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U.S. DEPARTMENT OF ENERGY

Characterization of PFAS in Groundwater at BNL

BNL Environmental Protection Division

Discussion with Suffolk County Water Authority

January 26, 2022

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Agenda

- PFAS Characterization (2017-Present)
- Installation of two PFAS groundwater treatment systems
- Possible influence of Wm. Floyd well field on groundwater flow and plume migration
- Joint BNL-SCDHS “Sentinel Well” program for Wm. Floyd Well Field

BNL

William Floyd
Well Field

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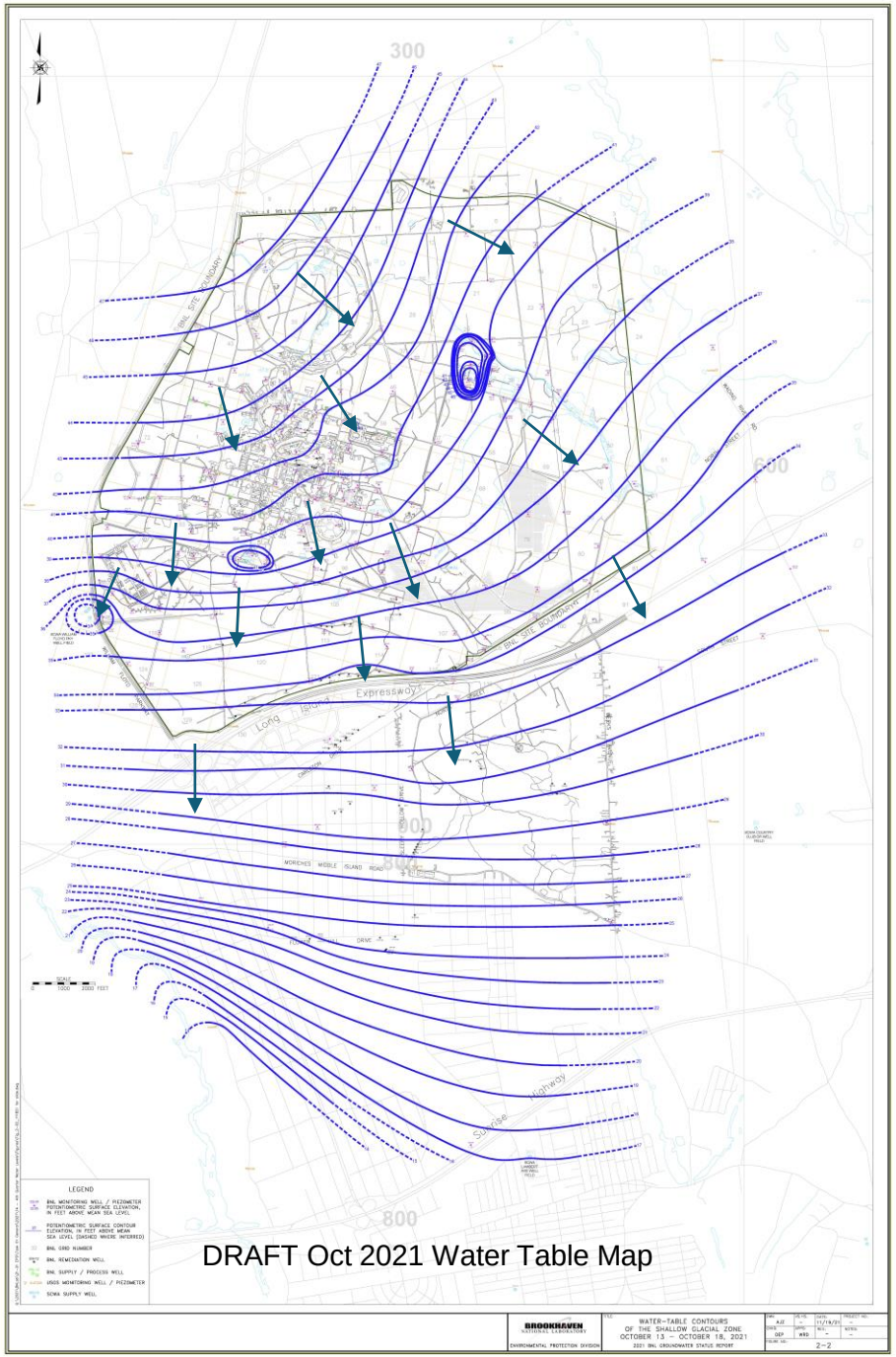
Groundwater Flow Directions

(Oct. 2021)



DRAFT Oct 2021 Water Table Map

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Efforts to Understand the Extent of PFAS

2017: First testing of BNL water supply wells for PFAS. PFAS were detected in 3 of the wells

2018: Identified 8 areas where firefighting foam had been released. Conducted initial testing for PFAS in source water contributing areas of BNL's water supply wells

2019 - Ongoing: Site-wide and Off-site Testing for PFAS

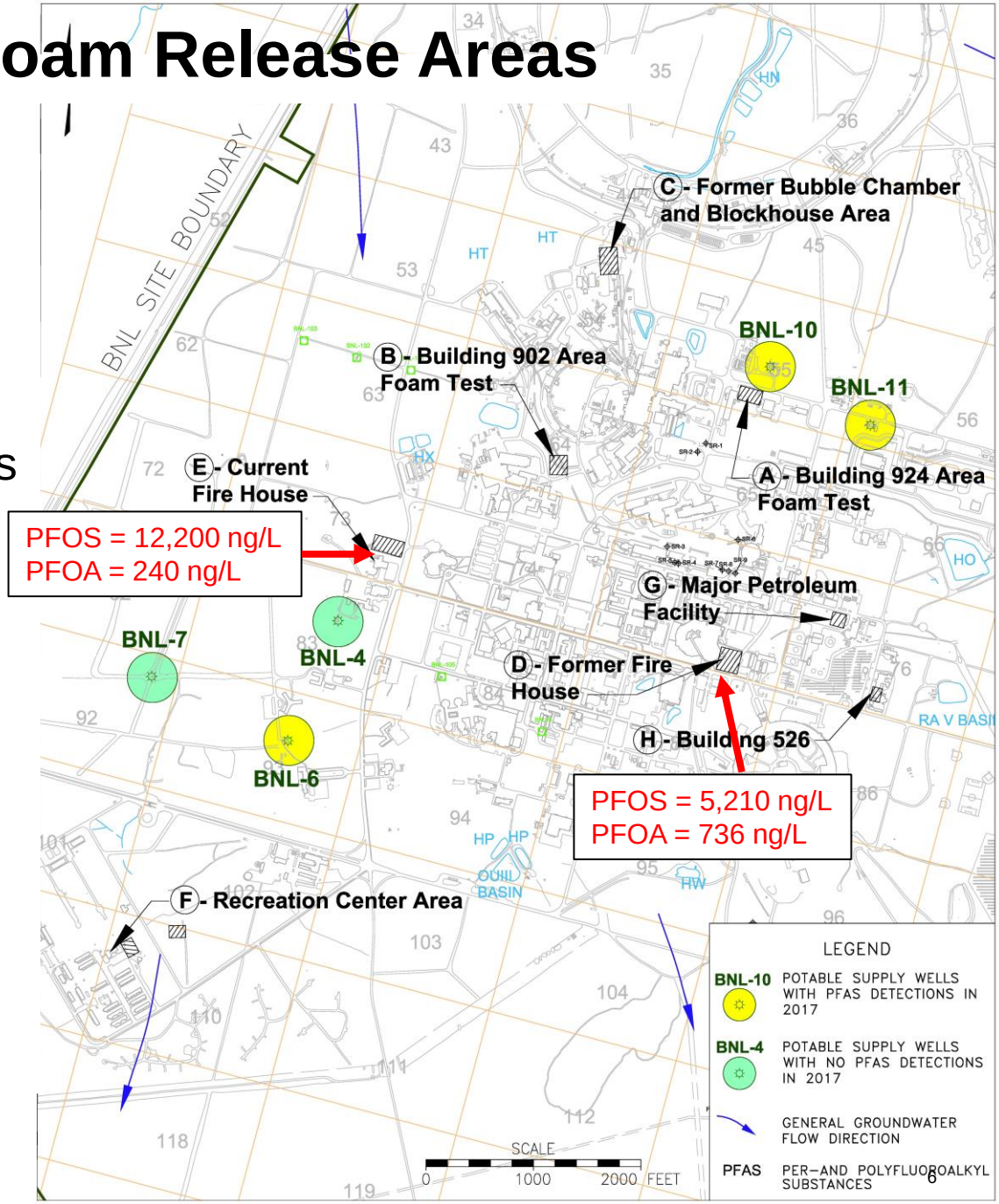
- Sampled 365 on-site and off-site monitoring wells
  - Selected from a network of approximately 1,200 wells
- Installed ~160 temporary profile wells
- Sampled on-site and off-site groundwater extraction wells and treatment system influent and effluent
- Sampled Sewage Treatment Plant influent and effluent

2020 - Ongoing: CERCLA Time Critical Removal Action (TCRA) Project

- Conducted detailed characterization of areas downgradient of the current and former firehouse facilities where the highest levels of PFAS are present
- Results were used to design two groundwater treatment systems

PFAS Detected in Foam Release Areas

- Firefighting foam that contained PFAS was used from 1966-2008
  - Firefighter training
  - Fire suppression systems
- Groundwater characterization was conducted at the 8 foam release areas
  - Highest PFAS levels are related to training:
    - Former firehouse (1966-1985)
    - Current firehouse (1986-2008)



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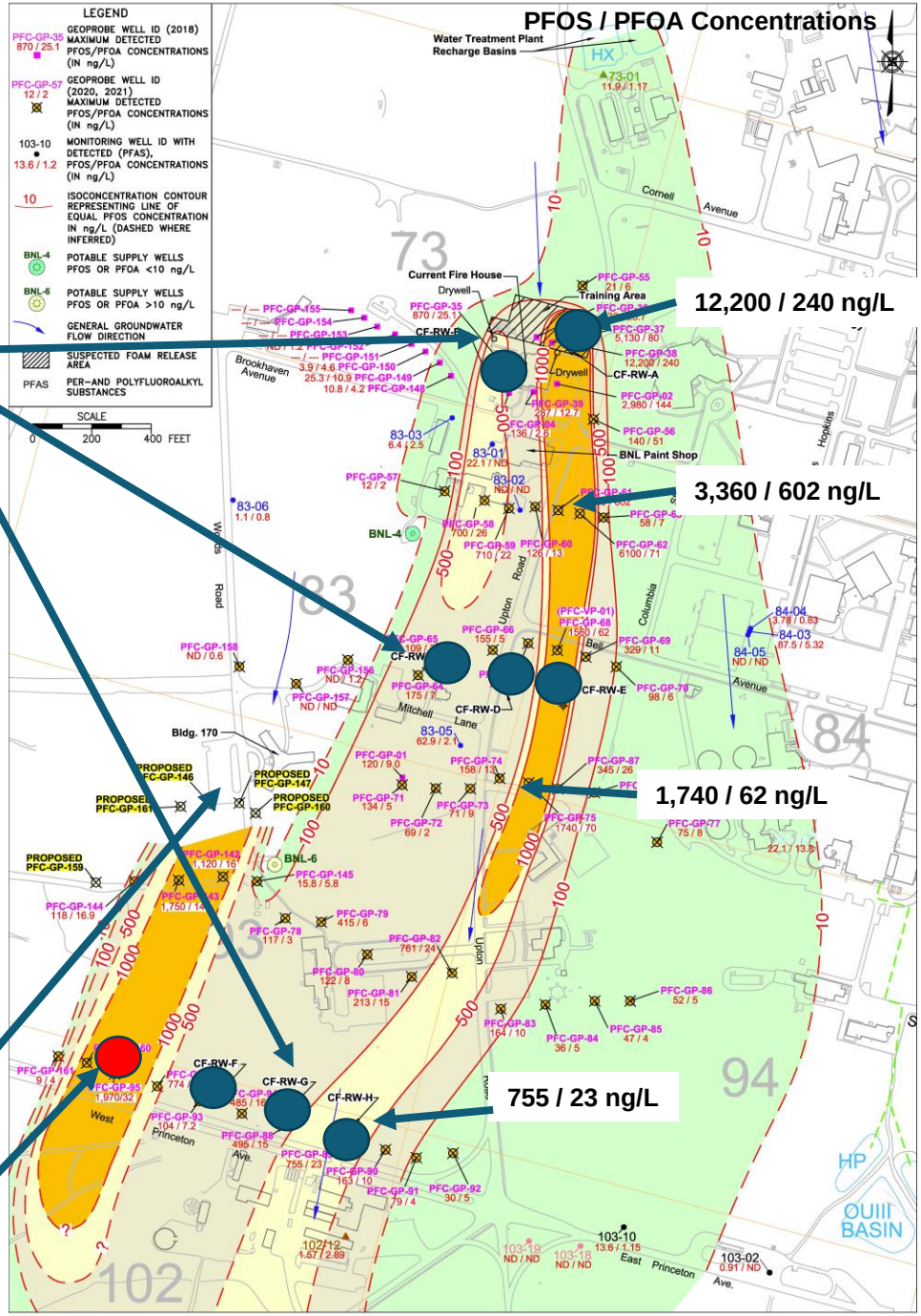
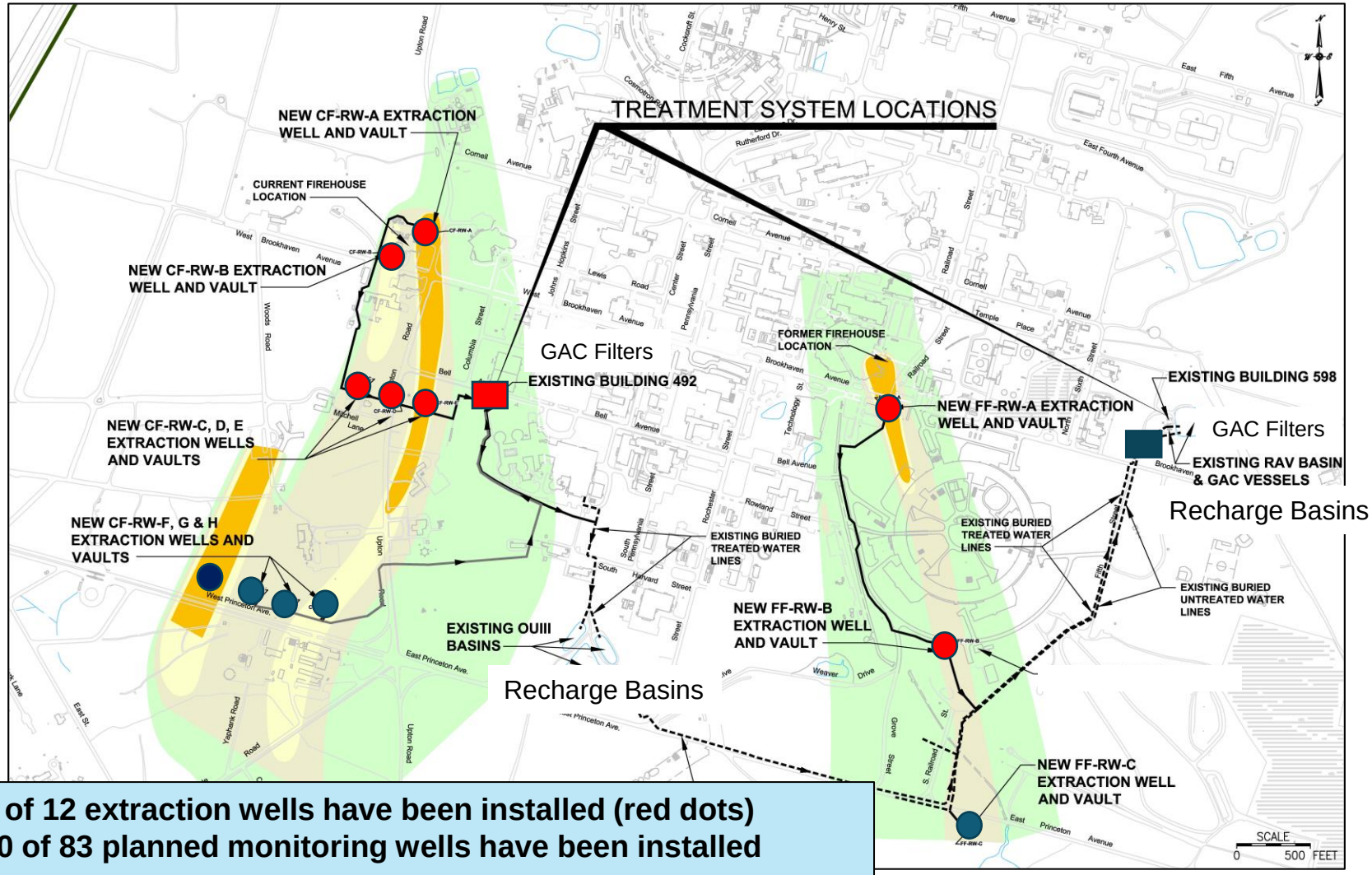
Current Firehouse Plume

- Installed 60 temporary wells to characterize plume
- Treatment system design
  - Initial plan was to install eight extraction wells
  - Capture goal of 100 ng/L for PFOS or PFOA
  - New carbon filters installed in repurposed treatment building
- Monitoring
  - Install 54 additional monitoring wells for long-term surveillance

- **April-Nov 2021, temporary wells were installed to verify western margin of the plume**
- **Found unexpected high levels of PFOS - up to 5,700 ng/L**
- **Current data suggest a different PFAS source area**
- **A ninth extraction well is required**



PFAS Treatment Systems – Current Status

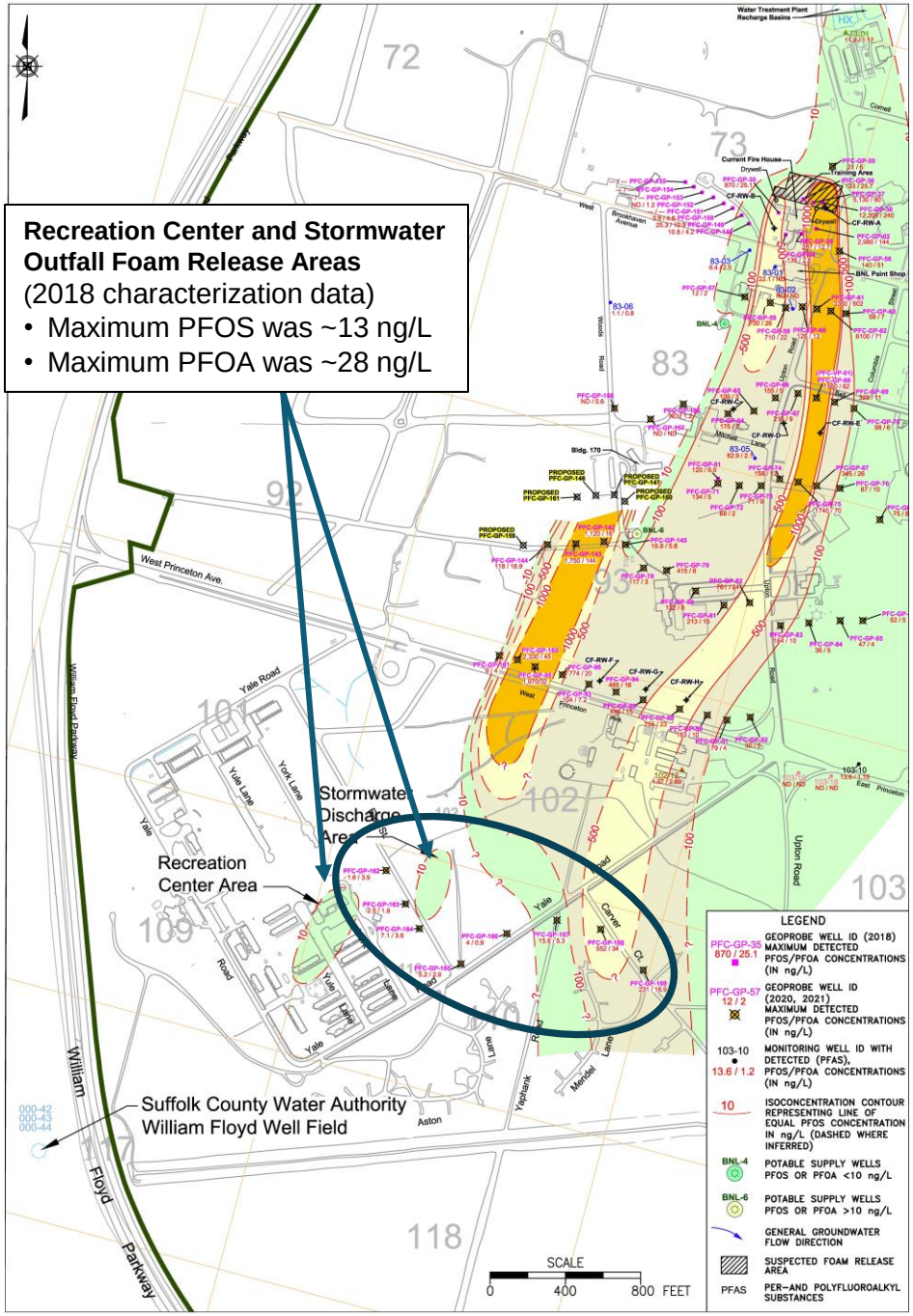


- **7 of 12 extraction wells have been installed (red dots)**
- **50 of 83 planned monitoring wells have been installed**

Most construction activities are expected to be completed by mid Summer 2022

Additional Plume Characterization

- Evaluate downgradient migration of the “western” high concentration PFAS plume segment and whether the migration pathway is being influenced by the Wm. Floyd well field
  - Low levels of PFOS (max. 7 ng/L; average <5 ng/L) have been detected in samples from the well field (SCWA, 2019 and 2020 data)
- Results from eight temporary wells show that the high concentration plume segment is not within the immediate capture zone of the well field



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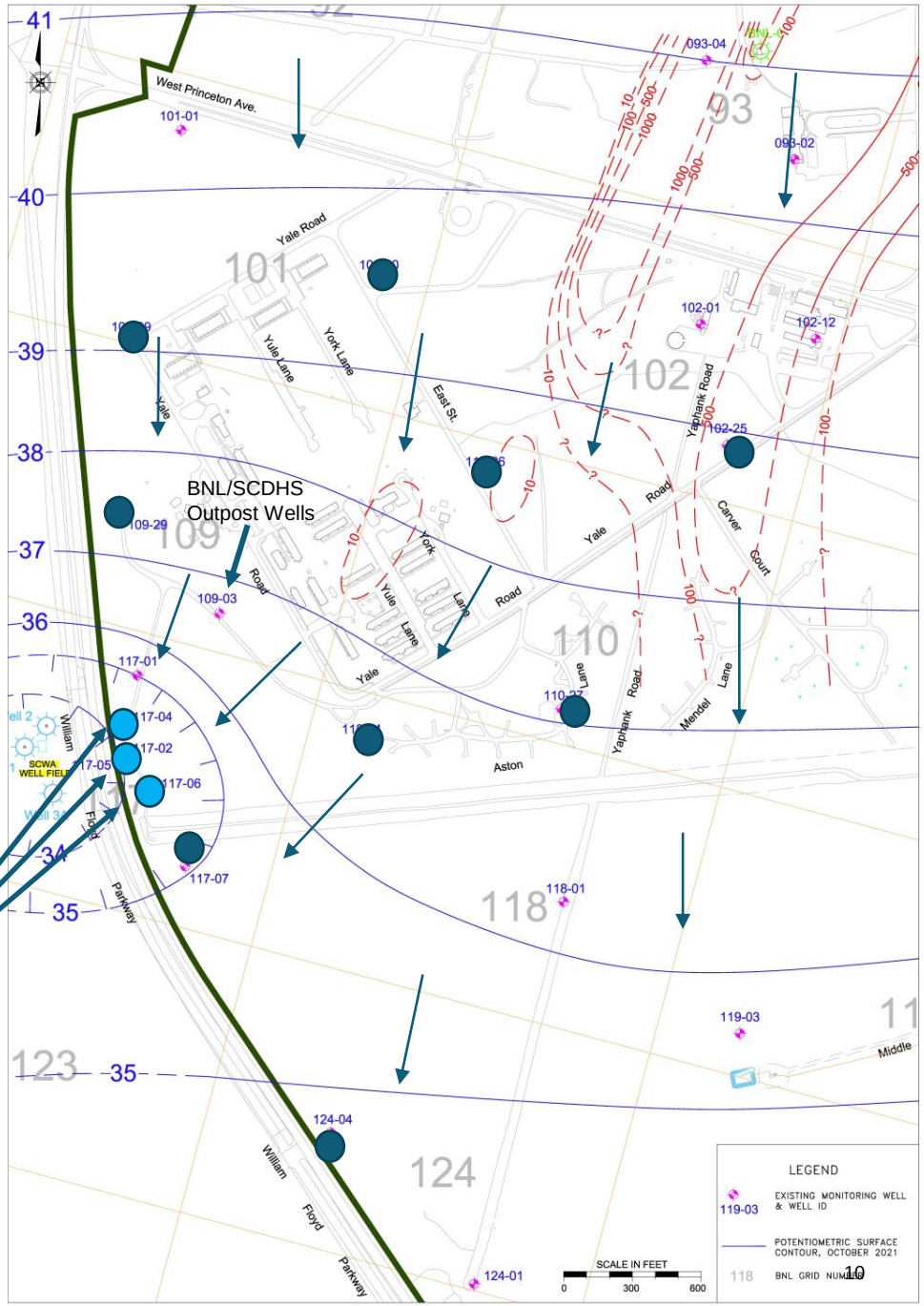
12 New Permanent Wells

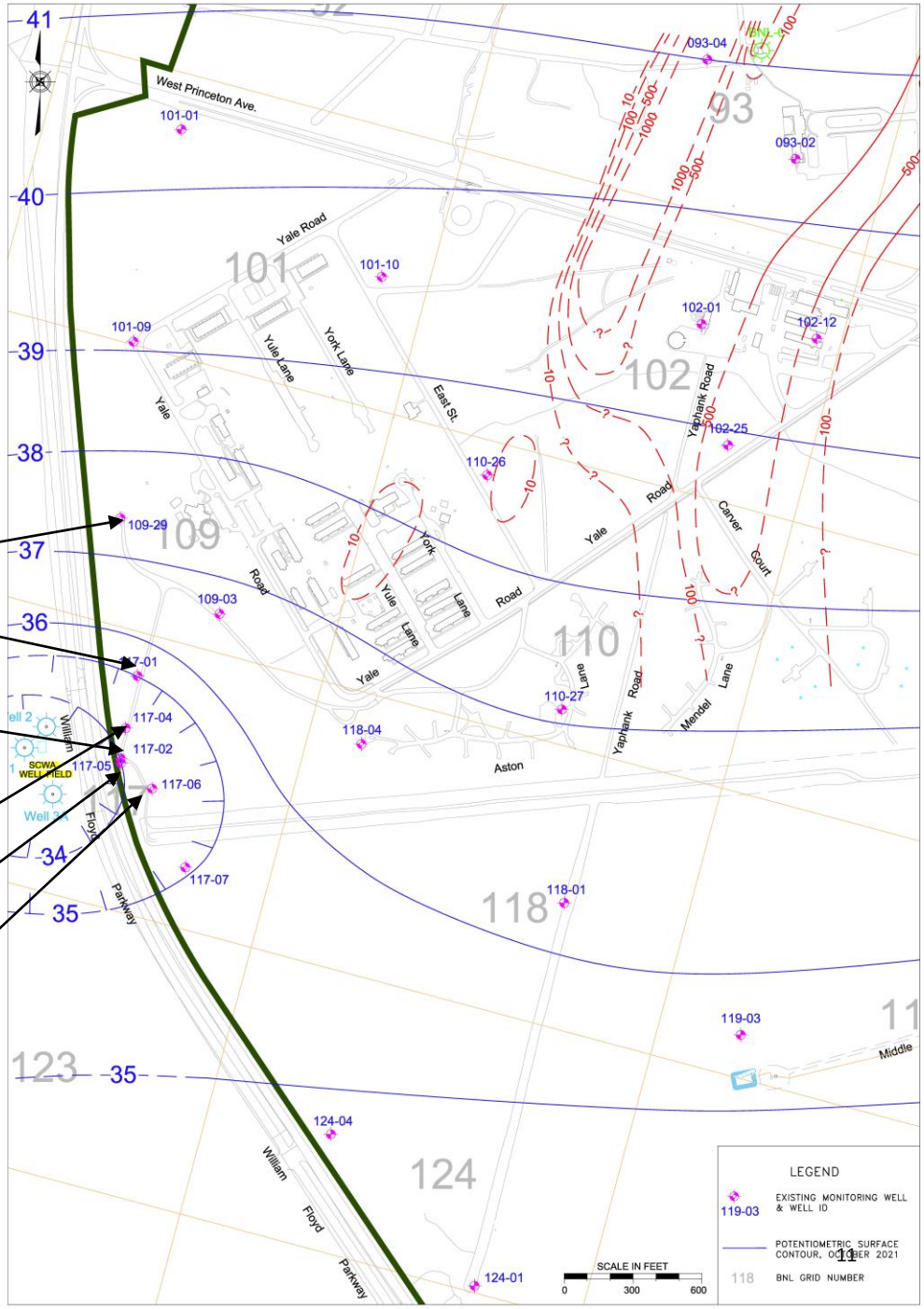
- Improve BNL's ability to evaluate influence the well field has on groundwater flow directions
  - Water level measurements from the wells are used to prepare groundwater contour maps
    - Wells have been surveyed and water levels measured
    - Water table data indicate the well field is impacting groundwater flow on-site
  - Plan was to also use 3 of the new wells for water quality surveillance
    - Wells screened from 130-140 ft. bls
    - Similar depth as the water supply wells (~125-170 ft. bls)



Monitoring Well Results
(Oct. – Nov. 2021)

Depth to GW ~80 ft

Well No./Screen Depth (BLS)	Collection Date	1,4-D (µg/L)	PFOS (ng/L)	PFOA (ng/L)
109-29 (99'-109')	11/3/2021	NA	1.78U	**0.94J**
117-01 (75'-85')	10/21/2021	0.2U	**7.47**	**6.48**
	11/3/2021	NA	**5.36**	**4.21**
117-02 (74'-84')	10/21/2021	0.2U	**4.86**	**1.35J**
	11/3/2021	NA	**0.79J**	1.91U
117-04 (130'-140')	10/7/2021	0.2U	1.84U	1.84U
117-05 (130'-140')	10/8/2021	0.2U	1.93U	1.93U
117-06 (130'-140')	10/7/2021	0.2U	1.83U	1.83U



U: Not detected above method detection limit

J: Estimated concentration

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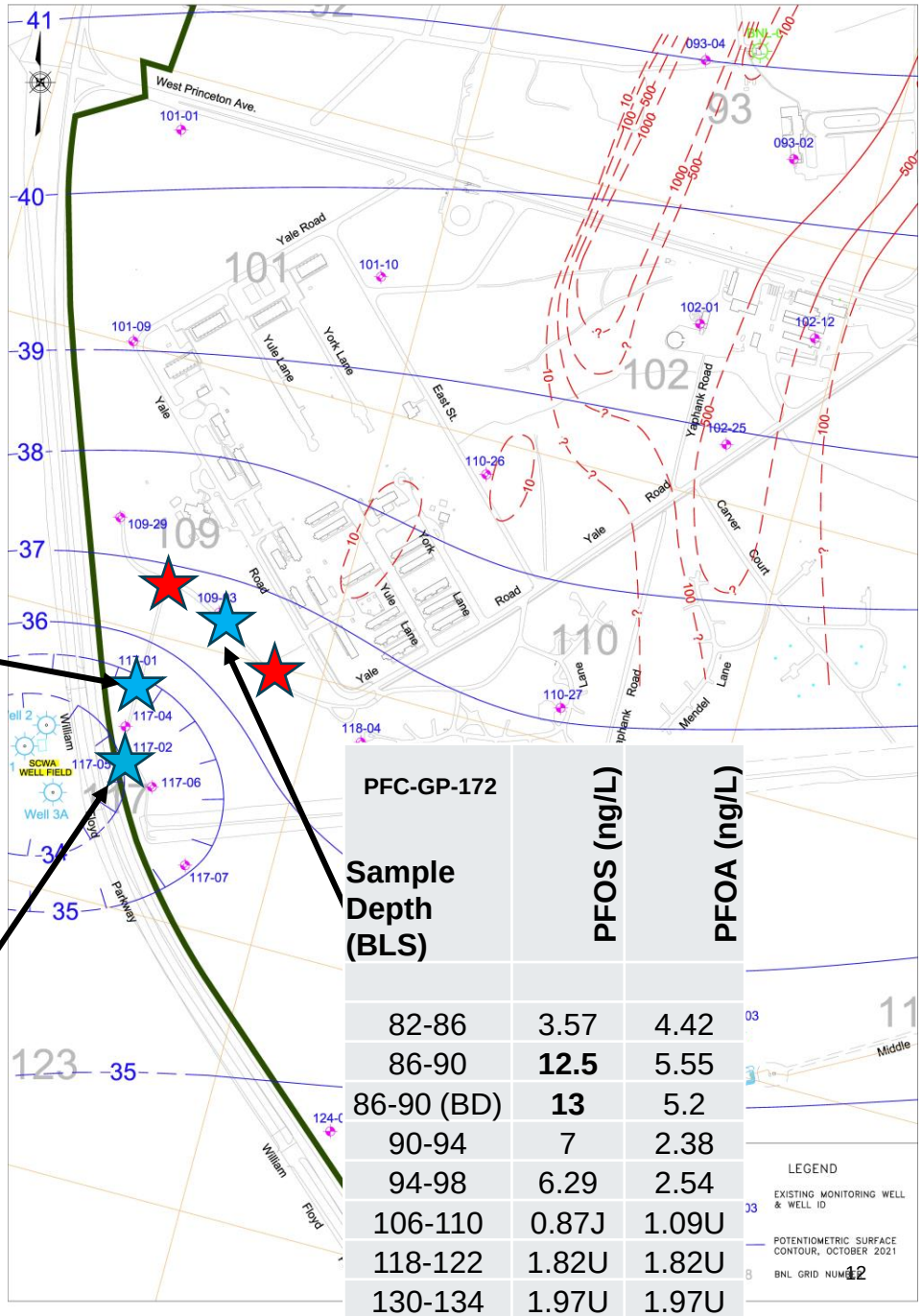
Temporary Wells
(Dec. 2021 – Jan. 2022)

Results for 3 of 5 planned temporary wells

Depth to GW ~80 ft

PFC-GP-170 Sample Depth (BLS)	PFOS (ng/L)	PFOA (ng/L)
82'-86'	7.68	8.77
86'-90'	7.6	9.8
90'-94'	9.58	6.59
90'-94' (BD)	7.29	5.59
94'-98'	3.23	3.46
106'-110'	0.88J	0.72J
118'-122'	1.87U	1.87U
130'-134'	1.86U	1.86U

PFC-GP-174 Sample Depth (BLS)	PFOS (ng/L)	PFOA (ng/L)
80-84	2.04J	0.88J
90-94	7.3	2.76
100-104	7.17	1.55J
110-114	2.01U	0.84J
120-124	1.23J	2.85
130-134	2.03U	2.03U
140-144	2.12U	2.12U



PFC-GP-172 Sample Depth (BLS)	PFOS (ng/L)	PFOA (ng/L)
82-86	3.57	4.42
86-90	**12.5**	5.55
86-90 (BD)	**13**	5.2
90-94	7	2.38
94-98	6.29	2.54
106-110	0.87J	1.09U
118-122	1.82U	1.82U
130-134	1.97U	1.97U

BD: Blind Duplicate Sample

U: Not detected above method detection limit

J: Estimated concentration

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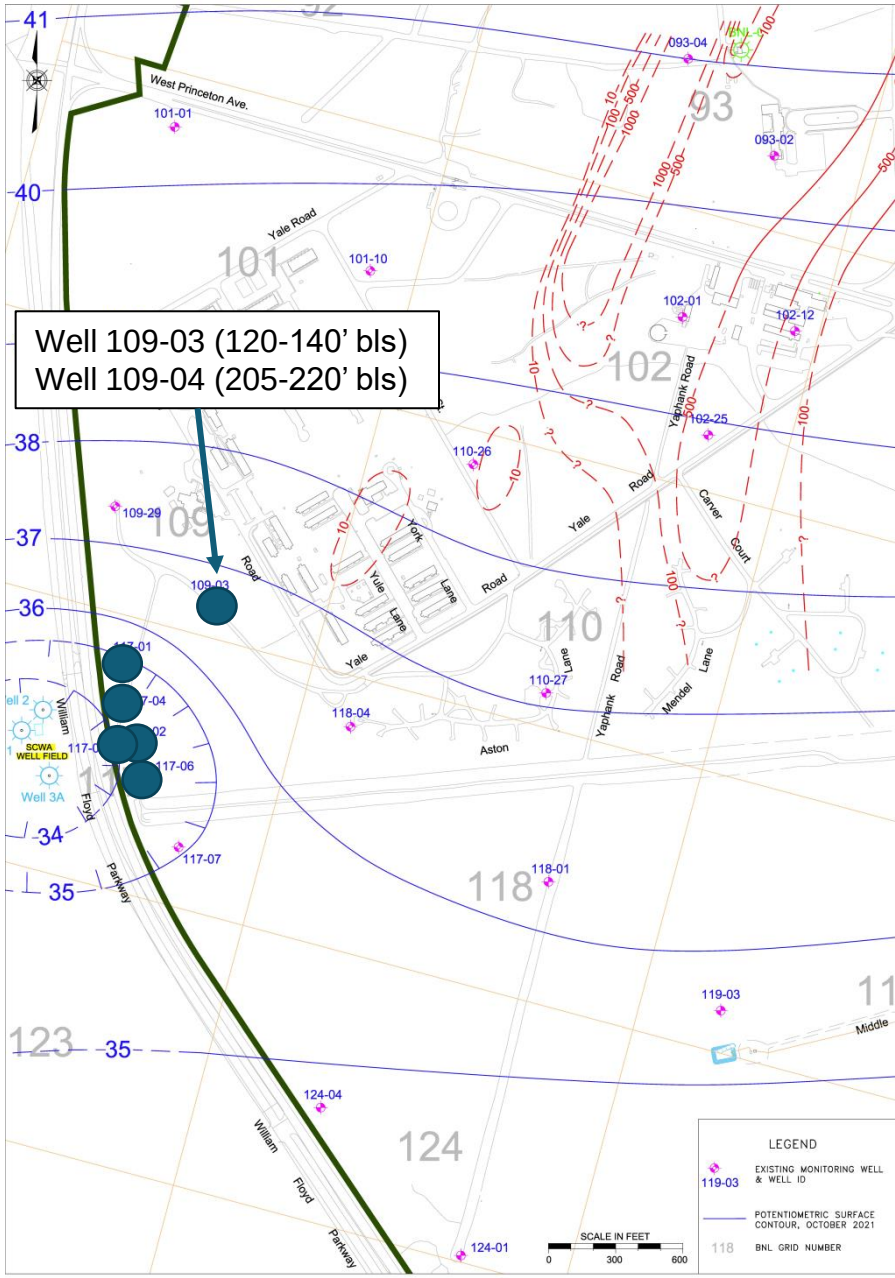
Wm. Floyd Well Field Sentinel Well Monitoring Program

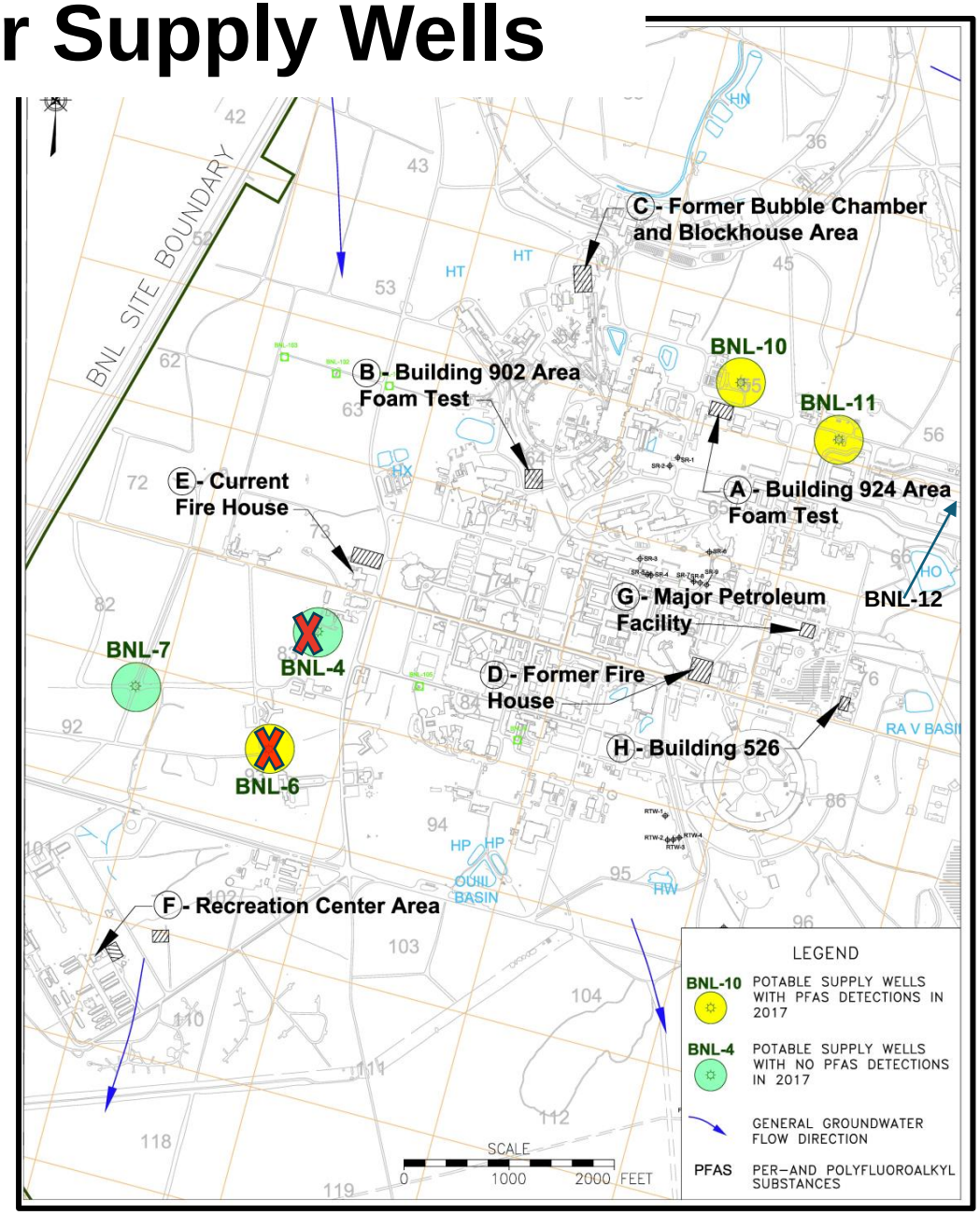
- Joint BNL-SCDHS program
- Started in Sept. 1996 with two wells (109-03 and 109-04)
  - Split samples collected
  - PFAS analyses added in 2018
  - PFAS were not detected
- For 2022, program was modified
  - Expanded to six wells (109-03, 117-01, 117-02, 117-04, 117-05, and 117-06)
- Wells will be sampled quarterly by BNL and SCDHS for:
  - VOCs
  - Sr-90
  - Tritium
  - Gamma spec
  - **1,4-dioxane**
  - **PFAS** (analysis only by BNL)
- Results published in BNL annual Groundwater Status Report
- Unexpected results would be reported immediately



Backup Slides

Status of BNL Water Supply Wells

- PFOS is detected >10 ng/L MCL in 3 of 6 supply wells
  - PFOA is <10 ng/L
- Returning to service granular activated carbon filters at wells #10, #11, and #12 to remove PFOS and PFOA (to comply with MCLs)
  - The filters were originally installed in the 1980s to remove VOCs (e.g., 1,1,1-TCA)
  - Filters at #10 and #11 are now back in service. Filters at #12 should be in service by March
    - Monitoring results show that the filters are effective
- Two wells (#4 and #6) will remain out of service



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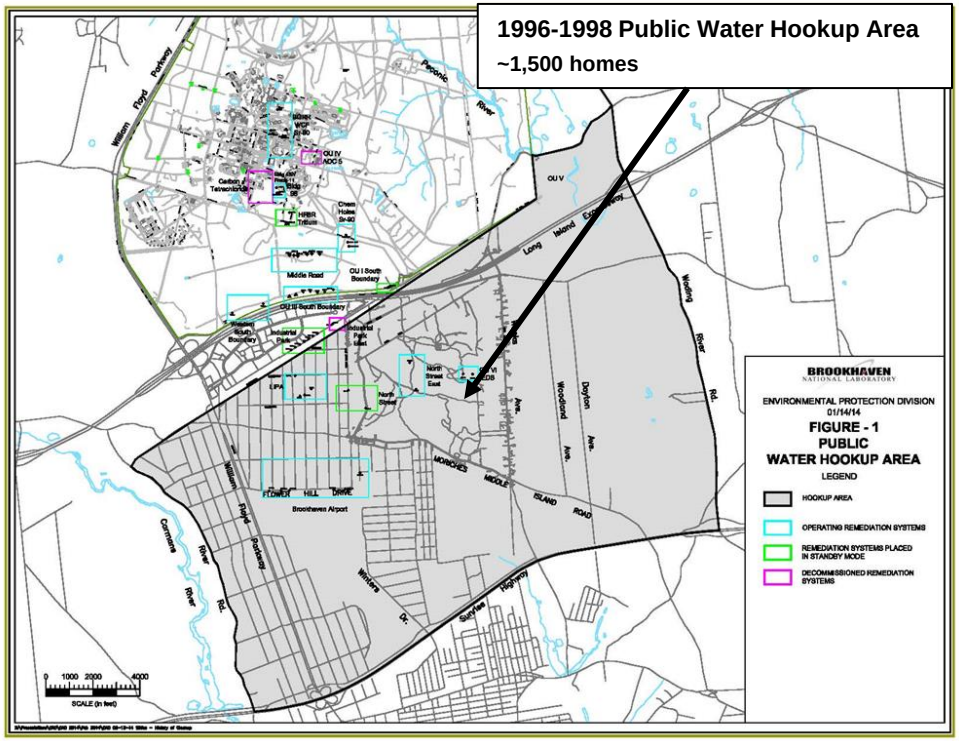
Testing of Private Wells for PFAS and 1,4-Dioxane

- SCDHS identified 161 properties downgradient of BNL suspected of not being connected to public water
  - Most of the properties are located outside (to the east and west) of the "1996-1998 public water hookup area"
  - In April 2019, BNL and the County established a "Technical Services Agreement."
    - Samples were collected by county sanitarians
    - PFAS analyses conducted by BNL's contract laboratory
    - 1,4-dioxane analyses conducted by the county's analytical laboratory
- 82 private wells were tested
- PFAS were detected in several wells - none linked to BNL
- Agreement ended in 2020



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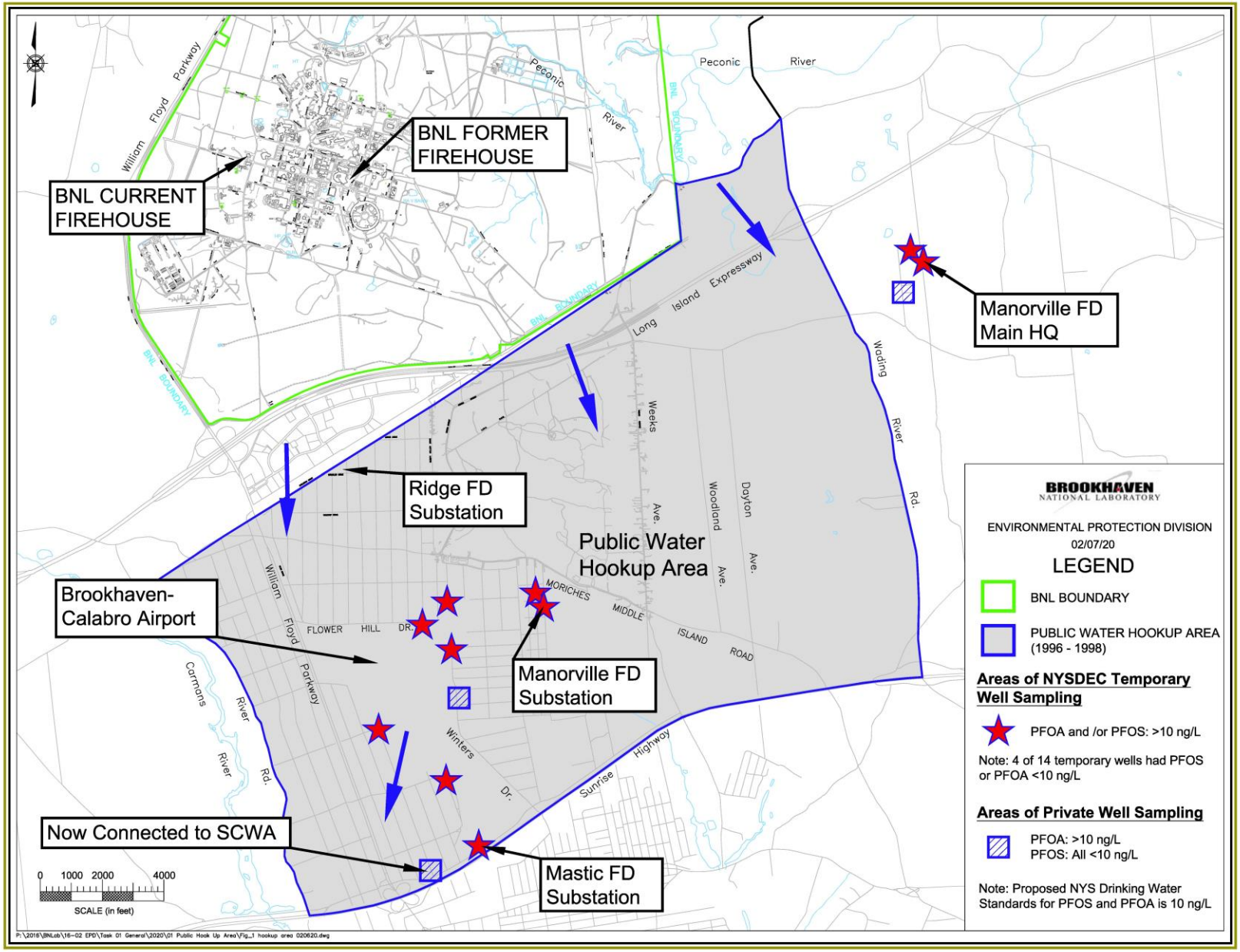
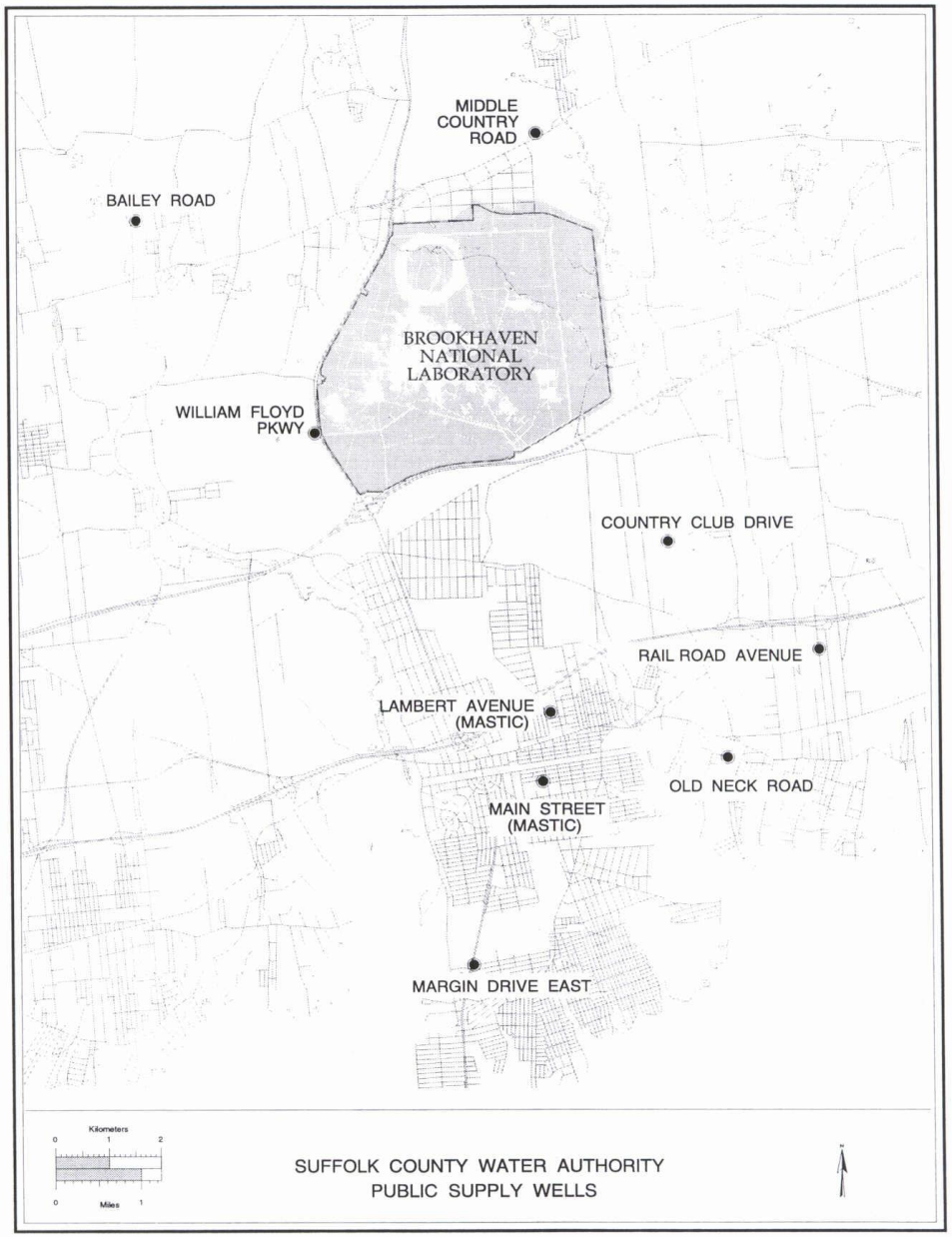
NYSDEC & Private Wells With PFOS or PFOA >10 ng/L

PFAS detected in several private wells. Off-site sources for the PFAS were identified



SCWA Well Fields in Vicinity of BNL



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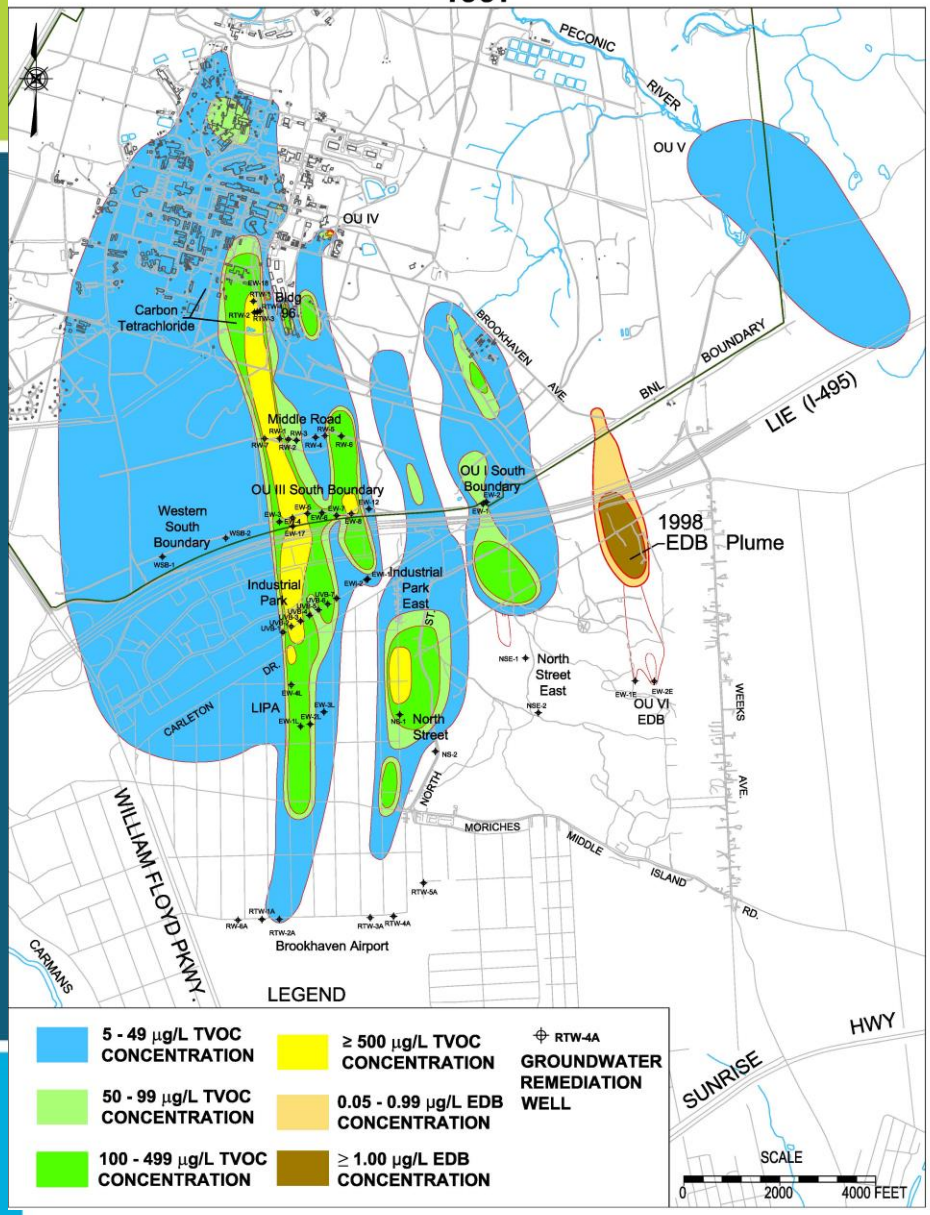
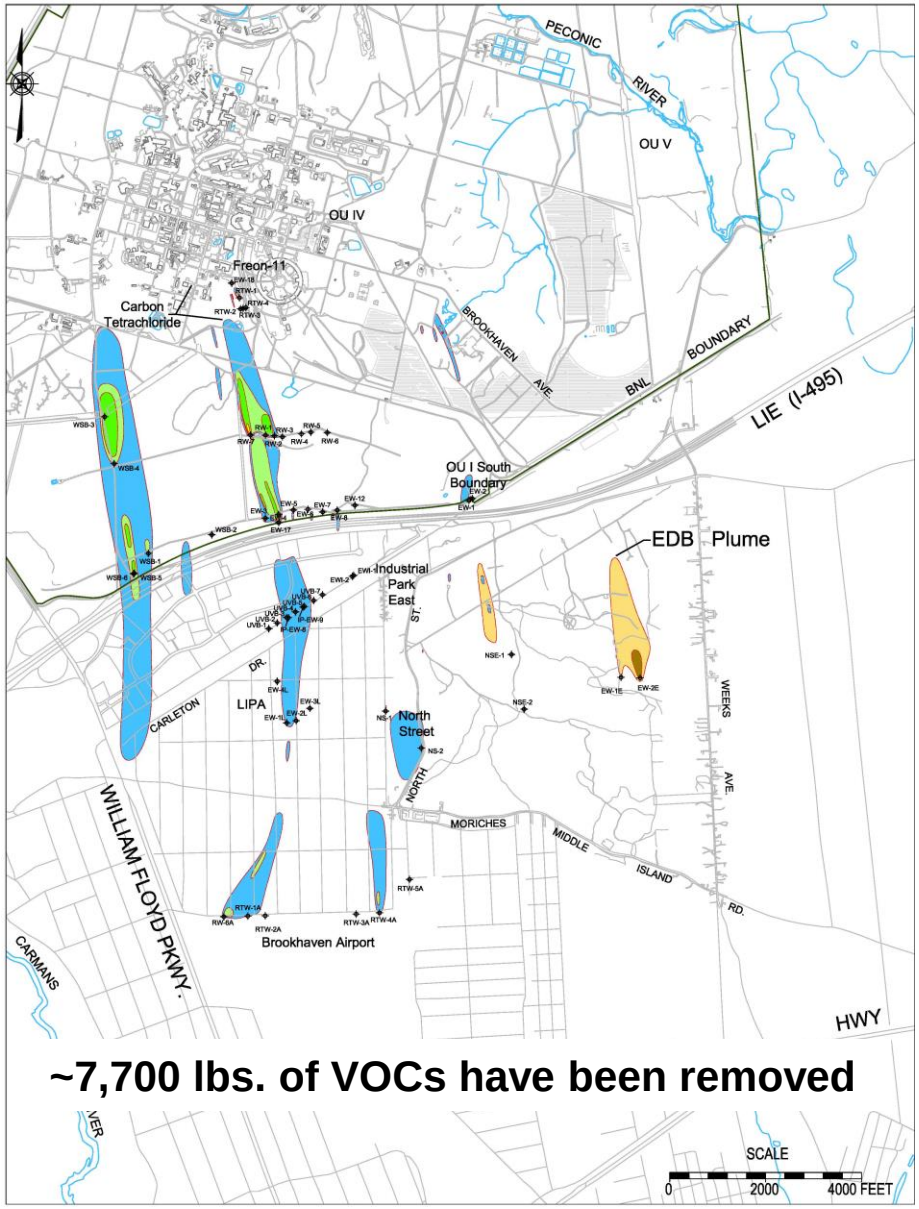
Overview of Cleanup Progress for VOCs

1997



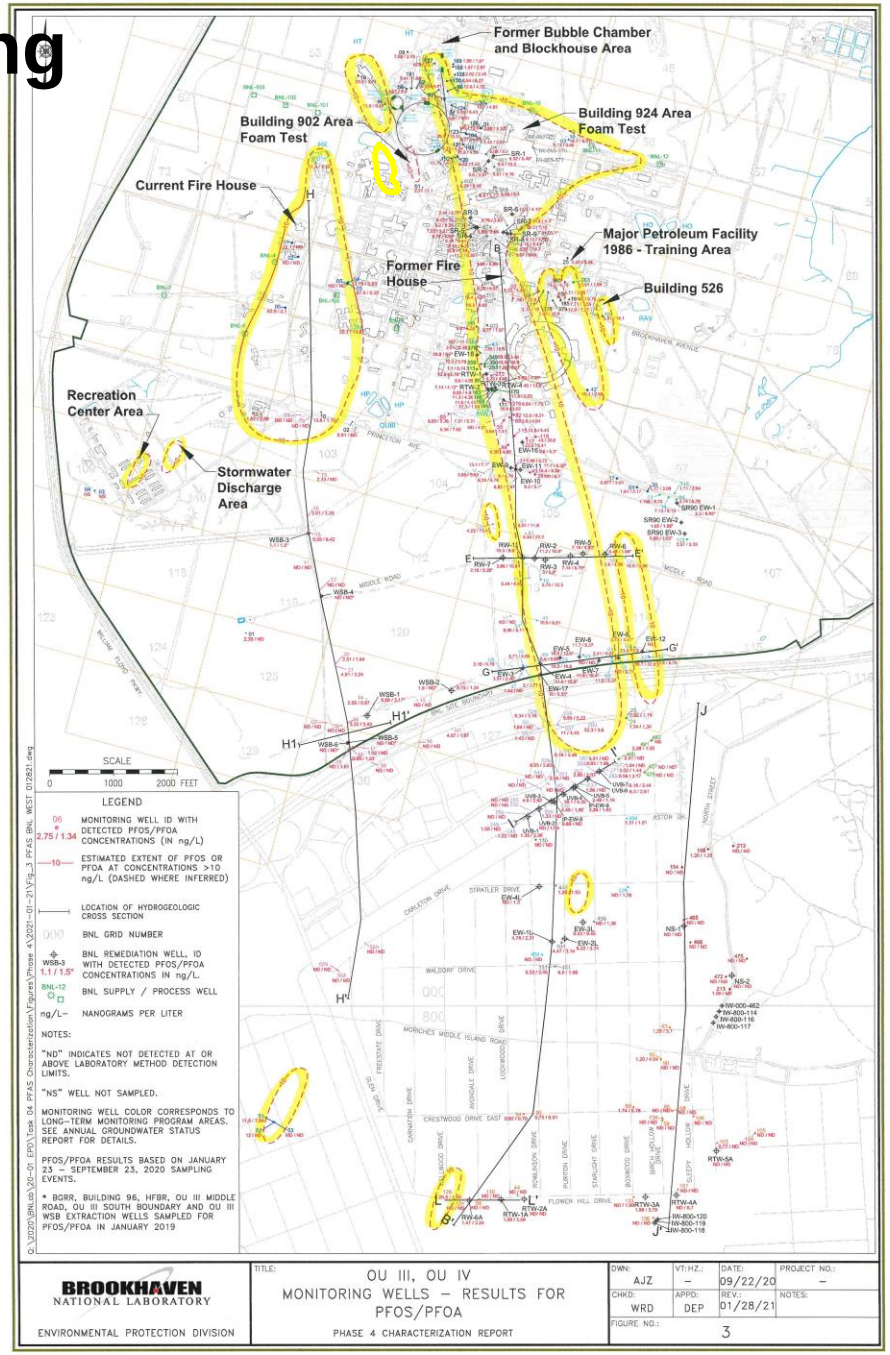
2020



~7,700 lbs. of VOCs have been removed

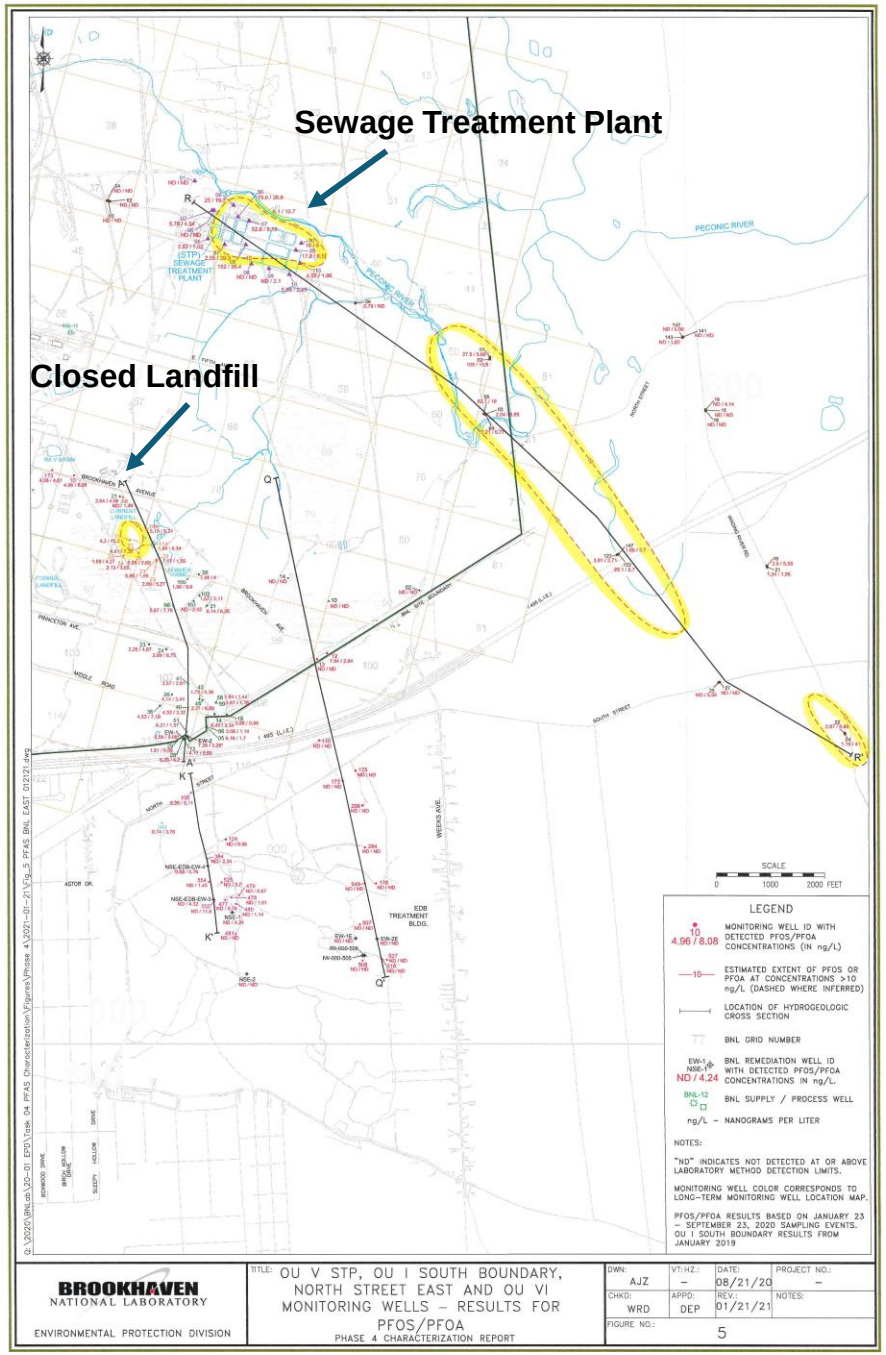
Onsite and Offsite Sampling
PFOS/PFOA
West-Central Area

- Numerous detections of PFOS or PFOA >10 ng/L
  - Associated with firefighting foam training areas and foam releases from fire suppression systems
  - Yellow outlines represent estimated extent of PFOS or PFOA >10 ng/L
  - Additional characterization is required in several areas
- Several off-site detections likely due to other sources



PFOS/PFOA
Eastern Area

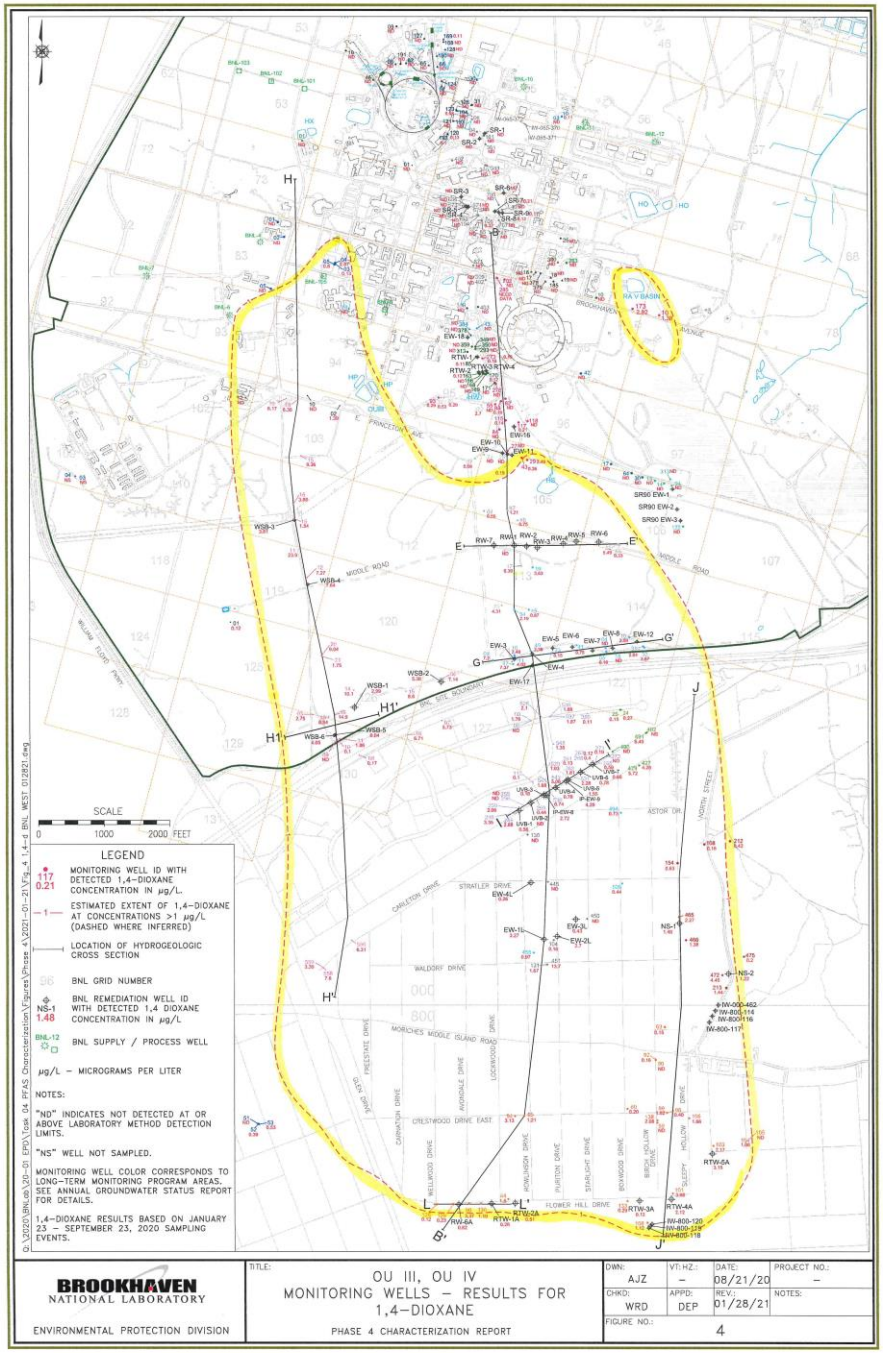
- PFAS were detected in several areas not used for firefighter training
  - Landfill
    - PFOA up to 45 ng/L
  - Sewage Treatment Plant (STP) area
    - PFOS up to 154 ng/L
- PFAS discharged to the sanitary system impacted groundwater at the STP and downgradient areas
  - Potable water that contained PFAS
  - Possible foam discharges to floor drains at the current firehouse
  - PFOS and PFOA in STP effluent is currently <10 ng/L



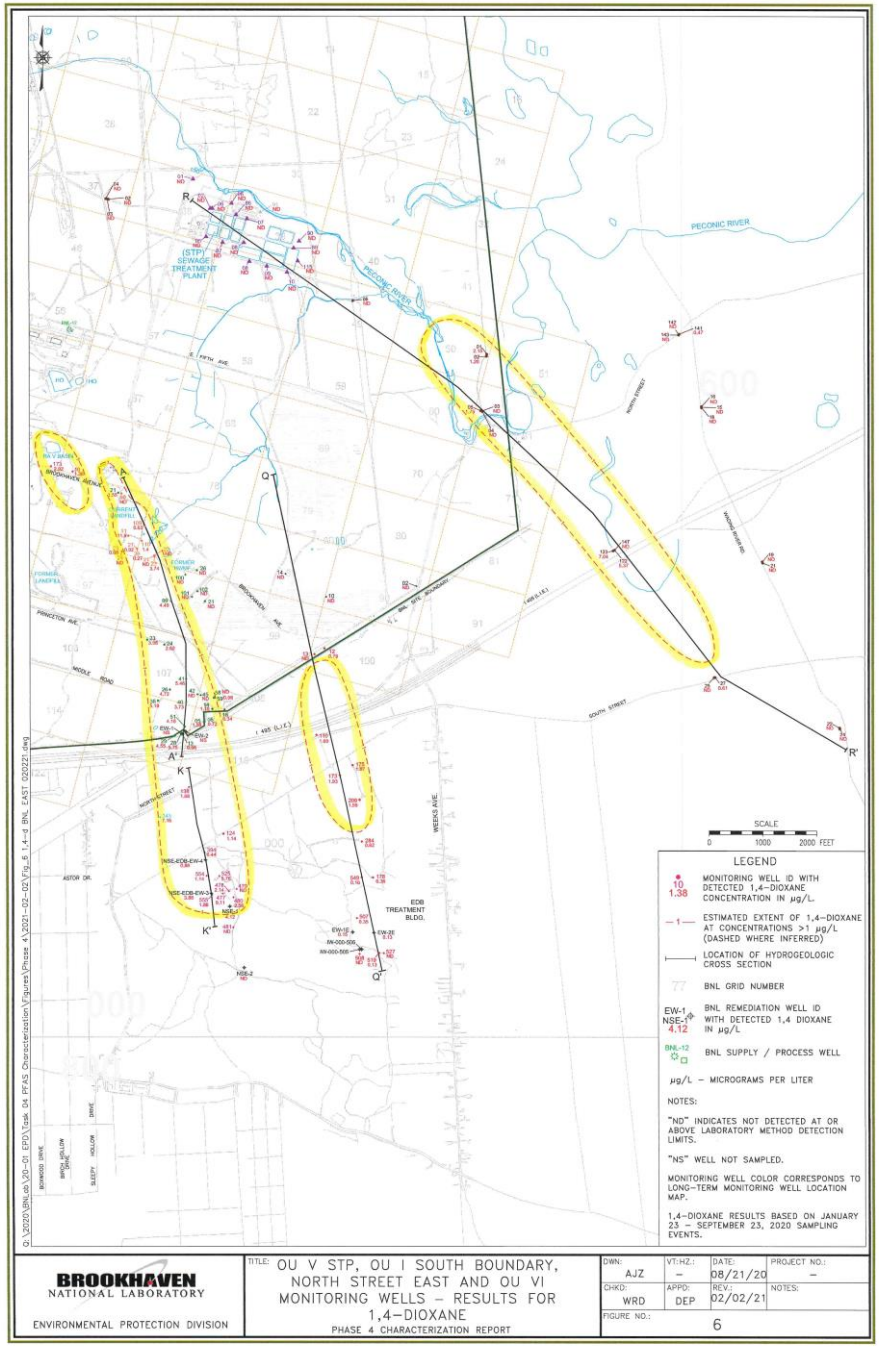
1,4-Dioxane

West-Central Area

- 1,4-dioxane detected >1.0 µg/L in many wells, from the south-central area of the site to the Airport treatment system
  - There are data gaps that need to be filled during the RI
- Concentrations generally <10 µg/L. Highest was ~25 µg/L (Well 119-11)
  - Additional characterization needed to better understand depth and width of 1,4-dioxane
- Concentrations >1 µg/L in on-site and off-site groundwater extraction wells and treatment system effluent
  - Effluent is discharged to basins or injection wells.
  - Impacts detected at OU III and RA V basins. Additional wells are needed to verify impacts in most recharge areas



1,4-Dioxane

Eastern Area

- 1,4-Dioxane detected in areas previously impacted by TCA releases:
  - Current Landfill/FHWMF downgradient to North Street East area
    - Detected up to ~12 µg/L
  - STP/OU V
    - Not detected in groundwater near the STP
    - Site boundary and off-site detected up to ~7 µg/L
- Former Biology agricultural fields – was 1,4-dioxane in pesticides?
  - Off-site northern OU VI EDB area
    - Detected up to ~2 µg/L
- Detected in NSE extraction wells and system effluent up to ~3 µg/L
- No detections in OU VI extraction wells or system effluent