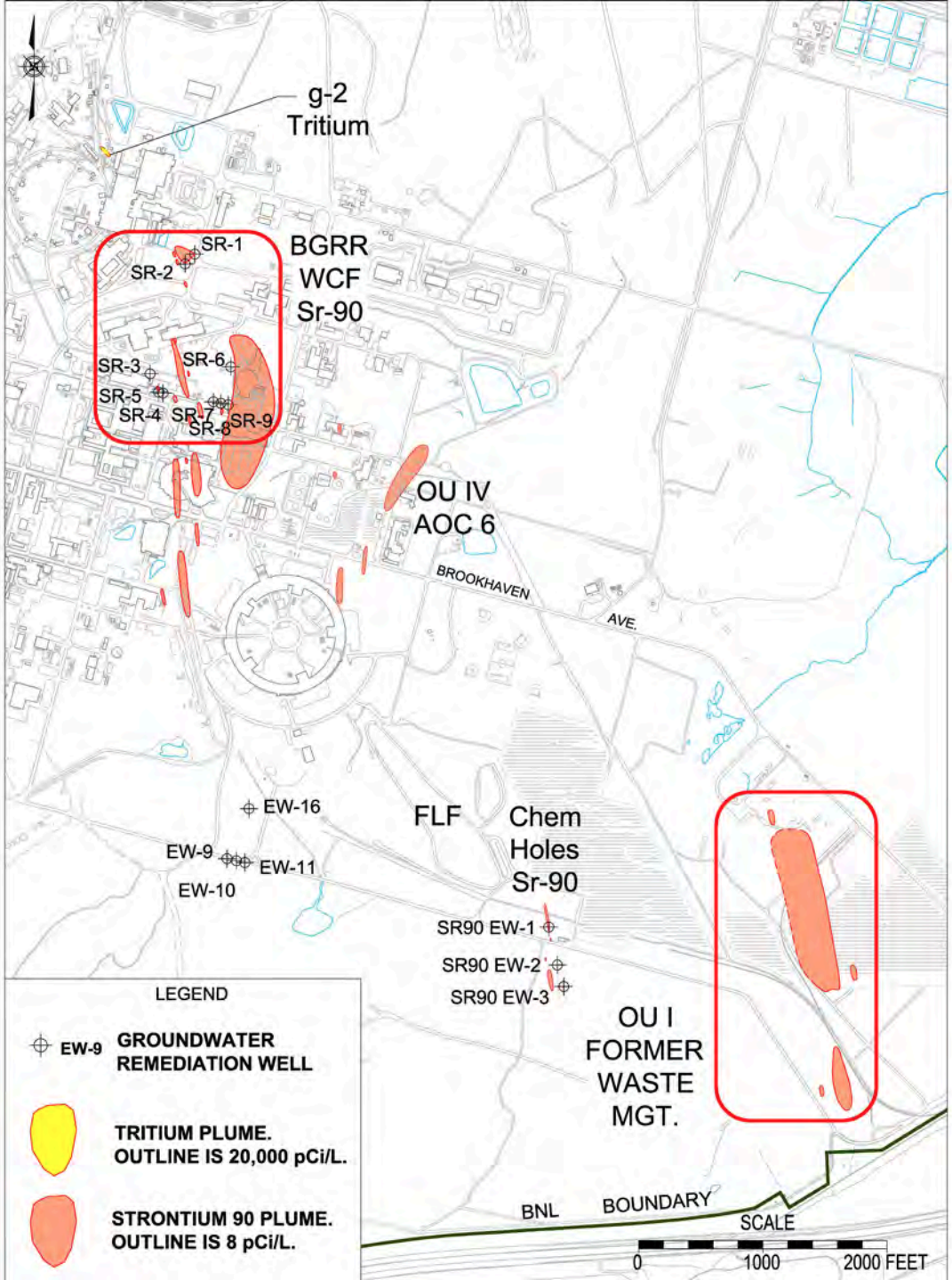
Radiological Plume Comparison





Groundwater Remediation – Sr-90 Cleanup Progress and Current Issues

- Discuss details of status, progress, issues and ongoing work for highlighted areas



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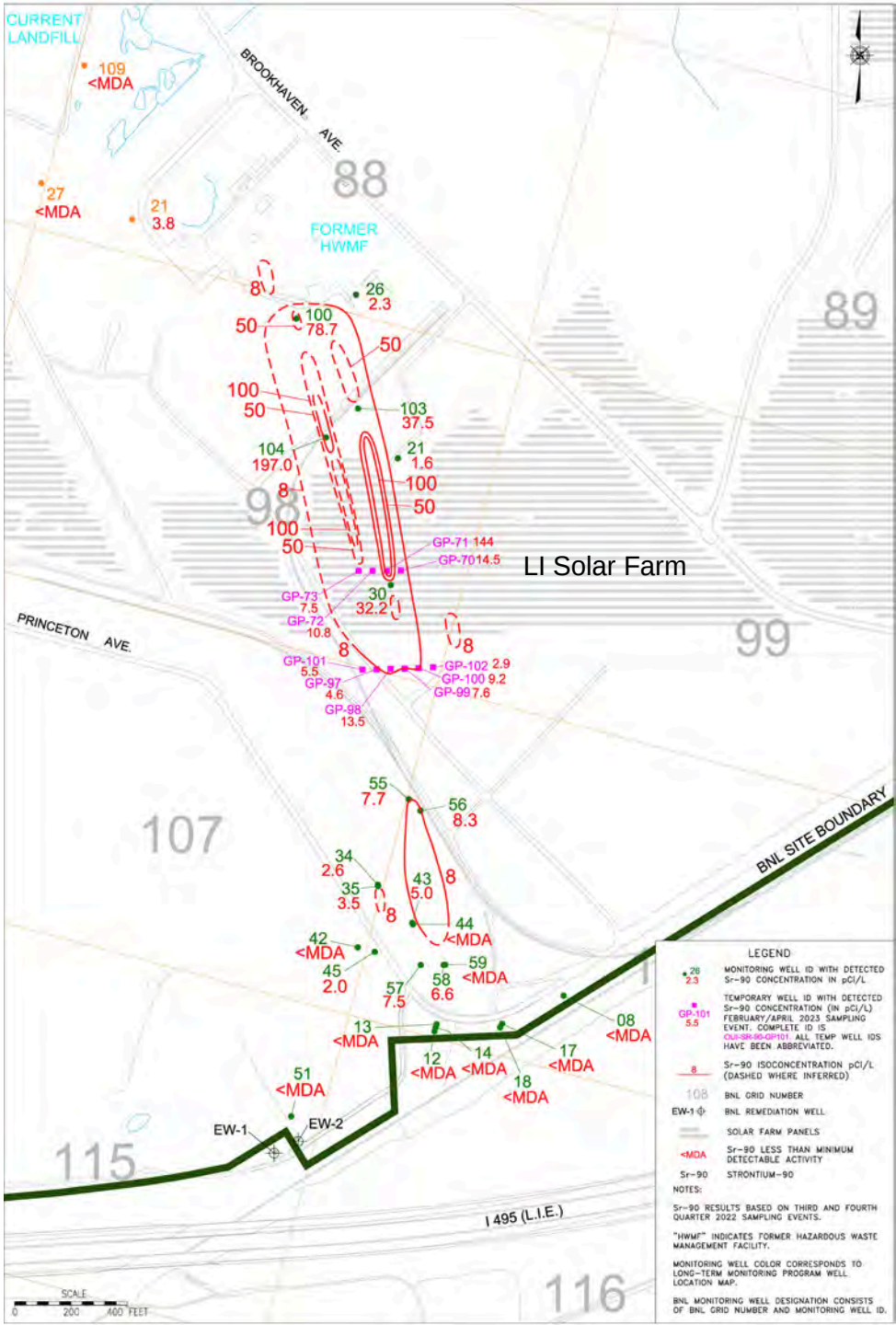
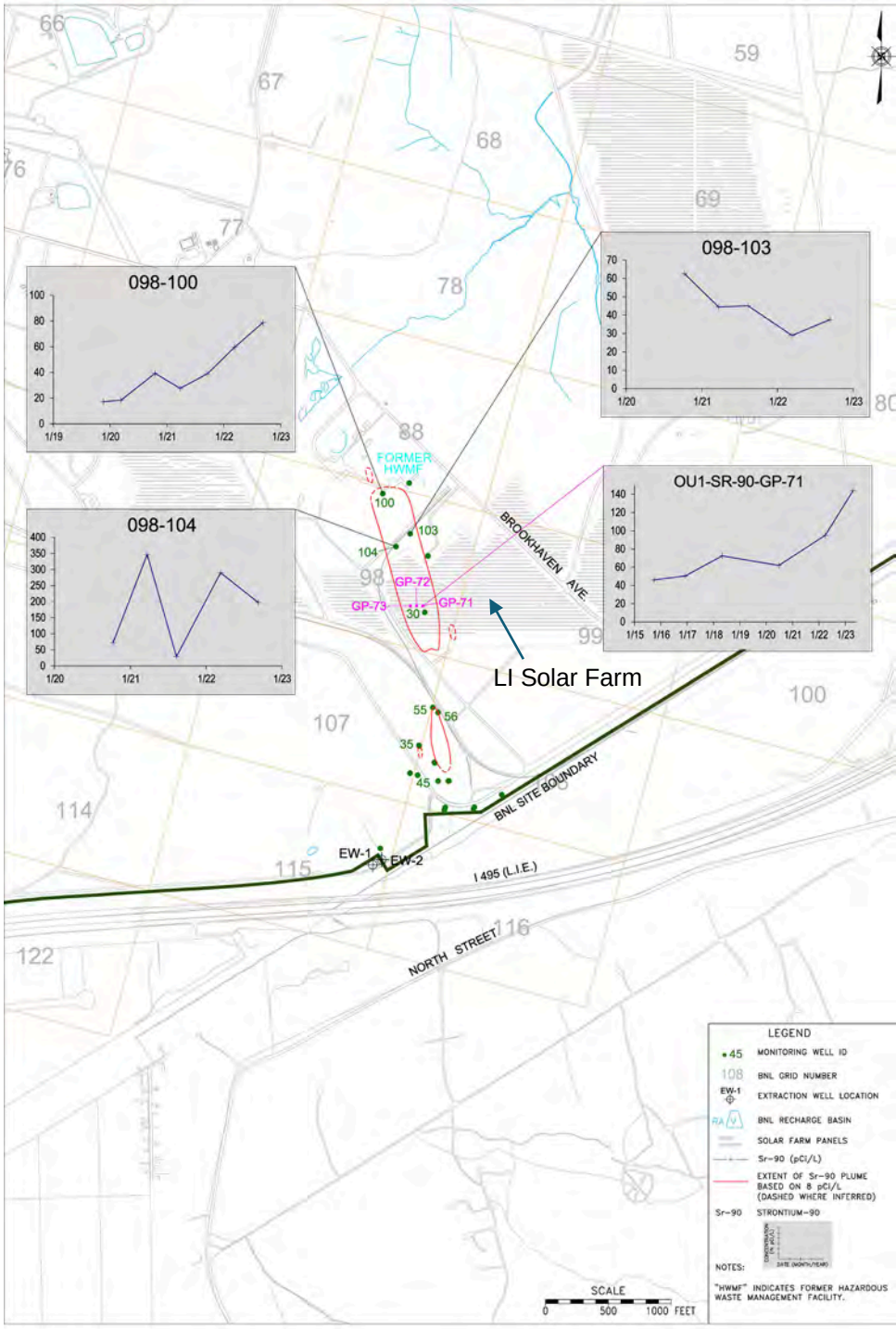
OU I South Boundary Sr-90

- Two narrow plumes of Sr-90 originating in central portion of the former hazardous waste management facility (FHWMF)
- Sr-90 migrates at rate of 20-50 feet per year in groundwater. Drinking Water Standard is 8 pCi/L
- Installed ten temporary wells in March-April 2023 to enhance Sr-90 monitoring network.



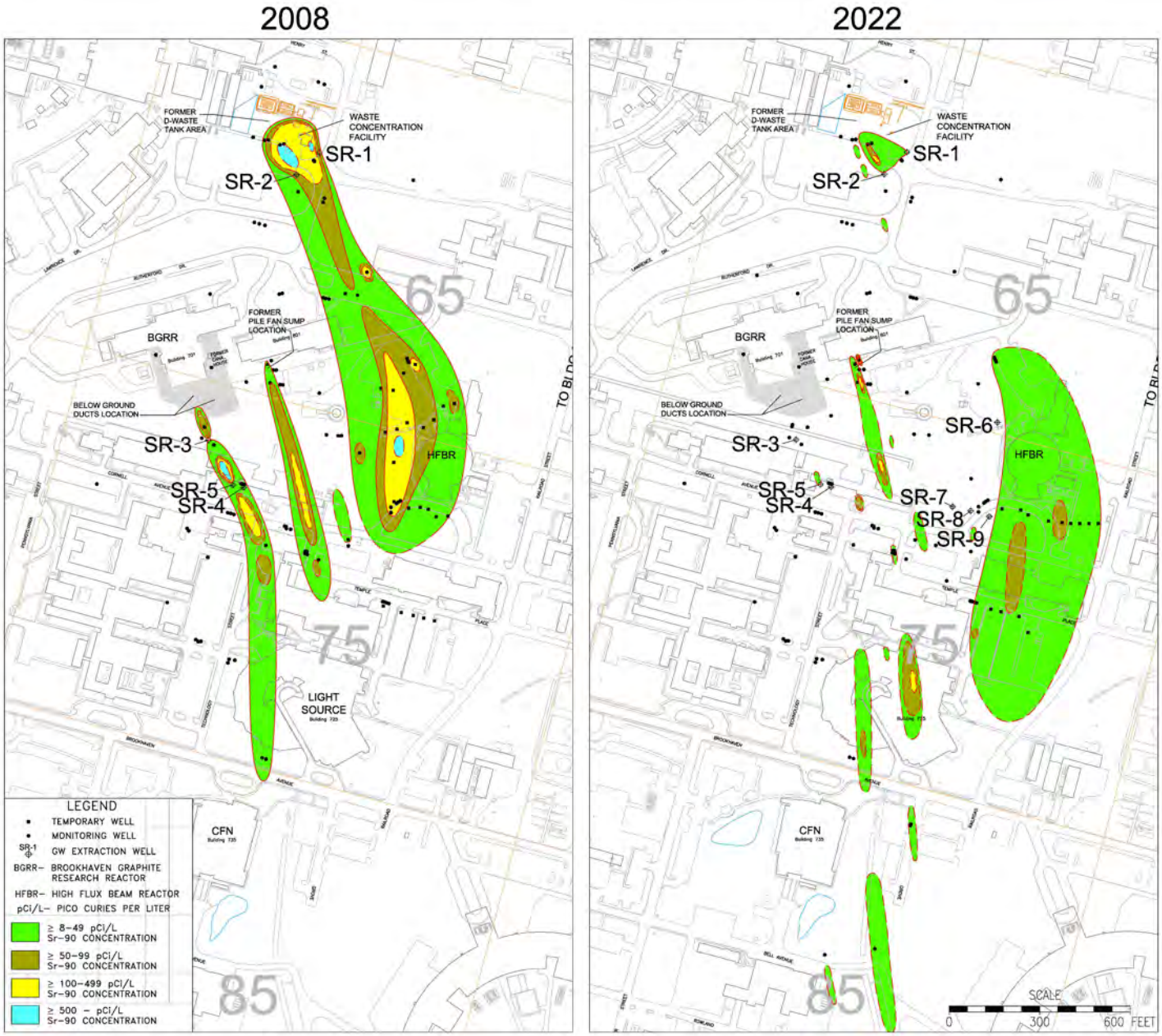
OU I South Boundary Sr-90

- Tracking leading edge of higher Sr-90 concentrations in LI Solar Farm
- Natural attenuation modeling of Sr-90 plume projects the remnants of plume to be near the site boundary at concentration of 10-25 pCi/L by approximately 2080
- GW Status Report recommendation to discontinue annual tritium and gamma spec sampling of 29 monitoring wells. There have been no significant detections in over 20 years in these wells.



BGRR/WCF/PFS

- SR-1 and SR-2 are the only extraction wells operating full-time
- Extraction well SR-9 was placed in standby mode in May 2023 as Sr-90 concentrations in this well have remained below the DWS since 2019
- Extraction well SR-3 currently in stand-by mode but can be restarted if source area monitoring well data indicate a significant increase in Sr-90 concentrations



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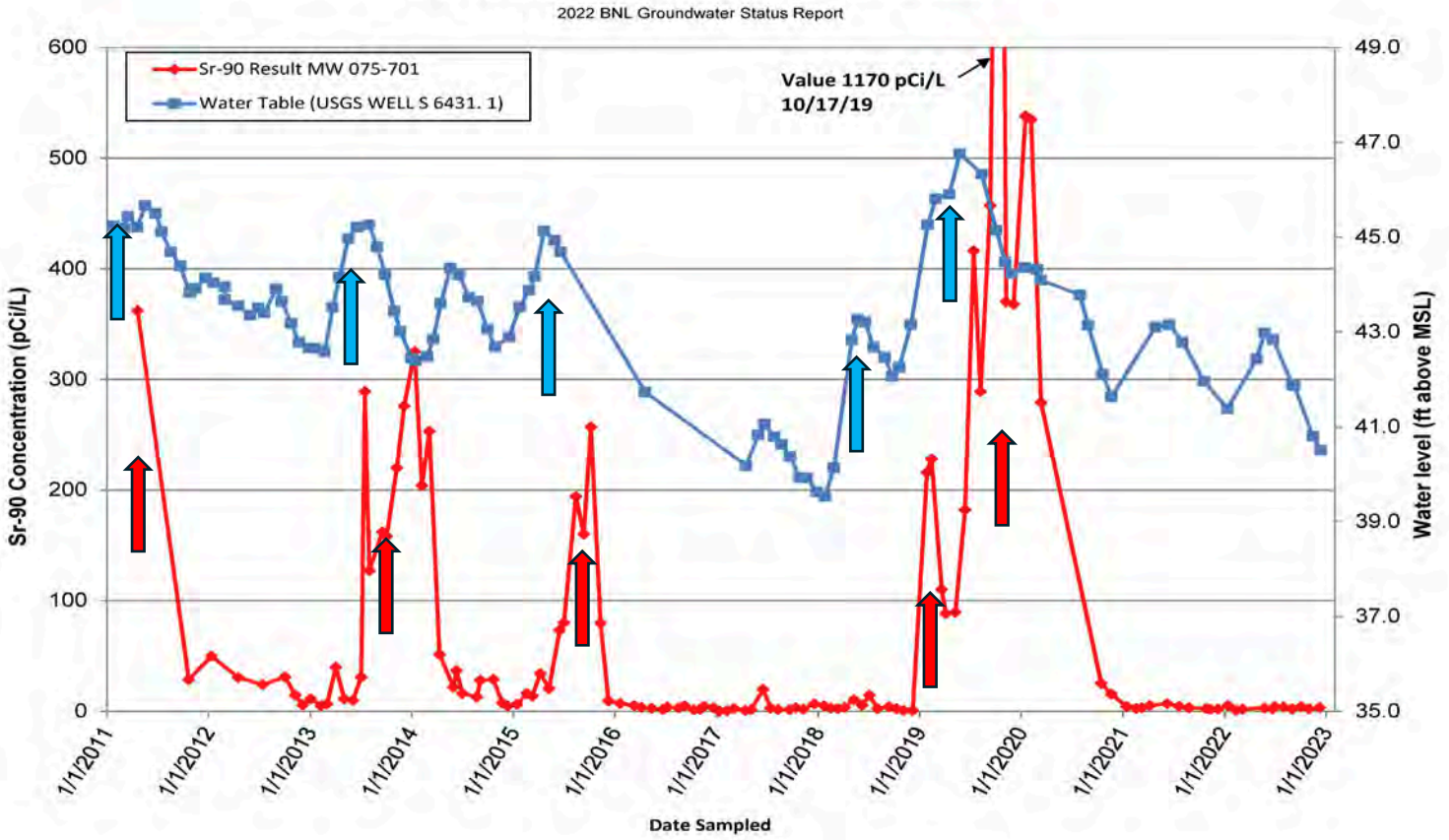
BGRR/WCF/PFS

Figure 3.2.11-6
OU III BGRR/WCF Monitoring Well 075-701
Sr-90 Concentration Comparison to Water Table Elevation



- Periodic increases in Sr-90 concentrations occur after significant seasonal rises in the water table
- This flushes out residual Sr-90 that is present close to the water table
- The amount of residual Sr-90 is expected to decreased over time by flushing and radioactive decay

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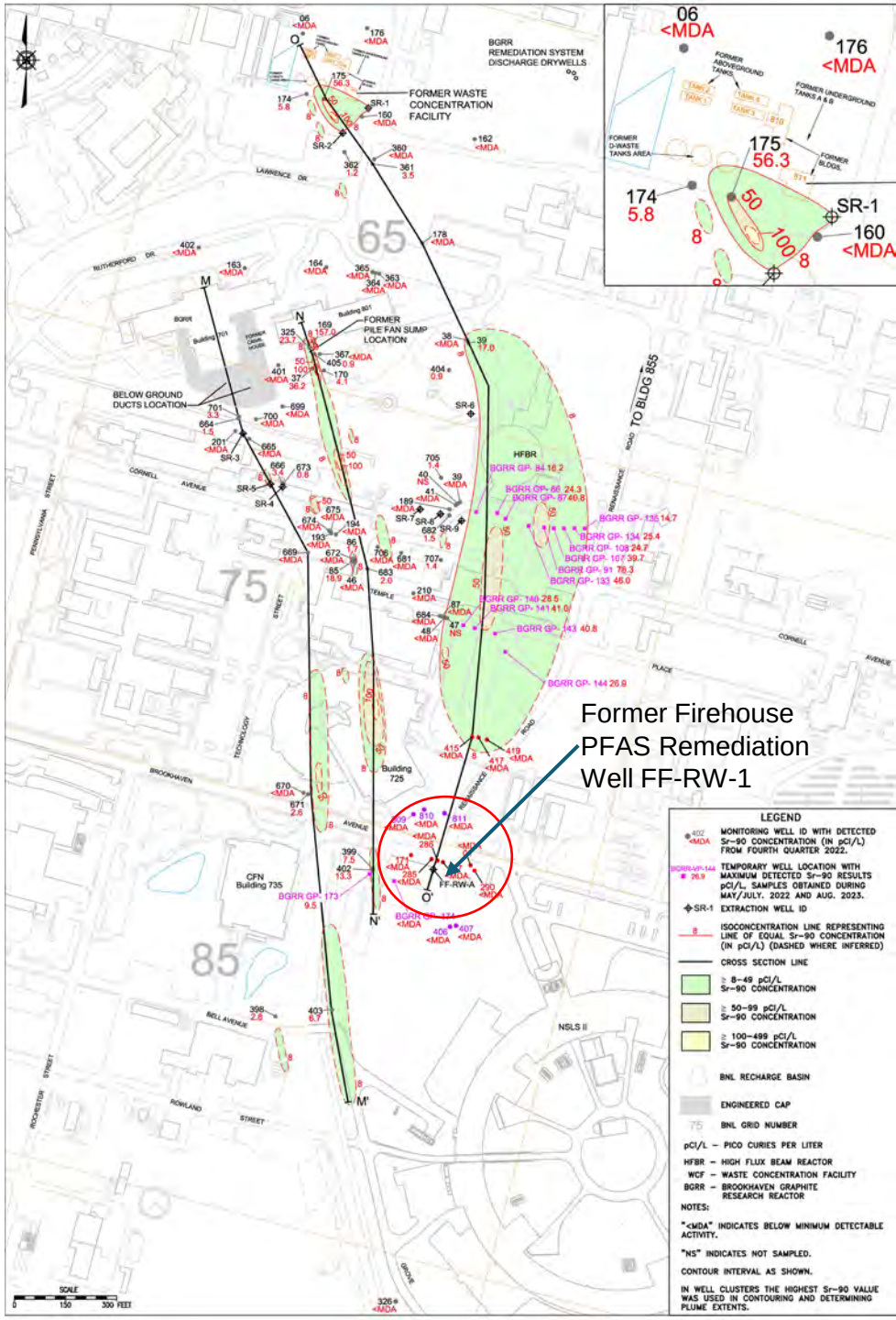
BGRR/WCF/PFS

Actions taken in 2023

- Leading edge of Sr-90 plume is close to new Former Firehouse PFAS extraction well FF-RW-A
  - Concern that Sr-90 could be drawn into the PFAS remediation system
  - Samples were collected from twelve nearby monitoring wells
  - All Sr-90 results <DWS
- Installed temporary wells to depth of 140 feet near well to characterize downgradient extent of Sr-90 plume
  - Two temporary wells were installed in late August 2023



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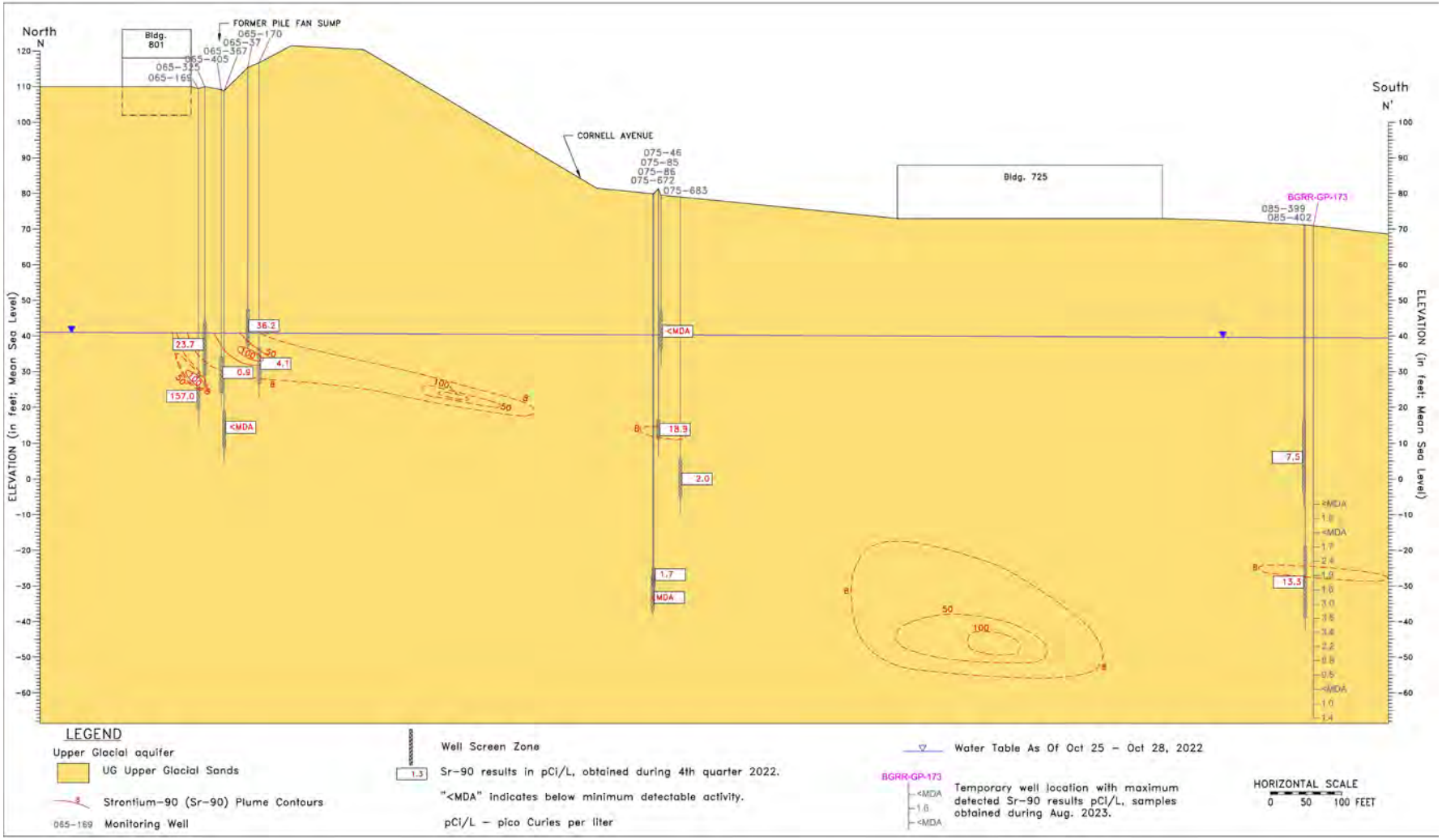
BGRR/WCF/PFS

Actions taken in 2023



- Results for the temporary vertical profile well GP-173 installed to depth of 140 feet near well 085-402 to characterize downgradient extent of Sr-90 plume migrating south under Building 725

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HFBR

- Program routinely monitors tritium levels in ten wells downgradient of the HFBR
  - Tritium concentrations during 2021-2022 were below the DWS
  - During 2022, maximum tritium concentration was 7,449 pCi/L

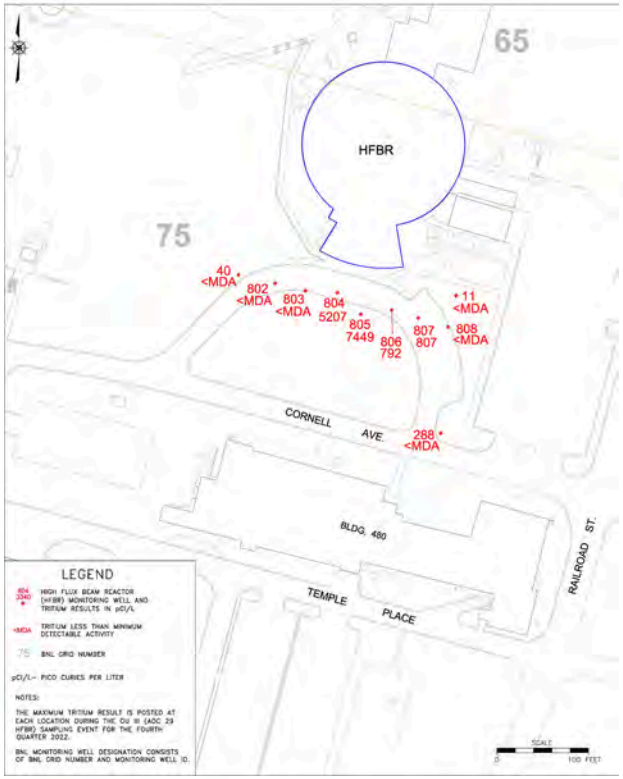
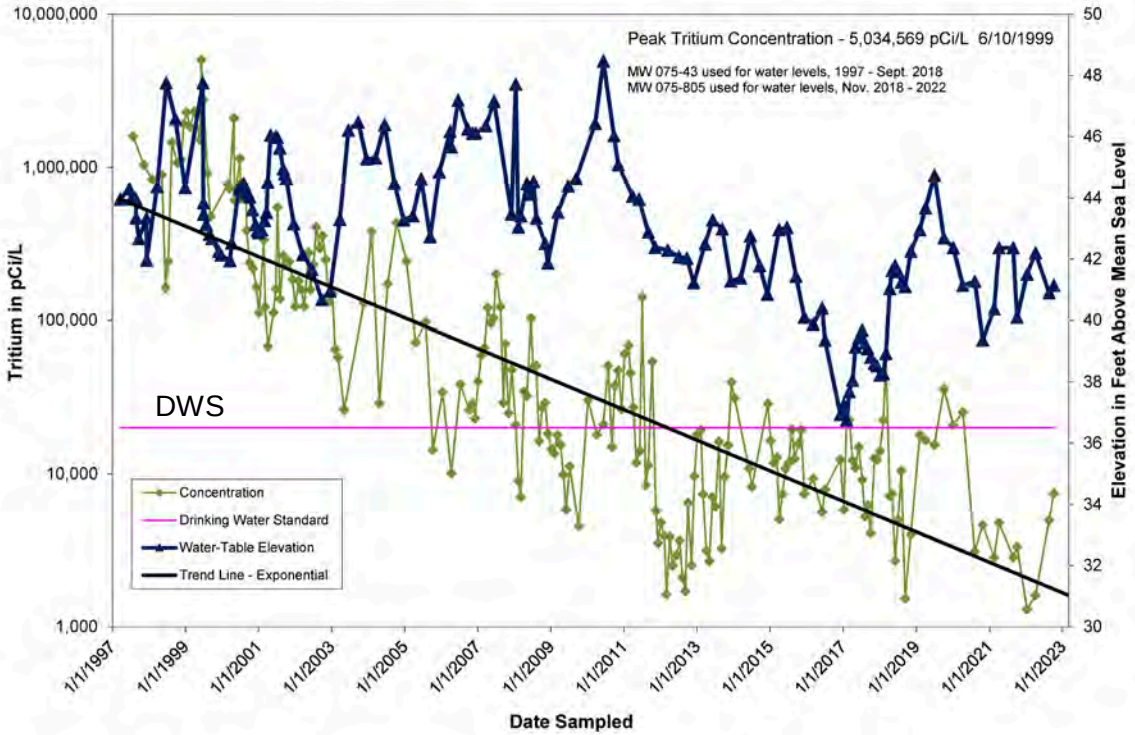


Figure 3.2.13- 2
OU III HFBR
Peak Tritium Concentrations in Groundwater - HFBR to Cornell Avenue

2022 BNL Groundwater Status Report



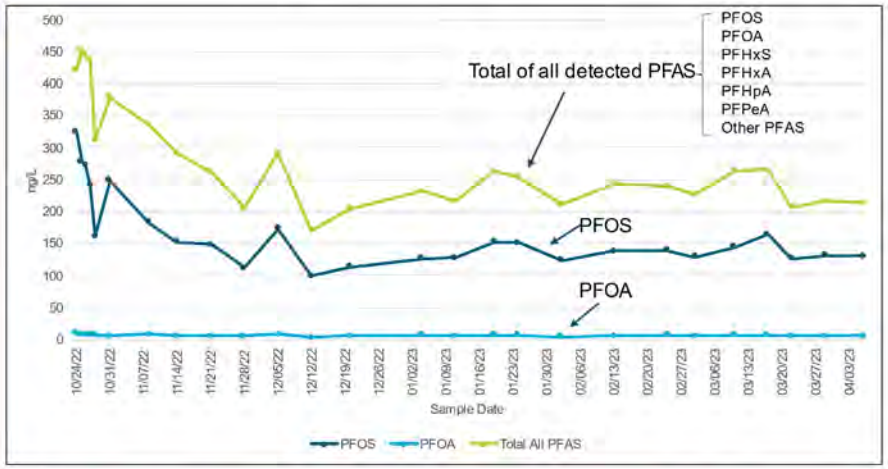
- Periodic increases in tritium concentrations occurred after significant seasonal rises in the water table
- During these periods residual tritium that is present close to the water table would be flushed from the soils
- Recent results suggest that the amount of residual tritium has decreased by flushing and natural radioactive decay

PFAS Groundwater Remediation

- Current Firehouse/Building 170 System began operating in October 2022
- Former Firehouse System started in January 2023
  - Both systems are operating as expected
  - PFAS not detected in treated effluent
    - Testing for 40 PFAS chemicals
  - Planning first carbon changeout for the Current Firehouse System

Current Firehouse/Building 170 Treatment System

Influent Concentrations (combined water from 9 extraction wells)



PFAS are not detected in the system effluent (treated water) samples

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Treatment System for Former Firehouse PFAS Plume

Granular Activated Carbon Filters

Photo Credit: DHGCarbon

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PFOS, PFOA and 1,4-Dioxane in Treatment System Discharges

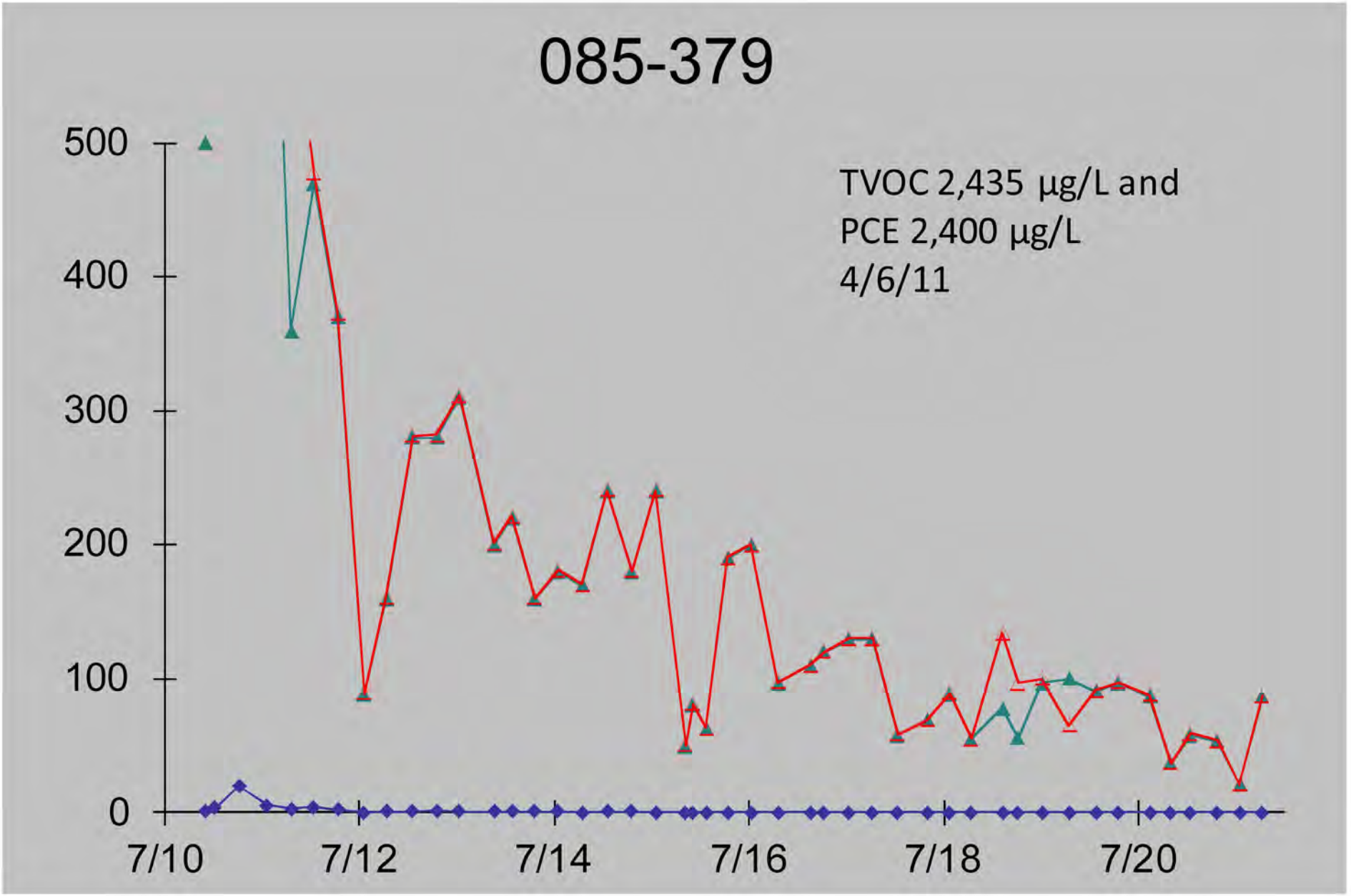
- NYS pollutant discharge elimination system (SPDES) equivalency permits are required for all groundwater treatment systems
- In March 2023, NYSDEC issued discharge guidance values for PFOS, PFOA and 1,4-dioxane that are lower than the State drinking water standards

Chemical	NYS Drinking Water Standard	NYS Discharge Guidance Value
PFOS	**10 ppt**	**2.7 ppt**
PFOA	**10 ppt**	**6.7 ppt**
1,4-Dioxane	**1.0 ppb**	**0.35 ppb**

- PFOS and/or 1,4-dioxane have been detected in the discharges of several active on-site and off-site treatment systems at levels that exceed the new guidance values
  - PFOS in three on-site systems ranging from 3.7 ppt to 16 ppt
  - 1,4-dioxane in one on-site and two off-site systems ranging from 1.6 ppb to 4.3 ppb
  - These systems are not designed to treat these chemicals
- BNL has met with and discussed this issue with the NYSDEC and other regulatory agencies
- NYSDEC agreed with BNL's proposed plan to collect additional PFAS and 1,4-Dioxane data needed to support decisions on whether modifications to the treatment systems are required

Next Steps

- Post Groundwater Status Report on website (completed)
- Submitted draft OU X Remedial Investigation Work Plan for PFAS/1,4-dioxane to regulators March 30, 2023
  - Working with regulatory agencies to finalize the Work Plan
- DOE PFAS Research & Development Workshop
  - Scheduled for July 9 -11, 2024 at BNL


085-379
500
400
300
200
100
0
7/10
7/12
7/14
7/16
7/18
7/20
TVOC 2,435 µg/L and
PCE 2,400 µg/L
4/6/11

OU 3 BGRR Building 701 Source Area Sr-90