



# 2022 Groundwater Update

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

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Groundwater Protection Group  
November 10, 2022

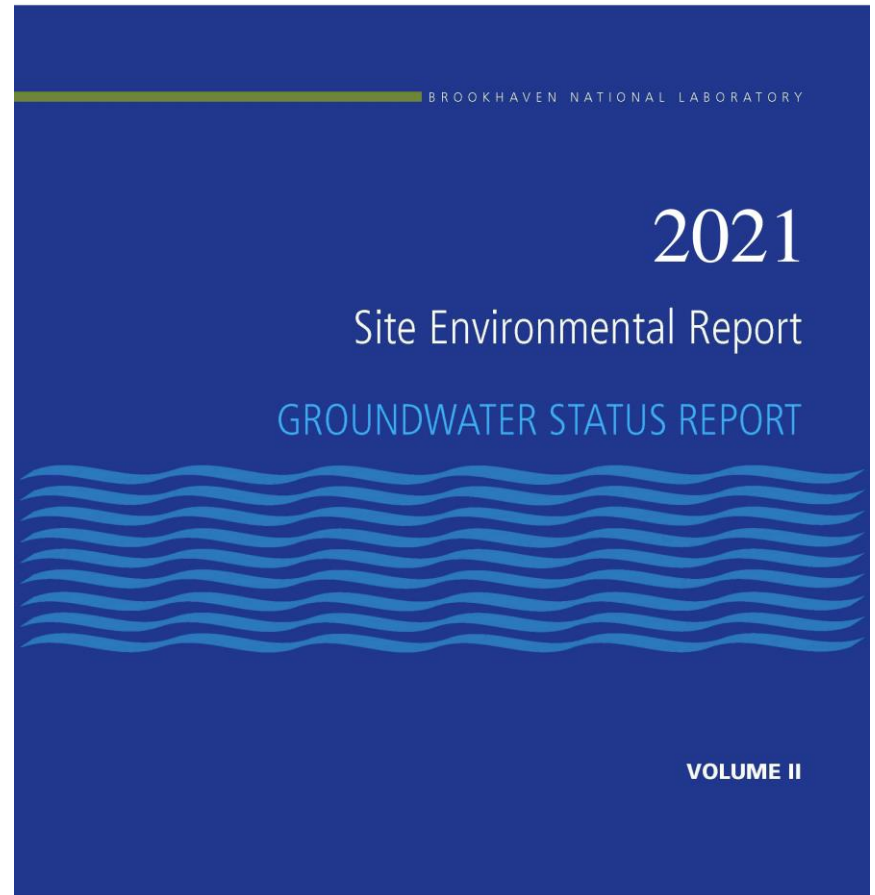


# Agenda

- Overview of Remediation Systems
  - VOC plume remediation progress, issues and optimization progress
  - Sr-90 plume remediation progress
- PFAS Time Critical Removal Action (TCRA) and OU X Remedial Investigation/Feasibility Study (RI/FS) Work Plan status

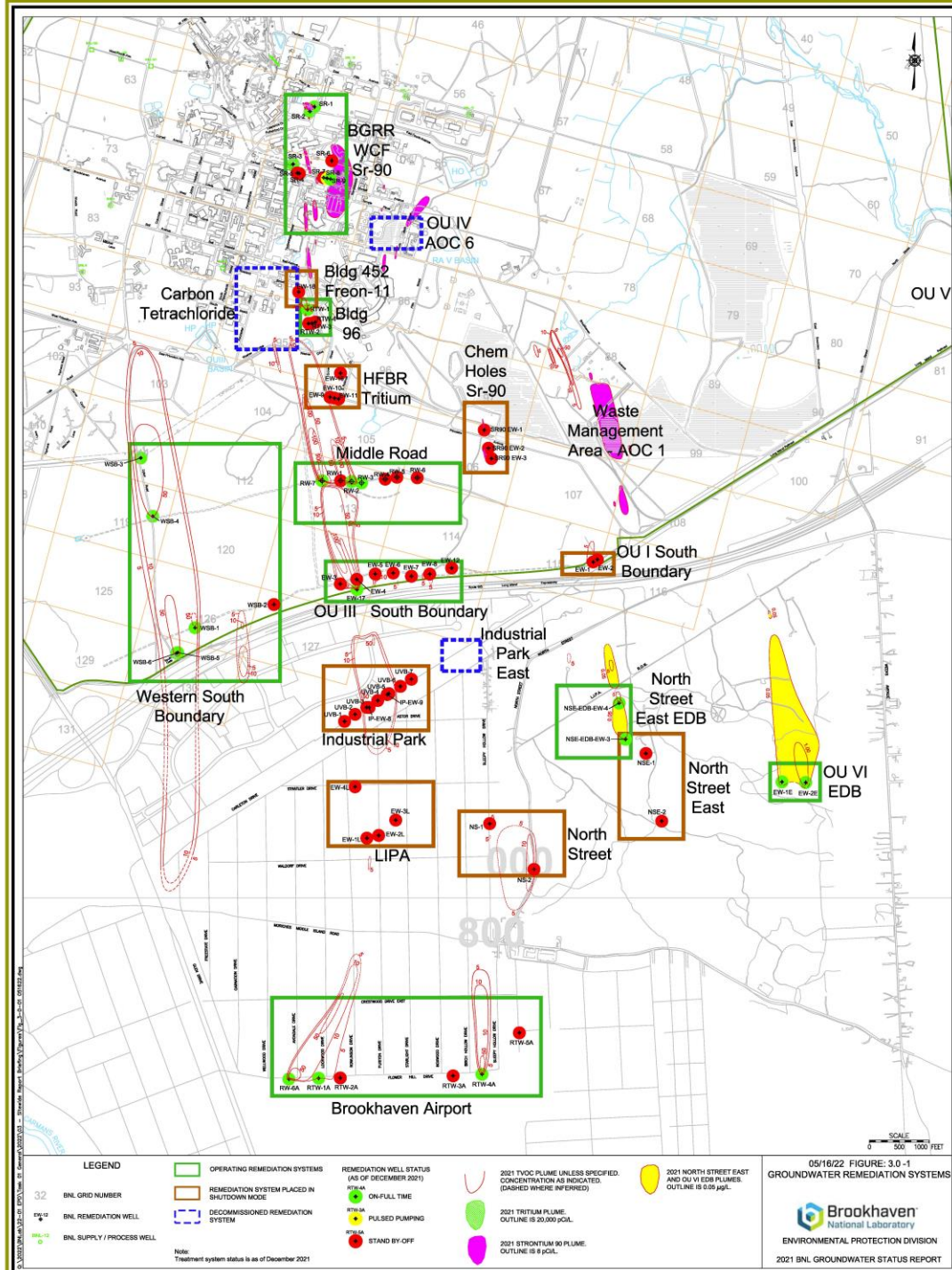
# Groundwater Status Report (Volume 2 of Site Environmental Report)

- Groundwater Status Report provides details on groundwater monitoring and remediation conducted during 2021 (and early 2022).
  - Chapter 7 of SER Vol. I provides a high-level overview
- Web link for 2021 Groundwater Status Report - <https://www.bnl.gov/gpg/files/groundwater-reports/2021-groundwater-status-report.pdf>

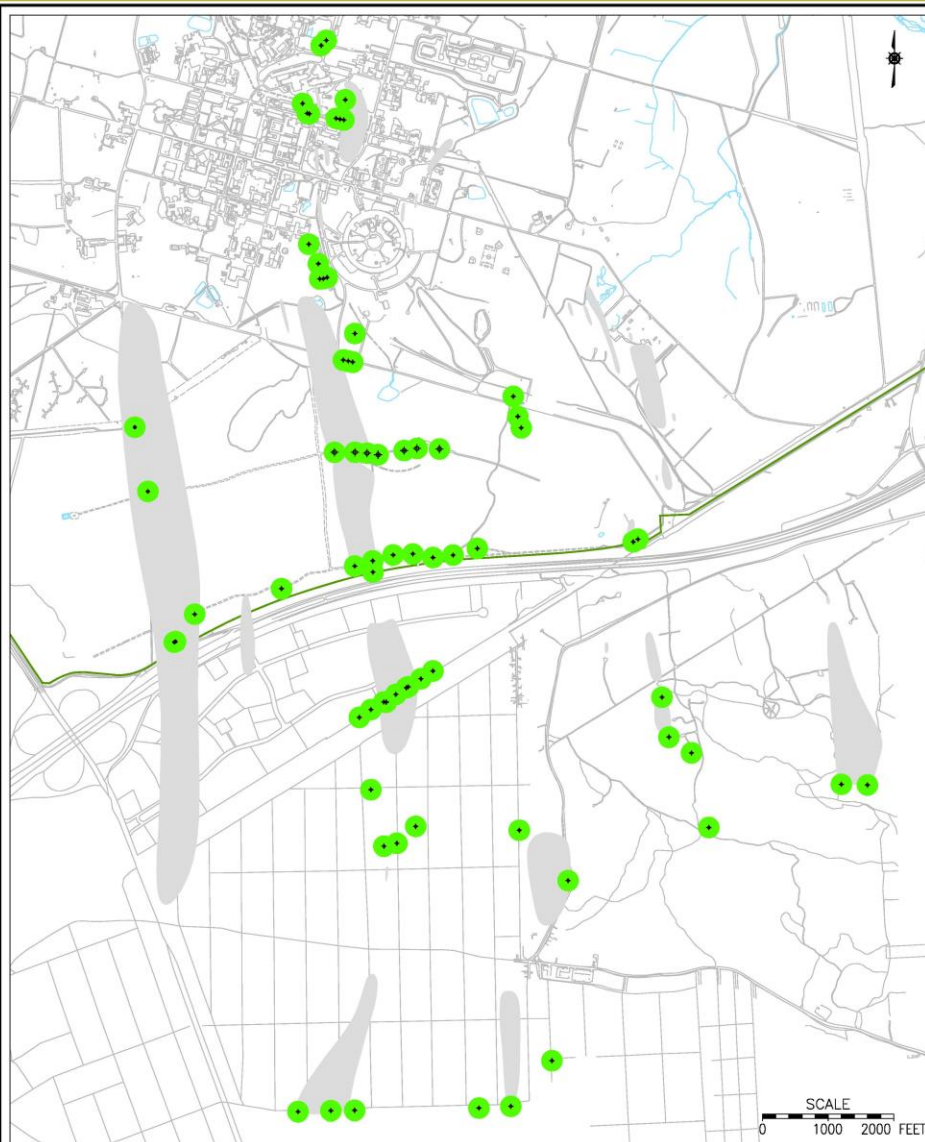


# Groundwater Remediation System Overview

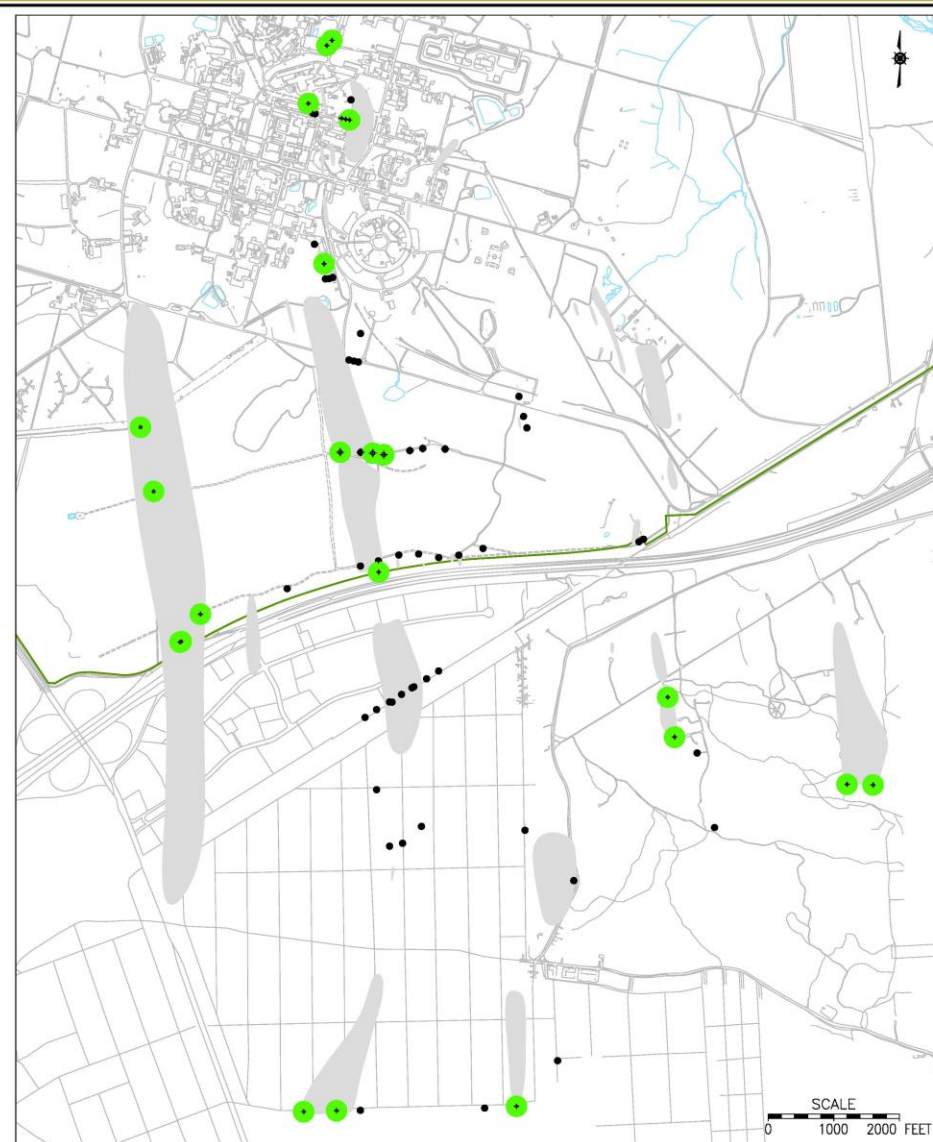
- Seven VOC Groundwater Remediation Systems and one Sr-90 System in operation
- 23 of 71 total extraction wells currently in operation
- One billion gallons groundwater treated in 2021
- 7,758 lbs. of VOCs removed from groundwater to date and 34 mCi Sr-90
- PFAS characterization and remediation is also discussed



# Groundwater Remediation – Extraction Well Operational Status



 ALL REMEDIATION SYSTEM WELLS

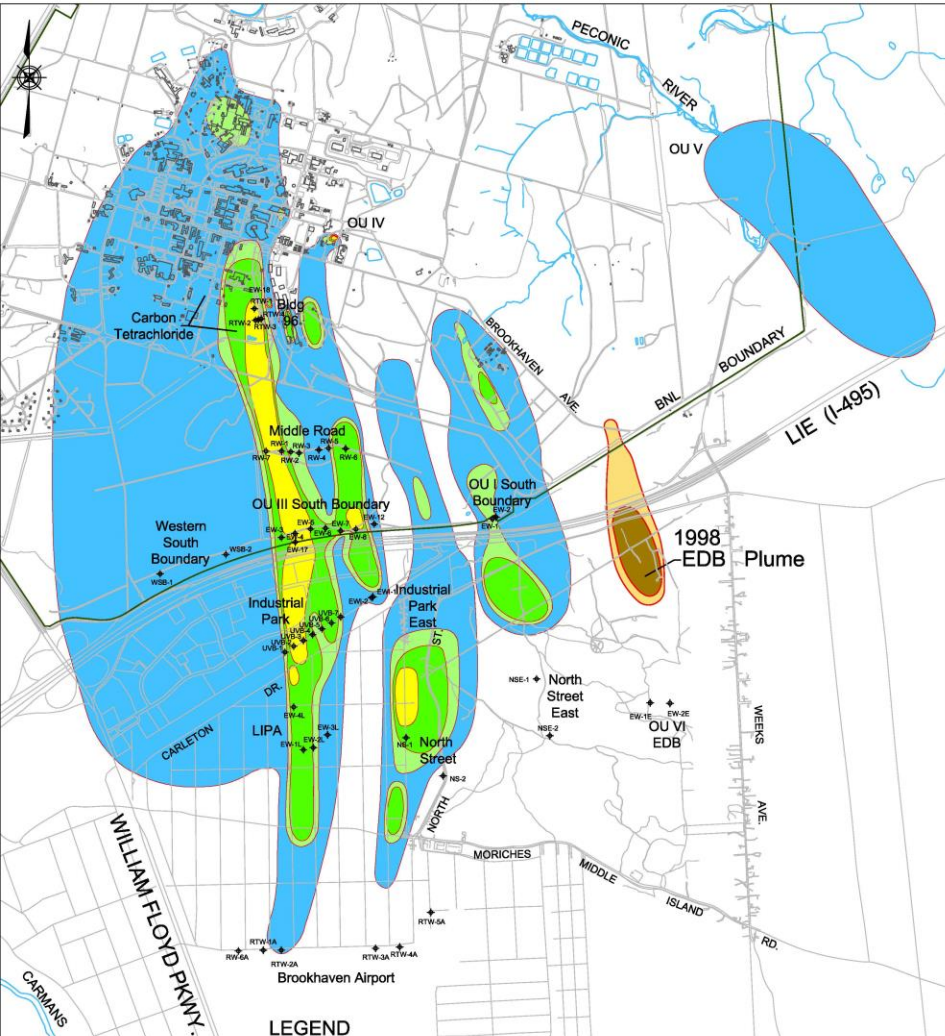


REMEDIATION WELLS IN OPERATION  
(AS OF DECEMBER 2021)

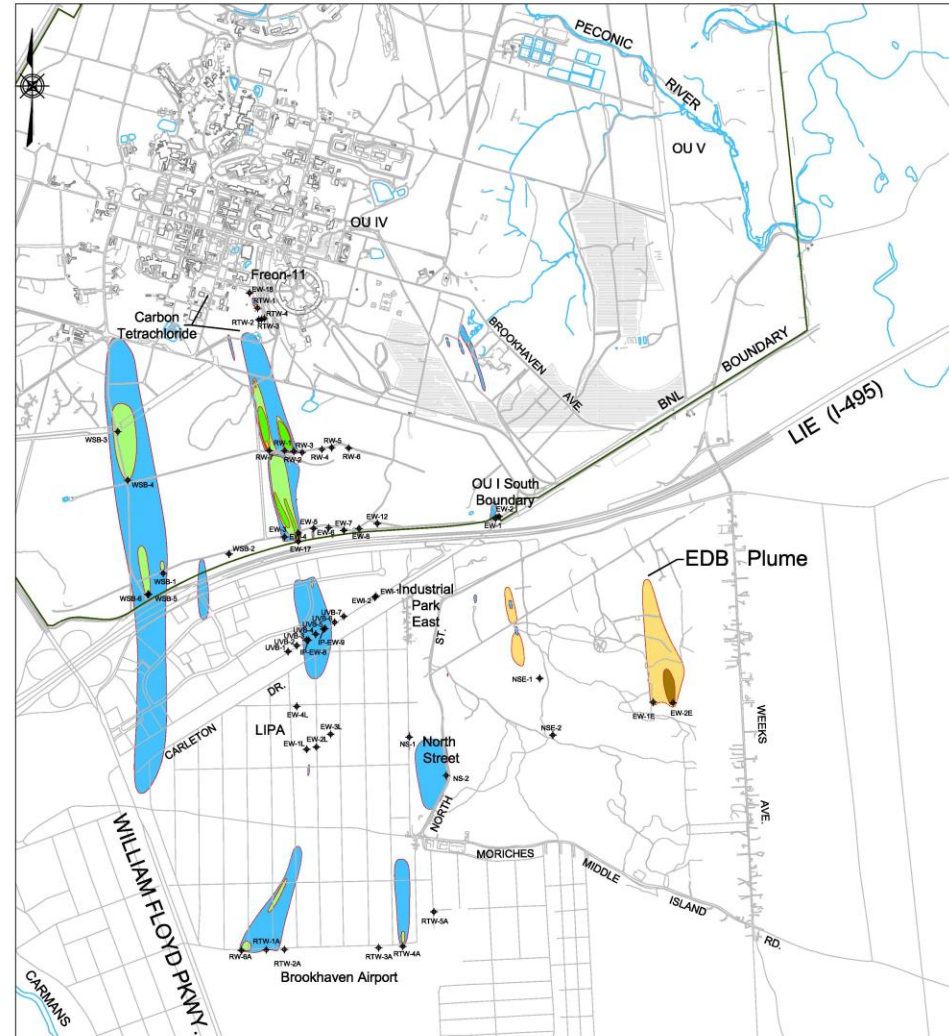
-  ON-FULL TIME
-  OFF

# VOC Plume Comparison

1997



2021



LEGEND

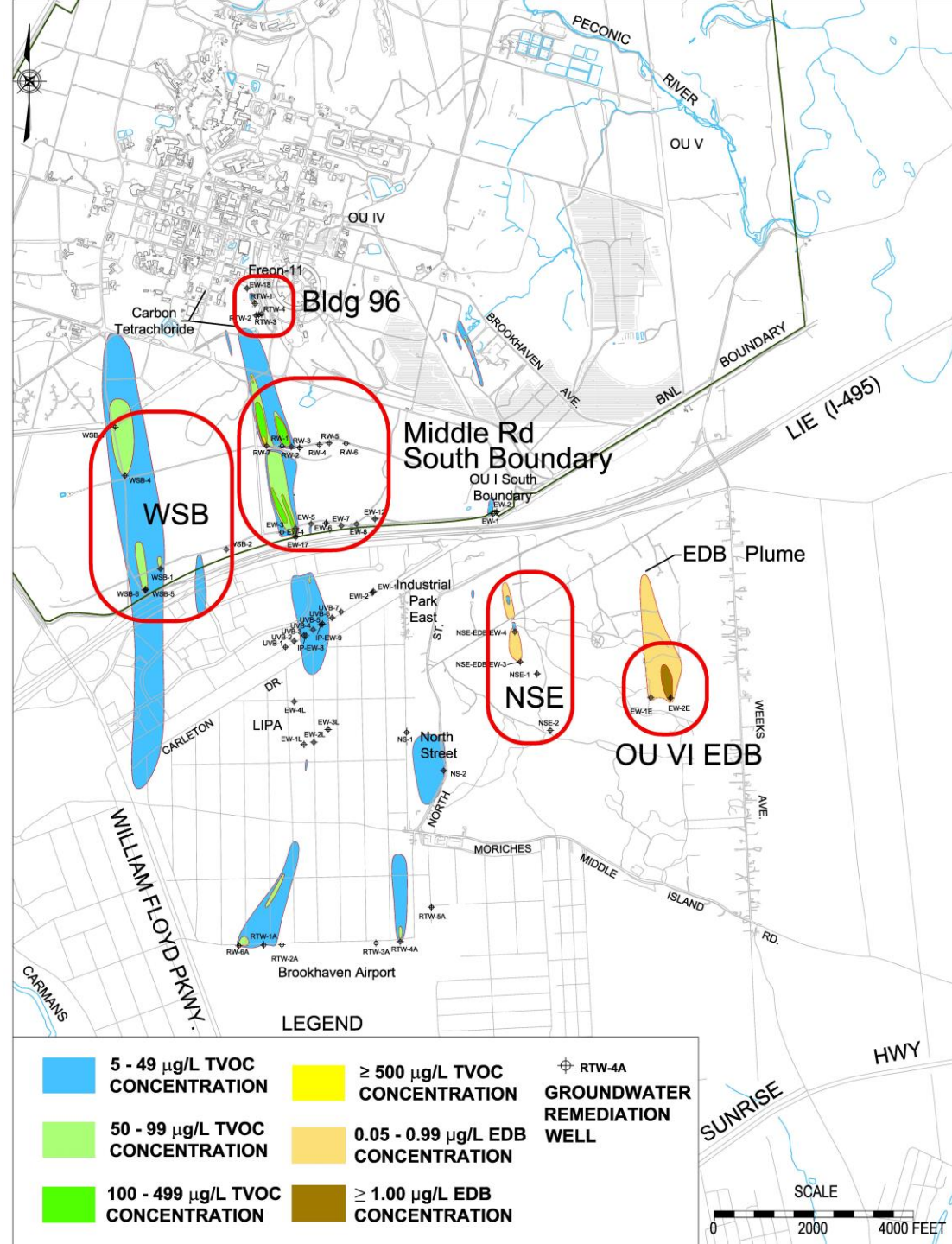
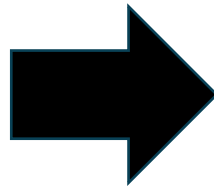
5 - 49 µg/L TVOC CONCENTRATION	≥ 500 µg/L TVOC CONCENTRATION	RTW-4A GROUNDWATER REMEDIATION WELL
50 - 99 µg/L TVOC CONCENTRATION	0.05 - 0.99 µg/L EDB CONCENTRATION	
100 - 499 µg/L TVOC CONCENTRATION	≥ 1.00 µg/L EDB CONCENTRATION	

SCALE  
0 2000 4000 FEET

SCALE  
0 2000 4000 FEET

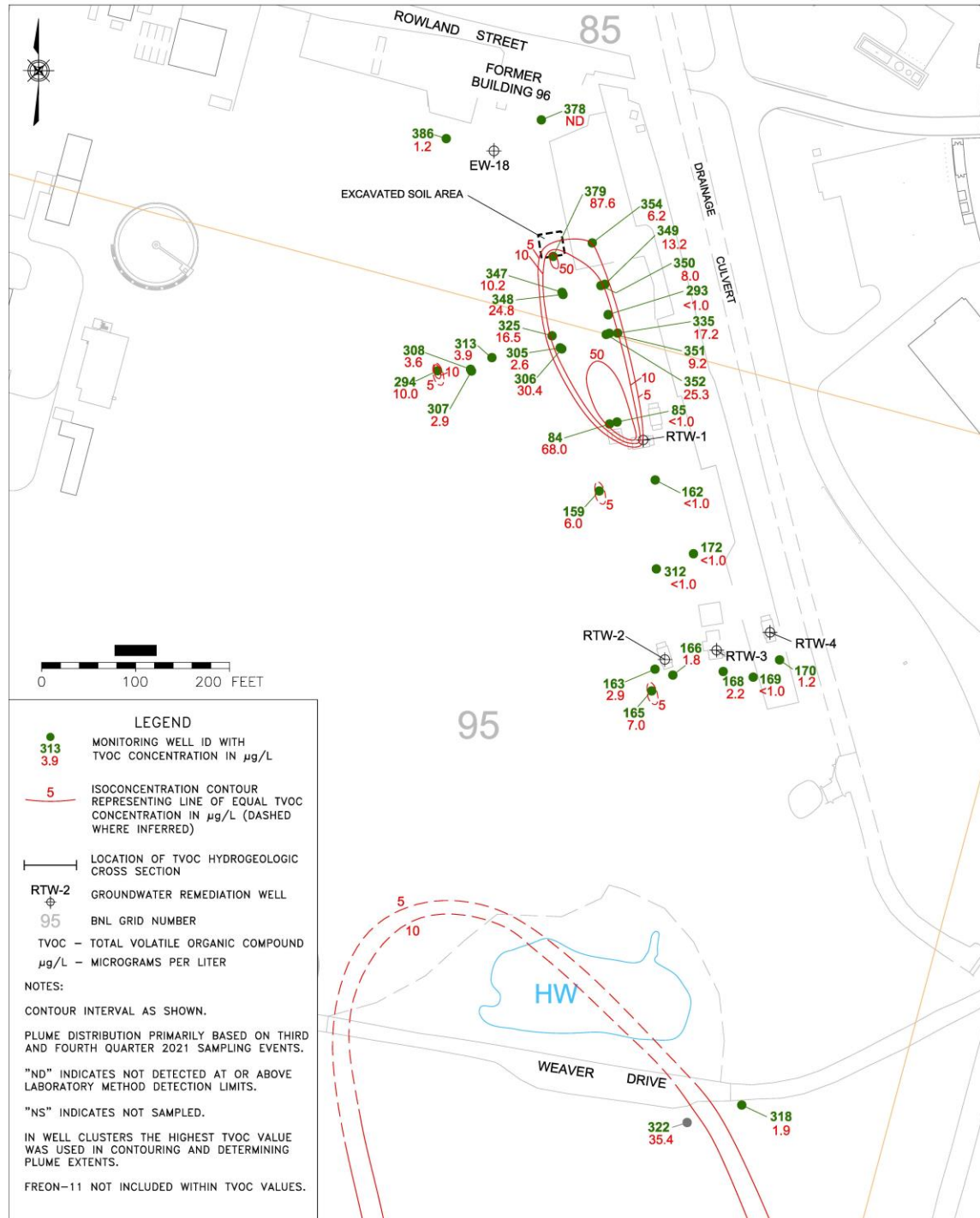
# Groundwater Remediation – VOC System Progress and Current Issues

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



# OU III Building 96

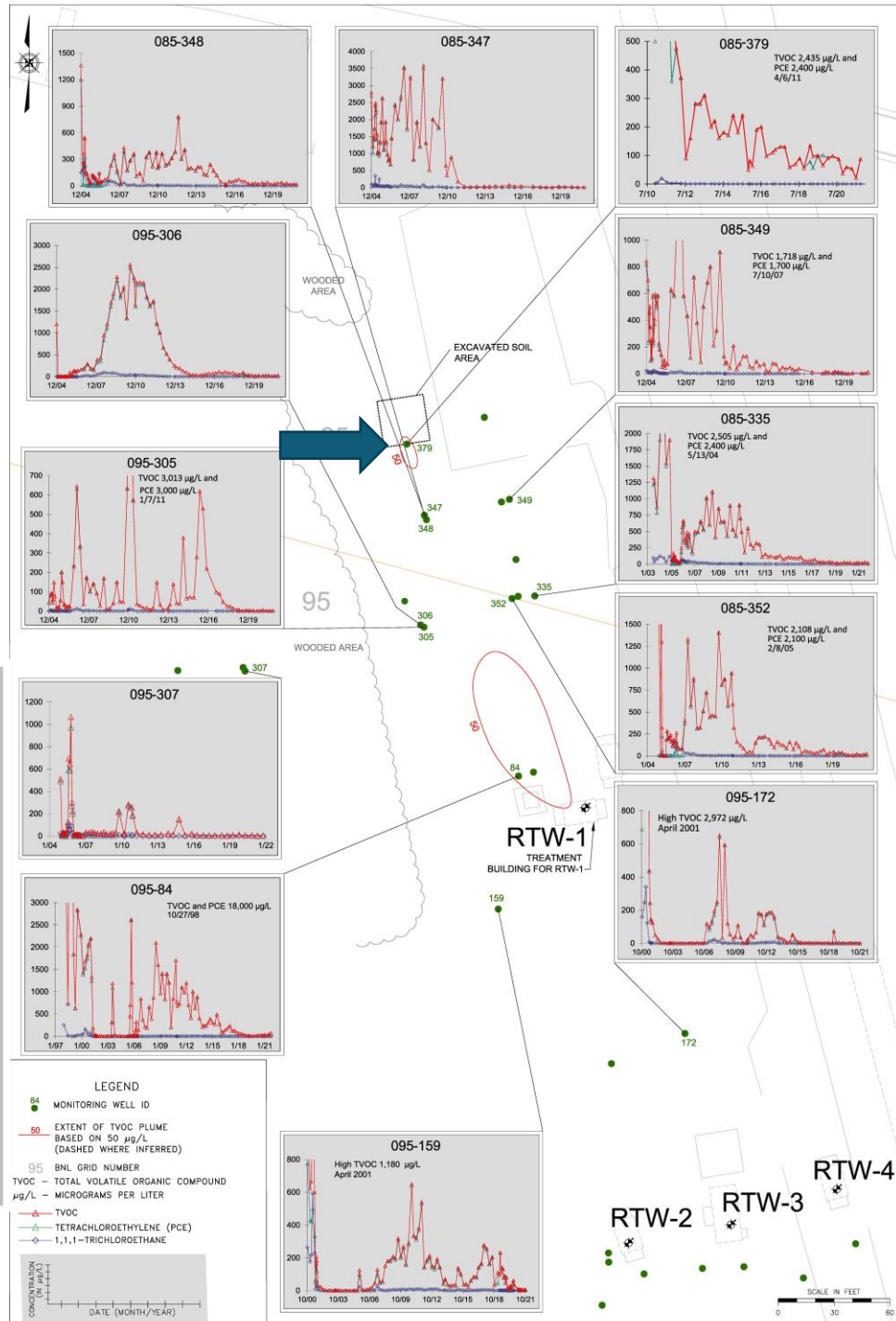
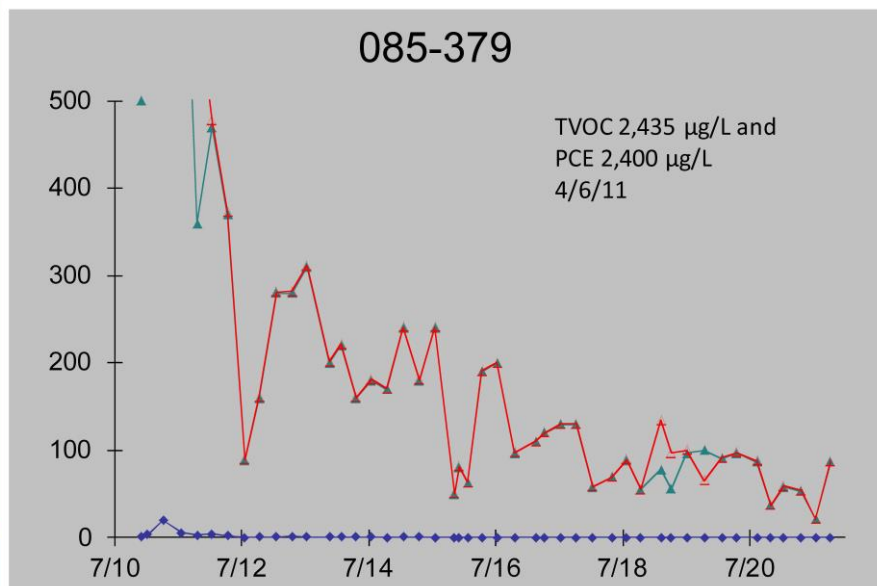
- Extraction well RTW-1 TVOC concentrations have been  $<50 \mu\text{g/L}$  (capture goal) since 2015 and VOCs  $<\text{MCLs}$  since 2020
- RTW-1 placed in pulsed pumping mode (one month on/one month off) in May 2022
- Overall VOC plume cleanup complete with exception of immediate source area. Well 085-379 has been slow to improve.





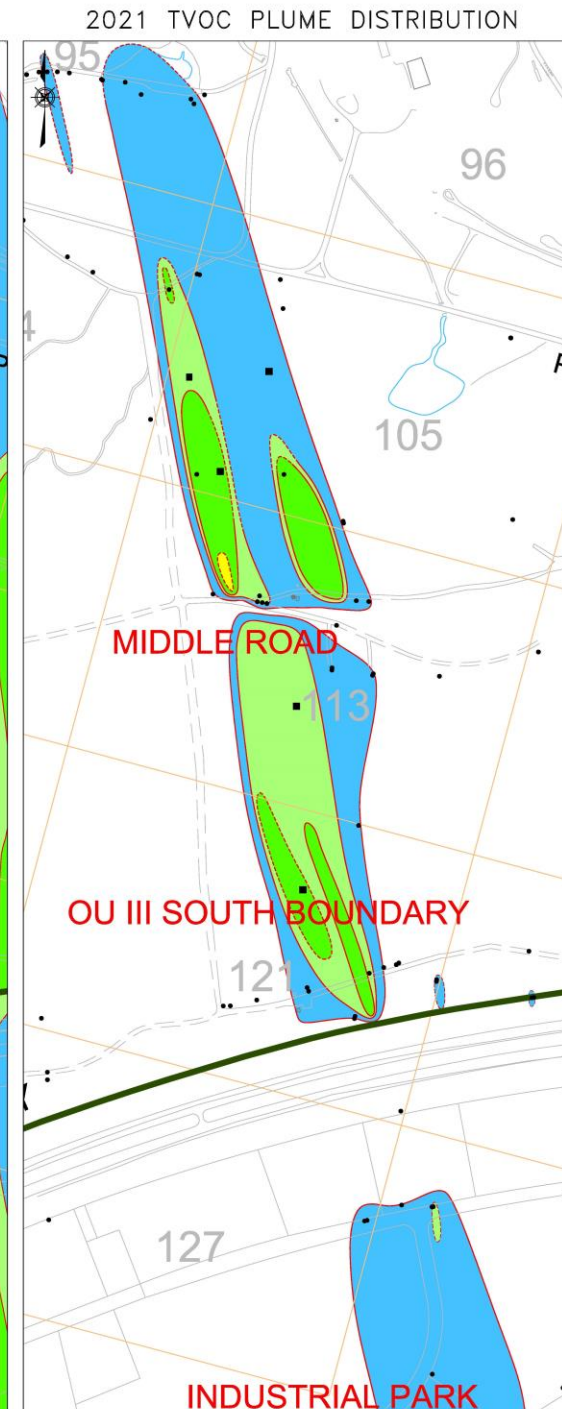
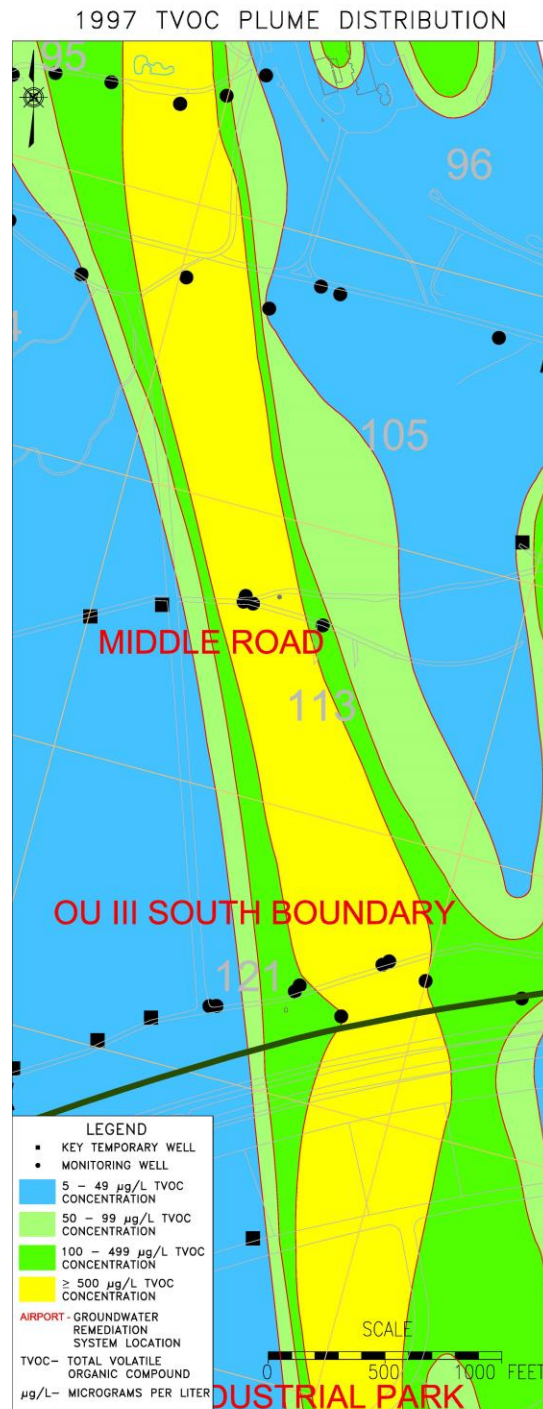
# OU III Building 96

- 2021 CERCLA Five-Year Review (FYR) recommendations:
  - Continue monitoring over next two years
  - Evaluate/implement in-situ chemical oxidation or reduction injections in the source area



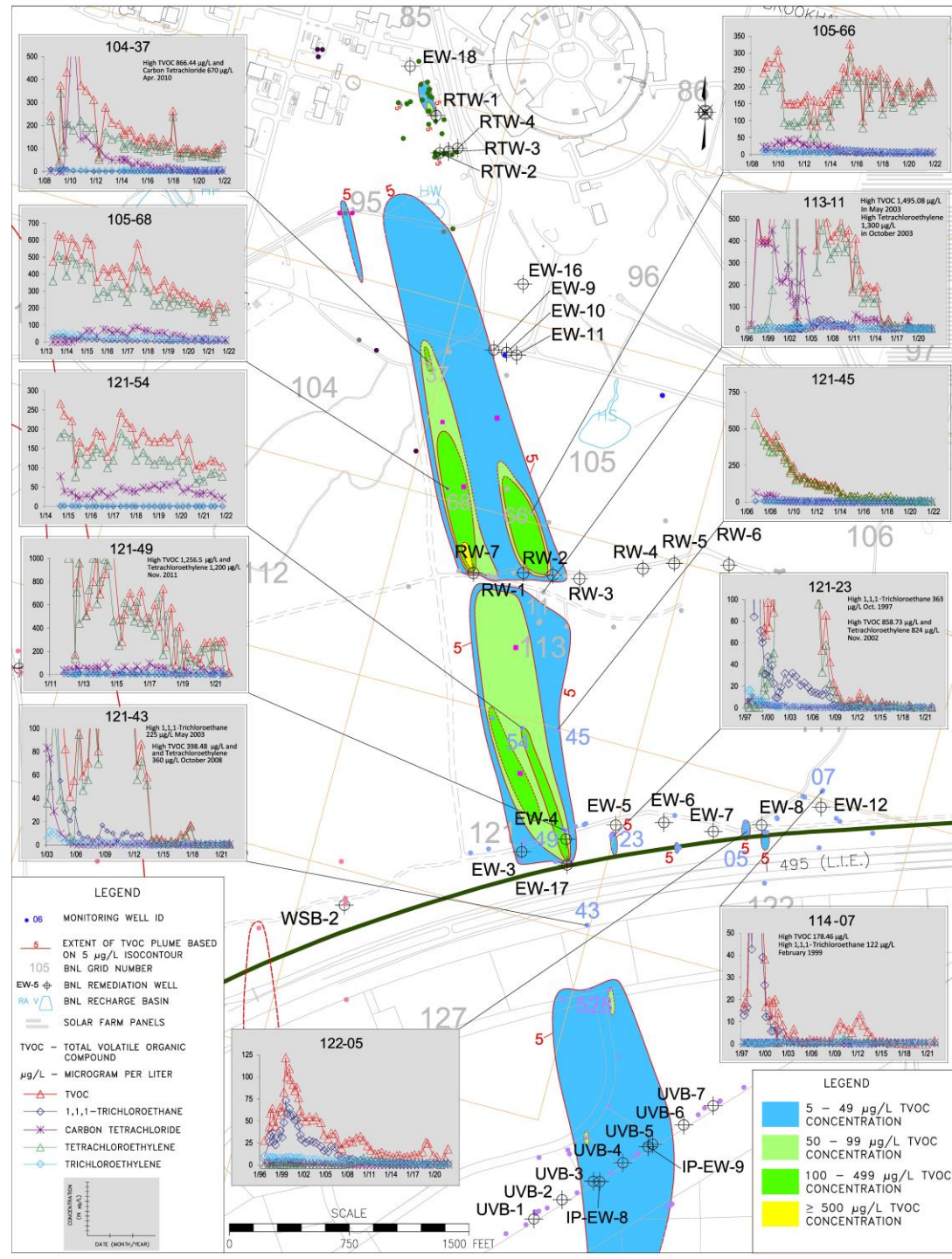
# OU III Middle Rd./South Boundary

- 2021 CERCLA FYR recommendation:
  - Make modifications to the OU III Middle Road and South Boundary remediation systems to address several areas of persistent elevated VOCs



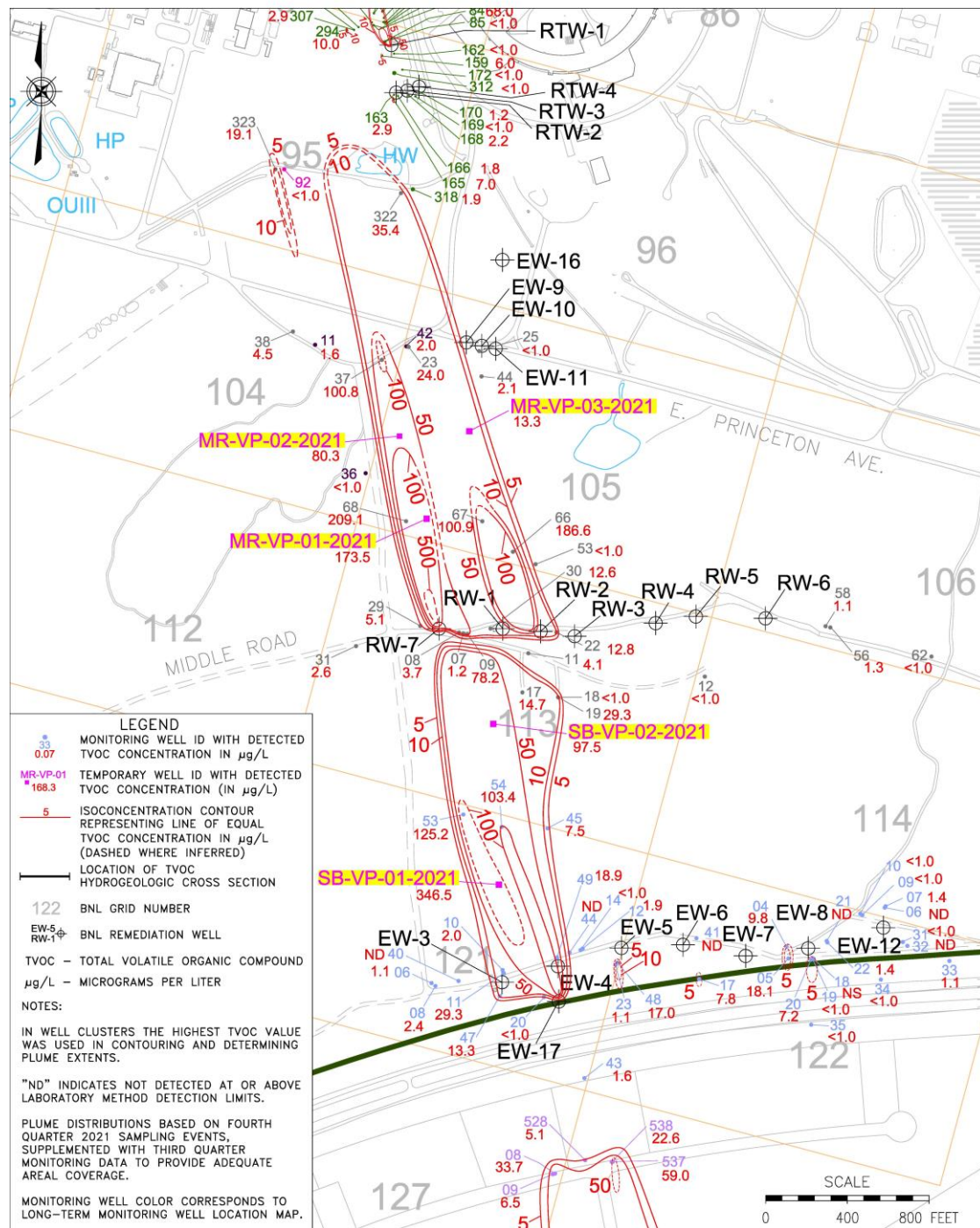
# OU III Middle Rd./South Boundary

- VOCs concentrations remain elevated in deep sections of the Upper Glacial aquifer.
  - This is observed in monitoring wells 104-37, 105-68, 105-66, and 121-54



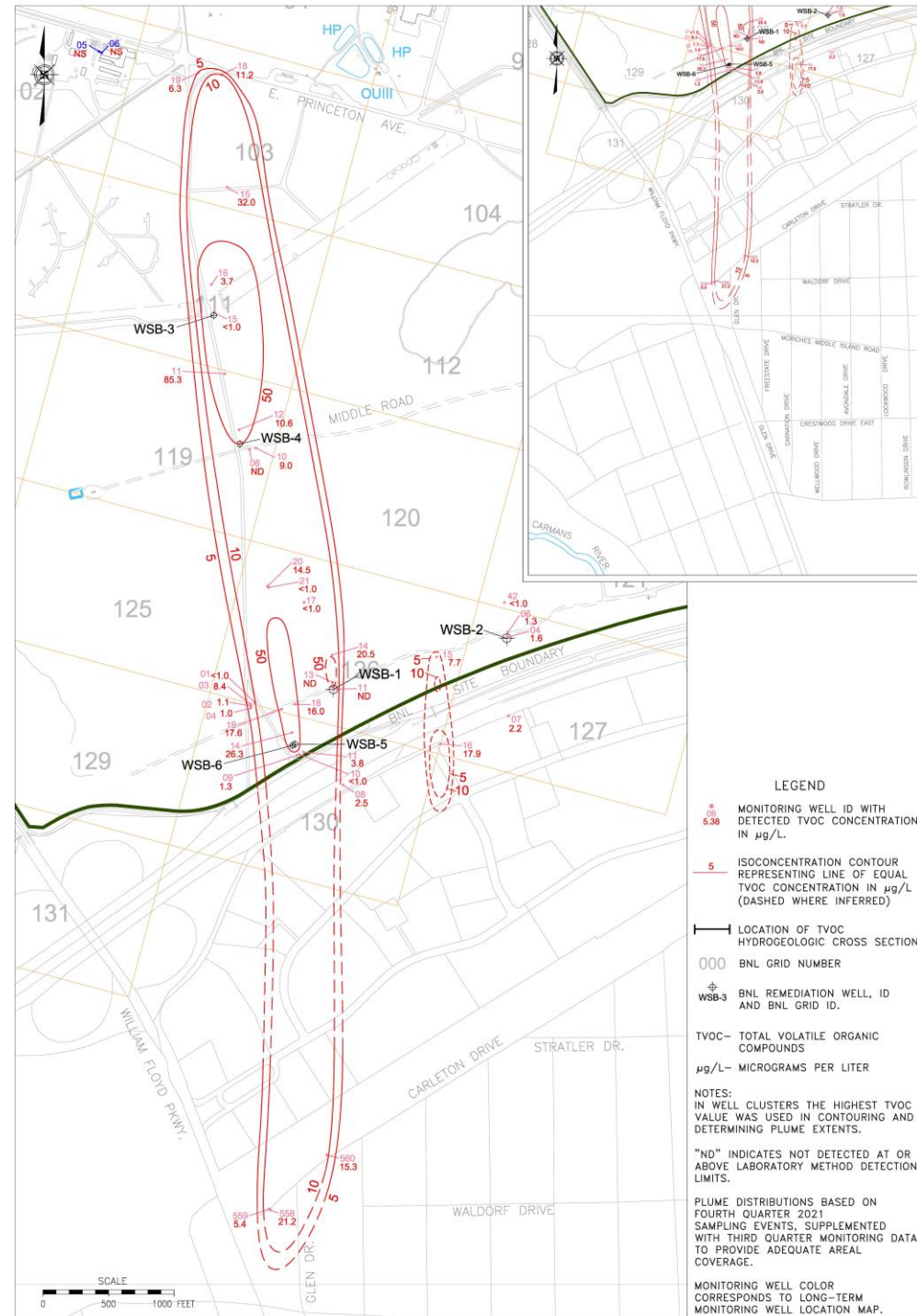
# OU III Middle Rd./South Boundary

- During 2021, continued to operate extraction wells RW-2, RW-3 and RW-7.
  - Maintained Middle Road extraction wells RW-1, RW-4, RW-5 and RW-6 in standby mode
  - Only operating EW-17 at South Boundary
- Installed five temporary vertical profile (VP) wells as recommended in the 2021 FYR
- In 2023, BNL will perform groundwater model simulations to evaluate the best locations, extraction rates, and number of extraction wells needed to meet the 2030 ROD cleanup goal



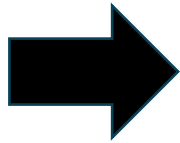
# OU III Western South Boundary

- The operation of four new extraction wells to capture and treat deeper VOCs was initiated in March 2019
- The system is remediating the deeper VOCs as expected
- In the off-site area, continue to detect low concentrations of VOCs (up to 20 µg/L)

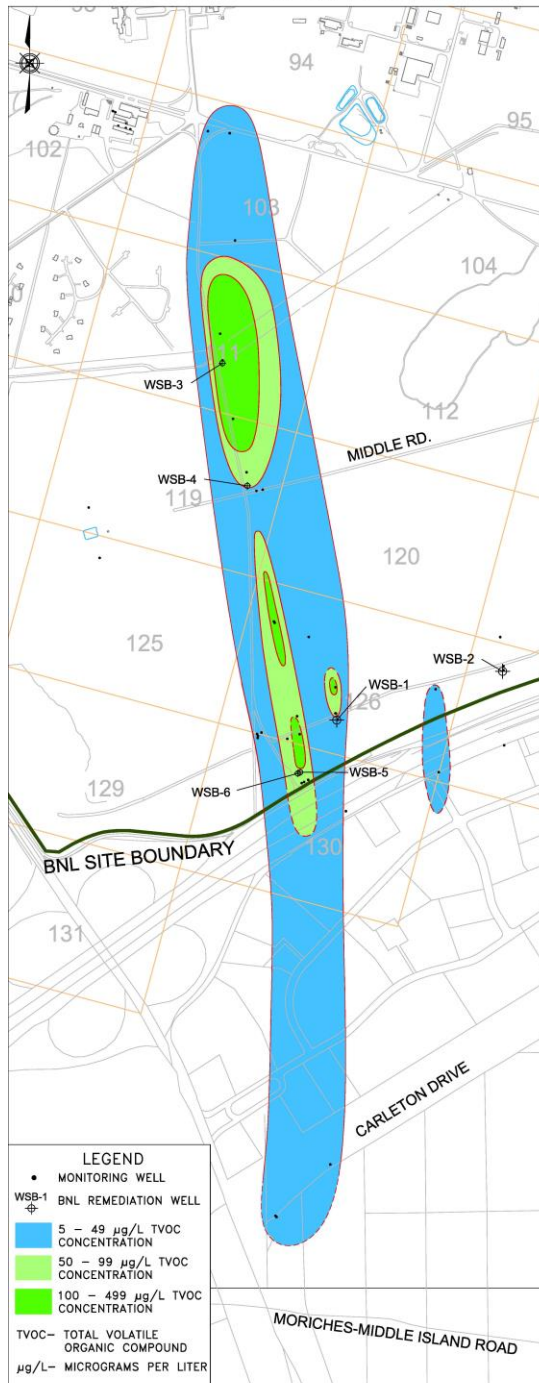


# OU III Western South Boundary Plume Cleanup Progress

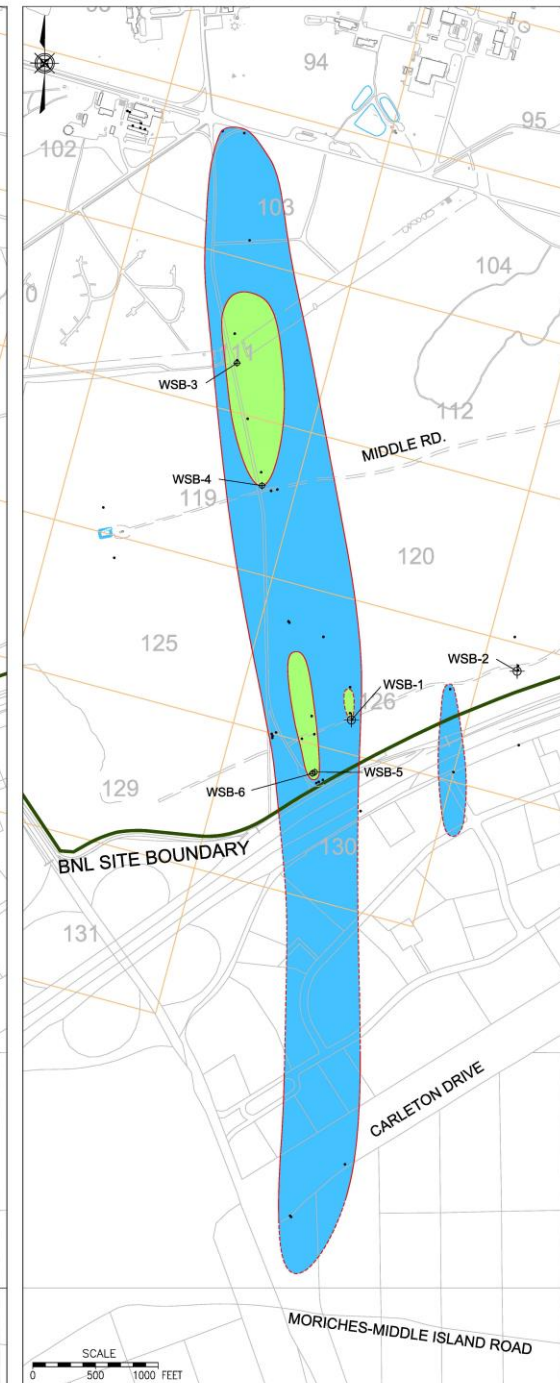
Plume comparison:  
before start of system  
modification and  
present plume



2018 WSB TVOC PLUME DISTRIBUTION

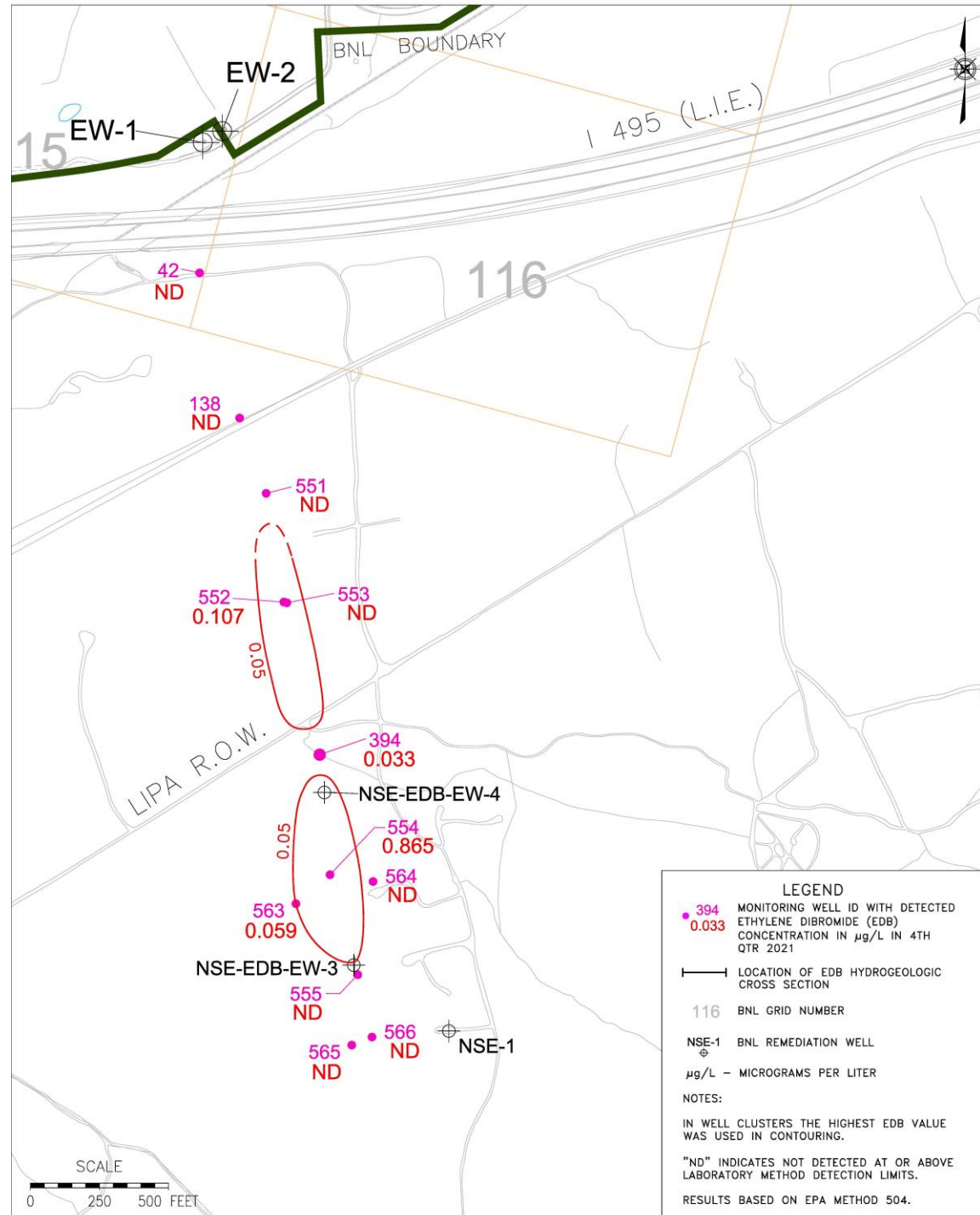


2021 WSB TVOC PLUME DISTRIBUTION



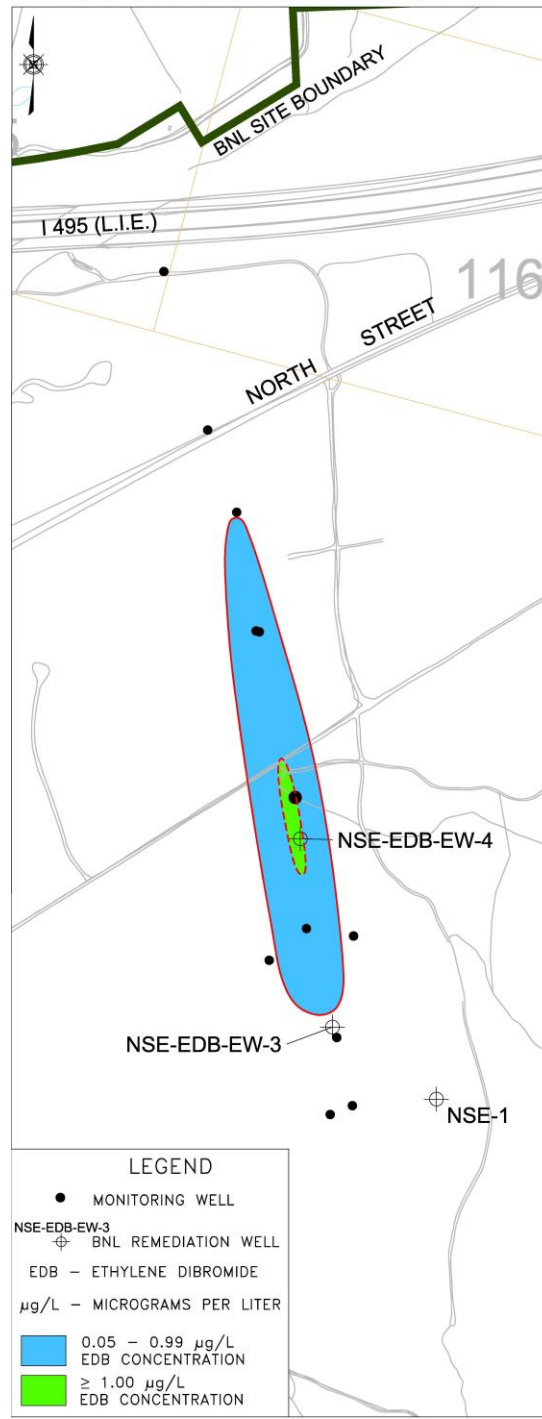
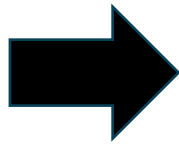
# OU III North St. East

- System designed for VOC remediation was shut down in 2014.
- However, Ethylene Dibromide (EDB) was detected in 2015
- Modified treatment system for EDB began operation in 2020
  - The system is making good progress in reducing EDB concentrations
- Continue with full-time system operation



# OU III North St. East EDB Plume Cleanup Progress

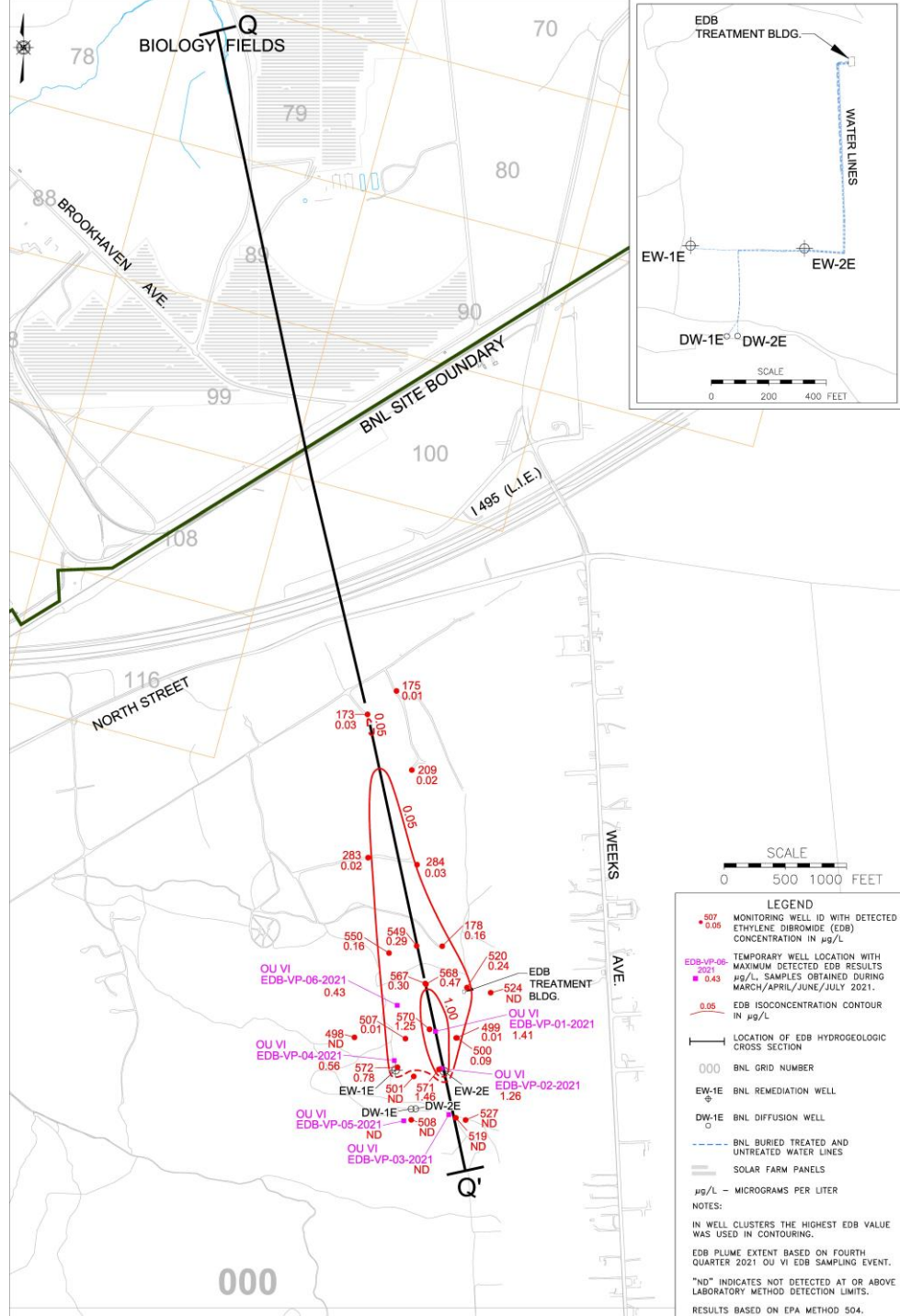
Plume comparison:  
before start of  
system  
modification and  
present plume



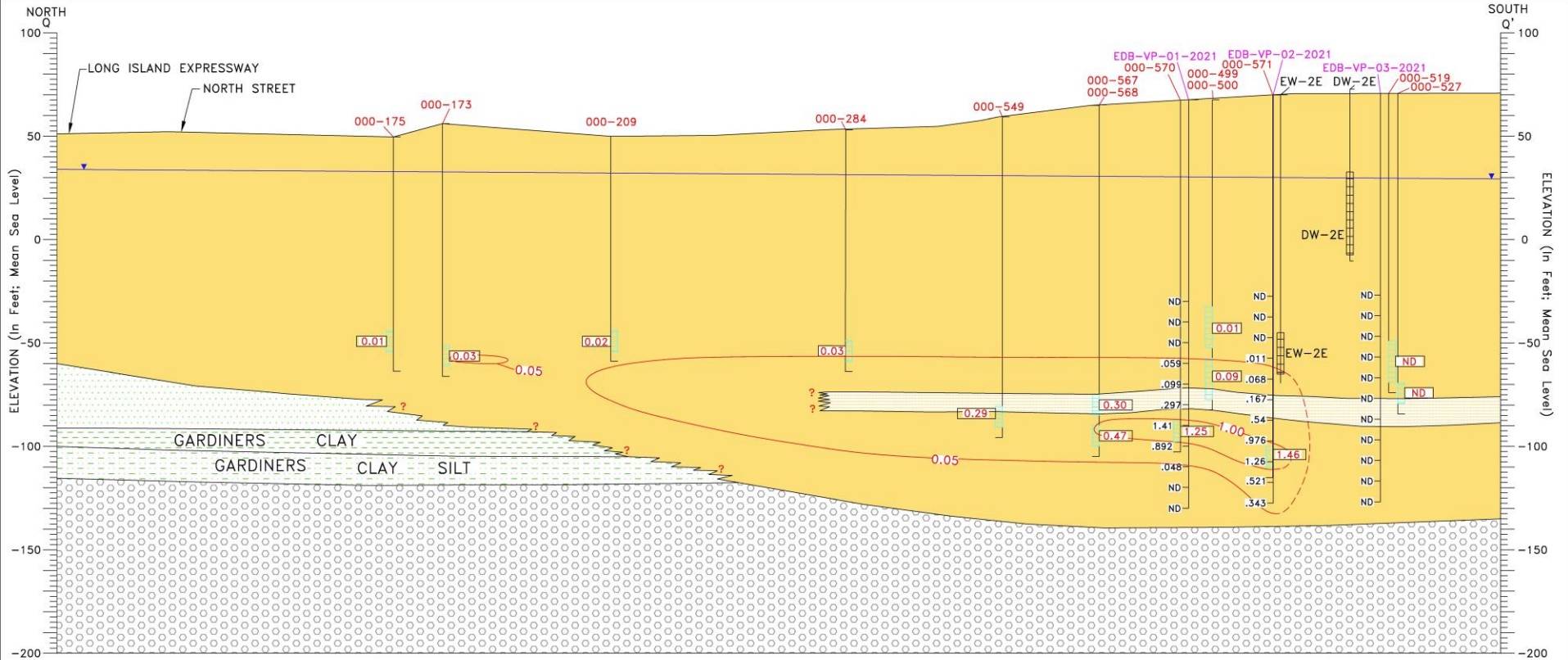


# OU VI EDB

- System began operation in 2004
- Because the system was not effective in capturing deeper portions of the EDB plume, BNL began design and groundwater modeling work for system modification as per the 2021 FYR recommendation to remediate the deeper EDB and meet 2030 ROD cleanup goal.



# OU VI EDB –cross sectional view of plume and geology



## LEGEND

### Upper Glacial aquifer

- UG Upper Glacial Sands
- UC Upper Glacial Silts & Clays
- UU Upton Unit

### Gardiners Clay

- GL Gardiners Clay
- GS Gardiners Clay - Silt

### Magothy aquifer

- MA Magothy Sands and Clay
- MB Magothy Brown Clay
- MC Magothy Clays (undifferentiated)
- MO Magothy - OTHER

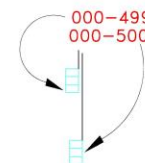
### 000-500 BNL Well ID

- ND Indicates not detected at or above laboratory method detection limits
- NS Indicates not sampled
- .080 Ethylene dibromide (EDB) Concentration (µg/L)
- 0.05 EDB Contour (µg/L) (Dashed Where Inferred)

### µg/L – Micrograms Per Liter

- Water Table As Of Oct. 13 – Oct. 18, 2021
- Monitoring Well Screen
- Extraction Well Screen
- HORIZONTAL SCALE

Monitoring Well IDs are stacked in order of the depth of the well from shallow to deep



### NOTES:

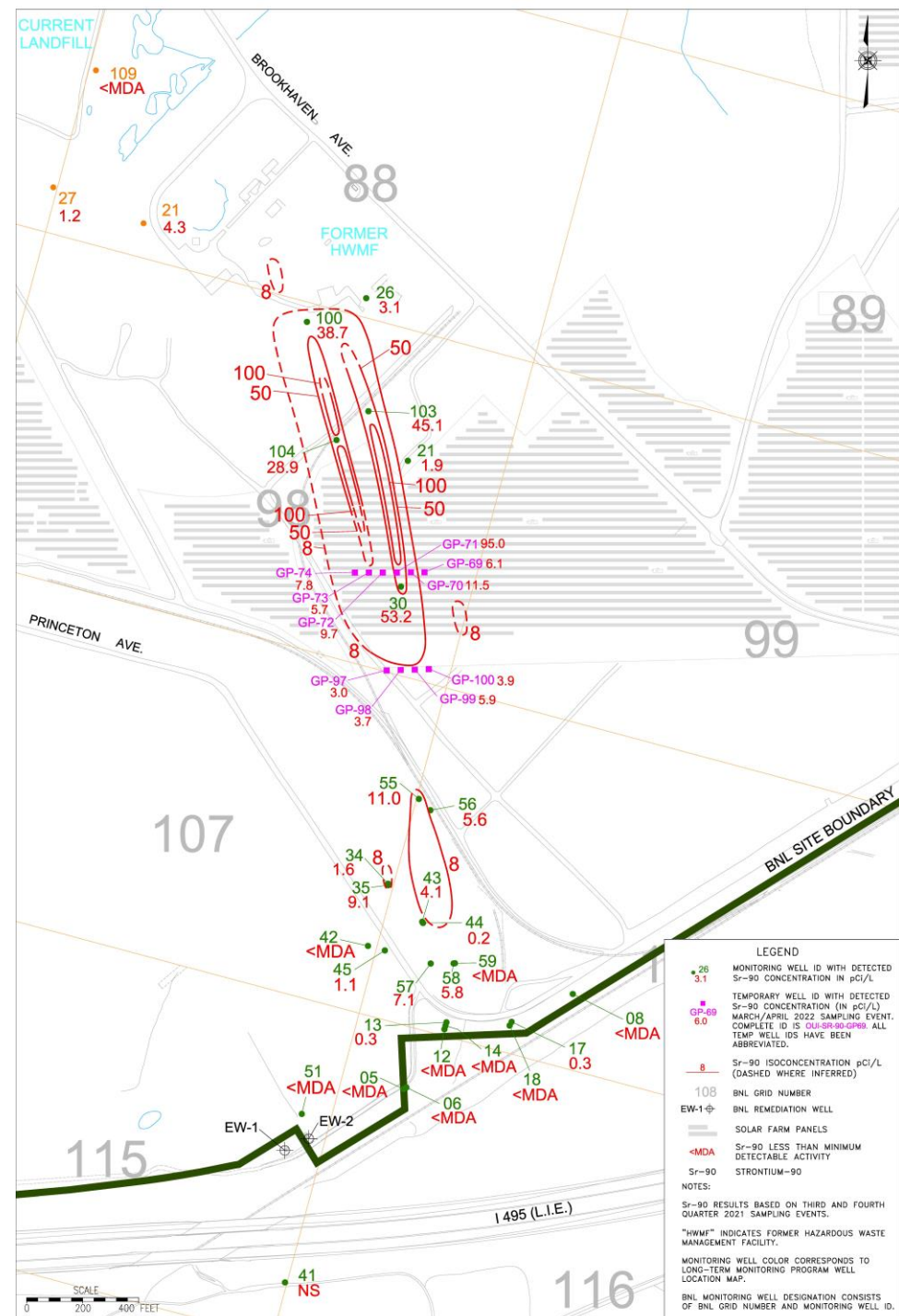
- 1) GEOLOGIC INFORMATION SHOWN IS BASED ON ADDITIONAL EXPLORATIONS (e.g., HYDROPUNCHES, GEOPROBES, VERTICAL PROFILES, AND/OR TEST WELLS) DOCUMENTED IN PREVIOUS, MORE DETAILED REPORTS.
- 2) EDB EXTENT IS BASED ON FOURTH QUARTER 2021 OU VI SAMPLING EVENTS.
- 3) RESULTS BASED ON EPA METHOD 504.

# Radiological Plume Comparison



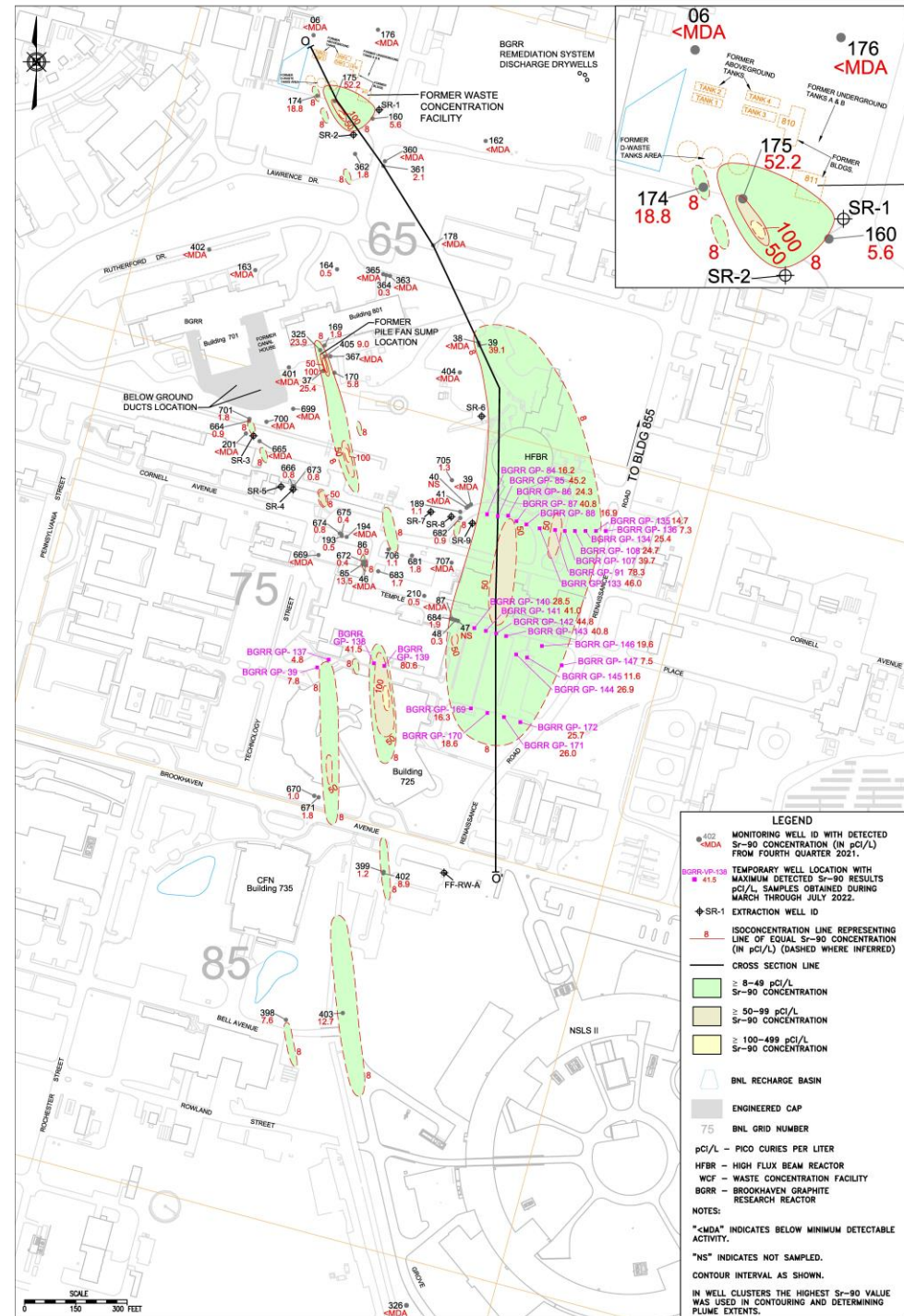
# OU I South Boundary Sr-90 Plume Monitoring

- Installed ten temporary wells in 2021/2022 to supplement the permanent monitoring wells
- The monitoring results indicate plume slowly migrating to south at approximate rate of 40 feet per year
- Natural attenuation modeling of Sr-90 plume projects the remnants of plume may extend just off-site at concentration of 10-25 pCi/L by 2080. Sr-90 drinking water standard is 8 pCi/L, Half-life is ~29 years

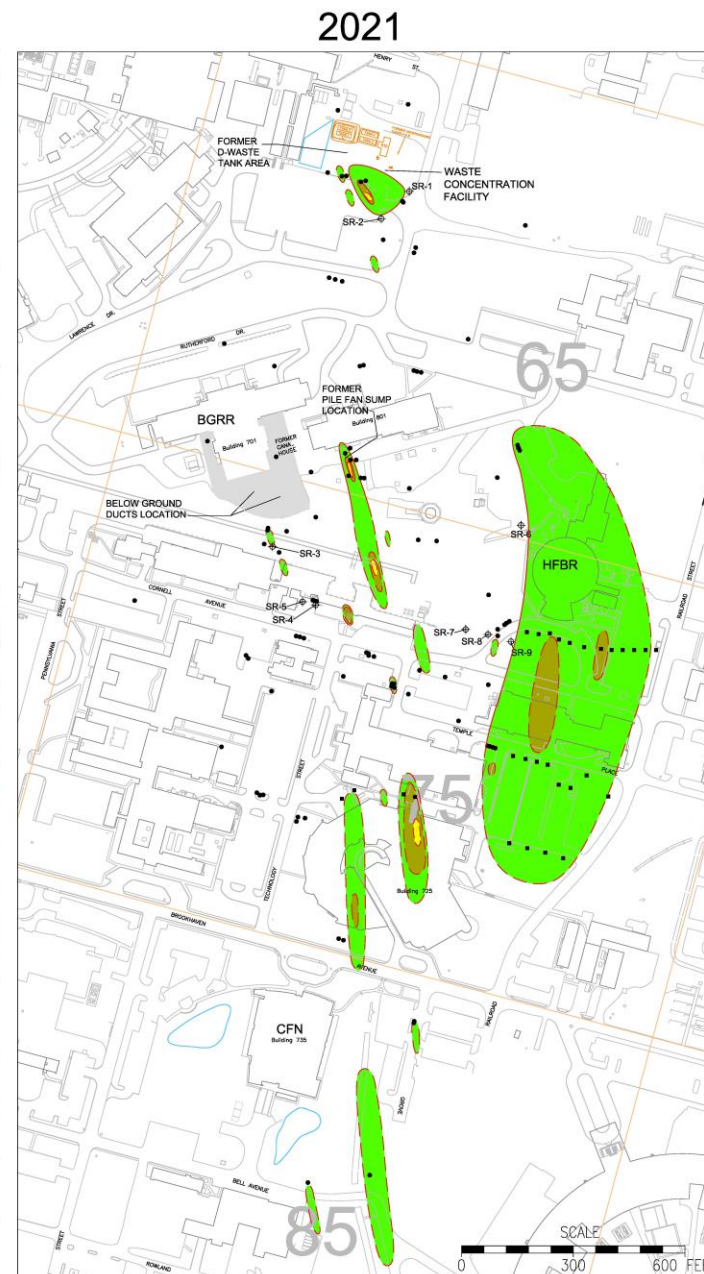
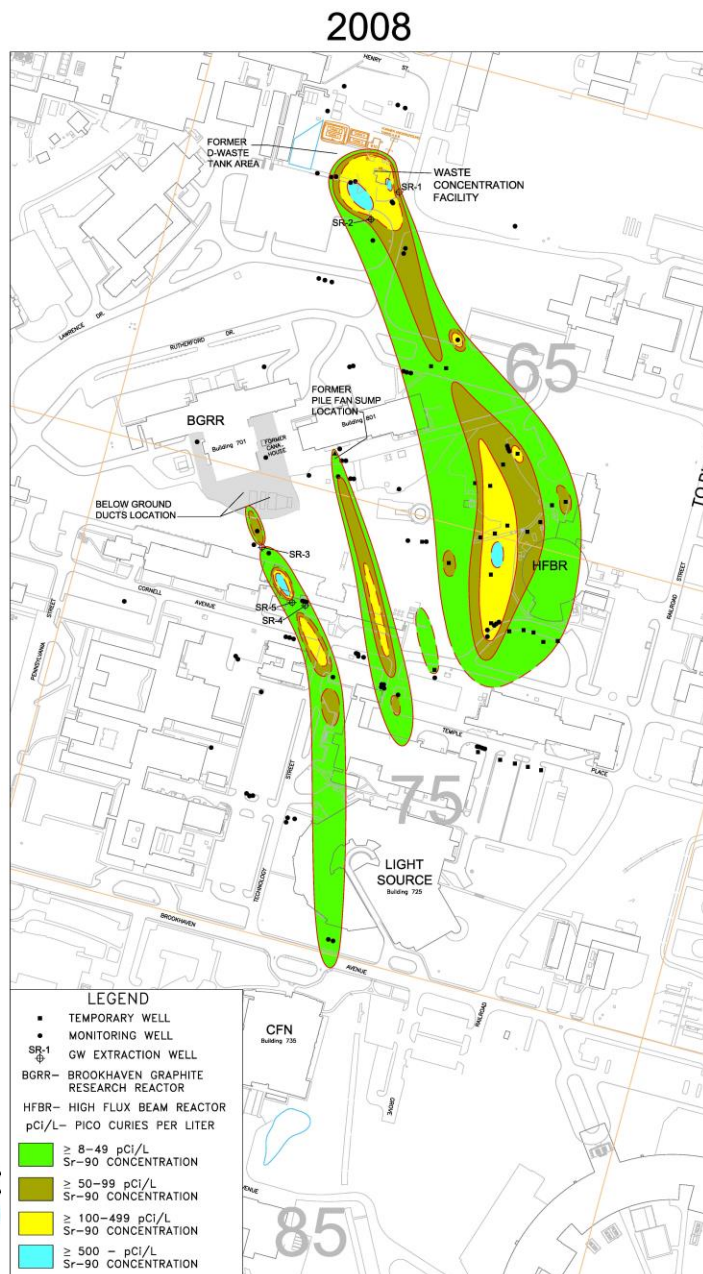


# BGRR/WCF/PFS

- Installed 28 temporary profile wells during 2021 to assist in the definition of the downgradient portion of the Sr-90 plumes.
  - BNL does this every few years to supplement the network of permanent monitoring wells
- Based upon the monitoring results:
  - Extraction well SR-8 was placed in standby mode in May 2022, as Sr-90 concentrations in this well have remained below the 8 pCi/L DWS since 2019
  - Extraction well SR-9 was placed in pulsed pumping mode in May 2022 (one month on and one month off) based on Sr-90 concentrations remaining below DWS since June 2020

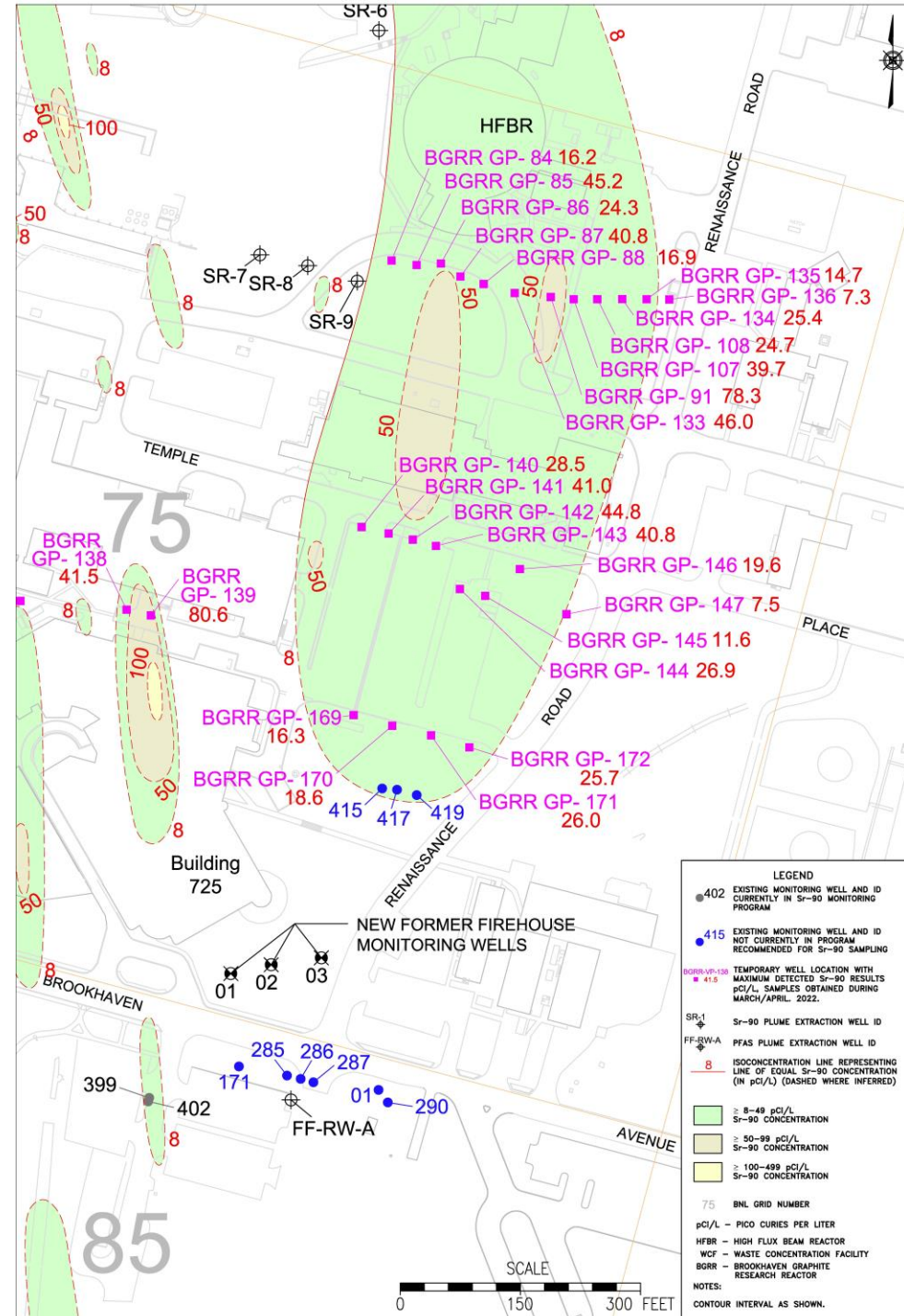


# BGRR/WCF/PFS – Plume Comparison



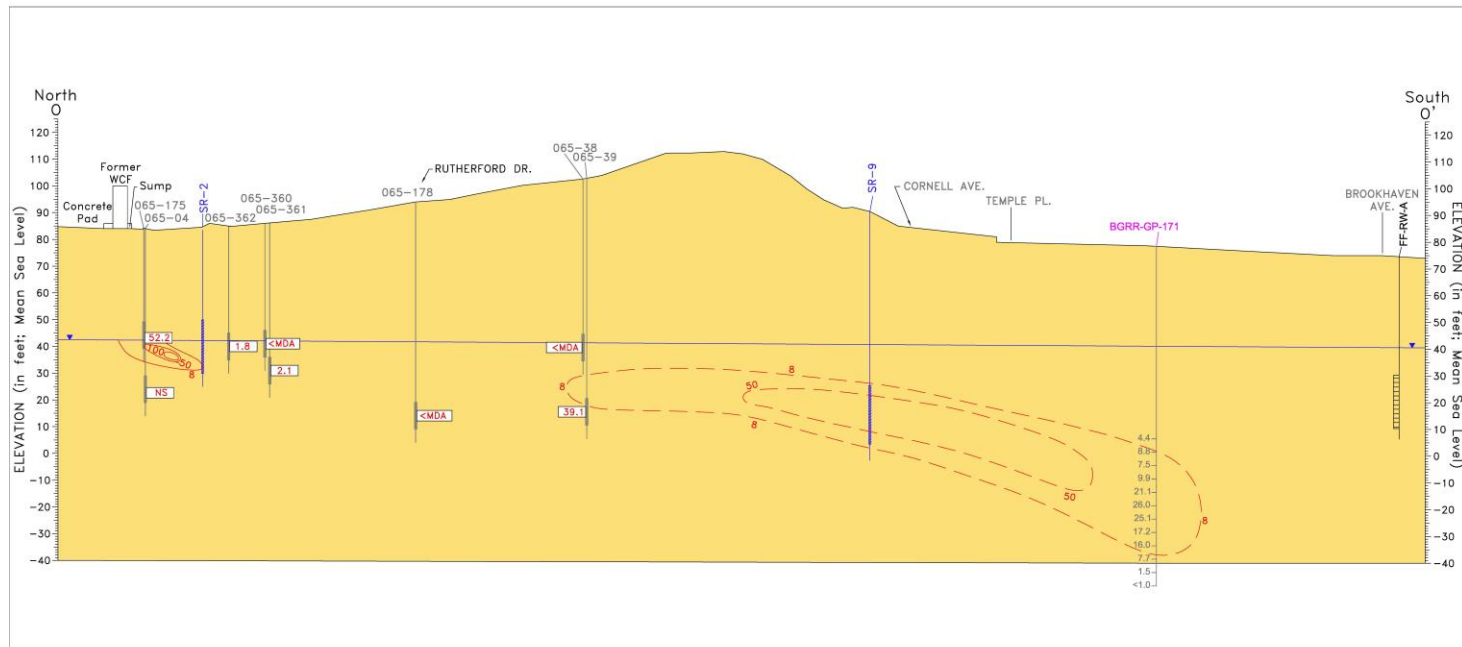
# BGRR/WCF/PFS – Leading Edge of WCF Plume Characterization

- Sr-90 plume approximately 400 feet north of PFAS TCRA extraction well FF-RW-A
- To evaluate whether Sr-90 may be intercepted by the PFAS extraction well, extraction well FF-RW-A and 12 area monitoring wells will be tested for Sr-90
  - April 2022 sample from FF-RW-A showed 2.5 pCi/L Sr-90



# BGRR/WCF/PFS – Leading Edge of WCF Plume Characterization

- Sr-90 plume is expected to be approximately 20 to 30 feet deeper than FF-RW-A
- Minimum 10 years travel time of leading Sr-90 plume edge to FF-RW-A area



## LEGEND

Upper Glacial aquifer

UG Upper Glacial Sands

Sr-90 Plume Contours (Dashed where inferred)

SR-2 Sr-90 Plume Extraction Well

FF-RW-A PFAS Plume Extraction Well

065-175 Monitoring Well

Well Screen Zone

39.1 Sr-90 results in pCi/L, obtained during 4th quarter 2021.

"<MDA" indicates below minimum detectable activity.

"NS" indicates not sampled.

pCi/L - pico Curies per liter

Water Table As Of Oct 13 - Oct 18, 2021

HORIZONTAL SCALE

0 100 200 FEET





# PFAS Status

- Two new systems installed (as TCRA) to treat PFAS using granular activated carbon
- Completed electrical and communications wiring and system controls for the treatment systems
- Collected initial (baseline) groundwater samples from the 95 new monitoring wells
- System startup testing
  - Current Firehouse/Building 170 system started October 24
  - Former Firehouse system expected to start by mid-November
  - NYSDEC issued SPDES Equivalency discharge permits for the treatment systems
    - During startup testing, there will be extensive sampling of the extraction wells, system influent and effluent
- Draft Remedial Investigation/Feasibility Study (RI/FS) Work Plan under internal review
  - Focus of the plan is to fill in the gaps in our understanding of the extent of PFAS and 1,4-dioxane (on-site and off-site)
  - Expect to submit draft Work Plan for regulatory review in early 2023

Questions?

