WHITE PLAINS FIRE DEPARTMENT DRILL SCHOOL

1402 OLD ORCHARD STREET
WHITE PLAINS, NEW YORK

Interim Remedial Measures Work Plan

AKRF Project Number: 200217
NYSDEC Site Number: 360193

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CERTIFICATION

I, Rebecca Kinal, P.E., certify that I am currently a NYS registered Professional Engineer as defined in 6 NYCRR Part 375 and that this Interim Remedial Measures Work Plan was prepared in accordance with all applicable statutes and regulations and in substantial conformance with the DER Technical Guidance for Site Investigation and Remediation (DER-10).



Rebecca Kinal, P.E.		05/20/2026
Name	Signature	Date

1.0 INTRODUCTION

This Interim Remedial Measures (IRM) Work Plan has been prepared by AKRF, Inc. (AKRF) on behalf of The City of White Plains (the City) for the property identified as the White Plains Fire Department Drill School (the Site) located at 1402 Old Orchard Street, White Plains, New York. The legal definition of the Site is City of White Plains Tax ID Section 120.20, Block 17, Lot 1, and the property class is identified as Public Services-Water Supply. A Site Location Plan is included as Figure 1. Although indicated as three separate parcels on the tax map, these parcels are identified under a single Tax ID number. The Site is 141 acres of mainly wooded land with small streams, and also includes the Fire Department Drill School (FDDS) within a 4-acre clearing that is located approximately 500 feet east of White Plains Reservoir No. 2, and the Orchard Street Pump Station (OSPS) property and its facilities, located within the western portion of the Site and south-adjacent to Reservoir No. 2. A Site Plan is included as Figure 2.

On September 18, 2020, the City signed a Consent Order (CO) with the New York State Department of Environmental Conservation (NYSDEC) to undertake a site characterization to determine whether per- and polyfluoralkyl substances (PFAS) are present at the Site. A series of investigations were conducted at the Site in accordance with NYSDEC-approved work plans, including a Site Characterization Investigation (SCI) and a Remedial Investigation (RI).

The SCI and RI confirmed two primary PFAS contamination soil source areas on the FDDS site, and a resulting plume emanating from the FDDS site through surface water into East Pond and Reservoir #2. The plume was documented to continue downgradient from East Pond and Reservoir #2 through surface water into the wetland adjacent to the OSPS, and in groundwater beneath the OSPS and wetland. The SCI and RI results documented that the PFAS soil source area continues to be an ongoing source of contamination to groundwater, and continues to add to surface water contamination in an intermittent stream that runs from the FDDS site into East Pond and Reservoir #2 (herein referred to as "the intermittent stream"). Based on these results, AKRF recommended that IRMs be implemented as proactive measures to address the ongoing source of PFAS in soil, groundwater and surface water. An NYSDEC Remedial Investigation Report (RIR) comment letter, dated May 30, 2024, confirmed that an IRM Work Plan should be prepared and submitted for NYSDEC review and approval. This IRM Work Plan presents the IRMs that are proposed to be implemented at the FDDS site. Implementation of the IRMs will be performed in accordance with the Health and Safety Plan and Community Air Monitoring Plan (HASP) provided in Appendix A, and the Quality Assurance Project Plan (QAPP) provided in Appendix B.

A separate Remedial Action Work Plan (RAWP), which would outline the requirements for a Site-wide remedy, would be developed during or following the implementation of this IRM Work Plan.

2.0 SITE CHARACTERISTICS AND HISTORY

2.1 Site Description and Current Usage

The Site is owned by the City of White Plains (the City) and is located at 1402 Old Orchard Street, White Plains, New York. The Site is 141 acres of mainly wooded land with small streams. The Fire Department Drill School (FDDS) is situated within a 4-acre clearing located in the eastern portion of the Site, approximately 500 feet east of White Plains Reservoir No. 2. The Orchard Street Pump Station (OSPS) property and its facilities, also owned and operated by the City, are located within the western portion of the Site, south-adjacent to Reservoir No. 2. The legal definition of the Site is City of White Plains Tax ID 120.20-17-1, and the property class is identified as Public Services-Water Supply. Although indicated as three separate parcels on the tax map, these parcels are identified under a single Tax ID number. A Site Location Map is provided as Figure 1, a Site Plan is provided as Figure 2, and the Project Study Area is shown on Figure 3.

2.2 Surrounding Properties

The Site is bounded to the northwest by Central Westchester Parkway, followed by a City-owned property that contains Reservoir No. 1 and Reservoir No. 2; to the north and northeast mainly by municipal land owned by the Town of North Castle, with some residential properties; to the east by Silver Lake Park (owned by Westchester County) and residential properties; and to the south, southeast, and southwest by residential properties. Reservoir No. 2 is approximately 500 feet west of the FDDS. The Site includes the OSPS property and its facilities.

2.3 Site Topography

Based on previous investigations and reports compiled by the U.S. Geological Survey (White Plains, NY Quadrangle), the surface topography at the Site is a mix of gentle and steep slopes with several isolated rocky peaks that top out between 340 and 365 feet elevation (National Geodetic Vertical Datum of 1929 and an approximation of mean sea level). Several lower lying ravines are present between the rocky peaks and make up the intermittent streams within the Site. Although sloping can be varied due to the various peaks, the Site generally slopes down to the southwest to a low point at the OSPS property at approximately 240 feet elevation.

2.4 Site History

Fire Department Drill School History

Fire Department Drill School (FDDS) has been in operation at the Site since approximately 1960. Prior to 1960, the Site was used by the police department for training exercises. Fire department training included live fire training in several different scenarios. The burn building on the eastern side of the clearing allows for multi-floor, realistic live fire training in a scenario where heat and smoke-filled rooms can be controlled for safety. Small training fires using vehicles, pallets, and furniture were also utilized to understand and anticipate the burn tendencies for many real fire response situations. The City reported historical aqueous film-forming foam (AFFF) usage by the fire department, as summarized below:

- Mid-1960s to mid-1970s: 3M AFFF
- Mid-1970s to 1998: 3M AFFF&ATC

- 1998 to June 2014: Angus AR-FFFP
- June 2014 to present: National Universal Gold AR-AFFF

AFFF was reported to be used sparingly during the training scenarios, due to the cost of using foam versus water, but it was used on occasion. Through interviews with City personnel, near empty barrels of foam and residual foam left in a pump truck after live fire response were reported to be cleaned out and discharged to the ground near the hydrant location on the Site, which is north adjacent to the access road and west adjacent to the stream that runs below the FDDS access driveway at the Site (the intermittent stream).

Reservoir/OSPS History

Reservoir 1 and Reservoir 2 were originally constructed in the early 1900s and have a combined volume of nearly 200 million gallons. The reservoir water supply was initially treated in the 1980s via a 3 million gallon per day (mgd) microstrainer plant located at the OSPS. In the late 1990s, additional filtration was required, and a 1.6 mgd microfiltration (MF) membrane plant was constructed at the OSPS. The MF plant operated from 1999 through 2005 until the membranes became fouled and damaged from iron and manganese precipitation, and the MF plant became too costly to operate. The reservoirs were removed as a water supply source for the City in 2005.

The four shallow cistern wells at the OSPS were constructed in the late 1800s to early 1900s. Three of the four cistern wells were used through 2005 as water supply sources without treatment as they produced generally high-quality water. The fourth well was not used due to lower quality water, attributed to its close proximity to the wetlands, and because pesticides were also detected as part of monitoring. Recent testing has documented that the pesticide contamination is no longer present in the fourth well. In 2006, a determination was made by consultants for the City that the cistern wells were groundwater under the direct influence (GWUDI) of surface water. The cistern wells were taken off-line since the City did not have a treatment measures to address GWUDI. The wells are currently permitted by Westchester County Department of Health to be used only for emergencies under the Permit to Operate a Public Water Supply.

Between 2007 and 2018, the City drilled three deep test wells located at the OSPS site as possible water supply wells. One of the wells was abandoned, and the necessary equipment (pumps, pipeline, and treatment) has not been installed in the remaining two deep wells. These wells have never been used for potable water supply.

With the reservoirs and cistern wells out of service, the water supply for White Plains comes from a sole source provided by purchasing water from New York City's water supply system through the Kensico-Bronx Pipeline. The pipeline is well over 100 years old. White Plains does not have any water source redundancy at this time. The cost for sourcing water from the NYC water supply includes excess demand charges during peak usage based on a per capita guideline which are being incurred up to 6 months out of the year.

In order to provide a much needed back-up water supply source, and to avoid excess charges for usage, the City completed a feasibility review for construction of a new water treatment plant at the OSPS. The feasibility review included a submittal of a Water Withdrawal Permit Application to NYSDEC. After completing the feasibility review, the City determined that it was not economically feasible to move forward with construction of a new treatment facility.

Investigation Background

As reported above, fire suppression foam was used sparingly during training activities at the Site, and residual foam in barrels/pump truck remaining after live fire application was rinsed out and discharged to the ground at the hydrant located north adjacent to the access driveway for the Site.

In September 2019, a Water Withdrawal Permit Application was submitted to NYSDEC for a new in-City water supply treatment facility at the OSPS that would use water from the adjacent reservoir and the cistern wells. Groundwater sampling conducted as part of the requirements of the withdrawal permit identified PFAS in water sampled directly from Reservoir 2 and from the cistern wells.

To identify the source of the PFAS identified during permit sampling, Hazen and Sawyer conducted two phases of investigation on behalf of the City in April 2019 and July 2019. The investigation included the collection of surface water samples from a stream system (including the intermittent stream) that runs through the Site, East Pond, Reservoir #1 and Reservoir #2, and the wetland area north and west of the OSPS, and the collection of groundwater samples from dam piezometer wells along the southern edge of Reservoir #2, and the four cistern wells located on the OSPS property. The majority of the locations were re-sampled in July 2019, which indicated comparative results.

In summary, the results were consistent between the April 2019 and July 2019 sampling events. The ranges of total PFAS detections are as follows.

- Reservoir #1 – 1.4 to 2.3 parts per trillion (ppt)
- Upstream of the FDDS – Not detected to 28.5 ppt
- Surface Water adjacent to the FDDS access driveway – 2,460 to 6,700 ppt
- Surface Water in East Pond – 17.2 to 62.8 ppt
- Surface Water in Reservoir #2 – 141 to 144 ppt
- Groundwater at DP-10 (between East Pond and the OSPS) - 111 ppt
- Dam Piezometers – 199 to 325 ppt
- Cistern Wells at the OSPS – 354 to 531 ppt

Based on the results of the investigations, the FDDS was identified as the potential source for PFAS contamination associated with East Pond, Reservoir #2, and the OSPS. As expected with fire suppression foam being the source of PFAS at the site, the primary contaminant of concern (COC) perfluorooctane sulfonate (PFOS) was detected at a much higher ratio than perfluorooctanoate (PFOA) (typically by one to two orders of magnitude) and made up a large component of the detected total PFAS concentrations.

On September 26, 2019, representatives of the City and NYSDEC attended a meeting to discuss the requirements of the water withdrawal permit and used that opportunity to voluntarily report the results of the PFAS investigation conducted in April and July 2019. The NYSDEC sent a letter to the City on December 4, 2019 identifying the Site as a potential hazardous waste site ("P" site), and a determination was necessary to determine whether hazardous waste had been disposed on the property. The letter indicated that the City could carry out an investigation under a legal agreement with NYSDEC in accordance with subdivision 27-1305(2)(a) of the Environmental Conservation Law (ECL).

3.0 PREVIOUS REPORTS

Site Characterization Work Plan (SCWP) – White Plains Fire Department Drill School, 1402 Old Orchard Street, White Plains, New York, AKRF, Inc., December 2020

AKRF prepared a SCWP for the Site in December 2020. The SCWP included a detailed reporting of Site history and usage. The proposed scope of the investigation included the advancement of soil borings, installation of monitoring wells, and the collection of soil samples, co-located stream sediment and surface water samples, and groundwater samples. The proposed soil sampling plan also included multiple depth sampling intervals [surface (0''-2''), near surface (2''-12''), and deep (water table and/or bedrock interface)] at selected soil boring locations. The investigation was designed to complete a preliminary evaluation of geologic and hydrogeologic conditions, and to confirm whether the FDDS was a source for PFAS compounds identified in groundwater and surface water during previous investigations, and if so, obtain a general depiction of the nature and extent of the PFAS release area.

Site Characterization Report (SCR) – White Plains Fire Department Drill School, 1402 Old Orchard Street, White Plains, New York, AKRF, Inc., April 2022

A Site Characterization Report (SCR) was prepared to document the results of the Site Characterization Investigation (SCI) at the Site that was completed in accordance with the NYSDEC-approved SCWP. The field sampling scope of work consisted of: the advancement of 19 soil borings with continuous soil sampling, the installation of six overburden monitoring wells, and the collection of 35 soil samples, 12 co-located stream sediment and surface water samples, one isolated surface water sample, and 14 groundwater samples (from the cistern wells, dam piezometers, and newly installed overburden monitoring wells) for laboratory analysis. All samples were analyzed for total emerging contaminants, with an array of selected samples being analyzed for leachable emerging contaminants, the full list of NYSDEC Part 375 parameters, and general chemistry parameters. The general chemistry parameters were added as recommended by NYSDEC PFAS guidance document to provide data to assist with understanding the nature and extent of contamination and to evaluate potential interim remedial measures to address the sources of PFAS contamination at the Site.

The investigation did not document any evidence of a release of volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), polychlorinated biphenyls (PCBs), pesticides, or metals. The investigation confirmed elevated concentrations of PFAS compounds were present in soil in the former fire suppression training area north-northeast of the fire training tower (on the southern end of the asphalt parking lot) and west of the burn building (on the eastern side of the asphalt) on the FDDS property, which constitutes the primary PFAS release area. PFAS compounds were detected at elevated, but lower concentrations relative to the fire suppression training area, in the PFAS drum washout area adjacent to the access driveway (considered a secondary source area) and intermittent stream on the FDDS property. The shallow soil samples (0 to 2 feet below grade) at both release areas contained significantly higher concentrations of PFAS relative to the deeper soil samples, supporting a surface release mechanism. The soil sampling results provided release area definition to the east and south, but the extent of PFAS contamination was not fully defined to the north and west of the former fire suppression training area on the FDDS property.

Remedial Investigation Work Plan (RIWP) – White Plains Fire Department Drill School, 1402 Old Orchard Street, White Plains, New York, AKRF, Inc., September 2022

The RIWP was approved by NYSDEC in September 2022, and was prepared to describe the procedures to be used during the continuing investigation to further define the nature and extent of the PFAS source area and plume. The objectives of the RI were to fill data gaps identified by the SCI, complete an ecological study, complete a Quantitative Human Health and Exposure Assessment (QHHEA), and

compile sufficient data to complete a remediation feasibility study and remedy selection in accordance with the NYSDEC Technical Guidance for Site Investigation and Remediation (DER-10).

Remedial Investigation Report (RIR) – White Plains Fire Department Drill School, 1402 Old Orchard Street, White Plains, New York, AKRF, Inc., April 2025

An initial draft RIR was submitted to NYSDEC in February 2024, and the report included a summary of all the field data collected during both the site characterization investigation and the initial remedial investigation. An NYSDEC Draft RIR comment letter, dated May 30, 2024, requested that two additional bedrock monitoring wells be installed and sampled for delineation purposes, and confirmed that an IRM Work Plan should be prepared and submitted for NYSDEC review and approval. The additional field work was completed in October 2024, and an updated draft RIR was submitted to NYSDEC in April 2025. The field sampling scope of work consisted of: the advancement of 16 soil borings, the installation of six new monitoring wells (two overburden wells and four bedrock wells), and the collection of 41 soil samples, eight co-located stream sediment and surface water samples, and 20 groundwater samples. The investigation results documented in the updated RIR confirmed the two primary PFAS source areas on the FDDS, provided delineation of PFAS contamination in overburden soil and overburden and bedrock groundwater, and characterized the nature and extent of PFAS in surface water and sediment.

4.0 SUMMARY OF ENVIRONMENTAL CONDITIONS

This section includes a summary of the data compiled during the SCI and RI completed by AKRF. Site plans showing the sampling locations for the SCI and the RI are included as Figure 4A and Figure 4B.

4.1 Applicable Criteria and Guidance

The previous investigations were completed in accordance with the NYSDEC-approved work plans, which were prepared following the requirements included in NYSDEC DER-10 and the NYSDEC PFAS guidance document titled *Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) – Under NYSDEC's Part 375 Programs (April 2023).* The original NYSDEC PFAS document was released in October 2020, with revisions in January 2021, June 2021, and April 2023, and is referred to herein as the NYSDEC PFAS guidance. The soil guidance values used for the Site include the Commercial Guidance Values (CGVs) for Site use and the Protection of Groundwater Guidance Values (PGWGVs). Sediment results were compared to the freshwater sediment guidance values included in the NYSDEC *Screening and Assessment of Contaminated Sediments, 2014* guidance document. Groundwater and surface water results were compared to the established NYSDEC Ambient Water Quality Standards and Guidance Values (AWQSGVs). In March 2023, NYSDEC released final AWQSGVs for emerging contaminants for sources of drinking water (groundwater and surface water) and fish propagation (acute) and fish survival (chronic) aquatic life. The AWQSGVs include values for PFOA, PFOS, and 1,4-dioxane.

4.2 Geological and Hydrogeological Findings

Geological conditions observed at the FDDS included a surface asphalt layer within a clearing that was underlain by native unconsolidated glacial deposits (till) with isolated pockets of fill. The fill was observed to consist of a sandy mixture combined with organics, wood fragments, concrete, and brick. A gneiss bedrock was encountered below the glacial deposits at depths ranging from 2.5 to 20 feet below grade, but was typically encountered between 4 to 6 feet below grade. The geology surrounding the FDDS clearing included exposed schist and gneiss bedrock with isolated areas of thin overlying glacial deposits. The intermittent stream also contained only thin layers of sediment over bedrock. South of the FDDS clearing, the exposed bedrock receded below grade in the area between East Pond and the OSPS, with 12.5 to 17 feet of native glacial deposits (same geology listed above) being present above bedrock.

The data from both the SCI and RI documented that overburden groundwater was encountered overlying bedrock in approximately half of the 45 soil borings drilled on the FDDS property during the SCI and RI. The borings that encountered groundwater within the overburden correlated to locations where bedrock was encountered typically at greater than 5 feet below grade. This hydrogeologic scenario likely results in isolated pockets of groundwater with restricted groundwater flow, especially on the northern and eastern portions of the FDDS property. Groundwater was measured in October 2022 at depths ranging from 2.84 feet below top of well casing (ftbtoc) in MW-3 (southwestern edge of the asphalt area near the stream) to 8.91 ftbtoc in MW-7 (northern edge of the asphalt area). Overburden groundwater, where interconnectivity exists, is expected to flow in a south-southwest direction from the FDDS property toward the intermittent stream and wetland area. In October 2022, groundwater was encountered in the area west of East Pond at depths of 9.60 ftbtoc in MW-06 to 10.56 ftbtoc. The flatter topography and lower bedrock elevations in this portion of the Site suggests a more consistent zone of overburden saturation as the area transitions downgradient to the OSPS. Groundwater was encountered at depths ranging from 7.51 ftbtoc to 15.56 ftbtoc in the dam

piezometers located within the dam structure on the southern end of Reservoir No. 2. It should be noted that a piezometer contains a solid casing with open bottom (no well screen), and the water level is indicative of the potentiometric hydraulic pressure at the bottom opening of the piezometer, and not the water table elevation.

4.3 Summary of Analytical Results

The analytical results compiled during both the SCI and RI confirmed that there are two primary PFAS release areas: the asphalt area west-adjacent to the burn building, and the drum cleanout area along the access driveway. The asphalt surface west-adjacent to the burn building was identified by total PFAS concentrations in soil that ranged from 280 µg/kg to 439 µg/kg (SB-05 to SB-9, SB-16, and SB-33), and the drum cleanout area adjacent to the hydrant along the access driveway was defined by total PFAS concentrations of 60.7 µg/kg to 173 µg/kg (SB-13, SB-15, and SB-31). A shallow soil total PFAS isocontour map is shown on Figure 5. The release areas converge into the intermittent stream, south of the access driveway. The total PFAS concentrations were comprised primarily of PFOS. The highest PFAS concentrations are in the shallow soil zone (0-2 ftbg) and taper off with depth into the deeper zones down to the bedrock interface, which is typically 5 to 10 ftbg, but up to 20 ftbg.

The RI provided plume definition in soil to the west, south, and southeast of the release areas (defined by SB-23, SB-21/SB-22, SB-29, SB-03, and SB-02) as the concentration of PFOS reduces to 0.89 µg/kg to 8.65 µg/kg. The concentration of PFAS compounds documented in soil samples collected from SB-24, SB-25 to the north, and SB-27 to the east of the release areas ranged from 23 µg/kg to 113 µg/kg. Although these detections may indicate that the extent of contamination is not fully defined, exposed nearby bedrock limits the extent of PFAS soil contamination to the north and east. PFOS concentrations in shallow soil at SB-30, which is downgradient of the release areas, peaked at 40.3 µg/kg (0.2-1 ftbg). Although this result suggests that the extent of the release areas is not defined at this location, exposed bedrock also dominates the land surface further south and defines the release area at this location. PFOS peaked at SB-29, located south of the release areas, at a concentration of 4.04 µg/kg. The laboratory results for soil samples collected from SB-29 and SB-03 (during the SCI) provide for plume definition to the south.

For deep soil, the PFOS results for soil samples collected from the perimeter of the asphalt release area [SB-28 (10-11 ftbg), SB-33 (13-14 ftbg), and SB-34 (10-11 ftbg)] ranged from 8.4 µg/kg to 47.7 µg/kg. This was consistent with the sampling results from the SCI, where the concentrations in the deep soil samples ranged from 4.87 to 43.1 surrounding the release area high points of SB-09 (6-7) at 283 µg/kg and SB-13 at 59.7 µg/kg. The RI confirmed that the highest PFAS concentrations are in shallow soil, the concentrations reduce with depth, and also reduce moving away from the two release areas. A deep soil total PFAS isocontour map is included on Figure 6.

The sediment and surface water sampling on the FDDS site documented that PFAS concentrations tapered off going upstream of the soil source areas, and SW-15 (approximately 120 feet north of the drum cleanout area) identifies an upgradient delineation point. Figure 7 documents the sediment and surface water exceedances for PFAS at the FDDS site. The results indicate that the PFOS concentrations in surface water at the source area and immediately downstream range from 290 ng/L to 704 ng/L, drop to 30.9 ng/L to 34.9 ng/L in the reservoir, and range from 7.87 ng/L to 53.6 ng/L in the wetland west of the OSPS. The sediment and surface water sampling in the wetland indicated a low level, widespread dispersion of PFAS compounds with leachable results in the sediment being below the screening criteria.

The groundwater sampling results compiled during both the RI and SCI document PFAS contamination being detected in overburden groundwater across the FDDS, East Pond, perimeter of Reservoir No. 2, and OSPS portions of the Site. As shown on the PFAS isoconcentration map on Figure 8A, the highest levels of groundwater contamination were observed within the overburden monitoring wells MW-2R (asphalt source area well) and MW-3 (downgradient edge of the asphalt source area). PFAS concentrations were one order of magnitude lower within monitoring wells MW-04 (located downgradient within the access driveway on the FDDS) and MW-01 (located at the northern edge of the asphalt-paved parking lot at the FDDS, upgradient of the two potential release areas on the FDDS site). PFAS contamination in overburden groundwater was detected at two to three orders of magnitude lower within groundwater samples collected at the East Pond, perimeter of Reservoir No. 2, and the cistern wells when compared to the FDDS source area wells (MW-02 and MW-03).

The PFAS plume area in overburden groundwater was in direct contact with a shallow, highly foliated and fractured gneiss bedrock, and this provided a pathway for PFAS to migrate into the shallow bedrock aquifer. The PFAS concentration in bedrock groundwater near the source area (MW-9) was two orders of magnitude higher than at locations at the perimeter of the FDDS, and three orders of magnitude higher than bedrock groundwater at East Pond. These results follow the overburden trend where concentrations dissipate moving away from the source area, and also suggest that the bedrock aquifer does not have a strong horizontal fracture connection with lateral groundwater flow, and the presence of PFAS in bedrock groundwater is more driven by vertical infiltration from the overlying overburden aquifer. Site-wide PFAS concentrations above the NYSDEC AWQSGVs, to include concentrations within the bedrock wells, are provided on Figure 8B.

4.4 Conceptual Site Model

Two potential release mechanisms were confirmed at the Site. The first included the direct discharge of fire suppression foam during firefighter training to the asphalt surface in the area west of the burn building, and the discharge of foam at the burn building. The second included the reported clean-out of residual foam from the pump truck, and also what was left over in barrels after fighting live fires. The clean-out took place at the hydrant location north-adjacent to the access driveway to the Site and west-adjacent to the culvert for the stream that runs beneath the access driveway. The rinsed material was reported to be discharged directly to the ground.

Fire suppression foam applied at the Site burn building and on the asphalt surface during training exercises would collect on the asphalt surface and flow downgradient to a grass covered area on the southwestern side of the Site clearing prior to discharging into the stream that runs under the access driveway for the Site. The foam fluid could also infiltrate through cracks in the asphalt, contaminate the thin layer of soil beneath the asphalt, and migrate with infiltrating precipitation down the slope (along the bedrock surface beneath the asphalt) toward the stream. Depth to groundwater measured at MW-2 and MW-3, at the southwestern end of the asphalt area, was near the ground surface (within a foot). This supports a groundwater discharge to the intermittent stream, and also could result in localized flooding (groundwater discharge to ground surface) during high water table conditions.

For the used drum/pump truck cleanout, which took place at the hydrant location in the access driveway, the residual foam would discharge directly to the asphalt surface and flow into the stream that runs beneath the hydrant location.

Both release models converge in the stream just downgradient from the access driveway, and flow approximately 450 feet on exposed bedrock, or a thin layer of silt over bedrock, to East Pond. Surface water from East Pond flows through two large diameter pipes directly into

Reservoir No. 2, and overflow from Reservoir No. 2 discharges into the low-lying wetland west-adjacent to the OSPS. Lateral flow is not expected from this stream channel as it is a topographical low point within exposed bedrock outcrops along each bank.

The land area west-adjacent to East Pond appears to be the on-site location where enough overburden is present to allow for the existence of a continuous overburden aquifer. Any discharge from the East Pond overburden groundwater would flow west beneath the OSPS to the low-lying wetland.

5.0 INTERIM REMEDIAL MEASURE OBJECTIVES

Previous investigations at the Site have identified two primary PFAS release areas: the asphalt area west-adjacent to the burn building, and the drum cleanout area along the access driveway. The investigation results demonstrate that the release areas are an ongoing source of contamination to groundwater and surface water. The objective of the IRM is to complete actions that mitigate the identified sources of contamination, and address the contaminated surface water flowing into East Pond and Reservoir #2. The actions proposed during the IRM include:

Soil:

- Asphalt Area: hot spot soil excavation and removal to bedrock. The asphalt area west-adjacent to the burn building contains the highest concentration of PFAS compounds in soil. The hot spot is generally defined by the area within the 200 part per billion (ppb) contour line identified in the shallow soil and deep soil isocontour maps (as shown on Figure 5 and Figure 6), and is estimated to be approximately 120 feet by 60 feet (as shown on Figure 9).

Soil/Groundwater:

- Drum Cleanout Area: The drum cleanout area, which is also downgradient of the asphalt clearing, is east adjacent to the intermittent stream and contains elevated levels of PFAS compounds in soil. Water table elevation data suggests that groundwater in the drum cleanout area is potentially discharging to the wetland/stream. An in-situ passive barrier treatment system (PBTS) will be installed within a trench located parallel and adjacent to the stream culvert (Figure 10). The PBTS will be backfilled with a powder-coated aggregate that allow movement of water through the matrix while binding to and minimizing leachability of PFAS contamination. The PBTS technology is designed to limit the ability for PFAS to enter the stream and continue along the migration pathway (towards the reservoir) identified in the CSM.

Groundwater:

- Localized groundwater removal from the hot spot soil excavation. Groundwater from the hot spot soil excavation will be collected using two methods:
  - Mobile sumps placed into the excavation during soil removal
  - Placing saturated excavated soil into a designed containment structure to collect and treat the contaminated groundwater decanted from the stockpile (wet excavation dewatering).

  The collected groundwater will be treated on-Site using a mobile treatment system (granular activated carbon drums) and reintroduced back into the excavation. These steps are designed to treat the PFAS contaminated groundwater migrating from the source area during remedial activities.
- In-situ groundwater treatment in the Asphalt Area hot spot soil excavation using a spray application of a liquid-based solution composed of fine particles of colloidal activated carbon. The material sorbs to and prevents further movement of PFAS compounds in groundwater allowing the downgradient plume to attenuate.
- Groundwater treatment injections. Groundwater treatment, outside of the soil source areas, will be completed by injecting the liquid based colloidal activated carbon solution into the saturated zone using direct push technology. The injections will be conducted along two linear transects llocated on the western/downgradient side of the asphalt clearing to expand the groundwater treatment zone area beyond the soil hot spot locations. The objective is to limit the potential for PFAS contaminated groundwater to migrate from the asphalt clearing towards the wetland and intermittent stream.

Surface Water – Pilot Program:

- Intermittent Stream: Installation, operation, and maintenance of one (1) permeable flow through filtration unit for in-situ treatment of surface water flow within the intermittent stream running from the FDDS site to East Pond. The filtration unit will be a site-specific design consisting of horizontally arranged treatment socks that are filled with an aggregate coated with an adsorbent material specifically designed to treat PFAS compounds. The treatment socks will allow for movement of water through the treatment matrix while binding to and minimizing the mobility of PFAS contamination in surface water.

The following Sections include a description of the elements for each of the IRMs listed above, and how they will be applied at the Site. It is anticipated that upon NYSDEC-approval of the IRM approach, the IRMWP will be followed by a IRM Design Document (IRMDD). The purpose of the IRMDD is to include the engineering design details for the IRMs proposed in the IRMWP and approved by NYSDEC to be used at the Site. The IRMDD is described in Section 11.

After completing the IRMs, the remaining remediation requirements for the Site will be addressed as part of a full site remedy that will be documented in a Remedial Action Work Plan.

6.0 SITE PREPARATION

The Site is owned by the City, only City personnel and approved parties are allowed access, and the Site is secured with a chain link fence and locking gate that prevents public access. Prior to conducting any intrusive IRM activities, the work zone(s), designated entry points, soil stockpile staging areas, decontamination zones, and truck routes will be established on a site plan, as applicable. The site plan will be updated as necessary to reflect any changes in operations during the intrusive work. Dust and odor control measures will be implemented as outlined in Section 7.5 and 7.14. Additional details of site preparation activities are provided in the following sections.

6.1 Mobilization

Site mobilization involving site security setup, installation of additional fencing and barriers (where applicable), erosion control measures, construction of decontamination and materials staging areas, equipment mobilization, utility mark outs and marking and staking excavation areas will be performed prior to undertaking any IRM excavation work.

6.2 Erosion and Sedimentation Controls

Erosion and sediment control measures will be installed at the Site prior to conducting any ground-intrusive work in accordance with the protocols presented in NYS Guidelines for Urban and Erosion Sediment Controls. The control measures will include procedures for perimeter Site/stockpile controls, stabilized construction entrance pads, equipment decontamination, drainage inlet protection, and dust suppression, as applicable.

6.3 Stabilized Construction Entrance(s)

A crushed stone path will be constructed at all truck entrances and exits. All trucks will drive over the path prior to leaving to ensure that they do not get re-contaminated prior to departure from the Site. A laborer will check the trucks as they leave, and will use a hose, shovel, and/or broom to clean the truck tires and body as it leaves the Site, as necessary.

6.4 Utility Marker and Easements Layout

The City and its contractors are solely responsible for the identification of utilities that might be affected by work under the IRM and implementation of all required, appropriate, or necessary health and safety measures during performance of work under this IRM. The City and its contractors are solely responsible for safe execution of all invasive and other work performed under this IRM. The City and its contractors must obtain any local, State or Federal permits or approvals pertinent to such work that may be required to perform work under this IRM. Approval of this IRMWP by NYSDEC does not constitute satisfaction of these requirements.

6.5 Support of Excavation

Appropriate management of structural stability of all excavations and on-site or off-site structures during on-site excavation activities is the sole responsibility of the City and its contractors. The City and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan. The City and its contractors must obtain any local, State or Federal permits or approvals that may be required to perform work under this Plan and/or where permit equivalency cannot be granted. Further, the City and its contractors are solely responsible for the implementation of all required, appropriate, or necessary health and safety measures during performance of work under the approved Plan.

6.6 Equipment and Material Staging

Staging and storage of equipment and materials will be contained within the secured site. By the nature of the work involved in this project, equipment and materials will be moved to different areas within the secured site as work progresses.

6.7 Decontamination Area

A decontamination area will be established in accordance with the HASP. All equipment in direct contact with known or potentially contaminated material will be either dedicated or decontaminated prior to handling less contaminated material or removal from the Site. All liquids used in the decontamination procedure will be collected, stored and disposed of in accordance with federal, state and local regulations. Personnel performing this task will wear the proper personal protective equipment as prescribed in the HASP.

6.8 Demobilization

After completing the scope of the IRM, equipment will be decontaminated prior to removal. Upon completion of the remedial excavation work, any waste materials (i.e., plastic sheet, absorbent pads, refuse) and the decontamination pad will be removed from the Site and properly disposed of. Areas that have been disturbed to accommodate support and temporary access areas will be restored.

7.0 IRM – SOIL EXCAVATION AND SOURCE AREA GROUNDWATER TREATMENT

The proposed IRM will include excavation and removal of the PFAS soil hot spot source in the asphalt area and treatment of excavation groundwater (wet dewatering and in-situ treatment). The hot spot source area is generally identified as the area within the 200 ppb total PFAS contour line, as depicted in Figure 6 (Shallow Soil Isocontour Map) and Figure 9 (Proposed Soil Hot Spot Excavation Plan). The area to be removed is estimated to be approximately 120 feet by 60 feet and is located at the asphalt area west-adjacent to the burn building.

Excavation for removal of the PFAS soil hot spot is anticipated to extend to bedrock, and at most locations extend below the water table. This will require the control of PFAS contaminated groundwater during the excavation process. Due to the low permeability soils, isolated bedrock peaks above the water table, and the anticipated lateral extent of the excavation, the preferred method for management of water-saturated soil excavated from below the water table includes "wet dewatering". Wet dewatering will be performed by placing saturated excavated soil into a fabricated structure that will allow the saturated stockpile to decant into a surface level groundwater collection unit. Intermittent use of in-excavation pumps is also anticipated, likely at the start of a workday, or to address an area of pooling water.

Prior to initiating the excavation work, the wet dewatering structure(s) will be installed immediately adjacent to the excavation. The wet dewatering structure(s) will be constructed in a manner that allows the soil to decant onto polyethylene sheeting, membrane, or equivalent, and direct the flow of groundwater into a collection area/sump. The wet dewatering units will be protected with control measures (i.e., line barriers, hay bales, etc.) to retain all decanted groundwater. Stockpile methods are discussed further in Section 7.2.

The accumulated liquids will be managed via an above-grade pump and treat system. Water collected in the dewatering structures, or pumped directly from the excavation, will be transferred to a holding tank (frac tank) to reduce sediment load. The water will then be transferred from the frac tank and through granular activated carbon drums prior to returning the groundwater back to the excavation. Excavation dewatering is discussed in Section 7.3.

All excavations will be considered open excavations and will be managed according to applicable local, State, and Federal regulations. The Owner and its contractors will be responsible for safe execution of all invasive and other work performed under this Plan. The presence of utilities and easements on the Site will be investigated by the City of White Plains and the Remedial Engineer. It will be determined whether a risk or impediment to the planned work under this IRMWP is posed by utilities or easements on the Site.

Due to excavation extending down to bedrock, endpoint samples will be collected from the sidewalls of the PFAS hot spot source area excavation in accordance with DER-10 sampling frequency requirements of 1 sample per 30 linear feet, but no bottom samples will be collected.[1] Due to the variable depth to bedrock on-site in the proposed excavation area (estimated between 2 and 12 feet bgs), sidewall samples will be collected from the 1-2 foot interval above the observed groundwater table or at bedrock, whichever is shallower. The samples will be submitted for laboratory analysis to document that residual PFAS contamination level following the remedial excavation work. All intrusive excavation work will be conducted in accordance with the procedures defined in the HASP and CAMP (Appendix A).

[1] In the event excavation to bedrock is not achievable, bottom samples will be collected in accordance with DER-10 5.4(b)2.5 (one bottom sample per 900 square feet of bottom area).

7.1 Soil Screening Methods

Visual, olfactory, and PID soil screening and assessment will be performed under the direction of a qualified environmental professional during all IRM excavations into known or potentially contaminated material.

Currently there is no field-based equipment capable of detecting PFAS compounds in soil. All excavated soil will be separated and stockpiled in accordance with Section 7.2. During the excavation activities, monitoring will still include inspecting soil for heavy staining, sheen, odors, or other evidence of gross contamination, and field screening for the presence of VOCs with a PID.

In addition to the soil screening activities during excavation, work zone air monitoring for VOCs will be performed according to the HASP, and perimeter monitoring will be conducted in accordance with the CAMP. The HASP and CAMP document is included as Appendix A.

The final excavation limits and amount of excavated soil will be measured and documented by field personnel.

7.2 Stockpile Methods

Soil characterization, either pre-excavation for live loading, or sampling of stockpiles, will be conducted in accordance with the requirements of the intended receiving facilities. Soil excavated from above the water table (unsaturated) will be placed in designated stockpiles. Each soil stockpile will be located based on security, or ease of loading onto haul trucks and will be placed on sheeting and kept fully covered whenever excavation and/or loading operations are not occurring with an appropriately anchored tarp or min 6-mil poly sheeting. Each stockpile cover will be routinely inspected to ensure adequate cover. If a damaged tarp/poly sheeting cover is observed, it will be promptly replaced. Soil stockpiles will be continuously encircled with a berm and/or silt fence as necessary to prevent runoff off-Site or to uncontaminated locations on-Site. Hay bales and/or other erosion and sediment controls will be used as needed near any catch basins or other discharge points. Soil excavated during the IRM will not be reused on-site.

Saturated soil excavated from below the water table will be placed in a fabricated wet dewatering structure that will allow the saturated stockpile to decant into a surface level groundwater collection unit. Prior to initiating the excavation work, the wet dewatering structure(s) will be installed immediately adjacent to the excavation. The wet dewatering structure(s) will be constructed in a manner that allows the soil to decant onto polyethylene sheeting, membrane, or equivalent, and flow into a groundwater collection area/sump. The wet dewatering units will be protected with control measures (i.e., line barriers, hay bales, etc.) to retain all decanted groundwater.

The location and classification of each stockpile and wet dewatering unit location will be tracked on Site drawings and updated, if necessary, at the end of each workday. Copies of Site drawings will be kept in the field logbook.

7.3 Excavation Dewatering - Fluids Management

All liquids removed from the excavation (e.g. accumulated stormwater and groundwater) will be managed via an above-grade treatment system, which will transfer the collected/decanted groundwater from the dewatering stockpile system into a holding (frac or equivalent) tank for sediment reduction, and then through carbon treatment for contaminant removal, before returning the treated groundwater back to the excavation. Prior to the treatment system being placed online, and at specified intervals during treatment, laboratory testing will be conducted to confirm that

the system design is operating effectively, and the effluent shows a significant reduction compared to the influent concentrations (i.e., greater than 90% reduction). After initial startup, monitoring frequency shall be bi-weekly during the treatment system operation. A totalizer will be used as part of the treatment system discharge to confirm the total gallons of treated groundwater that is returned to the excavation.

If there is a need for off-site disposal, contaminated groundwater will be transported and disposed of at an appropriate disposal facility in accordance with applicable local, State, and Federal regulations. NYSDEC and NYSDOH will be notified of the disposal location and methods, and the appropriate documentation, including characterization and manifest documentation, will be included in the construction completion report.

7.4 Air Monitoring

Work zone and community air monitoring will be conducted during all work identified in this IRM. The work zone air monitoring will be completed in accordance with the site-specific HASP and CAMP, which are provided in Appendix A.

7.5 Site Control Measures

The potential off-site transport of sediment, dust, and organic vapors potentially generated during soil excavation activities will be controlled by: placing stockpiles on and covering soil stockpiles and/or open excavations with 6-mil polyethylene sheeting; decontaminating equipment used for soil excavation/sampling; and providing erosion and sedimentation controls in accordance with this Section. In addition to the Site control measures listed above, a perimeter air monitoring will be implemented during all intrusive activities. The procedures for perimeter air monitoring are included in the HASP and CAMP document located in Appendix A and includes protocols for the monitoring of dust and organic vapors. The CAMP includes screening levels, and a response plan that is consistent with the NYSDOH CAMP requirements. These measures will be employed according to the requirements of all applicable or relevant and appropriate Federal, State and local laws.

7.6 Remedial Performance Evaluation

Post-excavation endpoint soil samples will be collected to evaluate the effectiveness of excavation as the chosen soil remedial method. This Section includes the methods to be implemented for soil sample collection.

7.6.1 End-Point Sampling Frequency

Per NYSDEC DER-10 Section 5.4, side-wall samples will be collected a minimum of one sample for every 30 linear feet.

7.6.2 End-Point Soil Sampling Objectives

The proposed size of the excavation was chosen based on a variety of factors including, but not limited to: safety, logistics, truck traffic, equipment/stockpile management, and targeted removal of the area of highest historical PFAS concentrations in overburden soil.

If any of the initial post-excavation sidewall samples from the Proposed Soil Excavation Area exceed a total PFAS concentration of 200 ppb, the excavation will be advanced two additional feet along the 30-foot section of sidewall represented by the exceedance and a supplemental endpoint sample will be recollected. The process will not be repeated as the

objective of this IRM is targeted source material to inform appropriate, safe, and cost-effective measures for additional remediation to be performed under a future RAWP.

7.6.3 Methodology

Each endpoint sample collected from the excavation will be analyzed for total PFAS compounds by EPA Method 1633. Samples will be shipped to the laboratory with appropriate chain of custody documentation. The samples will be analyzed in a laboratory following NYSDOH ASP Category B deliverables.

7.6.4 Quality Assurance/Quality Control (QA/QC)

Measures will be taken to provide for QA and maintain QC of environmental sampling and remedial activities conducted under the IRMWP. A QAPP that describes the QA/QC protocols and procedures that will be followed during implementation of the IRM is included in Appendix B. Adherence to the QAPP will ensure that defensible data will be obtained during the implementation of the IRM.

7.6.5 Data Usability Summary Reports

A DUSR will be prepared for all laboratory analytical results, which will be prepared by a third-party validator.

7.7 Decontamination

Sampling equipment (hand auger, shovels, etc.) will be either dedicated or decontaminated between sampling locations. The decontamination procedure will be as follows:

1. Scrub using tap water/Alconox® mixture and bristle brush.
2. Rinse with tap water.
3. Scrub again with tap water/ Alconox® and bristle brush.
4. Rinse with tap water.
5. Rinse with distilled water.
6. Air-dry the equipment, if possible.

Excavation equipment including the excavator bucket will be decontaminated prior to being mobilized off-Site by steam cleaning using a tap water/Alconox® solution. Decontamination of all equipment will be conducted on plastic sheeting (or equivalent) that is bermed to prevent discharge to the ground. The decontamination fluids will be either containerized for off-site disposal, or disposed of through the on-site treatment system described in Section 7.3.

7.8 Materials Load Out

A qualified environmental professional or person under his/her supervision will oversee all load-out of all contaminated excavated material for off-site disposal. The City and its contractors are solely responsible for safe execution of all invasive and other work performed under this Plan. Loaded vehicles leaving the Site will be appropriately lined, hard-tarped, manifested, and placarded in accordance with appropriate Federal, State, local, and NYSDOT requirements (and all other applicable transportation requirements). The qualified environmental professional will be responsible for ensuring that all egress points for vehicle and equipment transport from the Site are clean of dirt and other materials derived from the Site during intrusive excavation activities.

7.9 Materials Transport Off-Site

All transport of materials will be performed by licensed haulers in accordance with appropriate local, State, and Federal regulations, including 6 NYCRR Part 364. Haulers will be appropriately licensed and trucks properly placarded. Material transported by trucks exiting the Site will be covered with a tight-fitting tarp. Loose-fitting canvas-type truck covers will be prohibited. Proposed in-bound and out-bound trucks will travel the most appropriate route and take into account: (a) limiting transport through residential areas and past sensitive sites; (b) use of mapped truck routes; (c) limiting total distance to major highways; (d) promoting safety in access to highways; and (e) overall safety in transport. Trucks will be prohibited from stopping and idling in the residential neighborhoods outside of the Site. To the extent possible, queuing of trucks will be performed on-Site to minimize off-Site disturbance. The proposed truck route map is provided on Figure 11.

7.10 Materials Disposal Off-Site

Disposal locations will be established at a later date and will be reported to the NYSDEC Project Manager prior to removal of material from the Site. Samples will be collected in-situ and/or from soil stockpiles, and analyzed for waste characterization purposes in accordance with the disposal facility requirements.

1. All excavated soil and fill material that is removed from the Site will be treated as regulated material and will be disposed in accordance with all local, State (including 6NYCRR Part 360) and Federal regulations. Material that does not meet Track 1 unrestricted SCOs is prohibited from being taken to a New York State recycling facility (6NYCRR Part 360-16 Registration Facility). Non-hazardous historic fill and contaminated soil taken off-Site will be handled, at minimum, as a Municipal Solid Waste per 6NYCRR Part 360-1.2.
2. Non-hazardous and hazardous soil/fill determination will be decided upon completion of sampling performed during the waste characterization activities and in discussion with NYSDEC.

The following documentation will be obtained by the QEP (under supervision of the Remedial Engineer) for each disposal location used in this project to fully demonstrate and document that the disposal of material derived from the Site conforms with all applicable laws: (1) a letter from the QEP or the City to the receiving facility describing the material to be disposed of and requesting formal written acceptance of the material. This letter will state that material to be disposed of is contaminated material generated at an environmental remediation Site in New York State. The letter will provide the project identity and the name and phone number of the QEP. The letter will include as an attachment a summary of all chemical data for the material being transported; and (2) a letter from the receiving facility stating it is in receipt of the correspondence (above) and is approved to accept the material.

7.11 Materials Reuse On-Site

It is anticipated that all soil excavated as part of the IRM will be disposed of off-site. In the event that non-hazardous material is proposed for potential on-site reuse, it will be managed in accordance with protocols in this Section.

Contaminated soil, or any material in direct contact with the contaminated soil, may not be separated for reuse on-site and will be disposed of as described in Section 7.10. Organic matter (wood, roots, stumps, etc.) or other solid is prohibited for reuse on-site. Any demolished material, including any concrete slabs and the existing asphalt, will be disposed of in accordance with all

prevailing Federal, State, and local regulations. Soil that does not exhibit evidence of contamination during field screening (as described in Section 7.1) and is free of debris will be stockpiled, tested, and characterized in accordance with the sampling frequencies outlined in DER-10 Table 5.4(e)10 for reuse below the Site cover. Each sample will be tested for TCL VOCs by EPA Method 8260, TCL SVOCs by EPA Method 8270, PCBs by EPA Method 8082, pesticides by EPA Method 8081, TAL metals by EPA Method 6000/7000 series, and PFAS by EPA Method 1633. Samples will be shipped to the laboratory with appropriate chain of custody documentation. The samples will be analyzed in a laboratory following NYSDOH ASP Category B deliverables. Soil from representative samples that meet the lower or RRSCOs and PGWSCOs can be reused on-site, after submission of the data to and approval from the NYSDEC project manager. Soil reuse placement within 50 feet of surface water and/or wetlands will also be subject to the Protection of Ecological Resources Soil Cleanup Objectives (PERSCOs). All sampling of materials for potential reuse will be conducted in accordance with the QAPP included in Appendix B.

7.12 Source Area Groundwater Treatment

Prior to backfilling the hot spot excavation, a liquid composed of fine particles of colloidal activated carbon suspended in water (Regenesis® SourceStop® - Liquid) will be sprayed into the base and sidewalls of the open excavation (within the water bearing zone) to infiltrate the sorbent into the glacial sediments and the fractured bedrock surface. When applied to saturated media, the SourceStop® liquid permanently coats the soil and bedrock material, and the carbon particles sorb to and minimize further movement of dissolved PFAS contamination in groundwater. After applying SourceStop® Liquid, the excavation will be filled to grade with backfill material as described in Sections 7.13 and 7.15.

A technical specification sheet for the SourceStop liquid is included in Appendix C.

7.13 Backfill from Off-Site Sources

Material from industrial sites, spill sites, or other environmental remediation sites or potentially contaminated properties will not be imported to the Site. All imported soil will meet the backfill and cover soil quality standards established in 6 NYCRR 375-6.7(d). Approval will also be based on an evaluation of the land use, protection of groundwater, and protection of ecological resources criteria. Backfill that will be placed within 50 feet of surface water and/or wetlands will also be subject to the PERSCOs. Soil will be considered appropriate for use as on-Site imported backfill if contaminant concentrations are below the lesser of the 6 NYCRR Part 375 Restricted Residential and Protection of Groundwater SCOs. Soil that meet 'exempt' fill requirements under 6 NYCRR Part 360, but do not meet backfill or cover soil objectives for this Site, will not be imported onto the Site without prior approval by NYSDEC. Solid waste will not be imported onto the Site.

Native material from a New York State Department of Transportation (NYSDOT) designated virgin quarry source will not be sampled prior to use as backfill on the Site. Non-DOT designated virgin quarry sources, or non-virgin imported material that does not have an approved NYSDEC Beneficial Use Determination will be tested at the originating facility in accordance with Section 5.4(e) 10 of NYSDEC DER 10, and at a frequency indicated by the following table:

NYSDEC DER-10 Table 5.4(e) 10
Recommended Number of Soil Samples for Soil Imported To or Exported From a Site

	VOCs (EPA Method 8260)	SVOCs (EPA Method 8270), Inorganics (EPA Method 600/7000 Series, PCBs/Pesticides (EPA Methods 8082/8081) & PFAS (EPA Method 1633)	
Soil Quantity (cubic yards)	**Discrete Samples**	**Composite Samples**	**Composite Sample Protocol**
0-50	1	1	3-5 discrete samples from different locations in the fill being provided will comprise a composite sample for analysis
50-100	2	1	
100-200	3	1	
200-300	4	1	
300-400	4	2	
400-500	5	2	
500-800	6	2	
800-1,000	7	2	
>1,000	Add an additional 2 VOC and 1 composite for each additional 1,000 cubic yards or consult with NYSDEC		

After compliance with the above import criteria is established for a specific source, adjustment of the sampling frequency may be requested by the NYSDEC.

Samples will be analyzed for VOCs using EPA Method 8260, SVOCs using EPA Method 8270, TAL metals using EPA Method 6000/7000 series, PCBs using EPA Method 8082, pesticides using EPA Method 8081, and PFAS using EPA Method 1633. All sampling of imported backfill will be conducted in accordance with the QAPP included in Appendix B.

All sampling data and source information will be submitted to NYSDEC for review and approval prior to importing backfill to the site by submitting a request to import/reuse fill or soil from the NYSDEC Project Manager.

Backfilling of the IRM excavation will not occur until the associated endpoint or sidewall samples indicate that the IRM cleanup objective has been met. Due to the anticipated size of the excavation (approximately 60 feet by 120 feet), and the need to maintain safe control of an open excavation and safe site logistics for equipment and personnel, completed portions of the excavation will be backfilled (after confirmation that the IRM objectives have been met) while expanding the excavation in other areas. In areas where excavation was achieved down to bedrock and there are no adjacent sidewall samples, backfill may be placed once the on-Site QEP has documented the final excavation depths.

7.14 Odor, Particulate, and Nuisance Controls

Odor Controls

Specific odor control methods to be used during implementation of the IRM will include the use of a PID to screen for VOCs and olfactory observations by a field technician. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. The NYSDEC and NYSDOH project managers will be notified of all odor events and of any other complaints about the project.

All necessary means will be employed to prevent on- and off-site nuisances. At a minimum, procedures will include: (a) limiting the area of open excavations; (b) shrouding open excavations

with tarps or covers; and (c) using foams to cover exposed odorous soil. If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: (d) direct load-out of soils to trucks for off-site disposal; (e) use of chemical odorants in spray or misting systems; and, (f) use of staff to monitor odors in surrounding neighborhoods.

Where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

Particulate Controls

Particulate management during invasive on-site work will include, at a minimum, the items listed below and is further detailed in the Site-specific HASP and CAMP, included in Appendix A:

- Site fencing will be adequately constructed of plywood and/or chain-link fencing with a mesh fabric fence screen as an engineering control to help contain dust and debris during remedial activities.
- Particulate suppression will be achieved through the use of a dedicated hose connected to a fire hydrant. The hose will be equipped with a nozzle capable of spraying water directly onto off-road areas including excavations and stockpiles.
- Clearing and grubbing of the Sites will be done in stages to limit the area of exposed, non-vegetated soils vulnerable to airborne particulate production.
- Crushed stone will be used on on-site roadways to provide a clean and dust-free road surface.
- On-site roads will be limited in total area to minimize the area required for water spraying.

Other Nuisances

A plan for rodent control will be developed and utilized by the contractor prior to and during Site clearing and Site grubbing, and during all remedial work.

7.15 Site Restoration

The excavation and soil removal will be conducted as the initial phase of the IRM. After the soil removal and in-excavation groundwater treatment, the excavation will be backfilled to grade using the import process described in Section 7.13. During the backfill process, the fill will be compacted in 2-foot lifts, and finished at the surface with compacted road base gravel. The final restoration plan includes a new asphalt surface for the access driveway and full extent of the current asphalt clearing (approximately 165 feet by 300 feet). The asphalt cover is currently in poor condition, and a new asphalt surface is anticipated to help minimize rainwater infiltration in the asphalt clearing. The existing asphalt above the hot spot excavation area will be disposed of along with the excavated soil, with the remaining asphalt areas (e.g., outside of the hot spot excavation area, driveway, etc.) to be covered by new asphalt. In the event disposal of additional asphalt is required, it would be sampled and disposed of in accordance with the receiving disposal facility's requirements.

7.16 Existing Monitoring Well Abandonment

Considering that the terminus of MW-2 is above bedrock and is located within the proposed excavation area that extends to bedrock, MW-2 will be removed by excavator as part of the excavation activities. In the event complete removal of the monitoring is not achievable as part of

the IRM, the remainder of the MW-2 will be abandoned by grouting-in-place utilizing a tremie pipe in accordance with the well abandonment procedures detailed in NYSDEC CP-43: Groundwater Monitoring Well Decommissioning Policy.

8.0 IRM – PASSIVE BARRIER TREATMENT SYSTEM

An in-situ passive barrier treatment system (PBTS) is proposed to be installed in the former drum cleanout area. The PBTS will be installed by excavating a trench located parallel/adjacent to the stream culvert down to bedrock, and backfilling with AquaGate+RemBind®, a PFAS remediation product developed by AquaBlock®. The soil excavation work associated with installation of the PBTS, including screening, stockpiling, soil characterization and disposal, and groundwater management, will be completed in accordance with the soil handling procedures described in Section 7.0. The location of the proposed PBTS is depicted on Figure 10.

AquaGate+ consists of powdered amendments in a thin coating bound to an aggregate core (1/4" to 3/8" aggregate). The high permeability of the large-grained aggregate allows for water movement through the PBTS, while providing for a reaction system that maximizes contact with the binding amendments. The application of RemBind® as the coating material allows for PFAS specific treatment. RemBind® has been demonstrated to bind to PFAS and limit the migration of PFAS contaminants from soil and groundwater. Field studies have shown that RemBind® can reduce leachable PFAS by 90 to 99% while maintaining a long-term treatment window.

The benefits of the AquaGate+RemBind® approach include the expanded ability to use the product as stabilized backfill, versus other in-situ treatment materials that are applied via an injection process. The uniform and complete distribution of the coated aggregate that is backfilled within a trench promotes a higher contact probability of the PFAS contaminants flowing through the PBTS, maintains a higher permeability throughout the lifetime of the PBTS, and the powdered amendment provides for more treatment surface area compared to other granular treatment materials.

Additional design details and post installation monitoring requirements (to evaluate the effectiveness of the IRM) for the PBTS will be included in the forthcoming IRMDD, as described in Section 11.

Technical specification sheets for the AquaGate+RemBind® are included in Appendix C.

9.0 IRM – GROUNDWATER TREATMENT INJECTIONS

In addition to the source area groundwater treatment mechanisms described in Section 7.12 (Source Area Groundwater Treatment) and Section 8.0 (In-Situ Passive Barrier Treatment System), groundwater treatment injections are also proposed along the western and downgradient side of the asphalt clearing to expand groundwater treatment area beyond the soil source area locations. The goal being to collectively, with the previous groundwater treatment mechanisms previously discussed, limit the potential for PFAS contaminated groundwater to migrate towards the wetland and intermittent stream. The injections will be conducted along two linear transects located on the downgradient side of the asphalt clearing and north of the soil hot spot excavation area. The conceptual layout of the proposed groundwater injection transects are depicted on Figure 10.

Groundwater treatment will be completed by injecting an amendment solution into the saturated zone using direct push technology. Regenesis® PlumeStop®, which consists of a liquid/colloidal activated carbon, has demonstrated effectiveness in removing PFAS contaminants from the dissolved phase, thereby mitigating downgradient exposure risk while maintaining treatment performance over the long term. Field studies have shown that PlumeStop® can remain effective for decades beyond the initial application.

PlumeStop® is composed of very fine particles of activated carbon (1 to 2 micrometers) suspended in water by a patented organic polymer solution. This process prevents clumping and allows the carbon solution to move through all sizes of soil pores and rock fractures to uniformly "paint" the saturated zone with the amendment. Once in the subsurface, the material binds to the aquifer matrix and absorbs to dissolved contaminants in groundwater.

For injection specifics, Regenesis® has developed a proprietary injection model to account for site-specific factors, such as geology, porosity and permeability, and contaminant flux, and considers competitive sorption and biodegradation to determine the quantity of PlumeStop® (number of injection points/injection volumes, etc.) needed over a defined period. The injection process will be completed using temporary wellpoints installed with a direct push drill rig.

Additional design details for the groundwater treatment injections and post injection groundwater sampling requirements to evaluate IRM will be included in the forthcoming IRM Design Document, as described in Section 11.

Product specification sheets and case studies for PlumeStop® are included in Appendix C.

10.0 IRM – SURFACE WATER TREATMENT

The surface water in the intermittent stream that runs through the FDDS site has been identified as the transport mechanism for carrying the PFAS compounds into East Pond and Reservoir #2. As of the date of this report, there are no known and commercially available mobile treatment systems that can be used to address dissolved PFAS in stream-related surface-water. AKRF has proposed, as part of a pilot study, the implementation of one (1) customized permeable flow-through filtration unit for in-situ treatment of surface water flow in the stream.

The objective of the pilot program is to evaluate whether significant PFAS reductions can be achieved utilizing the proposed treatment unit. The monitoring data from the pilot program will be utilized to develop a long term monitoring and maintenance program, as well as to determine whether the design should be modified, additional treatment units should be deployed within the intermittent stream to increase the PFAS removal efficiency, and/or other surface water treatment units should be considered for use at the FDDS site as part of the site-wide remedy (to be developed as part of the forthcoming RAWP).

The permeable flow through filtration unit has been conceptually designed by AKRF, with input from AquaBlock®. Similar to the AquaGate+RemBind® PBTS system described in Section 8.0, AquaBlock® has documented positive results for PFAS treatment using AquaGate+ as part of permeable flow through treatment structures within surface water drainage systems. To maximize the potential for PFAS removal, it was determined that AquaGate+FLURO-SORB® would be used for the PFAS treatment material. FLURO-SORB® is a proprietary granular adsorbent media that removes PFAS at rates that have shown to have three to four times more adsorbent potential than activated carbon. In the planned application, the bulk density of AquaGate+FLURO-SORB® is 80 pounds per cubic foot, and the hydraulic conductivity is rated at approximately 3.5 centimeters per second (cm/s). Information regarding AquaGate+FLURO-SORB® is included in Appendix C. AquaBlock® will pre-mix the treatment mixture and place it into 6-inch diameter, pre-filled socks that will come in 2- and 3-foot lengths.

The treatment unit set-up includes identifying a section of the intermittent stream that has a relatively flat gradient, with approximately 6 inches of water under typical flow conditions. An area approximately 6-ft wide by 12-ft long section of the streambed will be graded to prepare it for the treatment system. The bottom of the graded area will be lined with approximately 3-in of AquaBlok 2080FW, a bentonite based low permeable sealing material design for submerged application, and will be used to separate any sediment underlying the treatment system from the treatment media. The AquaBlok 2080FW will be extended 3 feet upstream and downstream of the treatment structure to further isolate the existing sediment, and provide for pre- and post-treatment surface water sampling areas. The liner will be armored with a layer of gravel. A geotextile fabric will be placed between the AquaBlok 2080FW and the treatment socks to act as a separation barrier. The sides of the treatment unit will include a stacked wedge of low permeability material (AquaBlok 2080FW) to channel the flow through and treatment unit and prevent bypass. Approximately 2,700 pounds of AquaBlok 2080FW will to be utilized to create the unit bottom and side wedges. The AquaBlock 2080 FW specification sheet is included in Appendix C.

The treatment unit has been designed to consist of arranging the 2-feet land 3-feet long socks in a manner that will provide for a 6 feet wide by 12 feet long treatment zone. The two different lengths for the treatment socks will allow for a staggered arrangement that will minimize channeling and preferred flow pathways through the filtration socks. This arrangement is estimated to include approximately 3,000 pounds of the AquaGate+FLURO-SORB® amendments. The proposed location of the treatment system is included as Figure 12.

Additional design details (including timeline, construction requirements, post-installation performance monitoring details, and reporting) for the surface water treatment pilot system will be included in the forthcoming IRMDD, as described in Section 11. Removal of the treatment unit and subsequent stream

restoration will be completed in consultation with NYSDEC, with the timing subject to the efficacy of the surface water treatment and requirements of the future RAWP.

11.0 IRM DESIGN DOCUMENT

Upon approval of this IRM Work Plan, AKRF will prepare and submit an IRM IRMDD to NYSDEC prior to implementing the IRM program. The IRMDD will describe the scope of work, specifications, and methodologies for completing each of the proposed IRM treatment mechanisms, including:

- Excavation layout and logistics for soil and groundwater handling.
- Dewatering and on-site groundwater treatment specifications, including the gravity dewatering structure, groundwater decanting and collection process, above-grade groundwater treatment system, and performance sampling requirements.
- PBTS monitoring requirements (e.g., groundwater sampling), construction specifications, (e.g., trench location, design dimensions, etc.), and the total volume of amendments.
- Locations, spacing, and injection specifications, including the anticipated injection rate, duration, and total volume of groundwater treatment injection materials.
- Monitoring requirements (e.g., up- and downstream PFAS concentrations, pH, turbidity, oxygen, etc.), design specifications, and drawings for the surface water treatment pilot system.
- Monitoring requirements during the IRM activities to support treatment of dewatering fluids and performance of the on-site excavation dewatering treatment system.
- Post-IRM monitoring and maintenance requirements, including IRM performance monitoring, maintenance of treatment equipment, and post-IRM quarterly groundwater and surface-water sampling and laboratory analysis.

12.0 REPORTING REQUIREMENTS

AKRF will prepare and submit Daily Field Reports to NYSDEC and NYSDOH during implementation of the IRM. The Daily Field Reports will include a summary of the CAMP data (including exceedances), photographs, a figure(s), and summary of the work conducted.

12.1 Interim Remedial Measures CCR

Upon completion of all field work and receipt of laboratory analytical results, a CCR will be prepared that will: document field activities, present field and laboratory data, and discuss conclusions and recommendations drawn from the results of the IRM in accordance with DER-10. Endpoint sampling analytical reports and DUSRs will be included in the final report. Electronic Data Deliverables (EDDs) will be submitted to NYSDEC.

12.1.1 IRM Excavation Activities

This section of the CCR will describe the field methods used to oversee and direct the IRM excavation. The methods will include, but not be limited to field oversight, field screening, work zone and perimeter monitoring, equipment and screening methods; excavation equipment; all soil handling activities, soil import and export, backfilling, and soil endpoint sampling.

12.1.2 IRM Groundwater Treatment

This section of the CCR will describe the field methods used to oversee, direct, and document the implementation of the groundwater treatment programs. The methods will include, but are not limited to oversight, field screening, equipment and screening methods, confirmation of treatment materials, and the application methods for each treatment mechanism.

12.1.3 IRM Surface Water Treatment

This section of the CCR will describe the field methods used to oversee, direct, and document the installation and operation of the surface water treatment unit. The methods will include, but not be limited to oversight, field screening, equipment and screening methods; equipment and methods used for treatment unit installation, and any performance related analytical sampling. This section of the CCR will also include a recommendation on next steps for the surface water treatment unit.

12.1.4 IRM Data Assessment

This section will include a description of field and laboratory data, and a data analysis review to support the conclusions regarding the effectiveness of the IRM treatment mechanisms. The data analysis will be supported by tabulated data in the form of attached tables, and Site figures that will illustrate IRM treatment locations, sample locations, and laboratory results (spider maps). Field and laboratory analytical results will be compared to regulatory standards and/or guidance values. Laboratory analytical reports will be provided as attachments. The endpoint sample tables and figures included in the CCR also will be presented in the Final Engineer Report for the project to demonstrate the achievement of the SCOs established in the RAWP.

12.1.5 Monitoring Plan

This section will include a description of the proposed plan to monitor the effectiveness of the groundwater treatment program and the surface water pilot program, including the frequency and collection of groundwater and surface water samples and associated reporting.

12.1.6 Results and Conclusions

The CCR will include an analysis of the data compiled during the IRM excavation and implementation of the passive treatment mechanisms.

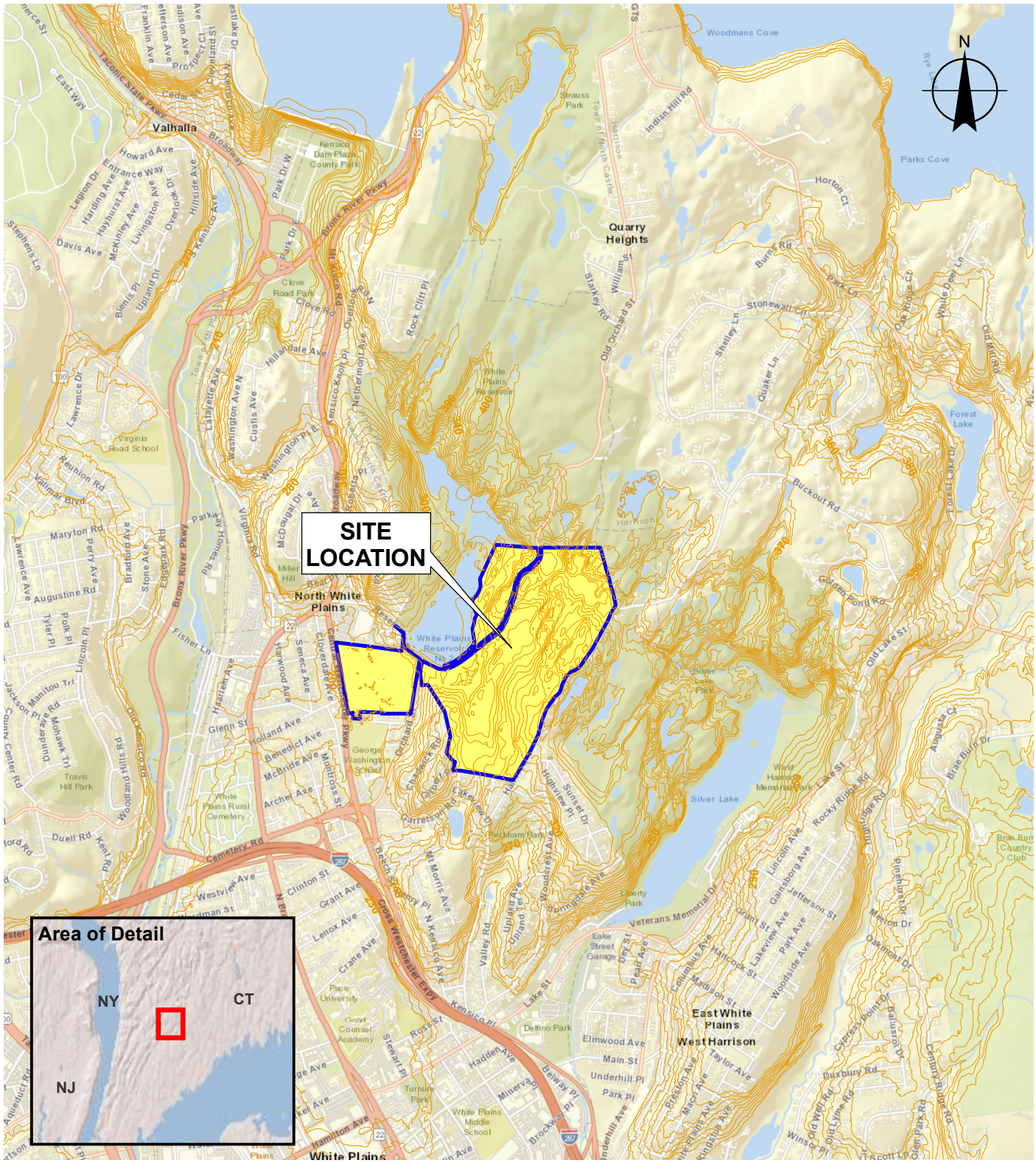
13.0 SCHEDULE OF WORK

The following tentative schedule has been developed for the project:

Table 1
Proposed IRM Schedule

Task	Date
Submit Draft IRM Work Plan to NYSDEC	June 2025
NYSDEC Provides IRMWP Comments	September 2025
Submit Updated IRMWP	April 2026
NYSDEC Review and Approval and Submit Final IRM Work Plan	May 2026
Submit IRM Design Document to NYSDEC	May 2026
IRM Procurement	June 2026
NYSDEC Review and Approval and Submit Final IRM Design Document	July 2026
Initiate IRMs	July 2026
Complete IRMs	September 2026
Submit IRM Construction Completion Report	December 2026

FIGURES



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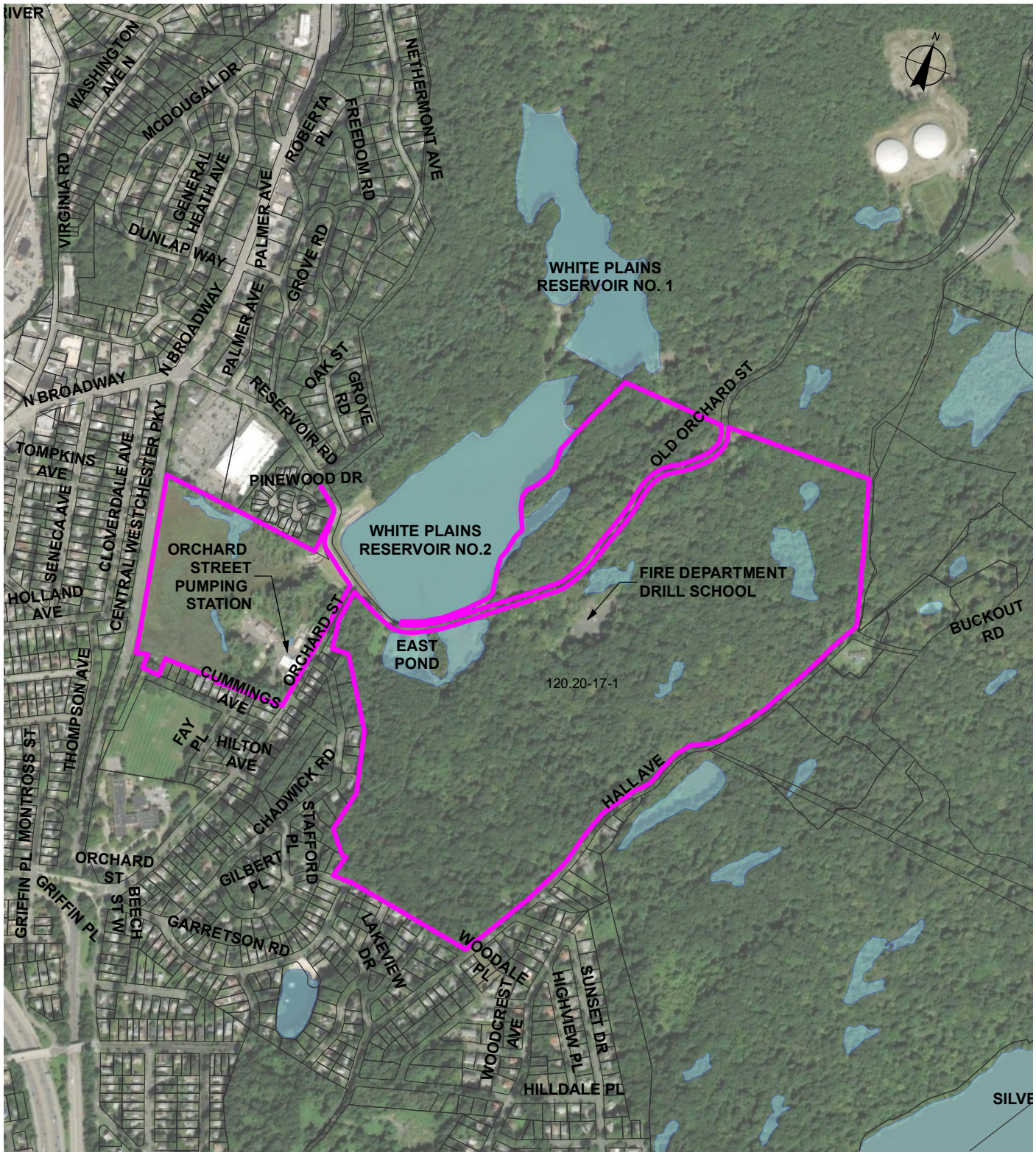
SITE LOCATION

DATE
6/16/2025

PROJECT NO.
200217

FIGURE
1

©2025 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\IRM Work Plan\200217 Fig 1 Site Location Map.mxd 6/16/2025 7:43:54 AM mveilleux



LEGEND

PROJECT SITE BOUNDARY

TAX PARCEL

Aerial Source:
2023 ESRI Imagery.

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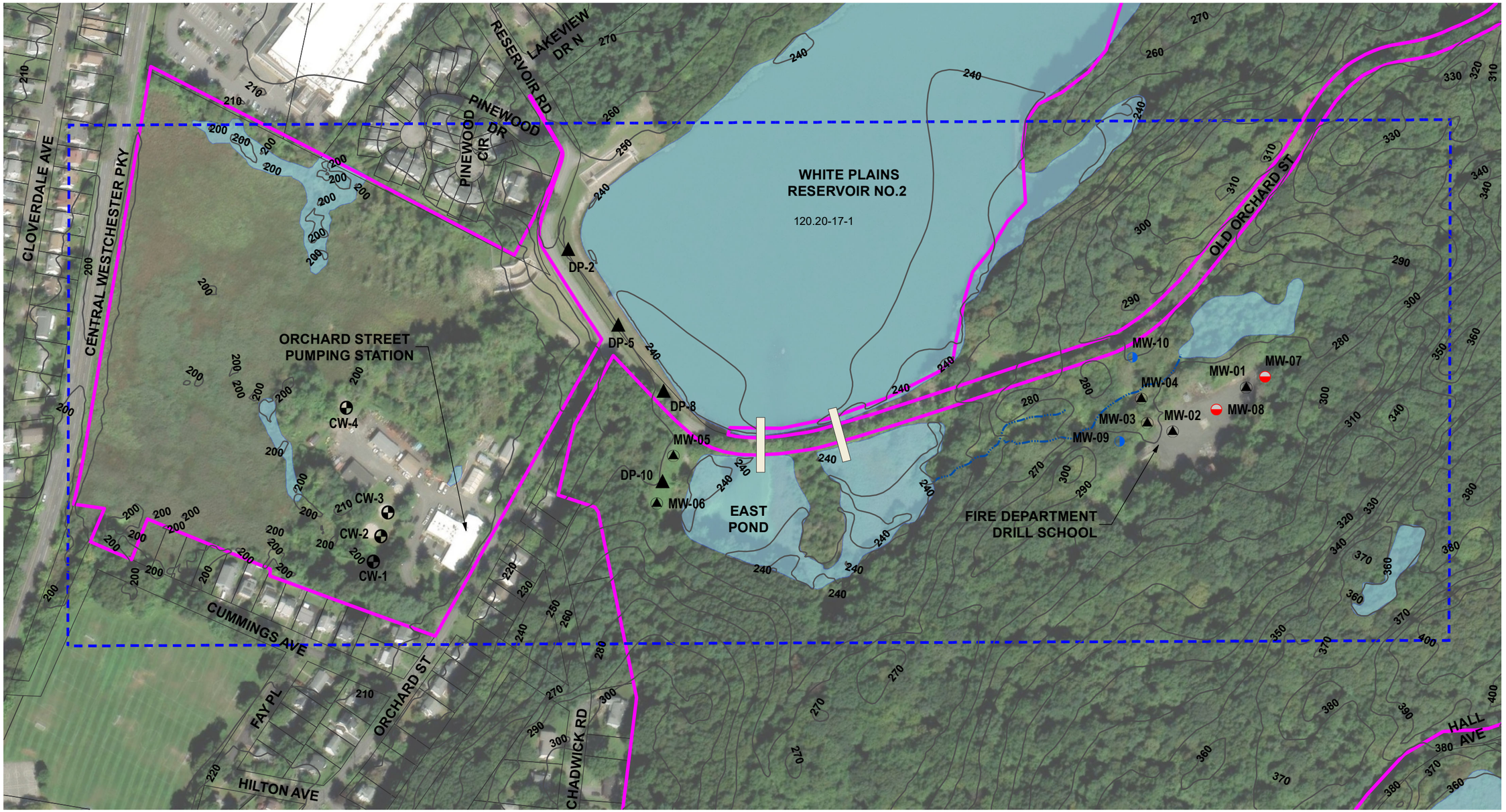
SITE PLAN

DATE
6/16/2025

PROJECT NO.
200217

FIGURE
2

©2025 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\IRM Work Plan\200217 Fig 2 Site Plan.mxd 6/16/2025 7:47:55 AM mvelleux



LEGEND

- PROJECT SITE BOUNDARY
- PROJECT STUDY AREA
- TAX PARCEL
- INTERMITTENT STREAM
- DAM PIEZOMETER
- CISTERN WELL
- SITE CHARACTERIZATION INVESTIGATION MONITORING WELL LOCATION
- REMEDIAL INVESTIGATION BEDROCK WELL LOCATION
- REMEDIAL INVESTIGATION OVERBURDEN MONITORING WELL LOCATION
- CULVERT PIPE

Aerial Source:
2020 ESRI Imagery.

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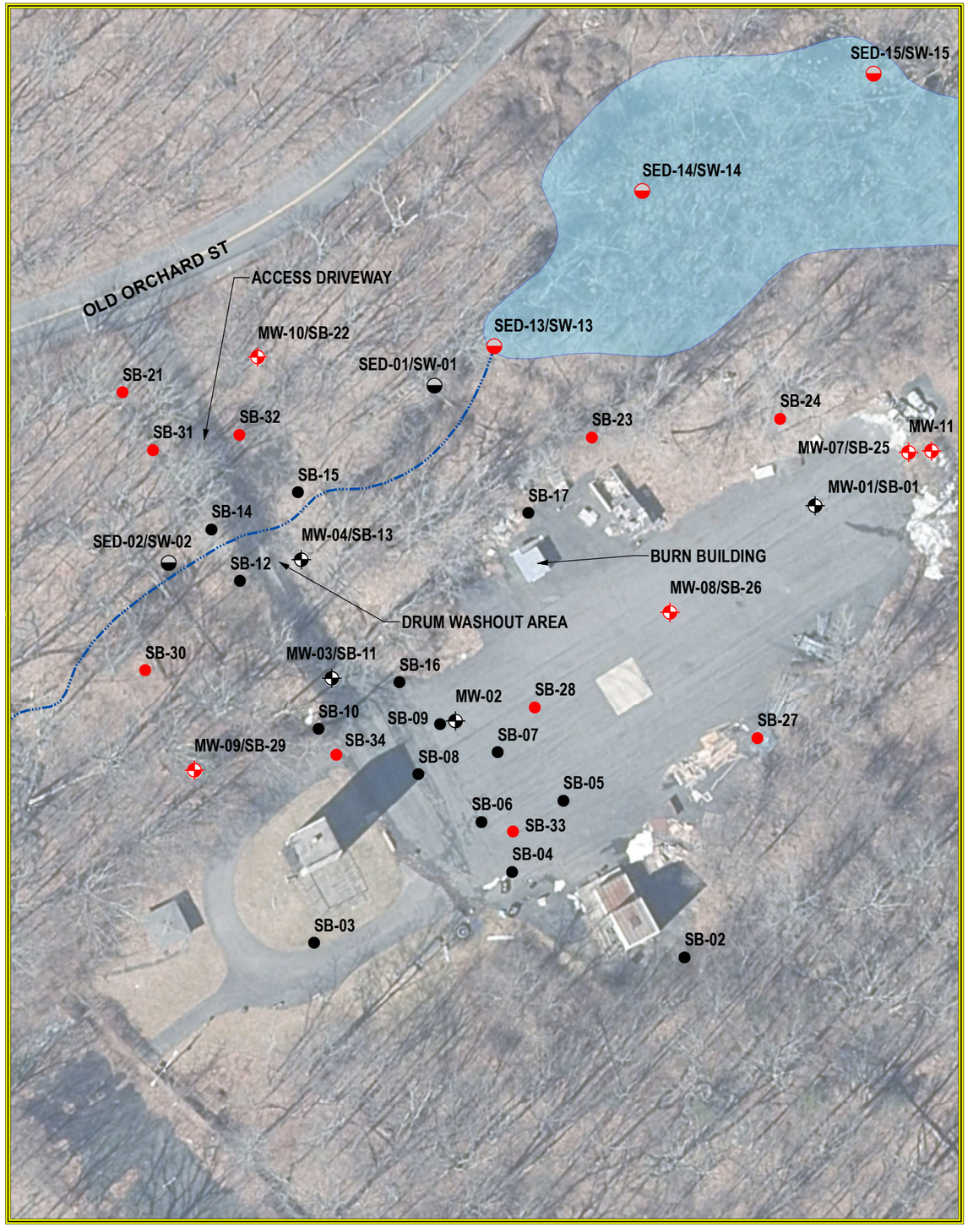
PROJECT STUDY AREA

DATE
6/16/2025

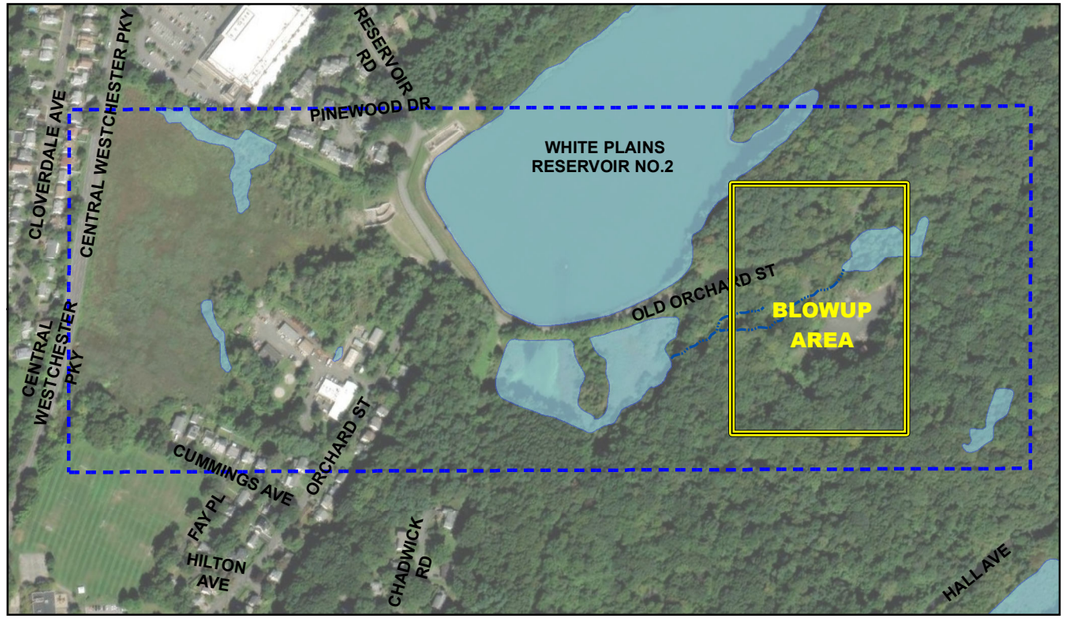
PROJECT NO.
200217

FIGURE
3

©2025 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\IRM Work Plan\200217 Fig 3 Project Study Area.mxd 6/16/2025 7:54:01 AM mvelleux



Aerial Source: 2020 ESRI Imagery.



Key Map

Scale: 1" = 500'

N

LEGEND

- PROJECT STUDY AREA
- INTERMITTENT STREAM
- SITE CHARACTERIZATION INVESTIGATION SOIL BORING LOCATION
- SITE CHARACTERIZATION INVESTIGATION SEDIMENT AND SURFACE WATER SAMPLE LOCATION
- SITE CHARACTERIZATION INVESTIGATION MONITORING WELL/SOIL BORING LOCATION
- REMEDIAL INVESTIGATION SOIL BORING LOCATION
- REMEDIAL INVESTIGATION SEDIMENT AND SURFACE WATER SAMPLE LOCATION
- REMEDIAL INVESTIGATION MONITORING WELL/SOIL BORING LOCATION

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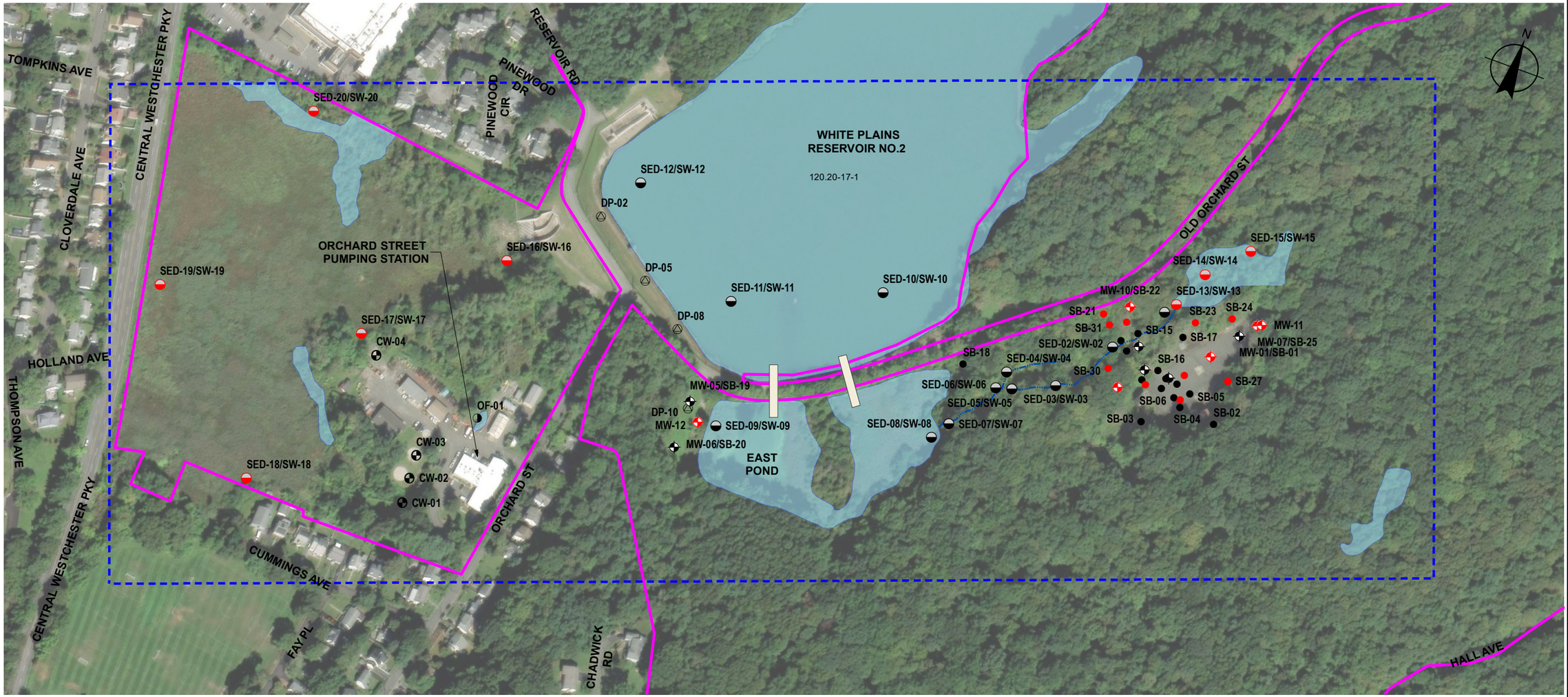
SAMPLE LOCATION PLAN - FIRE DEPARTMENT DRILL SCHOOL

DATE
1/8/2026

PROJECT NO.
200217

FIGURE
4A

©2026 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\IRM Work Plan\200217 Fig 4A Sample Location Plan.mxd 1/8/2026 1:56:33 PM mvelleux



Aerial Source:
2020 ESRI Imagery.

LEGEND

- SITE CHARACTERIZATION INVESTIGATION SOIL BORING LOCATION
- SITE CHARACTERIZATION INVESTIGATION SEDIMENT AND SURFACE WATER SAMPLE LOCATION
- SITE CHARACTERIZATION INVESTIGATION MONITORING WELL/SOIL BORING LOCATION
- REMEDIAL INVESTIGATION SOIL BORING LOCATION
- REMEDIAL INVESTIGATION SEDIMENT AND SURFACE WATER SAMPLE LOCATION
- REMEDIAL INVESTIGATION MONITORING WELL/SOIL BORING LOCATION
- SURFACE WATER SAMPLE LOCATION
- DAM PIEZOMETER
- CISTERN WELL
- PROJECT SITE BOUNDARY
- PROJECT STUDY AREA
- STREAM
- CULVERT PIPE

0 250 500
SCALE IN FEET

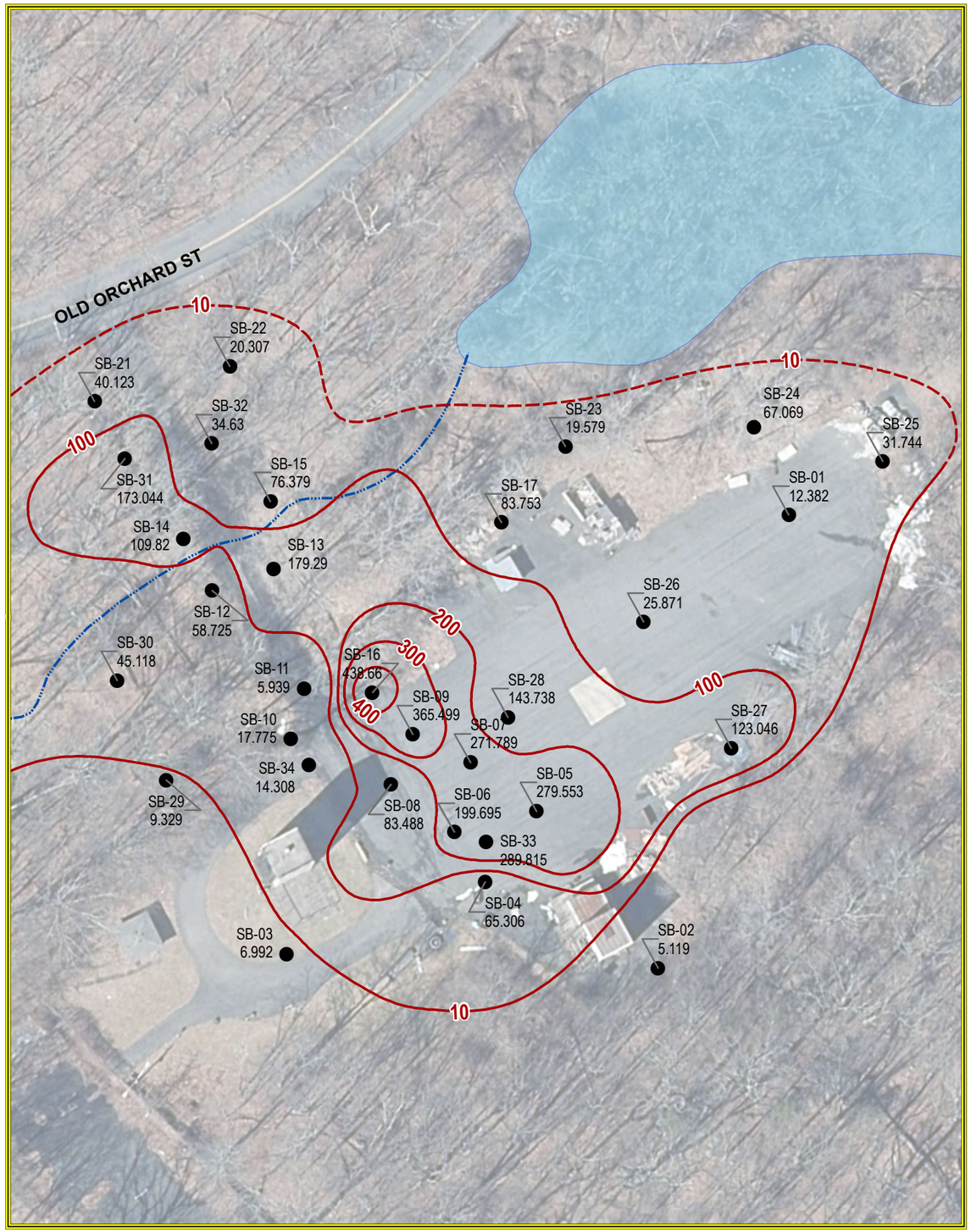
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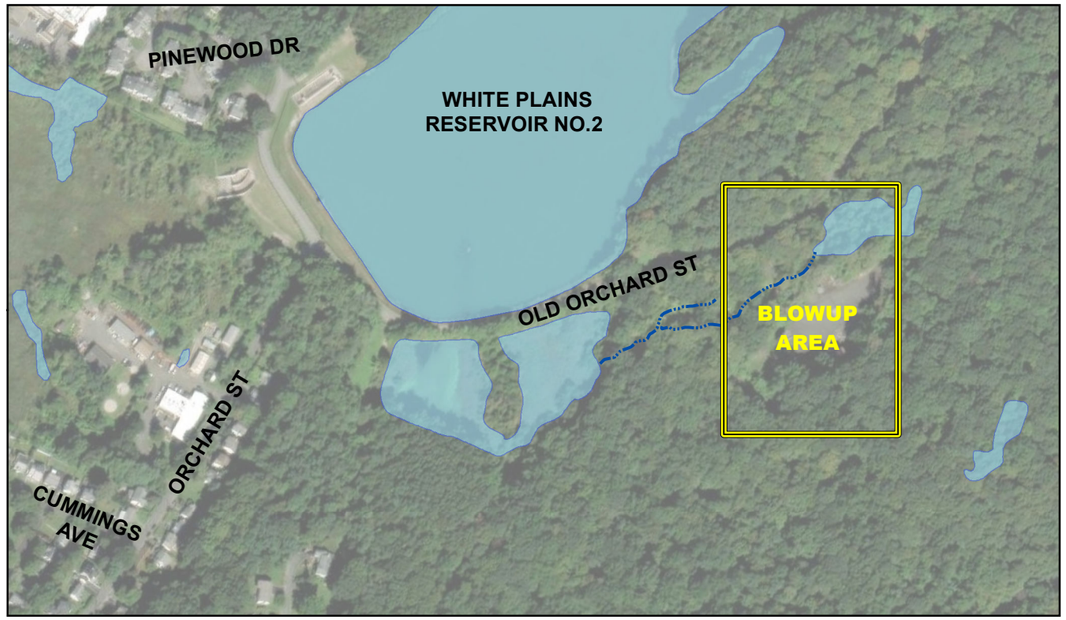
SAMPLE LOCATION PLAN - PROJECT STUDY AREA

DATE
6/16/2025
PROJECT NO.
200217
FIGURE
4B

©2025 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\IRM Work Plan\200217 Fig 4B Sample Location Plan.mxd6/16/2025 7:59:29 AM mveilleux



Aerial Source: 2020 ESRI Imagery.



Key Map

Scale: 1" = 400'

N

LEGEND

- STREAM
- SOIL BORING LOCATION
- TOTAL PFAS CONTOUR LINE (DASHED WHERE INFERRED) (MICROGRAMS PER KILOGRAM - µG/KG)

Note:
1. PFAS results shown are the highest concentration detected at each location within 0 - 2' below grade.

0 60 120

SCALE IN FEET

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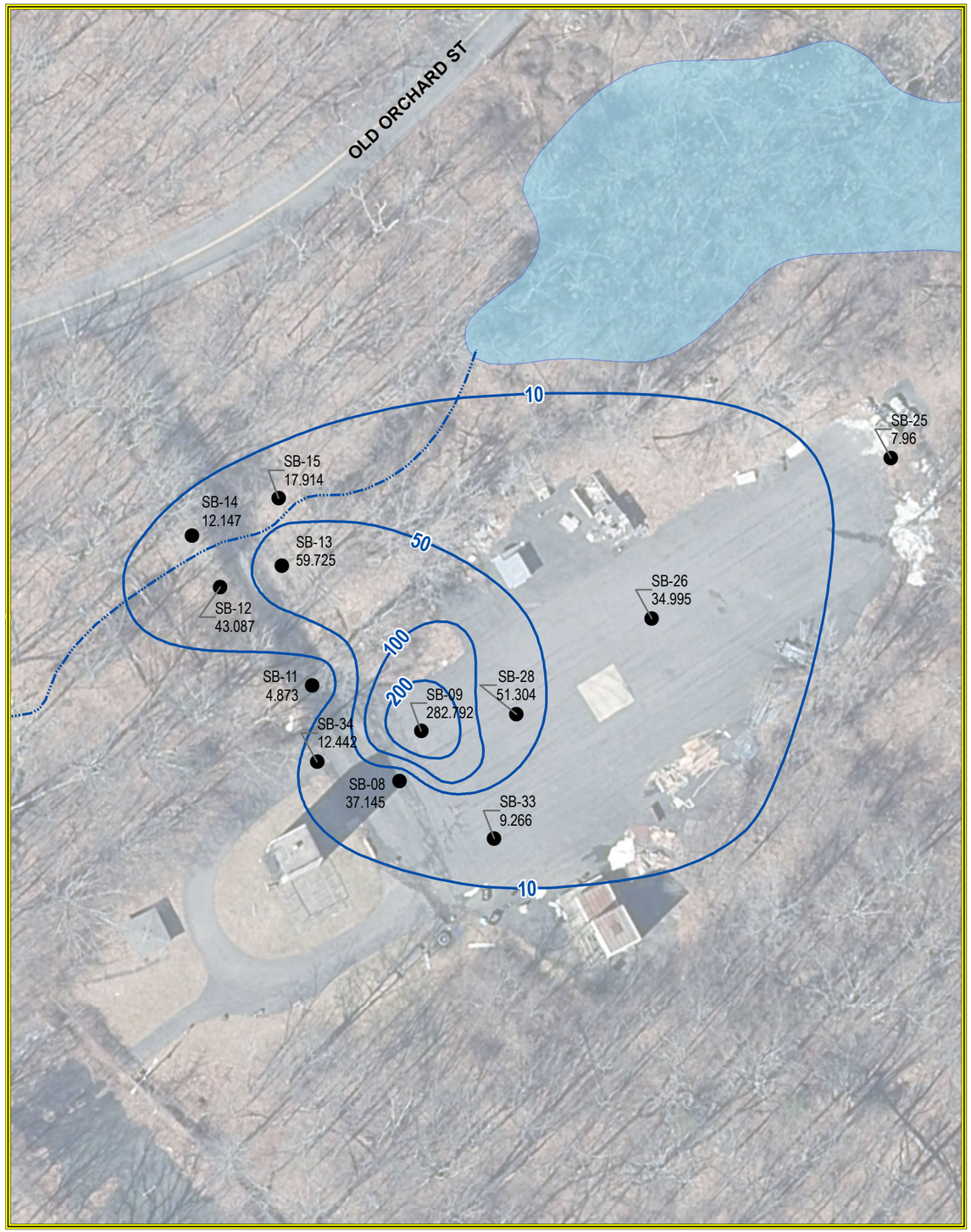
SHALLOW SOIL TOTAL PFAS ISOCONTOUR MAP

DATE
6/16/2025

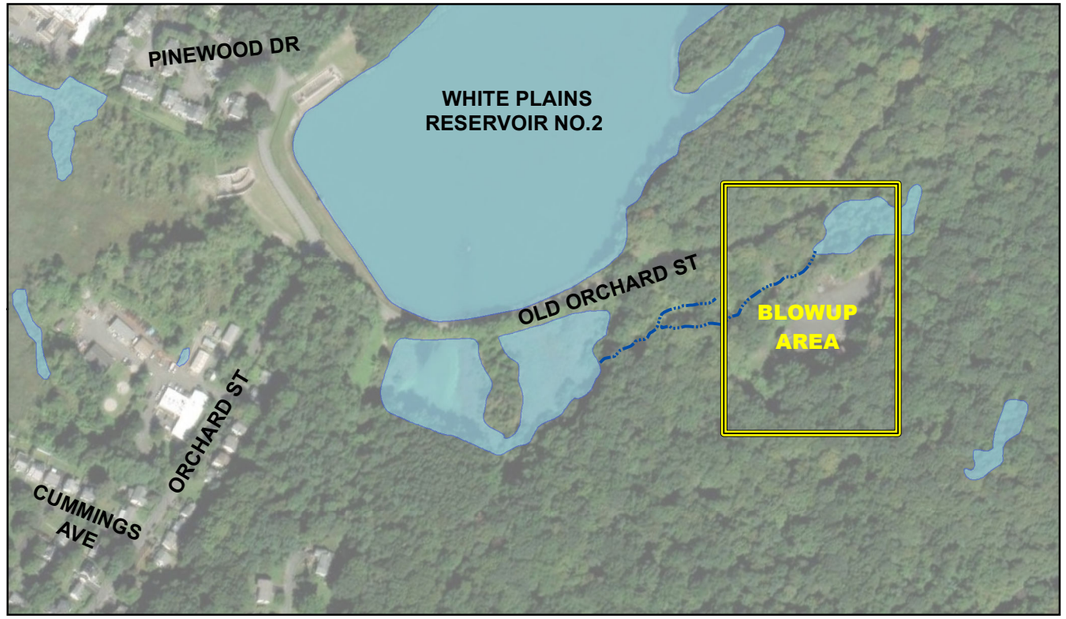
PROJECT NO.
200217

FIGURE
5

©2025 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\IRM Work Plan\200217 Fig 5 Shallow Soil Total PFAs Isocontour Map.mxd 6/16/2025 8:02:18 AM mveilleux



Aerial Source: 2020 ESRI Imagery.



Key Map

Scale: 1" = 400'

N

LEGEND

- STREAM
- SOIL BORING LOCATION
- TOTAL PFAS CONTOUR LINE (MICROGRAMS PER KILOGRAM - µG/KG)

Note:
1. PFAS results shown are concentrations of total PFAS at each location for the sample depth interval juist above the bedrock interface between 4 - 16' below grade.

0 60 120
SCALE IN FEET

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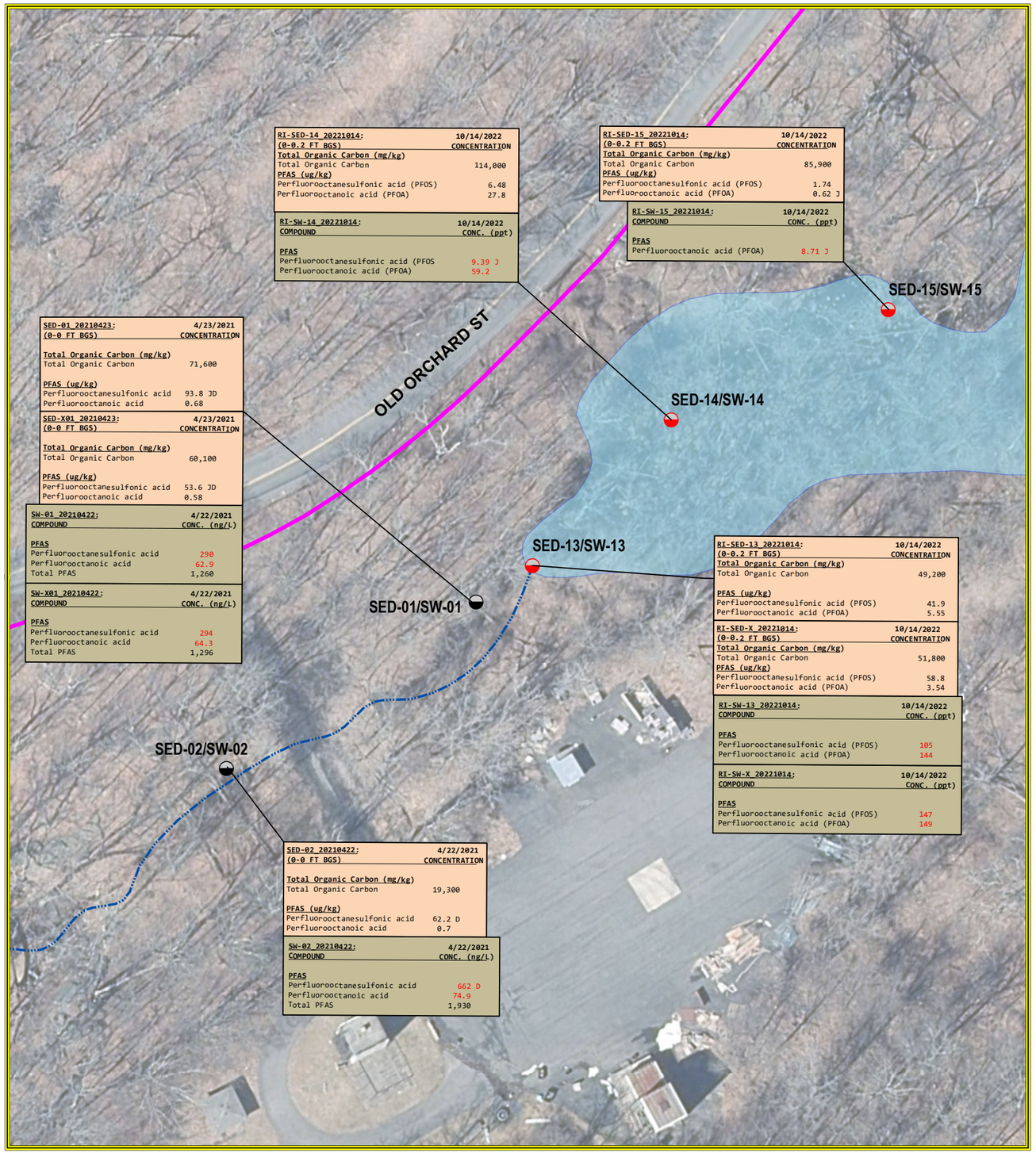
DEEP SOIL TOTAL PFAS ISOCONTOUR MAP

DATE
6/16/2025

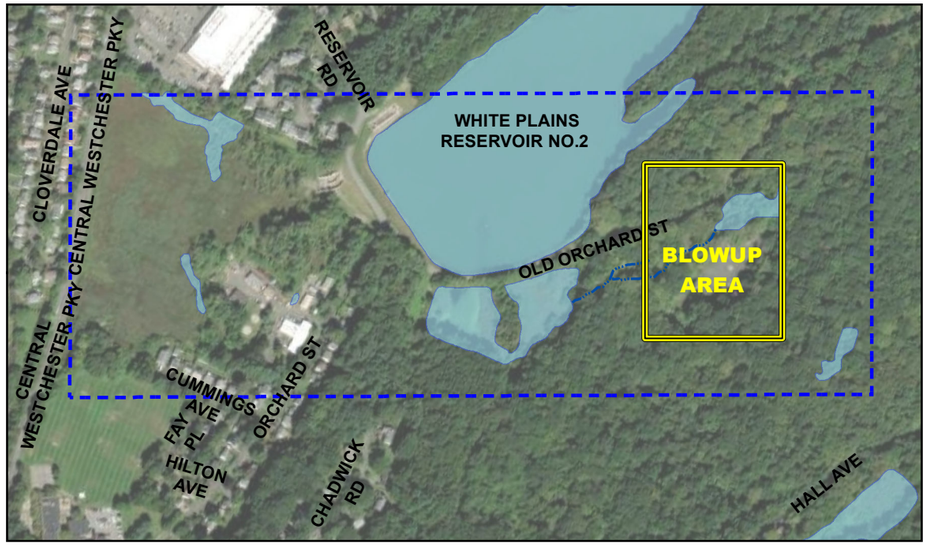
PROJECT NO.
200217

FIGURE
6

©2025 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\IRM Work Plan\200217 Fig 6 Deep Soil Total PFAs Isocontour Map.mxd6/16/2025 8:04:01 AM mveilleux



Aerial Source: 2020 ESRI Imagery.



Key Map

Scale: 1" = 600'

N

LEGEND

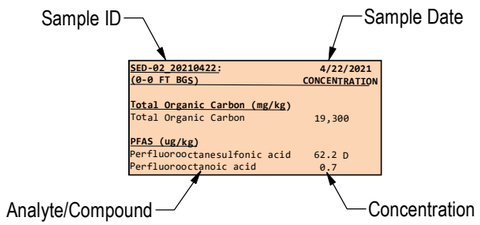
- PROJECT SITE BOUNDARY
- PROJECT STUDY AREA
- STREAM
- SITE CHARACTERIZATION INVESTIGATION SEDIMENT AND SURFACE WATER SAMPLE LOCATION (APRIL/MAY 2021)
- REMEDIAL INVESTIGATION SEDIMENT AND SURFACE WATER SAMPLE LOCATION

Sediment/Surface Water

Exceedances of NYSDEC's Final March 2023 Guidance Values for Human Health - Raw Water Source for PFOA and PFOS in surface water are presented red font.

mg/kg - milligrams per kilogram = parts per million (ppm)
ug/kg - micrograms per kilogram = parts per billion (ppb)
ng/L - nanograms per Liter = parts per trillion (ppt)

D: Analyte concentration obtained from dilution.
J: The concentration given is an estimated value.



Notes:
1. PFAS in sediment samples do not have applicable proposed guidance values.
PFOA and PFOS sediment values are provided for reference.
2.Total Organic Carbon concentrations are provided for reference only and are not compared to NYSDEC guidance values.
3. Total PFAS values above 500 ng/L are shown for reference only.

	NYSDEC PFAS AWQSGVs for Surface Water ng/l
PFAS	
Perfluorooctanesulfonic acid (PFOS)	2.7
Perfluorooctanoic acid (PFOA)	6.7

0 60 120
SCALE IN FEET

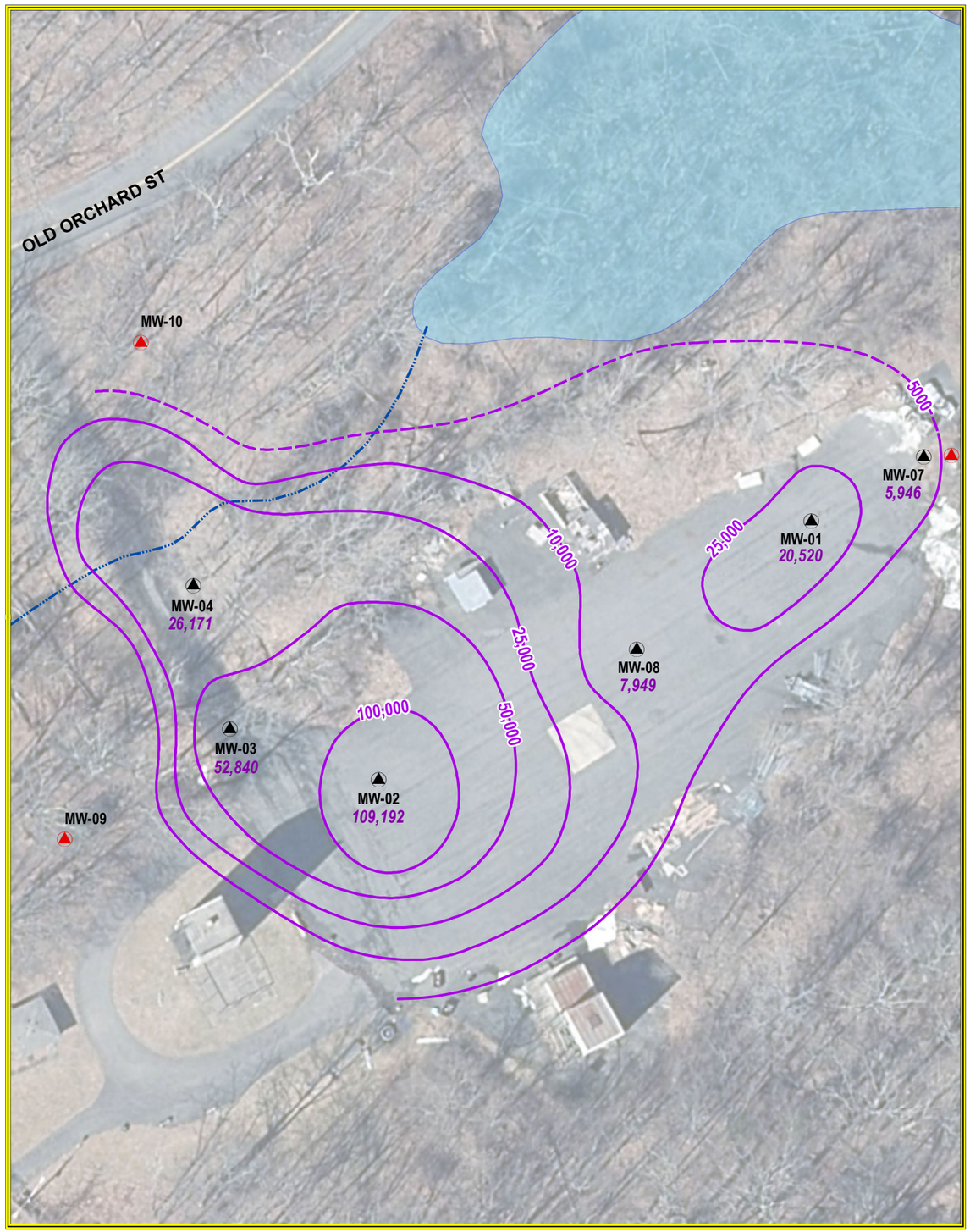
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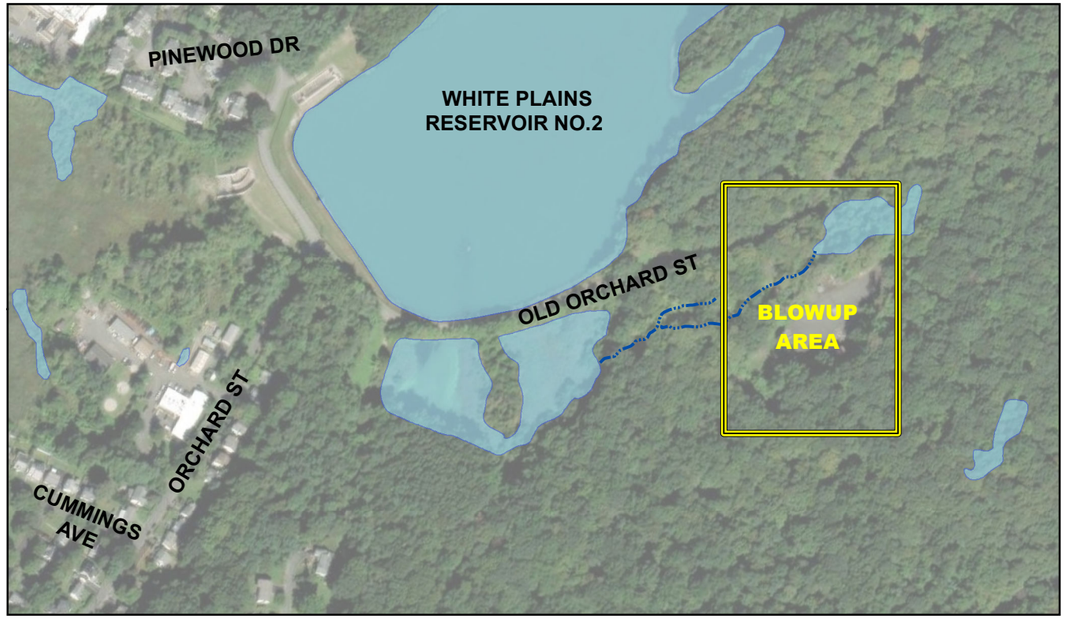
SAMPLE LOCATION PLAN - FIRE DEPARTMENT DRILL SCHOOL

DATE
6/16/2025
PROJECT NO.
200217
FIGURE
7

©2025 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\IRM Work Plan\200217 Fig 7 Sediment PFAS Results and Surface Water Exceedances for PFAS Above NYSDEC AWQSGVs – FDDS.mxd 6/16/2025 8:06:19 AM mvelleux



Aerial Source: 2023 ESRI Imagery.



Key Map

Scale: 1" = 400'

N

LEGEND

- STREAM
- MONITORING WELL LOCATION
- BEDROCK MONITORING WELL LOCATION
- TOTAL PFAS CONTOUR LINE (DASHED WHERE INFERRED) (MICROGRAMS PER KILOGRAM - µG/KG)

NOTE: MW-09 AND MW-10 ARE SCREENED WITHIN THE BEDROCK AQUIFER.

0 50 100

SCALE IN FEET

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White Plains, New York

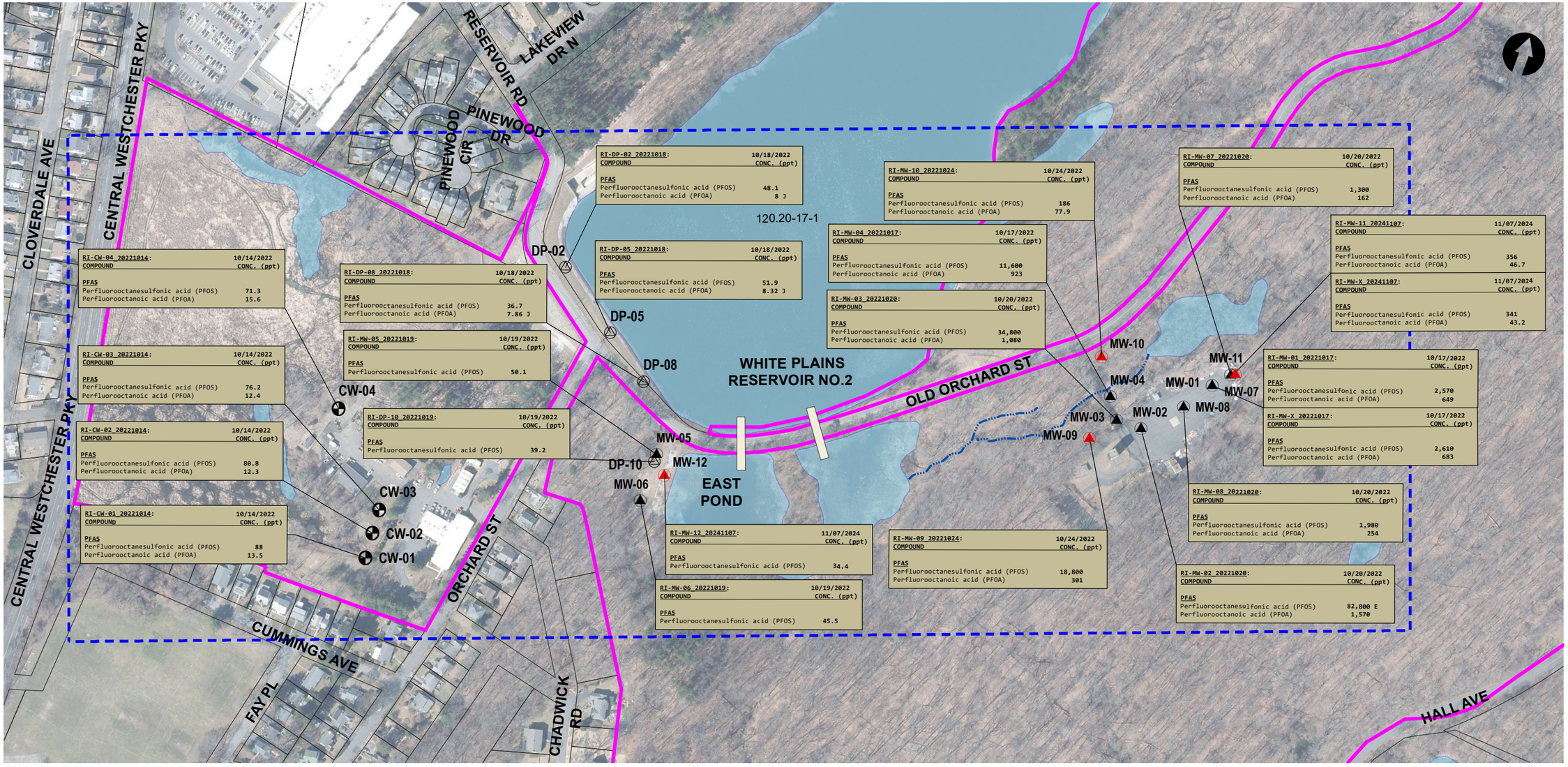
OVERBURDEN GROUNDWATER TOTAL PFAS ISOCONTOUR MAP

DATE
6/16/2025

PROJECT NO.
200217

FIGURE
8A

©2025 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\IRM Work Plan\200217 Fig 8 GW Total PFAs Isocontour Map.mxd 6/16/2025 8:07:58 AM mveilleux



LEGEND

- PROJECT SITE BOUNDARY
- PROJECT STUDY AREA
- TAX PARCEL
- STREAM
- CULVERT PIPE
- CISTERN WELL
- DAM PIEZOMETER
- MONITORING WELL LOCATION
- BEDROCK MONITORING WELL LOCATION

GROUNDWATER

Exceedances of NYSDEC's Guidance Values for Human Health - Raw Water Source for PFOA and PFOS are presented in bold font

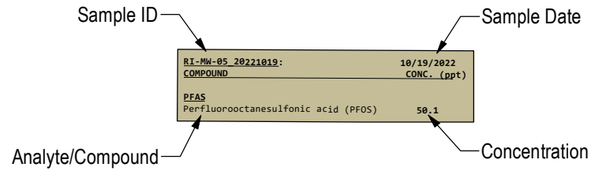
Groundwater PFAS results are compared to guidance values listed in NYSDEC's 2023 *Addendum to the Technical and Operational Guidance (TOGS) No. 1.1.1.*

ng/L - nanograms per Liter = parts per trillion (ppt)

D: Analyte concentration obtained from dilution.
J: The concentration given is an estimated value.

	NYSDEC PFAS AWQSGVs for Groundwater ng/l
PFAS	
Perfluorooctanesulfonic acid (PFOS)	2.7
Perfluorooctanoic acid (PFOA)	6.7

Aerial Source: 2023 ESRI Imagery.



0 250 500
SCALE IN FEET

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White Plains Fire Department Drill School
White Plains, New York

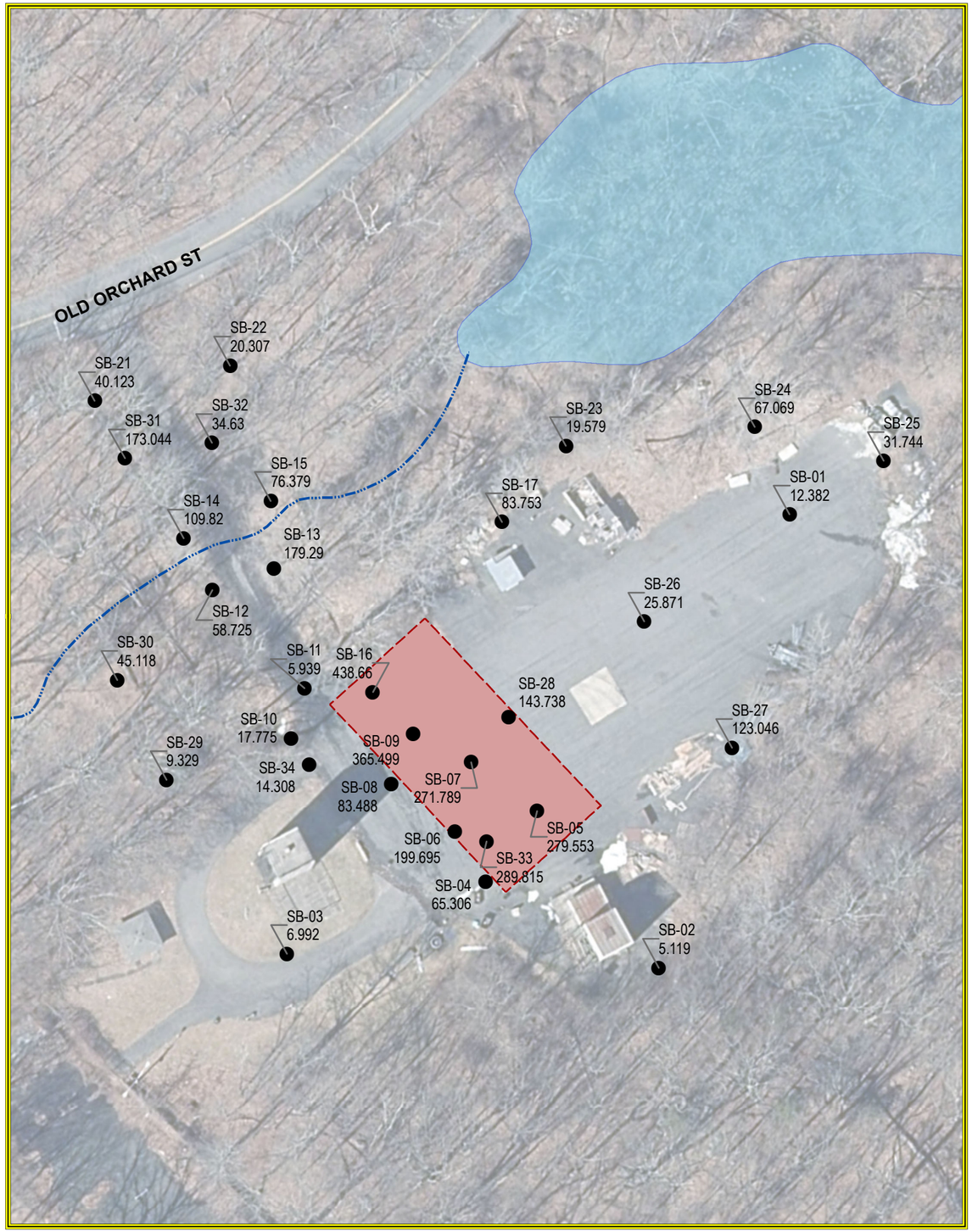
GROUNDWATER EXCEEDANCES FOR PFAS ABOVE NYSDEC AWQSGVS

DATE
1/21/2025

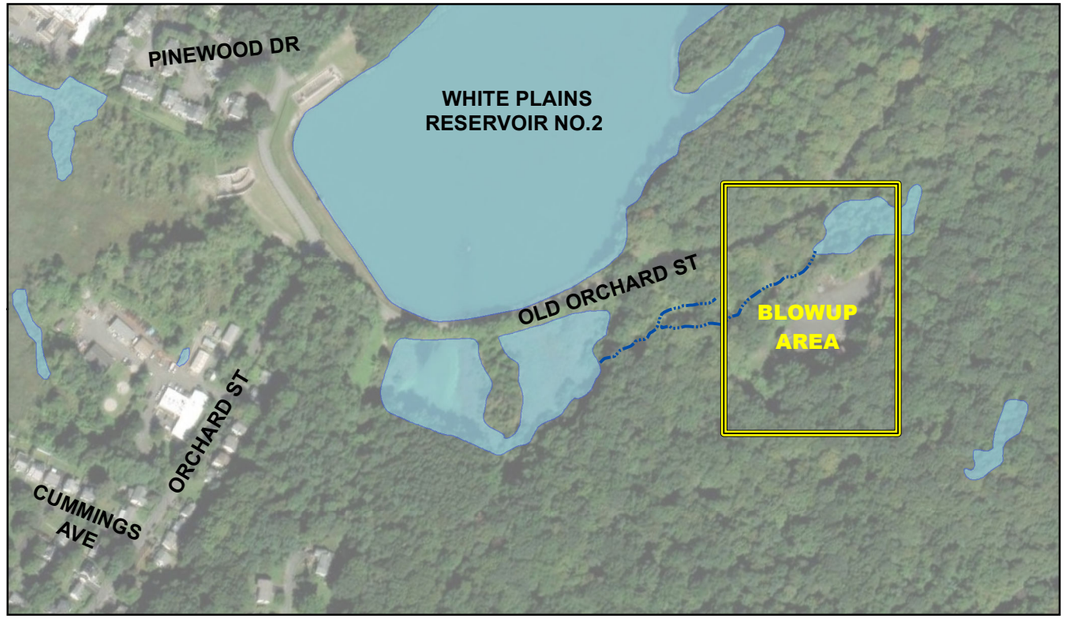
PROJECT NO.
200217

FIGURE
8B

©2025 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\RIR\200217 Fig 9 Groundwater Exceedances for PFAS Above Proposed NYSDEC AWQSGVs.mxd 1/21/2025 4:23:22 PM mvelleux



Aerial Source: 2020 ESRI Imagery.



Key Map

Scale: 1" = 400'

N

LEGEND

- STREAM
- SOIL BORING LOCATION
- PROPOSED SOIL EXCAVATION AREA

0 60 120

SCALE IN FEET

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White Plains, New York

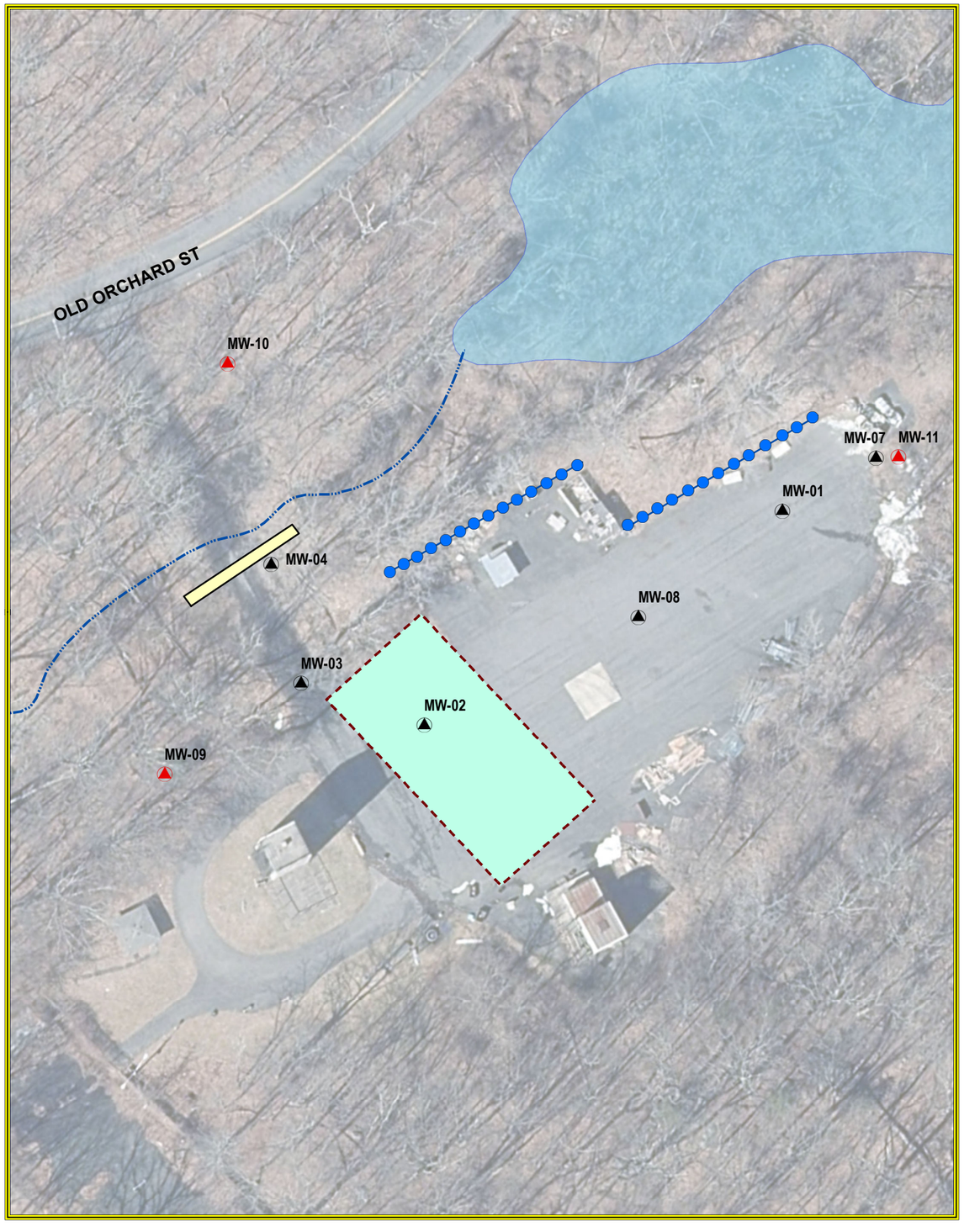
PROPOSED SOIL HOT SPOT EXCAVATION AREA

DATE
6/25/2025

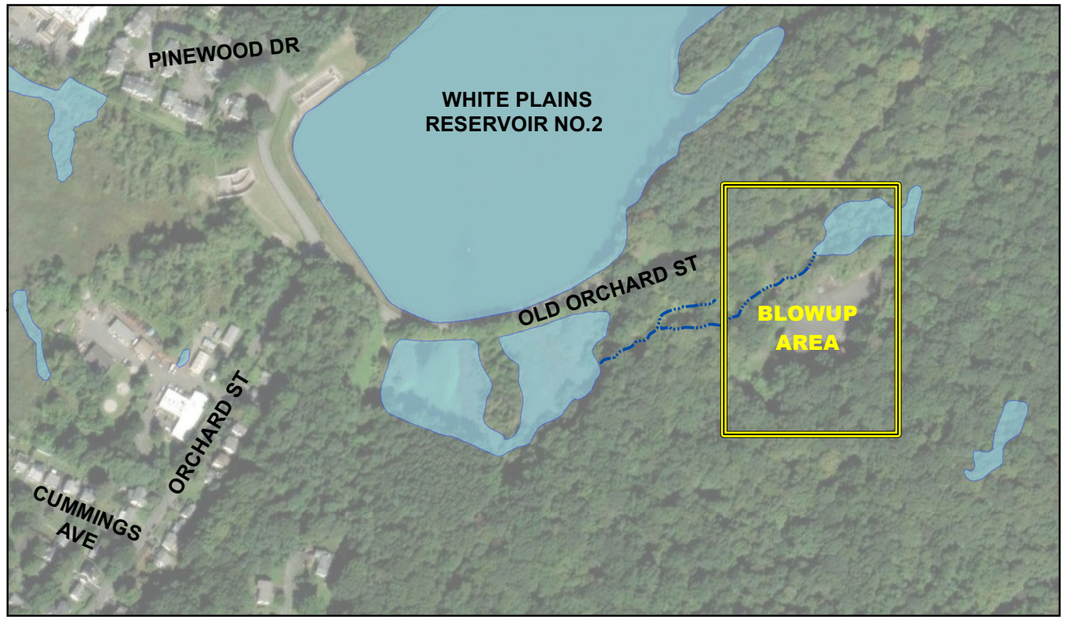
PROJECT NO.
200217

FIGURE
9

©2025 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\IRM Work Plan\200217 Fig 9 Proposed Soil HotSpot Excavation Area.mxd 6/25/2025 11:16:07 AM mvelleux



Aerial Source: 2020 ESRI Imagery.



Key Map

Scale: 1" = 400'

N

LEGEND

- STREAM
- MONITORING WELL LOCATION
- BEDROCK MONITORING WELL LOCATION
- APPLICATION AREA FOR REGENESIS® SOURCESTOP® - LIQUID
- PASSIVE BARRIER TREATMENT SYSTEM LOCATION - AQUAGATE+REMBIND®
- GROUNDWATER INJECTION TRANSECT LOCATION - REGENESIS® PLUMESTOP®

0 60 120

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White Plains, New York

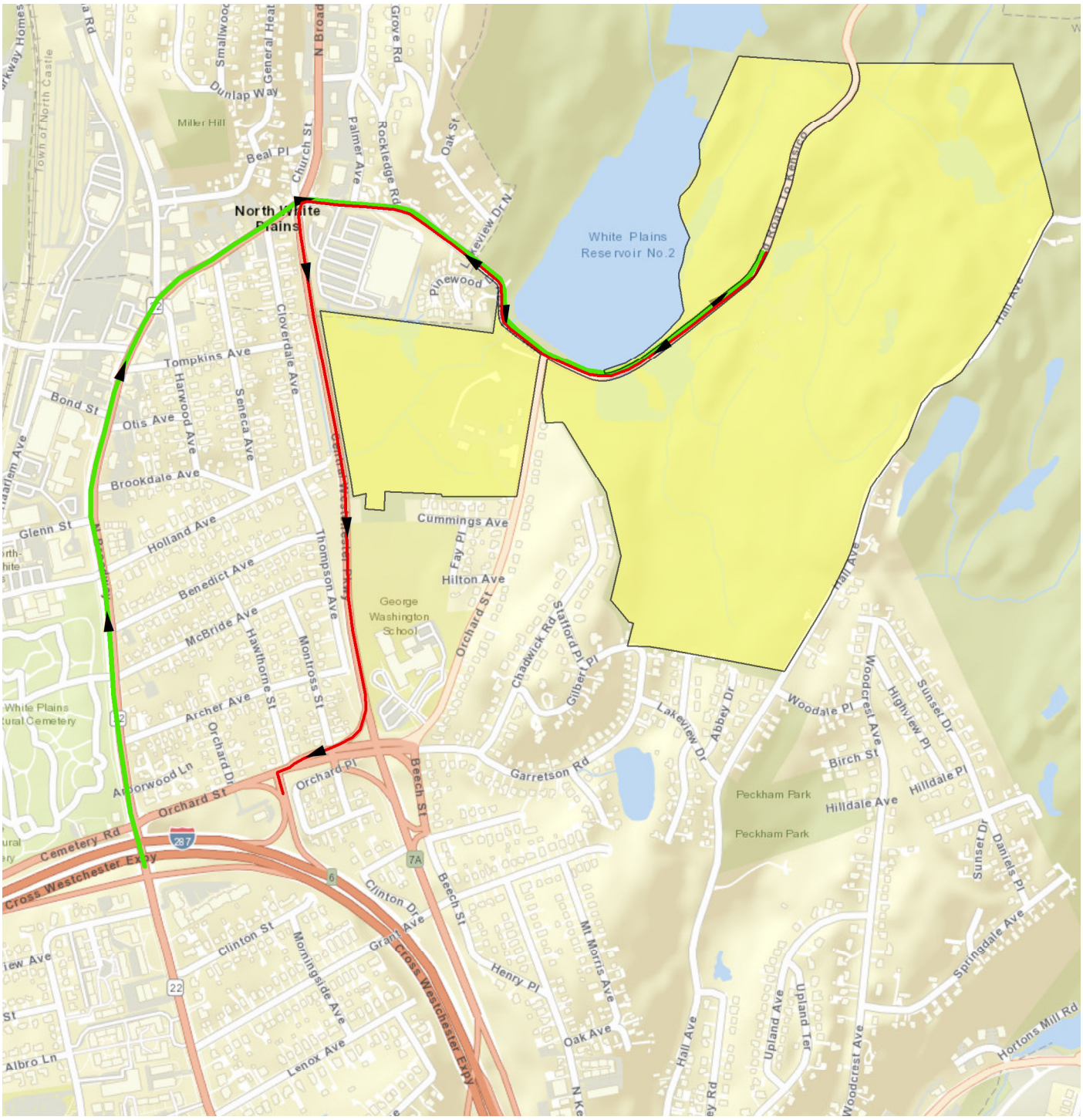
PROPOSED IN-SITU GROUNDWATER TREATMENT PLAN

DATE
6/25/2025

PROJECT NO.
200217

FIGURE
10

©2025 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\IRM Work Plan\200217 Fig 10 Proposed In-Situ Groundwater Treatment Plan.mxd 6/25/2025 11:33:04 AM mveilleux



LEGEND

- SITE BOUNDARY
- TRUCK ROUTE FROM SITE TO 287
- TRUCK ROUTE FROM 287 TO SITE

Service Layer Credits:
ESRI World Street Map 2023
City of New York Department of Transportation, April, 2019, New York City Truck Routes: New York City

0 800 1,600
SCALE IN FEET

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White Plains Fire Department Drill School
White Plains, New York

TRUCK ROUTE MAP

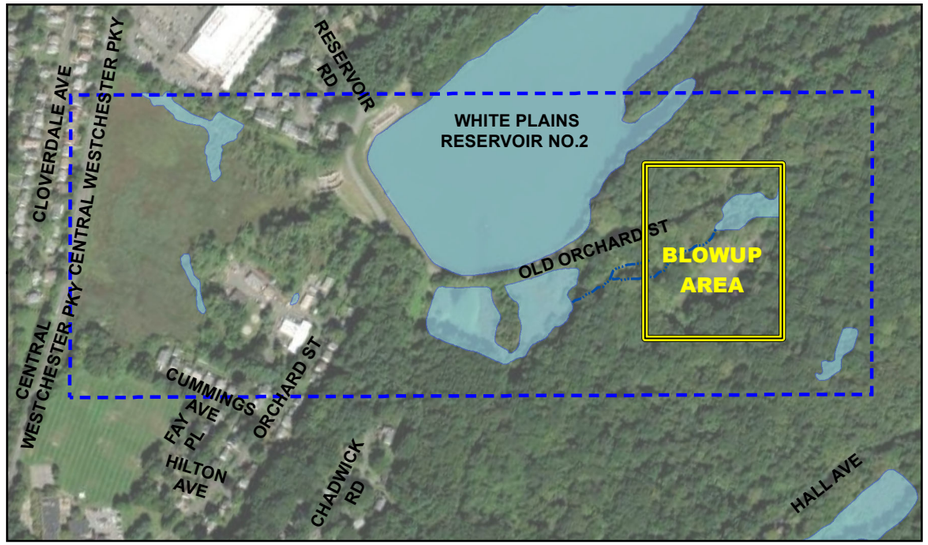
DATE
1/16/2026

PROJECT NO.
200217

FIGURE
11

©2026 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\200217 Truck Route Map.mxd 1/16/2026 12:53:36 PM mveilleux





Key Map

Scale: 1" = 600'

N

LEGEND

- PROJECT SITE BOUNDARY
- PROJECT STUDY AREA
- STREAM
- SITE CHARACTERIZATION INVESTIGATION SEDIMENT AND SURFACE WATER SAMPLE LOCATION (APRIL/MAY 2021)
- REMEDIAL INVESTIGATION SEDIMENT AND SURFACE WATER SAMPLE LOCATION
- PROPOSED APPROXIMATE LOCTION OF SURFACE WATER TREATMENT UNIT

0 60 120

SCALE IN FEET

Aerial Source: 2020 ESRI Imagery.

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White Plains Fire Department Drill School
White Plains, New York

PROPOSED SURFACE WATER TREATMENT PLAN

DATE
6/16/2025

PROJECT NO.
200217

FIGURE
12

©2025 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\IRM Work Plan\200217 Fig 11 Proposed Surface Water Treatment Plan.mxd6/16/2025 2:20:49 PM mvelleux

APPENDIX A
HEALTH AND SAFETY PLAN AND COMMUNITY AIR MONITORING PLAN

WHITE PLAINS FIRE DEPARTMENT DRILL SCHOOL

1402 OLD ORCHARD STREET
WHITE PLAINS, NEW YORK

Health and Safety Plan (HASP) and Community Air Monitoring Plan (CAMP)

NYSDEC Site #: 360193
AKRF Project Number: 200217

Prepared for:

The City of White Plains
255 Main Street
White Plains, New York 10601

Prepared by:

AKRF, Inc.
34 South Broadway, Suite 401
White Plains, New York 10601

JUNE 2025

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FIGURES

Figure 1 – Hospital Route Map

APPENDICES

Appendix A – Potential Health Effects from On-site Contaminants
Appendix B – Report Forms
Appendix C – Emergency Hand Signals

1.0 INTRODUCTION

The project site (Site) is located at 1402 Old Orchard Street, White Plains, New York. The legal definition of the Site is City of White Plains Tax ID 120.20-17-1, and the property class is identified as Public Services-Water Supply. The Site is approximately 141 acres, is mainly wooded with small streams, and contains the White Plains Fire Department Drill School (FDDS). The FDDS is situated within a 4-acre clearing that is located approximately 500 feet east of White Plains Reservoir #2. The Orchard Street Pump Station (OSPS) property, also owned and operated by The City, is west-adjacent to the southern portion of the Site, and south-adjacent to Reservoir #1.

This environmental Health and Safety Plan (HASP) and associated Community Air Monitoring Plan (CAMP) has been developed to be followed during implementation of the Interim Remedial Measures Work Plan (IRMWP) conducted by all personnel on-site, both AKRF employees and others. This HASP does not discuss routine health and safety issues common to general construction/excavation, including but not limited to slips, trips, falls, shoring, and other physical hazards.

The fire department training center has been in operation at the Site since approximately 1960. Prior to 1960, the Site was used by the police department for training exercises. Fire department training included live fire training in several different scenarios. The burn building on the eastern side of the clearing allows for multi-floor, realistic live fire training in a scenario where heat and smoke filled rooms can be controlled for safety. Small training fires using vehicles, pallets, and many types of furniture were also utilized to understand and anticipate the burn tendencies for many life situations. Firefighter foam was reported to be used on a limited basis during the training scenarios, and water collected while cleaning used foam barrels was discharged to the ground. This HASP identifies the hazards of concern, the specific chemicals associated with the Site-specific hazards, and measures to provide protection from exposure to the hazards during the IRM work.

All AKRF employees are directed that all work must be performed in accordance with the Company's Generic HASP and all OSHA applicable regulations for the work activities required for the project. All project personnel are furthermore directed that they are not permitted to enter Permit Required Confined Spaces (as defined by OSHA). For issues unrelated to contaminated materials, all non-AKRF employees are to be bound by all applicable OSHA regulations as well as any more stringent requirements specified by their employer in their corporate HASP or otherwise. AKRF is not responsible for providing oversight for issues unrelated to contaminated materials for non-employees. This oversight shall be the responsibility of the employer of that worker or other official designated by that employer.

2.0 HEALTH AND SAFETY GUIDELINES AND PROCEDURES

2.1 Hazard Evaluation

2.1.1 Hazards of Concern

Check all that apply		
(**X**) Organic Chemicals	(**X**) Inorganic Chemicals	( ) Radiological
( ) Biological	( ) Explosive/Flammable	( ) Oxygen Deficient Atm
(**X**) Heat Stress	(**X**) Cold Stress	( ) Carbon Monoxide
(**X**) Per- and Polyfluoroalkyl Substances (PFAS)		
Comments: No personnel are permitted to enter permit confined spaces.		

2.1.2 Physical Characteristics

Check all that apply		
(**X**) Liquid	(**X**) Solid	( ) Sludge
(**X**) Vapors	( ) Unknown	( ) Other
Comments:		

2.1.3 Hazardous Materials

Check all that apply					
Chemicals	**Solids**	**Sludges**	**Solvents**	**Oils**	**Other**
( ) Acids	( ) Ash	( ) Paints	( ) Halogens	( ) Transformer	( ) Lab
( ) Caustics	( ) Asbestos	( ) Metals	( ) Petroleum	( ) Other DF	( ) Pharm
( ) Pesticides	( ) Tailings	( ) POTW	( ) Other	( ) Motor or Hydraulic Oil	( ) Hospital
(**X**) Petroleum	( ) Other	( ) Other		(**X**) Gasoline	( ) Rad
( ) Inks				(**X**) Fuel Oil	( ) MGP
( ) PCBs					( ) Mold
(**X**) Metals					( ) Cyanide
(**X**) PFAS					
( )Other: VOCs & SVOCs					

2.1.4 Chemicals of Concern

Chemicals	REL/PEL/STEL	Health Hazards
PFAS	None established at this time.	Initial studies are inconclusive, but there is indication that the liver is the most sensitive target, with some association to increased uric acid levels, blood cholesterol, and high blood pressure.
Benzene	REL = 0.1 ppm PEL = 1 ppm STEL = 5 ppm	Irritation eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; anorexia, lassitude, dermatitis; bone marrow depression, potential occupational carcinogen.
Toluene	REL = 100 ppm PEL = 200 ppm STEL = 300 ppm	Irritation eyes, nose; lassitude, confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, insomnia; paresthesia (skin tingling or numbness); dermatitis; liver, kidney damage.
Ethylbenzene	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma.
Xylenes	REL = 100 ppm PEL = 100 ppm	Irritation eyes, skin, nose, throat; dizziness, excitement, drowsiness, poor coordination, staggering gait; corneal vacuolization; anorexia, nausea, vomiting, abdominal pain; dermatitis.
Naphthalene	REL = 10 ppm PEL = 10 ppm	Irritation eyes; headache, confusion, excitement, malaise; nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; jaundice; hematuria (blood in the urine), renal shutdown; dermatitis, optical neuritis, corneal damage.
Polycyclic Aromatic Hydrocarbons (PAHs)	PEL = 5 mg/m^3	Harmful effects to skin, bodily fluids, and ability to fight disease, reproductive problems; [potential occupational carcinogen]
Fuel Oil	REL = 350 mg/m^3 PEL = 400 ppm	Nausea, irritation – eyes, hypertension, headache, light-headedness, loss of appetite, poor coordination; long-term exposure – kidney damage, blood clotting problems; potential carcinogen.
Lead	REL= 0.1 mg/m^3 PEL= 0.05 mg/m^3	Weak, lassitude, insomnia; facial pallor, pale eye, anorexia, low-weight, malnutrition, constipation, abdominal pain, colic; anemia; gingival lead line; tremors, paralysis wrists and ankles; encephalopathy; kidney disease; irritation eyes; hypotension.
Comments: REL = NIOSH Recommended Exposure Limit PEL = OSHA Permissible Exposure Limit STEL = OSHA Short Term Exposure Limit ppm = parts per million mg/m^3 = milligrams per cubic meter		

2.2 Designated Personnel

AKRF will appoint one of its on-site personnel as the Site Safety Officer (SSO). This individual will be responsible for the implementation of the HASP. The SSO will have a 4-year college degree in occupational safety or a related science/engineering field, and experience in implementation of air monitoring and hazardous materials sampling programs. Health and safety training required for the SSO and all field personnel are outlined in Section 2.3 of this HASP.

2.3 Training

All personnel who enter the work area while intrusive activities are being performed will have completed a 40-hour training course that meets OSHA requirements of 29 CFR Part 1910,

Occupational Safety and Health Standards. In addition, all personnel will have up-to-date 8-hour refresher training. The training will allow personnel to recognize and understand the potential hazards to health and safety. All field personnel must attend a training program, whose purpose is to:

- Make them aware of the potential hazards they may encounter;
- Provide the knowledge and skills necessary for them to perform the work with minimal risk to health and safety;
- Make them aware of the purpose and limitations of safety equipment; and
- Ensure that they can safely avoid or escape from emergencies.

Each member of the field crew will be instructed in these objectives before he/she goes onto the Site. A site safety meeting will be conducted at the start of the project. Additional meetings shall be conducted, as necessary, for new personnel working at the Site.

2.4 Medical Surveillance Program

All AKRF and subcontractor personnel performing field work involving subsurface disturbance at the Site are required to have passed a complete medical surveillance examination in accordance with 29 CFR 1910.120 (f). A physician's medical release for work will be confirmed by the SSO before an employee can begin site activities. The medical release shall consider the type of work to be performed and the required PPE. The medical examination will, at a minimum, be provided annually and upon termination of hazardous waste site work.

2.5 Site Work Zones

During any activities involving subsurface disturbance, the work area must be divided into various zones to prevent the spread of contamination, ensure that proper protective equipment is donned, and provide an area for decontamination.

The Exclusion Zone is defined as the area where exposure to impacted media could be encountered. The Contamination Reduction Zone (CRZ) is the area where decontamination procedures take place and is located next to the Exclusion Zone. The Support is the zone area where support facilities such as vehicles, fire extinguisher, and first aid supplies are located. The emergency staging area (part of the Support Zone) is the area where all workers on-site would assemble in the event of an emergency. A summary of these areas is provided below. These zones may be changed by the SSO, depending on that day's activities. All field personnel will be informed of the location of these zones before work begins.

Task	Exclusion Zone	CRZ	Support Zone
Soil Excavation, Trenching and Bulk Application of Reagents	15 feet from excavation border and excavation equipment or vehicles	25 feet from excavation border and excavation equipment or vehicles	As Needed
Injection Point Installation and Reagent Injections	10 feet from drill rig and injection points	25 feet from drill rig and injection points	As Needed
Comments: Control measures such as "caution tape" and/or traffic cones will be placed around the perimeter of the work area when work is being done in a public area.			

2.6 Air Monitoring

The purpose of the air monitoring program is to identify any exposure of the field personnel to potential environmental hazards associated with the documented soil, sediment, surface water and groundwater contamination. Results of the air monitoring will be used to determine the appropriate response action, if needed.

2.6.1 PFAS Compounds

Currently there are no State or Federally-approved air monitoring procedures for PFAS compounds, and ambient particulate methods are under development by the EPA. Particulate monitoring in the work space will be conducted as a protective measure during implementation of the IRM activities. An MIE 1000 Personal DataRam or equivalent will be used to measure the concentration of airborne respirable particulates less than 10 micrometers in size (PM10). The dust monitor will be capable of calculating 15-minute running average concentrations and equipped with an audible alarm to indicate exceedance of action levels.

2.6.2 Volatile Organic Compounds

A photoionization detector (PID) will be used to perform air monitoring during soil disturbance activities to determine airborne levels of total VOCs. The PID will be calibrated at the start of the work day with a 100 ppm isobutylene standard.

2.6.3 Work Zone Air Monitoring

Real time air monitoring will be performed with a MIE 1000 (or equivalent) and a PID. Measurements will be taken prior to commencement of work and continuously during the work, as outlined in the following table. Measurements will be made as close to the workers as practicable and at the breathing height of the workers. The SSO shall set up the equipment and confirm that it is working properly. His/her designee may oversee the air measurements during the day. The initial measurement for the day will be performed before the start of work and will establish the background level for that day. The final measurement for the day will be performed after the end of work. The action levels and required responses are listed in the following table.

Instrument	Action Level	Response Action
MIE 1000	100 µg/m^3 above background	Dust suppression measures
	150 µg/m^3 above background	Stop work. Continue dust suppression and resume when readings are below 150 µg/m^3.
PID	Less than 5 ppm in breathing zone	Level D or D-Modified
	Between 5 ppm and 50 ppm	Level C
	More than 50 ppm	Stop work. Resume work when readings are less than 50 ppm.
Notes: ppm = parts per million, µg/m^3 = micrograms per cubic meter		

2.6.4 Community Air Monitoring Plan

The IRM activities will consist of soil excavation, trenching, dewatering, installation of injection points, and application of reagents in bulk and by injecting though points (wells). The IRM activities will have a low potential of generating significant vapors or contaminant-laden particulate and will be conducted on isolated portions of City property that are a minimum of approximately 300 feet to the nearest residential property. Additionally, the Site Characterization and Remedial Investigation sampling performed to date did not identify contamination in the sample media other than PFAS compounds.

Community air monitoring will be conducted as a protective measure in compliance with the New York State Department of Health (NYSDOH) Generic Community Air Monitoring Plan (CAMP), which would include real-time air monitoring for dust at the perimeter of the exclusion zone, as described below. CAMP data will be provided to NYSDEC and NYSDOH on a weekly basis. Any exceedances of CAMP action levels as well as correction measures taken will be reported to the Departments immediately (within 24 hours).

VOC Monitoring

Periodic monitoring for VOCs will be conducted during non-intrusive activities such as the collection of surface water and groundwater samples. Periodic monitoring may include obtaining measurements upon arrival at a location, when purging a sampling point, and upon leaving the location.

Continuous monitoring for VOCs will be conducted during all ground intrusive IRM activities that include excavation, trenching, drilling, or application of reagents. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background concentrations. VOCs will be monitored continuously at the downwind perimeter of the exclusion zone. Monitoring will be conducted with a PID equipped with an 11.7 eV lamp capable of calculating 15-minute running average concentrations. The following actions will be taken based on organic vapor levels measured:

- If total organic vapor levels exceed 5 ppm above background for the 15-minute average at the exclusion zone perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work activities will resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the exclusion zone persist at levels in excess of 5 ppm above background but less than 25 ppm, work activities

will be halted, the source of vapors identified, corrective actions taken to abate emissions, and monitoring continued. After these steps, work activities will resume provided that the total organic vapor level 200 feet downwind of the vapor source or half the distance to the nearest potential receptor or residential/commercial structure, whichever is less – but in no case less than 20 feet – is below 5 ppm above background for the 15-minute average.

- If the total organic vapor level is above 25 ppm at the perimeter of the exclusion zone, activities will be shutdown.

More frequent intervals of monitoring will be conducted if required as determined by the SSO. All PID readings will be recorded and available for NYSDEC and NYSDOH personnel to review. Instantaneous readings, if any, will also be recorded.

Dust Monitoring

Continuous monitoring for particulate will be conducted during all IRM activities that include excavation, trenching, drilling, or application of reagents. Community air monitoring for dust particulates will be conducted using a MIE 1000 Personal DataRam or equivalent to measure the concentration of airborne respirable particulates less than 10 micrometers in size (PM_{10}). The dust monitor will be capable of calculating 15-minute running average concentrations and equipped with an audible alarm to indicate exceedance of action levels. Background readings and any readings that trigger response actions will be recorded in the project logbook, which will be available on site for NYSDOH and/or NYSDEC review. If the downwind particulate concentrations are greater than 100 micrograms per cubic meter ($\mu g/m^3$) above background (upwind concentrations), and no other obvious source is apparent, then it will be assumed that the elevated particulate concentrations are a result of site activities. In such instances, dust suppression measures will be implemented and monitoring will be continued. Work will be allowed to continue with dust suppression if downwind particulate levels do not exceed 150 $\mu g/m^3$ above the background (upwind concentration) and provided that no visible dust is migrating from the work area. If particulate levels persist at 150 $\mu g/m^3$ above the background, work must be stopped until dust suppression measures bring particulate levels to below 150 $\mu g/m^3$ above background.

Major Vapor Emission Response Plan

If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the work Site, or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted or vapor controls must be implemented.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the exclusion zone, then the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20 foot zone).

If either of the following criteria is exceeded in the 20 foot zone, then the Major Vapor Emission Response Plan shall automatically be implemented:

- Sustained organic vapor levels approaching 1 ppm above background for a period of more than 30 minutes; or
- Organic vapor levels greater than 5 ppm above background for any time period.

Upon activation, the following activities shall be undertaken as part of the Major Vapor Emission Response Plan:

- The NYSDEC, NYSDOH, and local police authorities will be immediately contacted by the SSO and advised of the situation;
- Frequent air monitoring will be conducted at 30-minute intervals within the 20 Foot Zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the SSO; and
- All emergency contacts will go into effect as appropriate.

All readings will be recorded and be available for NYSDEC and NYSDOH personnel to review.

2.7 Personal Protection Equipment

The personal protection equipment required for various kinds of IRM tasks are based on 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response, Appendix B, "General Description and Discussion of the Levels of Protection and Protective Gear."

AKRF field personnel and other site personnel shall wear, at a minimum, Level D personal protective equipment. The protection will be based on the air monitoring described in Section 2.6.

LEVEL OF PROTECTION & PPE		**Soil Excavation, Trenching, Dewatering & Application/ Injection of Reagents**
Level D (**X**) Steel Toe Shoes (**X**) Hard Hat (within 25 ft of drill rig) (**X**) Work Gloves	(**X**) Safety Glasses ( ) Face Shield (**X**) Ear Plugs (within 25 ft of drill rig) (**X**) Nitrile Gloves (**X**) Tyvek for drill operator if NAPL present	Yes
Level C *(in addition to Level D)* (**X**) Half-Face Respirator OR (**X**) Full Face Respirator ( ) Full-Face PAPR	( ) Particulate Cartridge ( ) Organic Cartridge (**X**) Dual Organic/ Particulate Cartridge	If PID > 10 ppm (breathing zone) or respirable dust (PM_{10}) > 150 $\mu g/m^3$
Comments: Cartridges to be changed out at least once per shift unless warranted beforehand (e.g., more difficult to breathe or any odors detected).		

2.8 General Work Practices

To protect the health and safety of the field personnel, field personnel will adhere to the guidelines listed below during activities involving subsurface disturbance:

- Eating, drinking, chewing gum or tobacco, and smoking are prohibited, except in designated areas on the Site. These areas will be designated by the SSO.
- Workers must wash their hands thoroughly on leaving the work area and before eating, drinking, or any other such activity.
- The workers should shower as soon as possible after leaving the Site. Contact with contaminated or suspected surfaces should be avoided.
- The buddy system should always be used; each buddy should watch for signs of fatigue, exposure, and heat/cold stress.

3.0 EMERGENCY PROCEDURES AND EMERGENCY RESPONSE PLAN

The field crew will be equipped with emergency equipment, such as a first aid kit and disposable eye washes. In the case of a medical emergency, the SSO will determine the nature of the emergency and he/she will have someone call for an ambulance, if needed. If the nature of the injury is not serious, i.e., the person can be moved without expert emergency medical personnel, he/she should be taken to a hospital by on-site personnel. Directions to the hospital are provided below, and a hospital route map is attached.

3.1 Hospital Directions

Hospital Name:	White Plains Medical Center
Phone Number:	(914) 681-0600
Address/Location:	Davis Avenue at east Post Road, White Plains, NY 10601 The entrance to the Emergency Room is on Maple Avenue, just east of Davis Avenue
Directions:	Exit site and turn LEFT on Old Orchard Street Turn LEFT onto onramp for Central Westchester Parkway Merge LEFT onto I-287 East Take Exit 8W on right Turn LEFT at end of exit at stoplight onto Bloomingdale Road Turn Right onto Maple Ave Turn Right onto Davis Ave Turn Right into Hospital entrance

3.2 Emergency Contacts

Company	Individual Name	Title	Contact Number
AKRF	Marc Godick	Project Director	914-922-2356
	Bryan Zieroff	Project Manager	914-922-2382 (office) 203-246-1566 (cell)
	Steven Schmid	Site Safety Officer (SSO)	646-388-9567 (office) 614-560-5425 (cell)
	Patrick O'Mara	Alternate SSO	914-874-4309 (cell)
City of White Plains Department of Public Works	Stefania Mignone	Commissioner	914-422-1212 (office) 646-294-4689 (cell)
Ambulance, Fire Department & Police Department	-	-	911
NYSDEC Spill Hotline	-	-	800-457-7362

4.0 APPROVAL & ACKNOWLEDGMENTS OF HASP

APPROVAL

Signed: _____ Date: _____

AKRF Project Manager

Signed: _____ Date: _____

AKRF Health and Safety Officer

Below is an affidavit that must be signed by all workers who enter the Site. A copy of the HASP must be on-site at all times and will be kept by the SSO.

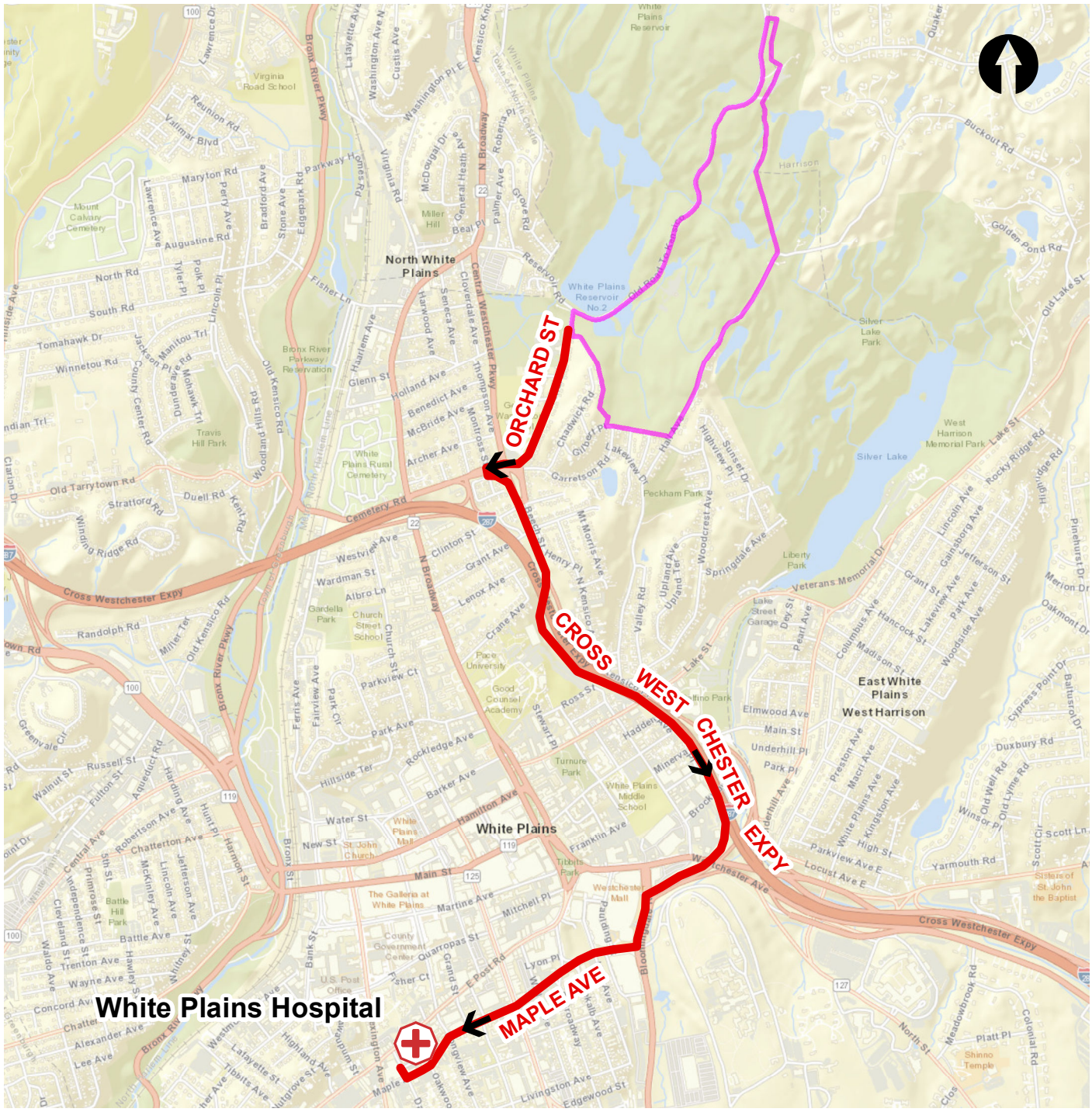
AFFIDAVIT

I,_____(name), of_____(company name), have read the Health and Safety Plan (HASP) for the White Plains Fire Department Drill School site. I agree to conduct all on-site work in accordance with the requirements set forth in this HASP and understand that failure to comply with this HASP could lead to my removal from the Site.

Signed: _____ Company: _____ Date: _____
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FIGURE 1

HOSPITAL ROUTE MAP



Service Layer Credits: ESRI World Street Map 2020

LEGEND

- PROJECT SITE BOUNDARY
- HOSPITAL LOCATION
- ROUTE TO HOSPITAL

White Plains Hospital
41 E. Post Road
White Plains, NY 10601
(914) 681-0600

0 2,000 4,000
SCALE IN FEET

AKRF
34 S. Broadway #401 White Plains, NY 10601

White Plains Fire Department Drill School
White Plains, New York

HOSPITAL ROUTE MAP

DATE
10/2/2020

PROJECT NO.
200217

FIGURE
1

©2020 AKRF Q:\Projects\200217 - CITY OF WHITE PLAINS FD PFA SITE\Technical\GIS and Graphics\Hazmat\200217 Hospital Route Map.mxd10/2/2020 2:19:08 PM mveilleux

APPENDIX A

POTENTIAL HEALTH EFFECTS FROM ON-SITE CONTAMINANTS

Perfluoroalkyls - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about perfluoroalkyls. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure can occur from ingesting contaminated food or drinking water or breathing contaminated air. Treated carpets can be an important source of exposure for children. Studies in humans suggest an association between increases in blood cholesterol and higher PFOA or PFOS blood levels. High blood levels of PFOA and PFOS may also be associated with increased uric acid levels and liver damage.

What are perfluoroalkyls?

Perfluoroalkyls are a family of human-made chemicals that do not occur naturally in the environment. The two perfluoroalkyls which were made in the largest amounts in the U.S. are perfluorooctanoic acid (PFOA) and perfluorooctane sulfonic acid (PFOS).

Perfluoroalkyls have been used in surface protection products such as carpet and clothing treatments and coating for paper and cardboard packaging. They have also been used in fire-fighting foams. Companies have stopped production or have begun changing manufacturing practices to reduce releases and the amounts of these chemicals in their products.

What happens to perfluoroalkyls when they enters the environment?

- Perfluoroalkyls can be found in air, soil, and water after release from the manufacture, use, and disposal of products that contain these chemicals, and during the manufacturing process. They may also be formed in the environment when other related chemicals break down.
- They break down very slowly in air, but fall to the ground within days to weeks.
- They do not break down in water or soil and may be carried over great distances.

How might I be exposed to perfluoroalkyls?

- Exposure to perfluoroalkyls is widespread. PFOA, PFOS, perfluorononanoic acid (PFNA), and perfluorohexane sulfonic acid (PFHxS) have been detected in 95-100% of samples of people's blood in 1999-2000 and 2003-2004. More recent monitoring data still show widespread exposure; however, the levels of these substances in people's blood appear to be declining.
- You may be exposed to perfluoroalkyls from the air, indoor dust, food, water, and various consumer products. Food is expected to be the most important source of exposure to perfluoroalkyls such as PFOA and PFOS. Human breastmilk may contribute to the exposure of infants since perfluoroalkyls have been detected in breast milk.
- Carpets treated with perfluoroalkyls can be an important source of exposure for children.
- Workers in facilities that make or use perfluoroalkyls can be exposed to higher amounts and have increased levels of these chemicals in their blood. Some communities near facilities where PFOA and PFOS were previously manufactured were exposed to high levels of these substances in drinking water.

How can perfluoroalkyls affect my health?

A large number of human studies have examined possible relationships between levels of perfluoroalkyls in blood and adverse health effects. It is difficult to interpret these results because they are not consistent; some studies have found an effect and others have not found the same effect. Even though some studies have found associations between serum perfluoroalkyl levels and adverse health effects, it does not mean that perfluoroalkyls caused these effects; they may be due to other factors not considered by researchers. The available human studies suggest that increases in blood cholesterol levels are associated with higher PFOA or PFOS blood levels. There is also some indication that serum PFOA or PFOS may be associated with increased uric acid levels, which may be associated with an increased risk of high blood pressure. PFOA or PFOS exposure may also cause liver damage.

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Human Health Sciences

ATSDR

CS265956-A

Perfluoroalkyls

Humans and animals react differently to PFOA and PFOS and not all effects observed in rats and mice may occur in humans. The liver appears to be the most sensitive target in animals ingesting perfluoroalkyls. Studies in mice found that the immune system is a sensitive target of PFOA and PFOS.

How likely are perfluoroalkyls to cause cancer?

There is no conclusive evidence that perfluoroalkyls cause cancer in humans. Some increases in prostate, kidney, and testicular cancers have been seen in individuals exposed to high levels. These results should be interpreted cautiously because the effects were not consistently found and most studies did not control for other potential factors such as smoking.

Rats that ingested PFOA and PFOS for a long time developed tumors. However, some scientists believe that based on the way this happens in rats and the differences between rats and humans, humans should not be expected to get cancer. Others believe that it is possible for perfluoroalkyls to cause cancer in humans.

The International Agency for Research on Cancer and the Department of Health and Human Services have not yet evaluated the carcinogenicity of perfluoroalkyls. The EPA has begun an evaluation.

How can perfluoroalkyls affect children?

No associations between serum PFOA and birth defects were observed in children of mothers living in an area with high PFOA in the water. Some studies of the general population and people living near a PFOA manufacturing facility have found that higher levels of serum PFOA or PFOS are associated with lower infant birth weights. However, the decrease in birth weight is small and may not affect the infant's health. A study of children exposed to high levels of PFOA in drinking water found increases in blood cholesterol, which is similar to the findings in adults.

Birth defects, delayed development, and early deaths have been observed in mouse and rat pups exposed to PFOA or PFOS, but not in animals exposed to perfluorobutyric acid (PFBA) or PFHxS. Scientists believe that some of the effects observed in rats and mice exposed to PFOA or PFOS may not be relevant to humans.

How can families reduce the risk of exposure to perfluoroalkyls?

- Families may choose to use consumer products that do not contain perfluoroalkyls.
- Families whose tap or well water that contains perfluoroalkyls may choose to drink or cook with bottled water or to install activated carbon water filters.

Is there a medical test to show whether I've been exposed to perfluoroalkyls?

Perfluoroalkyls can be measured in blood, but this is not a routine test that can be performed in a doctor's office. Mean serum concentrations of 3.07 and 9.32 µg/L of PFOA and PFOS, respectively, were measured in blood samples from members of the U.S. general population in 2009-2010.

Members of a community whose drinking water was contaminated with PFOA from a nearby industrial facility had a mean serum PFOA concentration of 83.6 µg/L in 2005. Fluorochemical product workers had mean serum PFOA and PFOS levels of 1,760 and 1,320 µg/L, respectively.

The presence of perfluoroalkyls in your blood may indicate that you have been exposed to and absorbed these chemicals into your body. However, it does not necessarily mean that you will suffer adverse health effects.

Has the federal government made recommendations to protect human health?

The EPA has established a provisional drinking water advisory for PFOA and PFOS of 0.4 and 0.2 µg/L, respectively.

References

This ToxFAQs™ information is taken from the 2015 Toxicological Profile for Perfluoroalkyls (Draft for Public Comment) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

NAPHTHALENE
CAS # 91-20-3

1-METHYLNAPHTHALENE
CAS # 90-12-0

2-METHYLNAPHTHALENE
CAS # 91-57-6

Division of Toxicology ToxFAQs™ **August 2005**

This fact sheet answers the most frequently asked health questions (FAQs) about naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because these substances may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene happens mostly from breathing air contaminated from the burning of wood, tobacco, or fossil fuels, industrial discharges, or moth repellents. Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. Naphthalene has caused cancer in animals. Naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene have been found in at least 687, 36, and 412, respectively, of the 1,662 National Priority List sites identified by the Environmental Protection Agency (EPA).

What are naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Naphthalene is a white solid that evaporates easily. Fuels such as petroleum and coal contain naphthalene. It is also called white tar, and tar camphor, and has been used in mothballs and moth flakes. Burning tobacco or wood produces naphthalene. It has a strong, but not unpleasant smell. The major commercial use of naphthalene is in the manufacture of polyvinyl chloride (PVC) plastics. Its major consumer use is in moth repellents and toilet deodorant blocks.

1-Methylnaphthalene and 2-methylnaphthalene are naphthalene-related compounds. 1-Methylnaphthalene is a clear liquid and 2-methylnaphthalene is a solid; both can be smelled in air and in water at very low concentrations.

1-Methylnaphthalene and 2-methylnaphthalene are used to make other chemicals such as dyes and resins. 2-Methylnaphthalene is also used to make vitamin K.

What happens to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene when they enter the environment?

- ❏ Naphthalene enters the environment from industrial and domestic sources, and from accidental spills.
- ❏ Naphthalene can dissolve in water to a limited degree and may be present in drinking water from wells close to hazardous waste sites and landfills.
- ❏ Naphthalene can become weakly attached to soil or pass through soil into underground water.
- ❏ In air, moisture and sunlight break it down within 1 day. In water, bacteria break it down or it evaporates into the air.
- ❏ Naphthalene does not accumulate in the flesh of animals or fish that you might eat.
- ❏ 1-Methylnaphthalene and 2-methylnaphthalene are expected to act like naphthalene in air, water, or soil because they have similar chemical and physical properties.

How might I be exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

- ❏ Breathing low levels in outdoor air.
- ❏ Breathing air contaminated from industrial discharges or smoke from burning wood, tobacco, or fossil fuels.
- ❏ Using or making moth repellents, coal tar products, dyes or inks could expose you to these chemicals in the air.
- ❏ Drinking water from contaminated wells.
- ❏ Touching fabrics that are treated with moth repellents containing naphthalene.
- ❏ Exposure to naphthalene, 1-methylnaphthalene and 2-methylnaphthalene from eating foods or drinking beverages is unlikely.

How can naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene affect my health?

Exposure to large amounts of naphthalene may damage or destroy some of your red blood cells. This could cause you to have too few red blood cells until your body replaces the destroyed cells. This condition is called hemolytic anemia. Some symptoms of hemolytic anemia are fatigue, lack of appetite, restlessness, and pale skin. Exposure to large amounts of naphthalene may also cause nausea, vomiting, diarrhea, blood in the urine, and a yellow color to the skin. Animals sometimes develop cloudiness in their eyes after swallowing high amounts of naphthalene. It is not clear whether this also develops in people. Rats and mice that breathed naphthalene vapors daily for a lifetime developed irritation and inflammation of their nose and lungs. It is unclear if naphthalene

ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html

causes reproductive effects in animals; most evidence says it does not.

There are no studies of humans exposed to 1-methylnaphthalene or 2-methylnaphthalene.

Mice fed food containing 1-methylnaphthalene and 2-methylnaphthalene for most of their lives had part of their lungs filled with an abnormal material.

How likely are naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene to cause cancer?

There is no direct evidence in humans that naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene cause cancer. However, cancer from naphthalene exposure has been seen in animal studies. Some female mice that breathed naphthalene vapors daily for a lifetime developed lung tumors. Some male and female rats exposed to naphthalene in a similar manner also developed nose tumors.

Based on the results from animal studies, the Department of Health and Humans Services (DHHS) concluded that naphthalene is reasonably anticipated to be a human carcinogen. The International Agency for Research on Cancer (IARC) concluded that naphthalene is possibly carcinogenic to humans. The EPA determined that naphthalene is a possible human carcinogen (Group C) and that the data are inadequate to assess the human carcinogenic potential of 2-methylnaphthalene.

How can naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene affect children?

Hospitals have reported many cases of hemolytic anemia in children, including newborns and infants, who either ate naphthalene mothballs or deodorants cakes or who were in close contact with clothing or blankets stored in naphthalene mothballs. Naphthalene can move from a pregnant woman's blood to the unborn baby's blood. Naphthalene has been detected in some samples of breast milk from the general U.S. population, but not at levels that are expected to be of concern.

There is no information on whether naphthalene has affected development in humans. No developmental abnormalities were observed in the offspring from rats, mice, and rabbits fed naphthalene during pregnancy.

We do not have any information on possible health effects of 1-methylnaphthalene or 2-methylnaphthalene on children.

How can families reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

❑ Families can reduce the risks of exposure to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene by avoiding smoking tobacco, generating smoke during cooking, or using fireplaces or heating appliances in the their homes.

❑ If families use naphthalene-containing moth repellents, the material should be enclosed in containers that prevent vapors from escaping, and kept out of the reach from children.

❑ Blankets and clothing stored with naphthalene moth repellents should be aired outdoors to remove naphthalene odors and washed before they are used.

❑ Families should inform themselves of the contents of air deodorizers that are used in their homes and refrain from using deodorizers with naphthalene.

Is there a medical test to determine whether I've been exposed to naphthalene, 1-methylnaphthalene, and 2-methylnaphthalene?

Tests are available that measure levels of these chemicals and their breakdown products in samples of urine, feces, blood, maternal milk, or body fat. These tests are not routinely available in a doctor's office because they require special equipment, but samples can be sent to special testing laboratories. These tests cannot determine exactly how much naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene you were exposed to or predict whether harmful effects will occur. If the samples are collected within a day or two of exposure, then the tests can show if you were exposed to a large or small amount of naphthalene, 1-methylnaphthalene, or 2-methylnaphthalene.

Has the federal government made recommendations to protect human health?

The EPA recommends that children not drink water with over 0.5 parts per million (0.5 ppm) naphthalene for more than 10 days or over 0.4 ppm for any longer than 7 years. Adults should not drink water with more than 1 ppm for more than 7 years. For water consumed over a lifetime (70 years), the EPA suggests that it contain no more than 0.1 ppm naphthalene.

The Occupational Safety and Health Administration (OSHA) set a limit of 10 ppm for the level of naphthalene in workplace air during an 8-hour workday, 40-hour workweek. The National Institute for Occupational Safety and Health (NIOSH) considers more than 500 ppm of naphthalene in air to be immediately dangerous to life or health. This is the exposure level of a chemical that is likely to impair a worker's ability to leave a contaminate area and therefore, results in permanent health problems or death.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2005. Toxicological Profile for Naphthalene, 1-Methylnaphthalene, and 2-Methylnaphthalene (Update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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POLYCYCLIC AROMATIC HYDROCARBONS (PAHs)

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.

- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

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FUEL OILS

CAS # 8008-20-6, 70892-10-3, 68476-30-2, 68476-34-6, 68476-31-3

This fact sheet answers the most frequently asked health questions (FAQs) about fuel oils. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Fuel oils are liquid mixtures produced from petroleum, and their use mostly involves burning them as fuels. Drinking or breathing fuel oils may cause nausea or nervous system effects. However, exposure under normal use conditions is not likely to be harmful. Fuel oils have been found in at least 26 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are fuel oils?

(Pronounced fyo͞o′əl oilz)

Fuel oils are a variety of yellowish to light brown liquid mixtures that come from crude petroleum. Some chemicals found in fuel oils may evaporate easily, while others may more easily dissolve in water.

Fuel oils are produced by different petroleum refining processes, depending on their intended uses. Fuel oils may be used as fuel for engines, lamps, heaters, furnaces, and stoves, or as solvents.

Some commonly found fuel oils include kerosene, diesel fuel, jet fuel, range oil, and home heating oil. These fuel oils differ from one another by their hydrocarbon compositions, boiling point ranges, chemical additives, and uses.

What happens to fuel oils when they enter the environment?

- Some chemicals found in fuel oils may evaporate into the air from open containers or contaminated soil or water.
- Some chemicals found in fuel oils may dissolve in water after spills to surface waters or leaks from underground storage tanks.
- Some chemicals found in fuel oils may stick to particles in water, which will eventually cause them to settle to the bottom sediment.
- Some of the chemicals found in fuel oils may be broken down slowly in air, water, and soil by sunlight or small organisms.
- Some of the chemicals found in fuel oils may build up significantly in plants and animals.

How might I be exposed to fuel oils?

- Using a home kerosene heater or stove, or using fuel oils at work.
- Breathing air in home or building basements that has been contaminated with fuel oil vapors entering from the soil.
- Drinking or swimming in water that has been contaminated with fuel oils from a spill or a leaking underground storage tank.
- Touching soil contaminated with fuel oils.
- Using fuel oils to wash paint or grease from skin or equipment.

How can fuel oils affect my health?

Little information is available about the health effects that may be caused by fuel oils. People who use kerosene

stoves for cooking do not seem to have any health problems related to their exposure.

Breathing some fuel oils for short periods may cause nausea, eye irritation, increased blood pressure, headache, lightheadedness, loss of appetite, poor coordination, and difficulty concentrating. Breathing diesel fuel vapors for long periods may cause kidney damage and lower your blood's ability to clot.

Drinking small amounts of kerosene may cause vomiting, diarrhea, coughing, stomach swelling and cramps, drowsiness, restlessness, painful breathing, irritability, and unconsciousness. Drinking large amounts of kerosene may cause convulsions, coma, or death. Skin contact with kerosene for short periods may cause itchy, red, sore, or peeling skin.

How likely are fuel oils to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that some fuel oils (heavy) may possibly cause cancer in humans, but for other fuel oils (light) there is not enough information to make a determination. IARC has also determined that occupational exposures to fuel oils during petroleum refining are probably carcinogenic in humans.

Some studies with mice have suggested that repeated contact with fuel oils may cause liver or skin cancer. However, other mouse studies have found this not to be the case. No studies are available in other animals or in people on the carcinogenic effects of fuel oils.

Is there a medical test to show whether I've been exposed to fuel oils?

There is no medical test that shows if you have been exposed to fuel oils. Tests are available to determine if some of the chemicals commonly found in fuel oils are in your blood. However, the presence of these chemicals in blood may not necessarily mean that you have been exposed to fuel oils.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) and the Air Force Office of Safety and Health (AFOSH) have set a permissible exposure level (PEL) of 400 parts of petroleum distillates per million parts of air (400 ppm) for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that average workplace air levels not exceed 350 milligrams of petroleum distillates per cubic meter of air (350 mg/m^3) for a 40-hour workweek.

The Department of Transportation (DOT) lists fuel oils as hazardous materials and, therefore, regulates their transportation.

Glossary

Carcinogenic: Able to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or a gas.

Hydrocarbon: Any compound made up of hydrogen and carbon.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Sediment: Mud and debris that have settled to the bottom of a body of water.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for fuel oils. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

BENZENE
CAS # 71-43-2

This fact sheet answers the most frequently asked health questions (FAQs) about benzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 813 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is benzene?

(Pronounced bĕn′zēn′)

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

- Industrial processes are the main source of benzene in the environment.
- Benzene can pass into the air from water and soil.
- It reacts with other chemicals in the air and breaks down within a few days.
- Benzene in the air can attach to rain or snow and be carried back down to the ground.
- It breaks down more slowly in water and soil, and can pass through the soil into underground water.
- Benzene does not build up in plants or animals.

How might I be exposed to benzene?

- Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
- Indoor air generally contains higher levels of benzene from products that contain it such as glues, paints, furniture wax, and detergents.
- Air around hazardous waste sites or gas stations will contain higher levels of benzene.
- Leakage from underground storage tanks or from hazardous waste sites containing benzene can result in benzene contamination of well water.
- People working in industries that make or use benzene may be exposed to the highest levels of it.
- A major source of benzene exposures is tobacco smoke.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

The major effect of benzene from long-term (365 days or longer) exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection.

Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries. It is not known whether benzene exposure affects the developing fetus in pregnant women or fertility in men.

Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How likely is benzene to cause cancer?

The Department of Health and Human Services (DHHS) has determined that benzene is a known human carcinogen. Long-term exposure to high levels of benzene in the air can cause leukemia, cancer of the blood-forming organs.

Is there a medical test to show whether I've been exposed to benzene?

Several tests can show if you have been exposed to benzene. There is test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood, however, since benzene disappears rapidly from the blood, measurements are accurate only for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 0.005 milligrams per liter (0.005 mgL). The EPA requires that spills or accidental releases into the environment of 10 pounds or more of benzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set a permissible exposure limit of 1 part of benzene per million parts of air (1 ppm) in the workplace during an 8-hour workday, 40-hour workweek.

Glossary

Anemia: A decreased ability of the blood to transport oxygen.

Carcinogen: A substance with the ability to cause cancer.

CAS: Chemical Abstracts Service.

Chromosomes: Parts of the cells responsible for the development of hereditary characteristics.

Metabolites: Breakdown products of chemicals.

Milligram (mg): One thousandth of a gram.

Pesticide: A substance that kills pests.

References

This ToxFAQs information is taken from the 1997 Toxicological Profile for Benzene (update) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

ETHYLBENZENE
CAS # 100-41-4

Agency for Toxic Substances and Disease Registry ToxFAQs **June 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about ethylbenzene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Ethylbenzene is a colorless liquid found in a number of products including gasoline and paints. Breathing very high levels can cause dizziness and throat and eye irritation. Ethylbenzene has been found in at least 731 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is ethylbenzene?

(Pronounced ĕthʹ əl bĕnʹ zēnʹ)

Ethylbenzene is a colorless, flammable liquid that smells like gasoline. It is found in natural products such as coal tar and petroleum and is also found in manufactured products such as inks, insecticides, and paints.

Ethylbenzene is used primarily to make another chemical, styrene. Other uses include as a solvent, in fuels, and to make other chemicals.

What happens to ethylbenzene when it enters the environment?

- Ethylbenzene moves easily into the air from water and soil.
- It takes about 3 days for ethylbenzene to be broken down in air into other chemicals.
- Ethylbenzene may be released to water from industrial discharges or leaking underground storage tanks.
- In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water.
- In soil, it is broken down by soil bacteria.

How might I be exposed to ethylbenzene?

- Breathing air containing ethylbenzene, particularly in areas near factories or highways.
- Drinking contaminated tap water.
- Working in an industry where ethylbenzene is used or made.
- Using products containing it, such as gasoline, carpet glues, varnishes, and paints.

How can ethylbenzene affect my health?

Limited information is available on the effects of ethylbenzene on people's health. The available information shows dizziness, throat and eye irritation, tightening of the chest, and a burning sensation in the eyes of people exposed to high levels of ethylbenzene in air.

Animals studies have shown effects on the nervous system, liver, kidneys, and eyes from breathing ethylbenzene in air.

How likely is ethylbenzene to cause cancer?

The EPA has determined that ethylbenzene is not classifiable as to human carcinogenicity.

ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html

No studies in people have shown that ethylbenzene exposure can result in cancer. Two available animal studies suggest that ethylbenzene may cause tumors.

How can ethylbenzene affect children?

Children may be exposed to ethylbenzene through inhalation of consumer products, including gasoline, paints, inks, pesticides, and carpet glue. We do not know whether children are more sensitive to the effects of ethylbenzene than adults.

It is not known whether ethylbenzene can affect the development of the human fetus. Animal studies have shown that when pregnant animals were exposed to ethylbenzene in air, their babies had an increased number of birth defects.

How can families reduce the risk of exposure to ethylbenzene?

Exposure to ethylbenzene vapors from household products and newly installed carpeting can be minimized by using adequate ventilation.

Household chemicals should be stored out of reach of children to prevent accidental poisoning. Always store household chemicals in their original containers; never store them in containers children would find attractive to eat or drink from, such as old soda bottles. Gasoline should be stored in a gasoline can with a locked cap.

Sometimes older children sniff household chemicals, including ethylbenzene, in an attempt to get high. Talk with your children about the dangers of sniffing chemicals.

Is there a medical test to show whether I've been exposed to ethylbenzene?

Ethylbenzene is found in the blood, urine, breath, and some body tissues of exposed people. The most common way to test for ethylbenzene is in the urine. This test measures substances formed by the breakdown of ethylbenzene. This test needs to be done within a few hours after exposure occurs, because the substances leave the body very quickly.

These tests can show you were exposed to ethylbenzene, but cannot predict the kind of health effects that might occur.

Has the federal government made recommendations to protect human health?

The EPA has set a maximum contaminant level of 0.7 milligrams of ethylbenzene per liter of drinking water (0.7 mg/L).

The EPA requires that spills or accidental releases into the environment of 1,000 pounds or more of ethylbenzene be reported to the EPA.

The Occupational Safety and Health Administration (OSHA) has set an occupational exposure limit of 100 parts of ethylbenzene per million parts of air (100 ppm) for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for ethylbenzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

TOLUENE
CAS # 108-88-3

Division of Toxicology ToxFAQs™ **February 2001**

This fact sheet answers the most frequently asked health questions (FAQs) about toluene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to toluene occurs from breathing contaminated workplace air, in automobile exhaust, some consumer products paints, paint thinners, fingernail polish, lacquers, and adhesives. Toluene affects the nervous system. Toluene has been found at 959 of the 1,591 National Priority List sites identified by the Environmental Protection Agency

What is toluene?

Toluene is a clear, colorless liquid with a distinctive smell. Toluene occurs naturally in crude oil and in the tolu tree. It is also produced in the process of making gasoline and other fuels from crude oil and making coke from coal.

Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes.

What happens to toluene when it enters the environment?

❑ Toluene enters the environment when you use materials that contain it. It can also enter surface water and groundwater from spills of solvents and petrolieum products as well as from leasking underground storage tanks at gasoline stations and other facilities.

❑ When toluene-containing products are placed in landfills or waste disposal sites, the toluene can enter the soil or water near the waste site.

❑ Toluene does not usually stay in the environment long.

❑ Toluene does not concentrate or buildup to high levels in animals.

How might I be exposed to toluene?

❑ Breathing contaminated workplace air or automobile exhaust.

❑ Working with gasoline, kerosene, heating oil, paints, and lacquers.

❑ Drinking contaminated well-water.

❑ Living near uncontrolled hazardous waste sites containing toluene products.

How can toluene affect my health?

Toluene may affect the nervous system. Low to moderate levles can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, loss of appetite, and

hearing and color vision loss. These symptoms usually disappear when exposure is stopped.

Inhaling High levels of toluene in a short time can make you feel light-headed, dizzy, or sleepy. It can also cause unconsciousness, and even death.

High levels of toluene may affect your kidneys.

How likely is toluene to cause cancer?

Studies in humans and animals generally indicate that toluene does not cause cancer.

The EPA has determined that the carcinogenicity of toluene can not be classified.

How can toluene affect children?

It is likely that health effects seen in children exposed to toluene will be similar to the effects seen in adults. Some studies in animals suggest that babies may be more sensitive than adults.

Breathing very high levels of toluene during pregnancy can result in children with birth defects and retard mental abilities, and growth. We do not know if toluene harms the unborn child if the mother is exposed to low levels of toluene during pregnancy.

How can families reduce the risk of exposure to toluene?

❑ Use toluene-containing products in well-ventilated areas.

❑ When not in use, toluene-containing products should be tightly covered to prevent evaporation into the air.

Is there a medical test to show whether I've been exposed to toluene?

There are tests to measure the level of toluene or its breakdown products in exhaled air, urine, and blood. To determine if you have been exposed to toluene, your urine or blood must be checked within 12 hours of exposure. Several other chemicals are also changed into the same breakdown products as toluene, so some of these tests are not specific for toluene.

Has the federal government made recommendations to protect human health?

EPA has set a limit of 1 milligram per liter of drinking water (1 mg/L).

Discharges, releases, or spills of more than 1,000 pounds of toluene must be reported to the National Response Center.

The Occupational Safety and Health Administration has set a limit of 200 parts toluene per million of workplace air (200 ppm).

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological Profile for Toluene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs™ Internet address is http://www.atsdr.cdc.gov/toxfaq.html . ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

XYLENE
CAS # 1330-20-7

This fact sheet answers the most frequently asked health questions (FAQs) about xylene. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Exposure to xylene occurs in the workplace and when you use paint, gasoline, paint thinners and other products that contain it. People who breathe high levels may have dizziness, confusion, and a change in their sense of balance. This substance has been found in at least 658 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is xylene?

(Pronounced zī′lēn)

Xylene is a colorless, sweet-smelling liquid that catches on fire easily. It occurs naturally in petroleum and coal tar and is formed during forest fires. You can smell xylene in air at 0.08–3.7 parts of xylene per million parts of air (ppm) and begin to taste it in water at 0.53–1.8 ppm.

Chemical industries produce xylene from petroleum. It's one of the top 30 chemicals produced in the United States in terms of volume.

Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

What happens to xylene when it enters the environment?

- Xylene has been found in waste sites and landfills when discarded as used solvent, or in varnish, paint, or paint thinners.
- It evaporates quickly from the soil and surface water into the air.
- In the air, it is broken down by sunlight into other less harmful chemicals.
- It is broken down by microorganisms in soil and water.
- Only a small amount of it builds up in fish, shellfish, plants, and animals living in xylene-contaminated water.

How might I be exposed to xylene?

- Breathing xylene in workplace air or in automobile exhaust.
- Breathing contaminated air.
- Touching gasoline, paint, paint removers, varnish, shellac, and rust preventatives that contain it.
- Breathing cigarette smoke that has small amounts of xylene in it.
- Drinking contaminated water or breathing air near waste sites and landfills that contain xylene.
- The amount of xylene in food is likely to be low.

How can xylene affect my health?

Xylene affects the brain. High levels from exposure for short periods (14 days or less) or long periods (more than 1 year) can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of

people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.

Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. We do not know if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy.

How likely is xylene to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that xylene is not classifiable as to its carcinogenicity in humans.

Human and animal studies have not shown xylene to be carcinogenic, but these studies are not conclusive and do not provide enough information to conclude that xylene does not cause cancer.

Is there a medical test to show whether I've been exposed to xylene?

Laboratory tests can detect xylene or its breakdown products in exhaled air, blood, or urine. There is a high degree of agreement between the levels of exposure to xylene and the levels of xylene breakdown products in the urine. However, a urine sample must be provided very soon after exposure ends because xylene quickly leaves the body. These tests are not routinely available at your doctor's office.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 10 ppm of xylene in drinking water.

The EPA requires that spills or accidental releases of xylenes into the environment of 1,000 pounds or more must be reported.

The Occupational Safety and Health Administration (OSHA) has set a maximum level of 100 ppm xylene in workplace air for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) and the American Conference of Governmental Industrial Hygienists (ACGIH) also recommend exposure limits of 100 ppm in workplace air.

NIOSH has recommended that 900 ppm of xylene be considered immediately dangerous to life or health. This is the exposure level of a chemical that is likely to cause permanent health problems or death.

Glossary

Evaporate: To change from a liquid into a vapor or a gas.

Carcinogenic: Having the ability to cause cancer.

CAS: Chemical Abstracts Service.

ppm: Parts per million.

Solvent: A liquid that can dissolve other substances.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for xylenes (update). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop E-29, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 404-498-0093. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES AND DISEASE REGISTRY

LEAD

CAS # 7439-92-1

Division of Toxicology and Environmental Medicine ToxFAQs™ **August 2007**

This fact sheet answers the most frequently asked health questions (FAQs) about lead. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to lead can happen from breathing workplace air or dust, eating contaminated foods, or drinking contaminated water. Children can be exposed from eating lead-based paint chips or playing in contaminated soil. Lead can damage the nervous system, kidneys, and reproductive system. Lead has been found in at least 1,272 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is lead?

Lead is a naturally occurring bluish-gray metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment. Much of it comes from human activities including burning fossil fuels, mining, and manufacturing.

Lead has many different uses. It is used in the production of batteries, ammunition, metal products (solder and pipes), and devices to shield X-rays. Because of health concerns, lead from paints and ceramic products, caulking, and pipe solder has been dramatically reduced in recent years. The use of lead as an additive to gasoline was banned in 1996 in the United States.

What happens to lead when it enters the environment?

- ❏ Lead itself does not break down, but lead compounds are changed by sunlight, air, and water.
- ❏ When lead is released to the air, it may travel long distances before settling to the ground.
- ❏ Once lead falls onto soil, it usually sticks to soil particles.
- ❏ Movement of lead from soil into groundwater will depend on the type of lead compound and the characteristics of the soil.

How might I be exposed to lead?

- ❏ Eating food or drinking water that contains lead. Water pipes in some older homes may contain lead solder. Lead can leach out into the water.
- ❏ Spending time in areas where lead-based paints have been used and are deteriorating. Deteriorating lead paint can contribute to lead dust.
- ❏ Working in a job where lead is used or engaging in certain hobbies in which lead is used, such as making stained glass.
- ❏ Using health-care products or folk remedies that contain lead.

How can lead affect my health?

The effects of lead are the same whether it enters the body through breathing or swallowing. Lead can affect almost every organ and system in your body. The main target for lead toxicity is the nervous system, both in adults and children. Long-term exposure of adults can result in decreased performance in some tests that measure functions of the nervous system. It may also cause weakness in fingers, wrists, or ankles. Lead exposure also causes small increases in blood pressure, particularly in middle-aged and older people and can cause anemia. Exposure to high lead levels can severely damage the brain and kidneys in adults or children and ultimately cause death. In pregnant women, high levels of exposure to lead may cause miscarriage. High-level exposure in men can damage the organs responsible for sperm production.

How likely is lead to cause cancer?

We have no conclusive proof that lead causes cancer in humans. Kidney tumors have developed in rats and mice that had been given large doses of some kind of lead compounds. The Department of Health and Human Services

(DHHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens and the EPA has determined that lead is a probable human carcinogen. The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans.

How can lead affect children?

Small children can be exposed by eating lead-based paint chips, chewing on objects painted with lead-based paint, or swallowing house dust or soil that contains lead.

Children are more vulnerable to lead poisoning than adults. A child who swallows large amounts of lead may develop blood anemia, severe stomachache, muscle weakness, and brain damage. If a child swallows smaller amounts of lead, much less severe effects on blood and brain function may occur. Even at much lower levels of exposure, lead can affect a child's mental and physical growth.

Exposure to lead is more dangerous for young and unborn children. Unborn children can be exposed to lead through their mothers. Harmful effects include premature births, smaller babies, decreased mental ability in the infant, learning difficulties, and reduced growth in young children. These effects are more common if the mother or baby was exposed to high levels of lead. Some of these effects may persist beyond childhood.

How can families reduce the risks of exposure to lead?

❑ Avoid exposure to sources of lead.

❑ Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint.

❑ If you have a water lead problem, run or flush water that has been standing overnight before drinking or cooking with it.

❑ Some types of paints and pigments that are used as make-up or hair coloring contain lead. Keep these kinds of products away from children

❑ If your home contains lead-based paint or you live in an area contaminated with lead, wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Is there a medical test to determine whether I've been exposed to lead?

A blood test is available to measure the amount of lead in your blood and to estimate the amount of your recent exposure to lead. Blood tests are commonly used to screen children for lead poisoning. Lead in teeth or bones can be measured by X-ray techniques, but these methods are not widely available. Exposure to lead also can be evaluated by measuring erythrocyte protoporphyrin (EP) in blood samples. EP is a part of red blood cells known to increase when the amount of lead in the blood is high. However, the EP level is not sensitive enough to identify children with elevated blood lead levels below about 25 micrograms per deciliter (μg/dL). These tests usually require special analytical equipment that is not available in a doctor's office. However, your doctor can draw blood samples and send them to appropriate laboratories for analysis.

Has the federal government made recommendations to protect human health?

The Centers for Disease Control and Prevention (CDC) recommends that states test children at ages 1 and 2 years. Children should be tested at ages 3–6 years if they have never been tested for lead, if they receive services from public assistance programs for the poor such as Medicaid or the Supplemental Food Program for Women, Infants, and Children, if they live in a building or frequently visit a house built before 1950; if they visit a home (house or apartment) built before 1978 that has been recently remodeled; and/or if they have a brother, sister, or playmate who has had lead poisoning. CDC considers a blood lead level of 10 μg/dL to be a level of concern for children.

EPA limits lead in drinking water to 15 μg per liter.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for lead (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

APPENDIX B

REPORT FORMS

WEEKLY SAFETY REPORT FORM

Week Ending: _____ Project Name/Number: _____

Report Date: _____ Project Manager Name: _____

Summary of any violations of procedures occurring that week:

_____

_____

_____

Summary of any job related injuries, illnesses, or near misses that week:

_____

_____

_____

_____

Summary of air monitoring data that week (include and sample analyses, action levels exceeded, and actions taken):

_____

_____

_____

Comments:

_____

_____

_____

Name: _____ Company: _____

Signature: _____ Title: _____

INCIDENT REPORT FORM

Date of Report: _____

Injured: _____

Employer: _____

Site: _____ Site Location: _____

Report Prepared By: _____ _____
Signature Title

ACCIDENT/INCIDENT CATEGORY (check all that applies)

___Injury	___ Illness	___ Near Miss
__ Property Damage	___ Fire	___ Chemical Exposure
__ On-site Equipment	___ Motor Vehicle	___ Electrical
__ Mechanical	___ Spill	___ Other

DATE AND TIME OF ACCIDENT/INCIDENT: Narrative report of Accident/Incident: Identify: 1) actions leading to or contributing to the accident/incident; 2) the accident/incident occurrence; and 3) actions following the accident/incident.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

WITNESS TO ACCIDENT/INCIDENT:

Name:	_____	Company:	_____
Address:	_____	Address:	_____
Phone No.:	_____	Phone No.:	_____
Name:	_____	Company:	_____
Address:	_____	Address:	_____
Phone No.:	_____	Phone No.:	_____

INJURED - ILL:

Name: _____ SSN: _____

Address: _____ Age: _____

Length of Service: _____ Time on Present Job: _____

Time/Classification: _____

SEVERITY OF INJURY OR ILLNESS:

____ Disabling ___ Non-disabling ___ Fatality

____ Medical Treatment ___ First Aid Only

ESTIMATED NUMBER OF DAYS AWAY FROM JOB: _____

NATURE OF INJURY OR ILLNESS: _____

_____

_____

_____

CLASSIFICATION OF INJURY:

__ Abrasions _____ Dislocations ____ Punctures

__ Bites _____ Faint/Dizziness ____ Radiation Burns

__ Blisters _____ Fractures ____ Respiratory Allergy

__ Bruises _____ Frostbite ____ Sprains

__ Chemical Burns _____ Heat Burns ____ Toxic Resp. Exposure

__ Cold Exposure _____ Heat Exhaustion ____ Toxic Ingestion

__ Concussion _____ Heat Stroke ____ Dermal Allergy

__ Lacerations

Part of Body Affected: _____

Degree of Disability: _____

Date Medical Care was Received: _____

Where Medical Care was Received: _____

Address (if off-site): _____

(If two or more injuries, record on separate sheets)

PROPERTY DAMAGE:

Description of Damage: _____

_____

Cost of Damage: $ _____

ACCIDENT/INCIDENT LOCATION: _____

ACCIDENT/INCIDENT ANALYSIS: Causative agent most directly related to accident/incident (Object, substance, material, machinery, equipment, conditions)

_____

_____

_____

_____

Was weather a factor?:_____

_____

Unsafe mechanical/physical/environmental condition at time of accident/incident (Be specific):

_____

_____

_____

Personal factors (Attitude, knowledge or skill, reaction time, fatigue):

_____

_____

ON-SITE ACCIDENTS/INCIDENTS:

Level of personal protection equipment required in Site Safety Plan:

_____

_____

Modifications:

_____

Was injured using required equipment?:

_____

_____

If not, how did actual equipment use differ from plan?:

_____

_____

ACTION TAKEN TO PREVENT RECURRENCE: (Be specific. What has or will be done? When will it be done? Who is the responsible party to insure that the correction is made?

ACCIDENT/INCIDENT REPORT REVIEWED BY:

SSO Name Printed | SSO Signature

OTHERS PARTICIPATING IN INVESTIGATION:

Signature | Title

Signature | Title

Signature | Title

ACCIDENT/INCIDENT FOLLOW-UP: Date: _____

Outcome of accident/incident: _____

Physician's recommendations: _____

Date injured returned to work: _____

Follow-up performed by:

Signature | Title

ATTACH ANY ADDITIONAL INFORMATION TO THIS FORM

APPENDIX C

EMERGENCY HAND SIGNALS

EMERGENCY SIGNALS

In most cases, field personnel will carry portable radios for communication. If this is the case, a transmission that indicates an emergency will take priority over all other transmissions. All other site radios will yield the frequency to the emergency transmissions.

Where radio communications is not available, the following air-horn and/or hand signals will be used:

EMERGENCY HAND SIGNALS

OUT OF AIR, CAN'T BREATHE!



Hand gripping throat

LEAVE AREA IMMEDIATELY, NO DEBATE!

(No Picture) Grip partner's wrist or place both hands around waist

NEED ASSISTANCE!



Hands on top of head

OKAY! – I'M ALL RIGHT!

- I UNDERSTAND!



Thumbs up

NO! - NEGATIVE!



Thumbs down

APPENDIX B
QUALITY ASSURANCE PROJECT PLAN

WHITE PLAINS FIRE DEPARTMENT DRILL SCHOOL

1402 OLD ORCHARD STREET
WHITE PLAINS, NEW YORK

Quality Assurance Project Plan

AKRF Project Number: 200217
NYSDEC Site Number: 360193

Prepared for:

The City of White Plains
255 Main Street
White Plains, New York 10601

Prepared by:

AKRF, Inc.
440 Park Avenue South
New York, NY 10016
212-696-0670

JUNE 2025

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ATTACHMENTS

Attachment A – Resumes for Remedial Engineer, QA/QC Officer, Project Manager, Project Manager Alternates, Field Team Leader, and Data Validator
Attachment B – New York State Department of Environmental Conservation – Guidelines for Sampling and Analysis of PFAS – April 2023

1.0 INTRODUCTION

This Quality Assurance Project Plan (QAPP) describes the protocols and procedures that will be followed during implementation of the Interim Remedial Measures Work Plan (IRMWP) for the White Plains Fire Department Drill School (the Site) located at 1402 Old Orchard Street, White Plains, New York. The legal definition of the Site is City of White Plains Tax ID 120.20-17-1, and the property class is identified as Public Services-Water Supply. The Site is approximately 141 acres, is mainly wooded with small streams, and contains the White Plains Fire Department Drill School (FDDS). The FDDS is situated within a 4-acre clearing that is located approximately 500 feet east of White Plains Reservoir #2. The Orchard Street Pump Station (OCPS) property and its facilities, also owned and operated by The City, are located within the western portion of the Site, and south-adjacent to Reservoir #1.

The IRM is being conducted to address an ongoing source of per- and polyfluoroalkyl substances (PFAS) contamination that was documenting during the Site Characterization Investigation (SCI) and the Remedial Investigation (RI). The SCI and RI were completed to satisfy the requirements of a New York State Department of Environmental Conservation (NYSDEC) Order of Consent (CO) associated with the Site (NYSDEC Site No. C360193). The objective of this QAPP is to provide for Quality Assurance (QA) and maintain Quality Control (QC) while performing the activities described in the IRMWP, and adherence to the QAPP will ensure that defensible data will be obtained during all environmental work at the Site. All activities identified in the QAPP will meet and be performed in accordance with DER-10.

The scope of the IRM includes excavation and disposal of a PFAS contaminated soil from a release area hot spot, soil trenching, excavation dewatering, installation of injection points via a direct push drilling rig, application of in-situ treatment reagents in bulk application and through injection points, and surface water treatment via a ground level permeable flow through treatment unit.

2.0 PROJECT TEAM

The project team will be drawn from AKRF professional and technical personnel, and AKRF's subcontractors. All field personnel and subcontractors will have completed a 40-hour training course and updated 8-hour refresher course that meet the Occupational Safety and Health Administration (OSHA) requirements of 29 CFR Part 1910. The following sections describe the key project personnel and their responsibilities.

2.1 Remedial Engineer

The Remedial Engineer (RE) for this project will be Rebecca Kinal, P.E. The RE will have primary direct responsibility for implementation of the IRMWP. The RE will coordinate the work of other contractors and subcontractors involved in all aspects of IRM construction, including soil excavation, stockpiling, characterization, removal and disposal, air monitoring, emergency spill response services, import of backfill material, and management of waste transport and disposal. The RE will be responsible for all appropriate communication with NYSDEC and New York State Department of Health (NYSDOH). Ms. Kinal's resume is included in Attachment A.

2.2 Quality Assurance/ Quality Control (QA/QC) Officer

Mr. Marc Godick will serve as the QA/QC officer and will be responsible for adherence to the QAPP. The QA/QC officer will review the procedures with all personnel prior to commencing any fieldwork and will conduct periodic Site visits to assess implementation of the procedures. The QA/QC officer will also be responsible for reviewing Data Usability Summary Reports (DUSRs) for soil analytical results. Mr. Godick's resume is included in Attachment A.

2.3 Project Manager

The project manager will be responsible for directing and coordinating all elements of the IRM. The project manager will communicate regularly with all members of the City, AKRF project team and the NYSDEC to ensure a smooth flow of information between parties involved. The project manager will prepare reports and participate in meetings with the City and/or the NYSDEC. Bryan Zieroff will serve as the project manager for implementation of the IRM. Mr. Zieroff's resume is included in Attachment A.

2.4 Project Manager Alternate

The project manager alternate will be responsible for assisting the project manager. The project manager alternate will help prepare reports and will participate in meetings with the Site owner, and/or the NYSDEC. Mr. Steve Schmid will serve as the project manager alternate for implementation of the IRM. Mr. Schmid's resume is included in Attachment A.

2.5 Field Team Leader, Field Technician, Site Safety Officer, and Alternates

The field team leader will be responsible for supervising the daily sampling and health and safety activities in the field and will ensure adherence to the work plan and Health and Safety Plan (HASP), included in Appendix B of the SCWP. The field team leader will also act as the field technician and Site safety officer (SSO), and will report to the project manager or project manager alternate on a regular basis regarding daily progress and any deviations from the work plan. The field team leader will be a qualified and responsible person able to act professionally and promptly during environmental work at the Site. Mr. Steve Schmid will act as the field team leader. The field team leader alternate is Patrick O'Mara of AKRF. Resumes for Mr. Schmid and Mr. O'Mara are included in Attachment A.

2.6 Laboratory Quality Assurance/Quality Control (QA/QC) Officer

The laboratory QA/QC officer will be responsible for quality control procedures and checks in the laboratory and ensuring adherence to laboratory protocols. The QA/QC officer will track the movement of samples from the time they are checked in at the laboratory to the time that analytical results are issued, and will conduct a final check on the analytical calculations and sign off on the laboratory reports. The laboratory QA/QC officer will be Carl Ambruster of Eurofins TestAmerica Laboratories (TestAmerica), the New York State Department of Health (NYSDOH) Environmental Laboratory Accreditation Program (ELAP)-certified laboratory being employed for all environmental sampling at the Site. Mr. Ambruster's resume is included in Attachment A.

2.7 Laboratory Data Validator

The laboratory data validator will be responsible for third party data validation and preparation of Data Usability Summary Reports (DUSRs). The third-party laboratory data validator will be Lori Beyer of L.A.B. Validation Corp. Ms. Beyer's resume is included in Attachment A.

3.0 STANDARD OPERATING PROCEDURES (SOPS)

The following sections describe the SOPs for the investigation activities included in the IRMWP. These procedures are consistent with the Guidelines for Sampling and Analysis of PFAS, which included in this document for reference as Attachment B. During these operations, safety monitoring will be performed as described in the HASP, included as Appendix A of the IRMWP.

3.1 Equipment

Materials considered acceptable for collecting samples where PFAS is the contaminant of concern (COC) includes stainless steel, high density polyethylene (HDPE), silicone, acetate, and polypropylene. Sampling equipment should not come in contact with aluminum foil, low-density polyethylene (LDPE), glass, polytetrafluoroethylene (PTFE or Teflon™), including sample jars with a PTFE liner under the cap. Field personnel should avoid clothing that contains PTFE, including Gore-Tex®, and any PFAS-related materials used in waterproofing, bug spray, and sunscreen.

3.2 Decontamination of Sampling Equipment

All sampling equipment (augers, drilling rods, split spoon samplers, hand augers, spoons, probe rods, pumps, etc.) will be either dedicated or decontaminated between sampling locations. Decontamination will be conducted on plastic sheeting (or equivalent) that is bermed to prevent discharge to the ground. The decontamination procedure will be as follows:

1. Scrub equipment with a bristle brush using a PFC-free water/Simple Green® solution.
2. Rinse with PFC-free water.
3. Scrub again with a bristle brush using a PFC-free water/Simple Green® solution.
4. Rinse with PFC-free water.
5. Rinse with distilled water.
6. Air-dry the equipment.

AKRF will provide documentation that the source of distilled water and the detergent (Simple Green® or alternate) being used for decontamination purposes are PFAS –free prior to the start of work.

3.3 Excavation and Removal of Contaminated Material

The IRMWP describes soil removal that will be completed at the Site. Soil removal will take place at two locations: 1) the PFAS source area hot spot centering on SB-7 in the asphalt clearing (approximately 60 feet by 120 feet), and 2) a trench (approximately 4 feet by 30 feet) along the eastern side of the stream culvert that is located below the access driveway to the Site. A site plan depicting the proposed soil excavation area is provided in the IRMWP as Figures 9 and 10.

Soil excavation in the asphalt clearing will be initiated based on the contractor's preference for managing site logistics while performing the excavation work, including managing soil transport to the designated stockpile areas, and backfilling the completed excavation areas as the excavation expands. Soil excavation for the trench will be completed in one linear, end to end effort. Both areas are anticipated to be excavated to bedrock.

During the excavation activities, the excavated material will be inspected by AKRF field personnel for evidence of contamination (i.e., staining and/or odors) and field-screened using a (photoionization detector) PID, which measures relative concentrations of volatile organic compounds (VOCs) in the soil. Work zone and community air monitoring will be conducted during all work identified in the IRMWP. The work zone air monitoring will be completed in accordance with the site-specific HASP and CAMP, which is provided in Appendix A of the IRMWP.

Post-excavation endpoint samples will be collected from the hot spot excavation for closure purposes. One sample will be collected from each sidewall from the first stage of excavation at a depth equal to the bottom of the excavation (5 feet below grade). After completing the second

stage of excavation, one sample will be collected from each sidewall of the excavation at a depth equal to the bottom of the excavation (ten feet below grade).

3.4 Stockpile Methods

Soil characterization, either pre-excavation for live loading, or sampling of stockpiles, will be conducted in accordance with the requirements of the intended receiving facilities. Soil excavated from above the water table (unsaturated) will be placed in designated stockpiles. Each soil stockpile will be located based on security, or ease of loading onto haul trucks and will be placed on sheeting and kept fully covered whenever excavation and/or loading operations are not occurring with an appropriately anchored tarp or min 6-mil poly sheeting. Each stockpile cover will be routinely inspected to ensure adequate cover. If a damaged tarp/poly sheeting cover is observed, it will be promptly replaced. Soil stockpiles will be continuously encircled with a berm and/or silt fence as necessary to prevent runoff off-Site or to uncontaminated locations on-Site. Hay bales and/or other erosion and sediment controls will be used as needed near any catch basins or other discharge points. Soil excavated during the IRM will not be reused on-site.

Saturated soil excavated from below the water table will be placed in a fabricated wet dewatering structure that will allow the saturated stockpile to decant into a surface level groundwater collection unit. Prior to initiating the excavation work, the wet dewatering structure(s) will be installed immediately adjacent to the excavation. The wet dewatering structure(s) will be constructed in a manner that allows the soil to decant onto polyethylene sheeting, membrane, or equivalent, and flow into a groundwater collection area/sump. The wet dewatering units will be protected with control measures (i.e., line barriers, hay bales, etc.) to retain all decanted groundwater. All retained fluids will be managed as documented in Section 3.5 below.

The location and classification of each stockpile and wet dewatering unit location will be tracked on Site drawings and updated, if necessary, at the end of each workday. Copies of Site drawings will be kept in the field logbook

3.5 Fluids Management

All liquids removed from the excavation or collected by the wet dewatering structure will be managed via an above-grade treatment system, which will transfer the collected/decanted groundwater from the dewatering stockpile system into a holding (frac or equivalent) tank for sediment reduction, and then through carbon treatment for contaminant removal, before returning the treated groundwater back to the excavation.

Prior to the treatment system being placed online, and at specified intervals during treatment, laboratory testing will be conducted to confirm that the system design is operating effectively, and the effluent shows a significant reduction compared to the influent concentrations (i.e., greater than 90% reduction). After initial startup, monitoring frequency shall be bi-weekly during the treatment system operation. A totalizer will be used as part of the treatment system discharge to confirm the total gallons of treated groundwater that is returned to the excavation.

If there is a need for off-site disposal, contaminated groundwater will be transported and disposed of at an appropriate disposal facility in accordance with applicable local, State, and Federal regulations. NYSDEC and NYSDOH will be notified of the disposal location and methods, and the appropriate documentation, including characterization and manifest documentation, will be included in the construction completion report.

3.6 Temporary Injection Points

Two linear transects of groundwater treatment injections will be drilled for installation of temporary injection points. Injection tooling will be advanced by a direct push drilling rig, and

the borings will be advanced to bedrock. The actual number of borings/injection points will be outlined in the IRM Design Document.

The injection process at each proposed injection point will be completed using fabricated injection tooling specifically designed to be implemented by a direct push drilling rig. The injection tooling will consist of a pressure activated injection probe that is capable of top-down or bottom-up injection methods, which allows for injection of remediation materials throughout the entire target interval at each injection point. The injection probe will be advanced into the ground to the target interval, and prepared remediation fluids are pumped from a holding tank, through tubing that is connected to the injection probe through the drilling rods. Groundwater in the treatment area is expected to be encountered at approximately 6 feet below grade, and bedrock is expected to be encountered at approximately 12 feet below grade.

The injection process at each injection point will conducted based on the following procedures:

- Measure the depth to water in nearby monitoring wells (MW-1, MW-4, MW-7 and MW-8) to establish the water table elevation.
- Advance the injection tooling to the designated target depth, either the water table for top down injection, or the bedrock interface for bottom up injection, to begin the injection of remediation fluids.
- For a top down injection, remediation fluids will be injected into the subsurface from the water table interface down to bedrock. For a bottom up injection, remediation fluids will be injected into the formation at designated intervals up to the water table interface.
- The type of injection (top down vs bottom up) and the injection interval (number of injections per boring) will be determined in consultation with the remediation fluids provider, who developed a proprietary injection model for optimum delivery results.
- Backfill the remaining annular space using a bentonite-cement grout.
- Decontaminate the probe and drilling rods prior to and following installation of each injection well as described in Section 3.2 of this QAPP.
- Document injection well installation data (location, depth, construction details, water level measurements) in the field logbook or on field data sheets.

3.7 Passive Barrier Treatment System

An in-situ passive barrier treatment system (PBTS) is proposed to be installed in the former drum cleanout area excavation trench. The PBTS will consist of backfilling the trench with an aggregate material (1/4" to 3/8" aggregate) covered with a thin coat of powdered amendments. The aggregate material will be backfilled in into the trench using the excavator bucket. An even spread of material will be backfilled and spread along the entire length of the trench in 1 foot lifts to allow for proper settlement of the aggregate material up to the seasonal high water table elevation. The remaining backfill and surface completion for the trench will be completed in accordance with the IRMWP.

3.8 Surface Water Treatment

In-situ treatment of surface water in the intermittent stream will be completed using a permeable flow through filtration unit.

The permeable flow through filtration unit will be installed along a section of the unnamed tributary that has a relatively flat gradient, with approximately six inches of water under typical flow conditions. An area approximately 6-ft wide by 12-ft long will be graded as part of

preparation for the treatment system. The bottom of the graded area will be lined with a bentonite based low permeable sealing material design for submerged application, and will be used to separate any sediment underlying the treatment system from the treatment media. The low permeability base material will be extended 3 feet upstream and downstream of the treatment structure to further isolate the existing sediment, and provide for pre- and post-treatment surface water sampling areas. The liner will be armored with a layer of gravel. A geotextile fabric will be placed between the base material and the treatment unit to act as a separation barrier. The sides of the treatment unit will include a stacked wedge of low permeability material to channel the flow through and treatment unit and minimize bypass.

The treatment amendments will be place in 6-inch diameter socks that will come pre-filled in two or three feet lengths, and provide for a bulk density of 80 pounds per cubic foot. The treatment socks will be arranged in a manner that will provide for a 6 feet wide by 12 feet long treatment zone. The two indicated lengths for the treatment socks will allow for a staggered arrangement that will minimize channeling and preferred flow pathways through the filtration socks. This arrangement is estimated to include approximately 3,000 pounds of treatment material.

4.0 SAMPLING AND LABORATORY PROCEDURES

The sampling of various media as outlined in the IRMWP and this Section will include the collection of samples for laboratory analysis of PFAS. All samples will be collected in accordance with NYSDEC's published protocols, including the acceptable/specific sampling materials, equipment, and QA/QC requirements. A copy of NYSDEC's protocol and guidance document is included in Appendix B.

4.1 End-Point Sampling

Per NYSDEC DER-10 Section 5.4, side-wall samples will be collected a minimum one sample for every 30 linear feet and bottom samples will be collected at a frequency of one every 900-SF. The proposed excavation areas are depicted in the IRMWP. As outlined in Section 4.2 of this QAPP, soil samples will be analyzed for the parameters listed Section 4.6, Table 3. Soil sampling will be conducted according to the following procedures:

The PID will be calibrated in accordance with manufacturer's recommendations prior to sampling.

Soil sampling will be conducted according to the following procedures:

- Characterize the sample according to the Unified Soil Classification System (USCS).
- Describing any evidence of contamination (e.g., staining, sheens, odors)
- Field screen the sample for evidence of contamination (e.g., odors, staining,) using visual and olfactory methods and screen for VOCs using a PID calibrated each day in accordance with the manufacturer's instructions.
- Collect an aliquot of soil from each proposed sample location, place in laboratory-supplied glassware, label the sample in accordance with Section 4.5, Table 2 of this QAPP, and place in an ice-filled cooler for shipment to the laboratory.
- Complete the proper chain of custody paperwork and seal the cooler.
- Record sample location, sample depth, and sample observations (evidence of contamination, PID readings, soil classification, etc.) in field log book and boring log data sheet, if applicable.

- Decontaminate any soil sampling equipment between sample locations as described in Section 3.2 of this QAPP.

4.2 Surface Water Sampling

The surface water samples will be collected with a pre-cleaned cup comprised of materials approved by NYSEC for the collection of samples containing PFAS, including stainless steel, HPDE, PVC, silicone, acetate, or polypropylene. The cup will be rinsed with the site media at the sampling location prior to collecting a sample. The sample will then be collected and poured into the provided laboratory containers.

4.3 Monitoring Well Sampling

For post IRM groundwater monitoring, which will be detailed in the forthcoming IRM Design Document, low flow sampling techniques will be used, as described in U.S. EPA's Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers [EPA 542-S-02-001, May 2002]. Sampling will be conducted according to the following procedure:

- Prepare the sampling area by placing plastic sheeting over the well. Cut a hole in the sheeting to provide access to the well cover.
- Slowly remove the locking cap and immediately measure the vapor concentrations in the well with a PID calibrated to the manufacturer's specifications.
- Measure the depth to water and total well depth, and check for the presence of non-aqueous phase liquid (NAPL) using an oil/water interface probe. Measure the thickness of NAPL, if any, and record in field book and well log. Groundwater samples will not be collected from wells containing measurable NAPL.
- Use the water level and total well depth measurements to calculate the length of the mid-point of the water column within the screened interval. For example, for a well where the total depth is 20 feet, screened interval is 10 to 20 feet, and depth to water is 14 feet, the mid-point of the water column within the screened interval would be 17 feet.
- Connect dedicated tubing and/or suitable pump (i.e., bladder pump) that is PFAS-free such that the intake is set at the mid-point of the water column within the screened interval of the well. Connect the discharge end of the tubing to the flow-through cell of a YSI multi-parameter (or equivalent) meter. Connect tubing to the output of the cell and place the discharge end of the tubing in a five-gallon bucket.
- Activate the pump at the lowest flow rate setting of the pump.
- Measure the depth to water within the well. The pump flow rate may be increased such that the water level measurements do not change by more than 0.3 feet as compared to the initial static reading. The well-purging rate should be adjusted so as to produce a smooth, constant (laminar) flow rate and so as not to produce excessive turbulence in the well. The expected targeted purge rate will be approximately 0.5 liters and will be no greater than 3.8 liters/minute.
- Transfer discharged water from the 5-gallon buckets to an on-site 55-gallon drum, as described in Section 3.5.
- During purging, collect periodic samples and analyze for water quality indicators (e.g., turbidity, pH, temperature, dissolved oxygen, reduction-oxidation potential, and specific conductivity) with measurements collected approximately every five minutes.

- Continue purging the well until turbidity is less than 50 NTU and water quality indicators have stabilized to the extent practicable. The criteria for stabilization will be three successive readings for the following parameters and criteria:

Table 1
Stabilization Criteria

Parameter	Stabilization Criteria
PH	+/- 0.1 pH units
Specific Conductance	+/- 3% mS/cm
ORP/Eh	+/- 10mV
Turbidity	<50 NTU
Dissolved Oxygen	+/- 0.3 mg/l
Notes: mS/cm = millisievert per centimeter mV = millivolts NTU = nephelometric turbidity units mg/l = milligrams per liter	

- If the water quality parameters do not stabilize and/or turbidity is greater than 50 NTU within two hours, purging may be discontinued. Efforts to stabilize the water quality for the well must be recorded in the field book, and samples may then be collected as described herein.
- After purging, disconnect the tubing to the inlet of the flow-through cell. Collect groundwater samples directly from the discharge end of the tubing and place into the required sample containers as described in Section 4.6 of this QAPP. Label the containers as described in Section 4.8.1.1, Table 4 of this QAPP and place in a chilled cooler.
- Once sampling is complete, remove the pump and tubing from the well. Dispose of the sampling materials and PPE in a designated 55-gallon drum. The purge water will be managed as described in Section 3.5 of this QAPP.
- Decontaminate the pump (where necessary), oil/water interface probe, and flow-through cell, as described in Section 3.4 of this QAPP.
- Record all measurements (depth to water, depth to NAPL, water quality parameters, turbidity), calculations (well volume) and observations in the project logbook and field data sheet, if applicable.

4.4 Sample Handling

Samples slated for laboratory analysis will be labeled and placed in laboratory-supplied containers and shipped to the laboratory via courier with appropriate chain of custody documentation in accordance with appropriate EPA protocols to Eurofins TestAmerica in Edison, New Jersey and Eurofins TestAmerica in South Burlington, Vermont, NYSDOH Environmental Laboratory Approval Program (ELAP)-certified laboratories. All samples will be analyzed for the standard list of 40 PFAS compounds using EPA Method 1633, as documented in Section 4.6, Table 2.

The laboratory report will be prepared using Category B deliverables and Electronic Data Deliverables (EDDs) in the latest NYSDEC format. A standard turnaround time will be requested from the laboratory.

4.5 Laboratory Methods

Table 1 summarizes the laboratory methods that will be used to analyze field samples and the sample container type, preservation, and applicable holding times. Eurofins TestAmerica of Edison, New Jersey and Eurofins TestAmerica in South Burlington, Vermont, NYSDOH ELAP-certified laboratories subcontracted to AKRF, will be used for all chemical analyses in accordance with the Division of Environmental Remediation (DER)-10 2.1(b) and 2.1(f) with Category B Deliverables. PFAS samples will be analyses will be conducted by Eurofins TestAmerica in South Burlington, Vermont. Reporting limits for PFOA and PFOS will not exceed 0.5 micrograms per kilogram (µg/kg) and 2 nanograms per liter (ng/L) in solid and aqueous samples, respectively. Reporting limits for all other PFAS compounds will be as close to these limits as possible.

Table 2
Laboratory Analytical Methods for Analysis Groups

Matrix	Analysis	EPA Method	Bottle Type	Preservative	Hold Time
Soil and Soil QA/QC	Standard List of 40 Per- and Polyfluoroalkyl Substances (PFAS) Compounds	EPA Modified 1663 D	4 oz. HDPE Plastic Container	≤ 6 °C	14 days to extract; 40 days to analyze
Groundwater, Surface Water and Water QA/QC	Standard List of 40 Per- and Polyfluoroalkyl Substances (PFAS) Compounds	EPA Modified 1663 D	4 oz. HDPE Plastic Container	≤ 6 °C	14 days to extract; 40 days to analyze
Notes: EPA – Environmental Protection Agency HDPE – High Density Polyethylene					

4.6 Quality Control (QC) Sampling

In addition to the laboratory analysis of the samples, additional analysis will be included for QC measures, as required by the Category B sampling techniques. These samples will include a field duplicate, matrix spike/matrix spike duplicate (MS/MSD), equipment blank, and trip blank samples at a frequency of one per 20 field samples collected or per sample digestion group (SDG). QC samples will be analyzed for the same parameters as the accompanying samples, with the exception of any trip blanks, which will be analyzed for the VOC list only.

Table 3
Field Sample and QC Sample Quantities

Sample Type	Parameters	EPA Method	Field Samples	QC Samples			
				Duplicate	MS/ MSD	Equipment Blank*	Trip Blank
Soil	PFAS	Modified 1663	20	1	1	*	1
Groundwater & Surface Water	PFAS	Modified 1663	TBD	**	**	*	**

Notes:
MS/MSD – matrix spike/matrix spike duplicate
* Equipment blanks for PFAS will be collected at a minimum frequency of one per day for surface water/groundwater.
** The actual number of field samples and associate QC samples will vary, depending on the duration of the sampling program.

4.7 Sample Handling

4.7.1 Sample Identification

All samples will be consistently identified in all field documentation, chain-of-custody (COC) documents, and laboratory reports. All samples will be amended with a collection date at the end of the sample same in a year, month, day (YYYYMMDD) format. Blind duplicate sample nomenclature will consist of the sample type, followed by an "X"; MS/MSD samples nomenclature will consist of the parent sample name, followed by "MS/MSD"; and trip and field blanks will consist of "TB-" and "FB-", respectively, followed by a sequential number of the trip/field blanks collected within the sample digestion group (SDG). Special characters, including primes/apostrophes (’), will not be used for sample nomenclature.

4.7.2 Interim Remedial Measure (IRM) Sample Identification

Soil endpoints samples will be collected during the IRM work, and groundwater, surface water, and sediment samples will be collected during the post IRM monitoring. The samples will be identified with "EP-" for soil endpoints, "MW" for groundwater monitoring wells, "DP" for dam piezometers, "CW-" for cistern wells, "SED-" for sediment sampling locations, and "SW-" for surface water sampling locations and the corresponding sampling identification number. Soil samples will also be amended with the sample collection depth interval in parentheses. Table 4 provides examples of the sampling identification scheme for samples collected during the site investigation. Soil endpoint samples will be identified with "EP-" and the endpoint sample number in sequential order that the endpoint sample was collected, and the depth below grade the sample was collected from in parentheses. Table 4 provides examples of the sampling identification scheme for the post-excavation endpoint samples.

Table 4
End-point Sample Nomenclature

Sample Description	Sample Designation
Soil endpoint sample collected from the excavation sidewall at 3 feet below grade on October 30, 2025	EP-1(3) 20251030
Surface water sample SW-10 collected on October 30, 2025	SW-10 20251030
Groundwater sample collected from groundwater dam piezometer well DP-10 on October 30, 2025	DP-10 20251030
Matrix spike/matrix spike duplicate sample of surface water sample collected from surface water sample SW-1 on October 30, 2025	SW-1 MS/MSD 20251030
Blind duplicate sample of groundwater sample collected from a groundwater monitoring well on October 30, 2025	MW-X 20251030
Second field blank collected on October 30, 2025	FB-2 20251030

4.7.3 Waste Classification

Any waste classification samples will be amended with "WC-", indicated the Stockpile ID or pre-characterization boring ID, and the alphanumeric order of collection. Table 5 provides examples of the sampling identification scheme for proposed waste classification samples and any hotspot or tank excavation samples.

Table 5
Waste Classification Sample Nomenclature

Sample Description	Sample Designation
Waste classification sample #4 collected from Stockpile 1 on October 30, 2025	WC-4_S1 20251030

Sample Labeling and Shipping

All sample containers will be provided with labels containing the following information:

- Project identification, including Site name, NYSDEC Site number, Site address
- Sample identification
- Date and time of collection
- Analysis(es) to be performed
- Sampler's initials

Once the samples are collected and labeled, they will be placed in chilled coolers and stored in a cool area away from direct sunlight to await shipment to the laboratory. All samples will be shipped to the laboratory at least twice per week. At the start and end of each workday, field personnel will add ice to the cooler(s) as needed.

The samples will be prepared for shipment by placing each sample in laboratory-supplied glassware, then wrapping each container in bubble wrap to prevent breakage, and adding freezer packs and/or fresh ice in sealable plastic bags. The COC form will be properly completed by the sampler in ink, and all sample shipment transactions will be

documented with signatures, and the date and time of custody transfer. Samples will be shipped overnight (e.g., Federal Express) or transported by a laboratory courier. All coolers shipped to the laboratory will be sealed with mailing tape and a COC seal to ensure that the samples remain under strict COC protocol.

Sample Custody

Field personnel will be responsible for maintaining the sample coolers in a secured location until they are picked up and/or sent to the laboratory. The record of possession of samples from the time they are obtained in the field to the time they are delivered to the laboratory or shipped off-site will be documented on COC forms. The COC forms will contain the following information: project name; names of sampling personnel; sample number; date and time of collection and matrix; and signatures of individuals involved in sample transfer, and the dates and times of transfers. Laboratory personnel will note the condition of the custody seal and sample containers at sample check-in.

4.8 Field Instrumentation

Field personnel will be trained in the proper operation of all field instruments at the start of the field program. Instruction manuals for the equipment will be on file at the Site for referencing proper operation, maintenance, and calibration procedures. The equipment will be calibrated according to manufacturer specifications at the start of each day of fieldwork. If an instrument fails calibration, the project manager or QA/QC officer will be contacted immediately to obtain a replacement instrument. A calibration log will be maintained to record the date of each calibration, any failure to calibrate and corrective actions taken. The PID will be equipped with a 10.6 electron volt (eV) lamp and will be calibrated each day using 100 parts per million (ppm) isobutylene standard gas in accordance with the manufacturer's standards.

4.9 Quality Assurance (QA)

All soil, groundwater, surface water, and sediment laboratory analytical data will be reviewed by a third-party validator and a Data Usability Summary Report (DUSR) will be prepared to document the usability and validity of the data. Data usability objectives for the project are further described in Section 4.6.1 below.

The Construction Completion Report (CCR) will include a detailed description of endpoint sampling activities, data summary tables, concentration map showing sample locations and concentrations, DUSR, and laboratory reports.

4.9.1 Data Usability Objectives Assessment

Summarize the usability assessment process and all procedures, including interim steps and any statistics, equations, and computer algorithms that will be used:

Data to be used in evaluating project technical objectives must be assessed to determine whether the data are of sufficient quality to allow for their proposed use. It is the joint responsibility of the AKRF project manager to ensure that the data collected meets the requirements specified in this QAPP. After sampling is complete and the laboratory has submitted the final data package, a third-party data validator will validate the data and will prepare the DUSR. The DUSR will include limitations of the data and recommendations on the usability of the data for decision making. The AKRF project manager will review the report and, as needed, resolve any issues. The DUSR will be provided as an appendix to the CCR.

The following steps are taken in the data review/validation process. The DUSR will identify any non-conformances and explains any limitations on the use of the data.

Data Review/Validation Steps

- Verify that all collected samples were analyzed, using COC records.
- Compare sample collection, extraction and analysis dates to applicable holding times.
- Review all calibration records against method and project criteria (MPC).
  - Verify frequency and criteria of initial calibrations.
  - GC/MS organics: verify frequency and criteria of tune performance analysis.
  - Verify frequency and criteria of continuing calibrations.
  - Recalculate one or more data points from raw data (RF/CF/%D).
- Review MDL study and compare to reported DLs.
- Verify frequency and criteria of method blanks.
- Organic analyses: compare surrogate recovery results to applicable criteria.
- GC/MS analyses: Review internal standard results for RT and area criteria.
- Precision and accuracy results are reviewed against applicable criteria:
  - Matrix duplicate or MS/MSD results are compared to RPD criteria.
  - Matrix spike results are compared to % Recovery criteria.
  - Spiked blanked results (LCS) are evaluated against % Recovery criteria.
  - Review field duplicate results against MPC.
- Evaluate results of any trip and field blanks.
- Recalculate 25% of sample results from raw data, using unedited data.
- Assign Data Validation Qualifiers (DVQs) as needed.

Describe the evaluative procedures used to assess overall measurement error associated with the project:

Sample data that do not meet the measurement performance criteria established in this QAPP will be evaluated to determine whether they are usable for meeting project objectives. Data will be assigned a DVQ when the performance criteria are not met and will be considered as estmated values (DVQ = J or UJ) or will be rejected (DVQ=R) based on the degree and impact of the non-conformance. Non-conformances and the DVQ deterination will be documented in the DUSR. Guidelines from the EPA Region 2 Data Validation SOPs along with professional judgement will be used to evaluate sample data and assign DVQs.

Trends in precision and accuracy of the project duration will be assessed by calulating average % recovery of all matrix spikes along with minimum and maximum values and the number of results that fall outside control limits. The range of precision values will be reported along with the number of any outliers. Field duplicate results will be evaluated for each matrix to proivde a measure of representativeness and matrix heterogenity. All results, decisions and a discussion of the impact on projetc objectives will be included in the DUSR.

Identify the personnel responsible for performing the usability assessment:

The AKRF project manager and Third-Party Data Validator will be responsible for performing the usability assessment.

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies:

Following data review and validation, the Third-Party Data Validator will prepare a DUSR. The report will include the following:

- Introduction: Summarizes the purpose of the QA review and validation process and the samples reviewed.
- Data quality indicators: discussion of the measurements and calculations applied to the assessment of the data quality indicators - precision, accuracy, sensitivity, representativeness, comparability, and completeness.
- Conclusions and data usability: provides a summary of the results of the QC measurements (averages, ranges, trends) and discusses any limitations in the use of the analytical data.
- QC Results: all QC measurements evaluated as per above (data review) are presented by analytical parameter. Any non-conformances identified during the review process are discussed with respect to the impact on overall data quality and data usability. QC measurements are summarized, and results provided in tabular form (average, range, applicable control limits, number of results outside limits).

ATTACHMENT A
RESUMES OF REMEDIAL ENGINEER, QA/QC MANAGER, PROJECT MANAGER, PROJECT MANAGER ALTERNATE, AND FIELD TEAM LEADER

MARC S. GODICK, LEP

SENIOR VICE PRESIDENT

Marc S. Godick, a Senior Vice President of the firm, has 20 years of experience in the environmental consulting industry. Mr. Godick's broad-based environmental experience includes expertise in remedial investigation, design and implementation of remedial measures, environmental/compliance assessment, litigation support, and storage tank management.

RELEVANT EXPERIENCE

Queens West Development Project, AvalonBay Communities, Queens, NY

Mr. Godick managed one of the largest remediation projects completed to date under the New York State Department of Environmental Conservation (NYSDEC) Brownfields Cleanup Program (BCP). The remedy for the site, which was contaminated by coal tar and petroleum, included the installation of a hydraulic barrier (sheet pile cut off wall), excavation of contaminated soil under a temporary structure to control odors during remediation, a vapor mitigation system below the buildings, and implementation of institution controls. The investigation, remediation design, remedy implementation, and final sign-off (issuance of Certificate of Completion) were completed in two years. Total remediation costs were in excess of $13 million.

Williamsburg Waterfront Redevelopment, RD Management/L&M Equities/Toll Brothers, Brooklyn, NY

The project is one of the largest development projects in the Greenpoint/Williamsburg Rezoning Area, which includes the construction of nearly 1 million square feet of residential and retail space along the Williamsburg waterfront. The site had a variety of industrial uses, including a railyard, junk yard, and waste transfer station. As part of the City's rezoning, the site was assigned an E-designation for hazardous materials. Mr. Godick managed the preparation of the Phase I and II environmental site assessments, remedial action plan (RAP), and construction health and safety plan (CHASP). Mr. Godick obtained NYSDEC closure of an open spill associated with former underground storage tanks at the site. The NYCDEP-approved RAP and CHASP included provisions for reuse of the existing fill material, with the excess being disposed off-site, installation of a vapor barrier below the new buildings, installation of a site cap, and environmental monitoring during the construction activities. Mr. Godick is currently managing the environmental monitoring work that began in 2006. A Notice of Satisfaction has been issued by NYCDEP for the first phase of the development.

BACKGROUND

Education

M.E., Engineering Science/Environmental Engineering, Pennsylvania State University, 1998

B.S., Chemical Engineering, Carnegie Mellon University, 1989

Licenses/Certifications

Licensed Environmental Professional (License # 396) – State of Connecticut – 2003

40 Hour HAZWOPER and Annual Refresher Training, 1990-2008

Supervisors of Hazardous Waste Operations (8 Hour), 1990

Professional Memberships

Chair, Village of Larchmont/Town of Mamaroneck Coastal Zone Management Commission, 1997 - Present

Chair, Westchester County Soil and Water Conservation District, 2005 - Present

Member, NYSDEC Risk-Based Corrective Action (RBCA) Advisory Group for Petroleum-Impacted Sites, 1997

Community Leadership Alliance, Pace University School of Law, 2001

Years of Experience

Year started in company: 2002

Year started in industry: 1990

Landfill Closure & Compost Facility Application, White Plains, NY

Mr. Godick is currently managing the closure of a formal ash landfill, which is currently being utilized as a leaf and yard waste compost facility by the City of White Plains. The remedial investigation included on-site and off-site assessment of soil, groundwater, and soil gas to delineate the extent of methane and solvent contamination associated with the landfill. The landfill closure plan includes provisions for enhancing the existing cap, methane venting, and groundwater treatment for solvent contamination. Mr. Godick also managed the preparation of the compost facility permit application, which required modification to the facility's operations necessary to close the landfill and address other regulatory requirements.

Landfill Redevelopment – RD Management, Orangeburg, NY

Mr. Godick is currently managing the remediation of the former Orangeburg Pipe site under the NYSDEC Voluntary Cleanup Program. The site contains widespread fill material, which has fragments of Orangeburg pipe that is impregnated with asbestos and coal tar. The site is being redeveloped for retail use. The site's closure plan provides for reuse of all fill material on-site and methane mitigation (vapor barrier and passive sub-slab ventilation system) for all new buildings. The fill management activities will include dust and sediment control measures and air monitoring to prevent airborne dust in accordance with a closure plan, stormwater pollution prevention plan (SWPPP), and CHASP. In pervious areas, the site cap will consist of 2 feet of clean fill and a liner in larger areas.

National Grid – Halesite Manufactured Gas Plant Site, Town of Huntington, NY

Mr. Godick managed the remedial design and engineering work associated with remediation of National Grid's former manufactured gas plant (MGP) located in the Town of Huntington. The site is situated in a sensitive location along the waterfront, surrounded by commercial and residential properties, and half the property where the remediation was conducted is a steep slope. The remedy consisted of soil removal, oxygen injection, and non-aqueous phase liquid recovery. Mr. Godick was responsible for the development of the remedial work plans, design/construction documents, landscape architecture, confirmatory sampling, air monitoring, supervision, and preparation of close-out documentation in accordance with NYSDEC requirements.

Site Investigation–7 World Trade Center Substation, Con Edison, New York, NY

Mr. Godick managed the site investigation at the former 7 World Trade Center Substation in an effort to delineate and recover approximately 140,000 gallons of transformer and feeder oil following the collapse of the building. The project involved coordination with several crews, Con Edison, and other site personnel.

Site Investigation–Former Manufactured Gas Plant (MGP) Facilities, Con Edison, New York, NY

Mr. Godick managed site investigations at four former MGP facilities. The investigations at three of the four sites were completed at a Con Edison substation, flush pit facility, and service center, respectively. The details associated with the fourth site are confidential. Site characterizations at the substation and flush pit facility were conducted in preparation of expansion at these locations. The findings from these characterizations were used by Con Edison to make appropriate changes to the design specifications and to plan for appropriate handling of impacted materials and health and safety protocols during future construction activities.

Verizon, Investigation & Remediation, Various Locations, NY, PA and DE

Mr. Godick managed over 50 geologic/hydrogeologic assessments and site remediation projects related to petroleum releases at various facilities. Responsibilities included annual budgeting, day-to-day project management, development and implementation of soil and ground water investigation workplans, ground water modeling, risk evaluation, remedial action work plans, remedial design, system installation, waste disposal, well abandonment, and operation and maintenance. Many of the assessment and remedial projects followed a risk-based approach. Remedial technologies implemented included air sparging, soil vapor extraction, bioremediation, pump and treat, soil excavation, and natural attenuation.

Storage Tank Management, Verizon, Various Locations, NY, PA, DE, and MA

Mr. Godick managed the removal and replacement of underground and aboveground storage tank systems for Verizon in New York, Pennsylvania, Delaware, and Massachusetts. Responsibilities included the management of design, preparation of specifications, contractor bidding, construction oversight, project budget, and documentation. For selected AST sites, managed the development of Spill Control, Contingency and Countermeasures (SPCC) plans.

Brownfield Opportunity Area (BOA) Grant Program Services for the Town of Babylon, Wyandanch, NY

AKRF was retained by the Town of Babylon to prepare a blight study, market study, NYS BOA Step 2 Nomination, an Urban Renewal Plan, and a Generic Environmental Impact Statement (GEIS) as part of a revitalization and redevelopment effort for downtown Wyandanch. Mr. Godick was responsible for overseeing the environmental data collection effort for the 226 brownfields identified in the 105-acre project area, and for identifying strategic sites for which site assessment funding should be sought. He also prepared the Hazardous Materials section of the Wyandanch Downtown Revitalization Plan (which incorporates the Nomination, Urban Renewal Plan, and GEIS), involving a summary of available environmental reports, a review of regulatory records, and limited street-level site inspections.

Alexander Street Urban Renewal Plan, Master Plan, Brownfield Opportunity Area Plan, Yonkers, NY

AKRF was retained by the City of Yonkers to prepare an Urban Renewal Plan, Master Plan, Brownfield Opportunity Area Plan, and a Generic Environmental Impact Statement (GEIS) for a 153 acre industrial area along Alexander Street on the Yonkers Waterfront. Mr. Godick was responsible for the Hazardous Materials sections of the GEIS and Urban Renewal Plan. Mr. Godick managed the environmental data collection effort for the entire study area which involved review and summary of existing environmental reports, a review of regulatory records, and field inspections. The collected information was used to prioritize individual parcels for funding and remediation. The Master Plan for the area called for the development of a mixed-use neighborhood consisting of residential, neighborhood retail, and office space uses with substantial public open space, access to the Hudson River, and marina facilities.

SEMINARS, LECTURES & PUBLICATIONS

"Let Nature Do the Work – Onsite Stormwater Management," Westchester County Department of Parks, Recreation and Conservation, Fall 2003

"Water Pollution Control and Site Assessments and Audits," Environmental Health and Safety Issues Course, Building Owners and Managers Institute (BOMI), 1997-1999

"Hydrogeologic and Geological Aspects of Tank Closures and Remedial Action," Underground Storage Tanks Course, Government Institutes, Summer 1996, Fall 1997

REBECCA KINAL, P.E.

VICE PRESIDENT

Rebecca Kinal has over 20 years of experience in the assessment and remediation of soil and groundwater contamination and other hazardous/non-hazardous waste problems. Ms. Kinal's experience includes environmental due diligence, soil and groundwater investigations, leaking underground storage tank studies, soil gas/vapor intrusion surveys, and oversight of small- and large-scale remediation programs, including design of groundwater remediation systems and vapor mitigation systems. She has directed numerous Phase I and Phase II investigations and remediation programs, many of them in conjunction with commercial/residential developers, law firms, lending institutions, and public agencies. She is experienced in the cleanup of contaminated properties under New York State Brownfield Cleanup Program (BCP) regulations and the New York City "E-designation" program. As a part of this work, her duties have included technical and report review, proposal writing, scheduling, budgeting, and acting as liaison between clients and regulatory agencies, and project coordination with federal, state, and local authorities.

BACKGROUND

Education

M.S., Hydrogeology, Rensselaer Polytechnic Institute, 1995

B.S., Civil Engineering, Lafayette College, 1992

Licenses/Certifications

State of New York, P.E. Registration No. 082046, 2004

Years of Experience

Year started in company: 2000

Year started in industry: 1996

RELEVANT EXPERIENCE

New York City School Construction Authority On-Call Contract for Environmental Consulting Services, Various Sites, NY

Ms. Kinal serves as the project manager for AKRF's on-call hazardous materials consulting contract with the New York City School Construction Authority for over 8 years. For potential new school sites, assignments include initial due diligence, Phase I environmental site assessments, (ESAs) and subsurface investigation of soil, groundwater, and soil vapor to determine the suitability of a site for development as a school, likely remediation requirements, and associated costs. For sites undergoing design and development, assignments include preparation of remediation plan, contract specifications, and design drawings. The work has also included conducting indoor air quality testing, vapor intrusion assessments, preparation of specifications, supervision of storage tank removals, and investigation and remediation of spills for existing schools. Due to the sensitivity of school sites, work under this contract is often conducted on short notice and during non-school hours.

USTA National Tennis Center, Queens, NY

AKRF prepared an EIS for the New York City Departments of City Planning (DCP) and Environmental Protection (DEP) as co-lead agencies to analyze the expansion of the National Tennis Center, which includes

multiple improvements and construction projects at the USTA campus over several years. As part of the EIS requirements, AKRF prepared a Remedial Action Plan for implementation during the proposed project's construction. In accordance with the RAP, vapor mitigation systems were incorporated into the design for several of the proposed structures at the facility, including two new stadiums, a new transportation center, and several practice court facilities. Ms. Kinal prepared the specifications and design drawings for the vapor mitigation and is providing on-going construction support to review contractor submittals and inspect the vapor barrier and sub-slab depressurization system installations.

Montefiore Medical Center, Various Locations, NY

Ms. Kinal provides due diligence assistance to Montefiore Medical Center (MMC) for the ongoing expansion of their facilities, primarily in the Bronx and Westchester County. She conducts and manages environmental due diligence tasks related to their property transactions, including Phase I Environmental Site Assessments (ESAs), Phase II investigations, and geophysical surveys. She also assists MMC in making decisions with respect to environmental risk issues.

Queens West Development Project, Long Island City, NY

For over 20 years, AKRF has played a key role in advancing the Queens West development, which promises to transform an underused industrial waterfront property into one of largest and most vibrant mixed-use communities just across the East River from the United Nations. AKRF has prepared an Environmental Impact Statement that examines issues pertaining to air quality, land use and community character, economic impacts, historic and archaeological resources, and infrastructure. As part of the project, AKRF also undertook the largest remediation ventures completed to date under the NYSDEC Brownfields Cleanup Program (BCP). Ms. Kinal helped prepare the Remedial Work Plan (RWP) and oversaw the remediation of Parcel 9, a 1.8-acre former industrial site. Remediation includes installation of a sheet pile containment wall, excavation of coal tar- and petroleum-contaminated soil under a temporary structure to control odors during remediation, vapor mitigation for the future buildings, and institutional controls. Upon completion of the remediation activities, Ms. Kinal managed the preparation of a Final Engineering Report (FER) to document the clean-up activities. The NYSDEC issued a Certificate of Completion (COC) for the Parcel 9 site in December 2006. Ms. Kinal continues to oversee post-remediation monitoring and site management activities to ensure that the remedy remains in-place and effective.

Roosevelt Union Free School District, Roosevelt, NY

Ms. Kinal is managing environmental investigation and remediation activities for the sites of three new elementary schools and a new middle school in Roosevelt, New York. Remediation activities include removal/closure of contaminated dry wells and underground petroleum storage tanks, and excavation and off-site disposal of petroleum- and pesticide-contaminated soil.

Proposed NYC Public School Campus, Bronx, NY

Ms. Kinal provided environmental consulting services to the selected environmental remediation contractor for this former manufactured gas plant in the Mott Haven neighborhood of the Bronx, which was remediated under the NYSDEC BCP. These services included: preparation of an in situ sampling plan and excavation plan for waste characterization and disposal; supervision of waste characterization sampling activities; development and implementation of a community air monitoring program during all remediation activities; and daily reporting to the NYC School Construction Authority.

National Grid – Halesite Manufactured Gas Plant Site, Town of Huntington, NY

Ms. Kinal served as the project manager for the remedial design and engineering work associated with remediation of National Grid's former manufactured gas plant (MGP) located in the Town of Huntington. The site is situated

in a sensitive location along the waterfront, surround by commercial and residential properties, and half the property where the remediation was conducted is a steep slope. The remedy consisted of soil removal, oxygen injection, and non-aqueous phase liquid recovery. Ms. Kinal developed the remedial work plans, design/construction documents, and managed environmental oversight of the remedial work, including waste characterization and tracking, confirmatory endpoint sampling, air monitoring, and reporting to the NYSDEC. After the remediation work was completed, Ms. Kinal prepared appropriate close-out documentation in accordance with NYSDEC requirements.

Shell Service Station, Millwood, NY

Ms. Kinal planned and oversaw a Phase I Environmental Site Assessment and Phase II Subsurface Investigation of this active gasoline station in northern Westchester County. The Phase I/Phase II investigations were performed for the potential buyer of the property who wished to redevelop it with a more modern service station and convenience store. Ms. Kinal also prepared a conceptual remediation plan to address several areas of petroleum contamination identified during the Phase II. The plan, which was approved by NYSDEC, will be implemented in conjunction with the site redevelopment activities to achieve closure for several spills reported at the site.

Pelham Plaza Shopping Center Site Investigation & Remediation, Pelham Manor, NY

Ms. Kinal managed a Site Investigation at Pelham Plaza, an approximately ten-acre site that formerly contained a manufactured gas plant. The site was investigated under a voluntary clean-up agreement entered into with the NYSDEC by the site owner. The site investigation included advancing over 100 soil borings with continuous soil sampling to bedrock, installing monitoring and recovery wells, and conducting test pitting both indoor and outdoor locations to collect soil and groundwater samples and determine the extent of Non-Aqueous Phase Liquid (NAPL). The investigation also included: soil gas sampling to determine contaminant concentrations in the vapors beneath the foundation of an on-site retail store; sediment sampling in an adjacent creek to identify off-site impacts; and a tidal survey to determine tidal influence on groundwater levels at the site. Ms. Kinal also oversaw on-going interim remedial measures, which include biweekly pumping of recovery wells to remove dense NAPL (DNAPL) from the site subsurface.

Shaws Supermarket Redevelopment Project, New Fairfield, CT

Ms. Kinal managed the Remedial Investigation (RI) for an approximately nine-acre shopping center site that was contaminated by releases from former dry cleaning operations. The site was being redeveloped with a new supermarket and separate retail stores. The investigation included the installation of monitoring wells in the intermediate overburden aquifer and bedrock aquifer, sampling of existing and newly installed wells, geophysical logging in bedrock wells, and pump testing in intermediate and bedrock wells. Ms. Kinal prepared a Remedial Action Work Plan (RAWP) based on results from the RI, which included a groundwater pump and treat system to contain a plume of perchlorethylene (PCE)-contaminated groundwater, and excavation and disposal of contaminated soil in the presumed source area. Following CTDEP approval of the RAWP, Ms. Kinal prepared bid specifications for soil excavation and remediation system installation, and oversaw their implementation. Ms. Kinal also prepared NPDES permit applications for discharges from construction dewatering and the groundwater remediation system, and conducted associated discharge monitoring.

Yankee Stadium, Bronx, NY

Ms. Kinal performed the hazardous materials analysis for the Draft Environmental Impact Statement for the proposed new Yankee Stadium. The analysis included a Phase I Environmental Site Assessment of the entire project area and Subsurface (Phase II) Investigation in areas where environmental conditions were identified. The Phase II investigation included geophysical surveys to search for potential underground storage tanks; and soil, soil gas, and groundwater sampling at over 40 locations to determine potential environmental impacts during and after the proposed construction.

Avalon on the Sound, New Rochelle, NY

Ms. Kinal oversaw environmental investigation and soil remediation during the construction of two luxury high-rise apartment buildings and an associated parking garage. Investigation activities included an electromagnetic survey to search for possible underground storage tanks, and subsurface sampling to characterize soil and groundwater. Remediation activities included removing underground storage tanks, excavating and disposing of soil contaminated with volatile and semi-volatile organic compounds, and collecting end-of-excavation confirmation samples.

Davids Island Environmental Audit, New Rochelle, NY

Ms. Kinal managed the hazardous materials portion of the audit of this undeveloped island site, including a Phase I Environmental Site Assessment (ESA) and Subsurface (Phase II) Investigation in areas where environmental conditions were identified. The Phase II investigation included collecting soil samples from more than 100 locations and analyzing them for targeted compounds, including volatile organic compounds, semi-volatile compounds, metals, pesticides, and polychlorinated biphenyls (PCBs). Ms. Kinal also oversaw an electromagnetic (EM) survey conducted to identify the location of suspected underground storage tanks on the island. Based on soil sample results, Ms. Kinal estimated the volume of contaminated soil requiring remediation and prepared cost estimates for soil excavation and for transportation and disposal of contaminated soil and hazardous materials.

Outlet City Site Investigation, Queens, NY

Ms. Kinal prepared a work plan for remedial investigation of the Outlet City site, a property in Long Island City that was formerly occupied by a manufacturer of industrial cleaners and pharmaceuticals. The site is being investigated and remediated under the NYSDEC voluntary clean-up program. In preparing the work plan, Ms. Kinal evaluated results from several previous investigations and conducted a limited groundwater sampling program to determine future data needs for designing remediation of creosote-contaminated soil and groundwater. The work plan included additional soil and groundwater sampling, a tidal survey to determine tidal influence on groundwater levels, and pilot free product recovery testing. Ms. Kinal also helped design a venting system for an on-site basement and performed exposure calculations for the vented vapors.

Yonkers Waterfront Redevelopment Project, Yonkers, NY

For this redevelopment along Yonkers' Hudson River waterfront, Ms. Kinal supervised the remediation of Parcels H and I that were contaminated with hazardous soil. During the remediation process, she reviewed the subcontractor health and safety plans, delineated the areas of excavation, and oversaw field activities to ensure compliance with the specifications and appropriate regulations. This property was remediated under the NYSDEC Environmental Restoration Program (ERP).

U.S. Post Office Main Vehicle Maintenance Facility, Washington, D.C.

While with another firm, Ms. Kinal designed and supervised the installation of a remediation system to treat petroleum-contaminated groundwater. Ms. Kinal also established O&M and monitoring protocols to ensure efficient operation of the air sparging/soil vapor extraction system, and to monitor contaminant recovery/degradation rates.

Aberdeen Proving Ground Building 4025 Site, Aberdeen, MD

While with another firm, Ms. Kinal provided services for this leaking underground storage tank site, Ms. Kinal planned and oversaw investigation and pilot testing activities to delineate contamination and determine feasible in-situ remediation options. Investigation activities included soil and groundwater sampling using a direct-push (Geoprobe) rig and mobile laboratory. Pilot testing included in-situ respirometry testing, and field testing of bioremediation and free-product recovery technologies.

BRYAN ZIEROFF, LEP

SENIOR HYDROGEOLOGIST

Bryan Zieroff has 15 years of experience in the environmental consulting industry. Mr. Zieroff's experience includes the conceptual design, implementation and reporting of detailed field investigations including assessments of ground-water supplies for residential, municipal and industrial users, and evaluation, monitoring and remediation of soil and ground-water contamination for sites regulated by the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), Connecticut's Remediation Standard Regulations, and by the New York State Department of Environmental Conservation's (New York State Department of Environmental Conservation's (NYSDEC)) cleanup programs. These studies include investigations at sites impacted by petroleum products, chlorinated solvents, metals and landfill leachate. Mr. Zieroff's tasks often include characterization of the extent of contamination in soil, ground water, and soil vapor, evaluation of compliance with the established regulatory criteria, and operation and maintenance of remediation systems. Mr. Zieroff's familiarity with various field investigation techniques enhances his management skills.

BACKGROUND

Education

B.S., Geological Sciences, The Ohio State University, 1994

Licenses/Certifications

Certified Professional Geologist-American Institute of Professional Geologists, License # CPG-11197

40 Hour HAZWOPER and Annual Refresher Training

Supervisors of Hazardous Waste Operations (8 Hour)

Professional Memberships

American Institute of Professional Geologists

Association of Ground-Water Scientists and Engineers (National Ground Water Association)

Environmental Professionals' Organization of Connecticut (EPOC)

Years of Experience

Year started in company: 2006

Year started in industry: 1995

RELEVANT EXPERIENCE

Gedney Way Leaf and Yard Waste Composting Facility, White Plains, NY

Mr. Zieroff is Project Manager for a remediation and landfill closure project at an existing composting facility. The project included documenting the entire disposal history and completing a site-wide investigation to confirm the extent of a solvent release and to provide data necessary to complete landfill closure. The investigation was required to satisfy the requirements in the NYSDEC DER-10 and 6NYCRR Part 360. After receiving state approval of the Site Investigation Report, the project has moved into the remediation and landfill closure design phase. The remedial design includes the testing and implementation of a chemical oxidation injection program, and landfill closure includes design, state approval, and construction of a landfill cap.

New City Plaza, New City, NY

Mr. Zieroff is Project Manager for an investigation and remediation project at a former dry cleaning facility. Investigation and remediation at the site currently are being conducted under review of the NYSDEC Brownfield Cleanup Program. Tasks have included preparation and state approval of a Site Investigation Work Plan, Site Quality Assurance Project Plan, Health and Safety Plan, a Community Participation Plan, and completion of the investigation phase of the Brownfield's program. Interim Remedial activities include contamination source removal from soil and installation of a sub-slab depressurization system to address soil vapor. A feasibility study is currently being completed to determine the optimal remedial approach for site-wide remediation.

Orangeburg Pipe Site, Orangeburg, NY

Mr. Zieroff completed a subsurface investigation to determine the extent of soil and groundwater contamination at the former Orangeburg Pipe facility. The investigation results were used to develop a Remedial Action Plan to address solid waste, petroleum contamination, worker safety during site development, and capping requirements to satisfy the NYSDEC Voluntary Remediation Program. The Remedial Action Plan included a Heath and Safety Plan, Community Air Monitoring Plan, and specifications for soil management, a vapor mitigation system and dewatering procedures during the construction of multiple commercial buildings.

Magna Metals Facility, Cortlandt, NY

Mr. Zieroff managed a soil-gas investigation project at an existing commercial warehouse and office building. The project included installation of permanent soil gas sampling points and completion of a sampling program that met the requirements of the New York State Department of Health (NYSDOH) Guidance for Evaluating Soil Vapor Intrusion in the State of New York. Site activities included a pre-sampling investigation with the NYSDOH to document materials storage, air flow specifications, historical uses, site uses and areas of concern for sub-slab and ambient air sampling. The investigation work was being conducted to satisfy the NYSDEC consent order.

Paragon Paint Company Facility, Long Island City, NY

Mr. Zieroff was Project Manager for an investigation and remediation project at a former paint manufacturing facility. The project has included a multiple subsurface investigations to determine the extent of solvent and petroleum contamination at the site. All phases of remediation at the site are being completed under review of the NYSDEC Brownfield Cleanup Program. Tasks include completion and state approval of a Site Investigation Work Plan, Quality Assurance Project Plan, Health and Safety Plan, Community Participation Plan, Remedial Action Plan, and Final Remediation Report.

Pathmark Stores Site, Bronx, NY

Mr. Zieroff completed a Remedial Action Plan, Construction Health and Safety Plan and a Soil Management Plan for a former materials storage facility associated with Manhattan College. The plans were completed to provide worker safety and soil handling guidelines during the construction of a large retail facility and parking garage. Development activities at the site were conducted under oversight of the New York City Department of Environmental Protection (NYCDEP). A Notice of Satisfaction was received after project completion.

Yale and Towne Site, Stamford, CT

Mr. Zieroff provided oversight services for a remediation project at a former industrial site. The site included over 35 buildings and 87 areas of environmental concern that required investigation and remediation. Tasks included providing technical support in understanding the Connecticut regulatory requirements, investigation and remediation costs, and confirmation of appropriate schedules to address the environmental issues during redevelopment of the project site.

Aluminum Company of America (ALCOA) Facility, Guilford, CT

Mr. Zieroff managed a ground-water remediation project at an existing aluminum manufacturing facility. The project included soil, vapor and ground-water sampling to confirm the extent of a solvent release, determination of ground water and aquifer characteristics, operation and maintenance of a ground-water pump-and-treat system and compliance sampling in association with a Connecticut Department of Environmental Protections (CTDEP) consent order.

Coats North America Facility, Watertown, CT

Mr. Zieroff was the Project Manager for site compliance work at an existing synthetic treads facility. The project included an evaluation of activities, chemical uses and waste handling practices to determine areas of environmental concern. Investigations to determine the status of these areas included installation of monitoring wells, soil and ground-water sampling, soil-vapor sampling, liquid storage tank removal and Resource Conservation and Recovery Act (RCRA) closure of waste storage areas. The project activities were completed in compliance with the CTDEP property transfer program.

United Parcel Service, Storm Water Management, 9 Connecticut Facilities

Mr. Zieroff managed the design and implementation of a storm water pollution prevention project at nine United Parcel Service facilities. The project included analysis of drainage areas, determination of sheet flow characteristics and the collection of storm-water discharge samples and SMR reporting in accordance with the CTDEP General Permit for the Discharge of Storm Water.

Meriden Enterprise Center, Meriden, CT

Mr. Zieroff developed and directed a subsurface investigation to determine the nature and extent of contamination related to releases from multiple underground storage tank farms, silverware plating, machining and furniture stripping operations. Project activities included ground-penetrating radar, drilling of test borings, installation of monitoring wells, developing a conceptual site model for the established releases and preparing a report detailing remedial alternatives for the property and owner requirements under the CTDEP Property Transfer Act.

Development properties in Kent, Ridgefield, and Greenwich, CT and Mahopac and Brewster, NY

Mr. Zieroff directed an evaluation and testing program of bedrock water-supply wells to determine long-term yield, impact on local users, and water quality results. The project included compilation of data, construction of hydrographs, determination of aquifer characteristics and reporting.

Bettsville Quarry, Bettsville, OH

Mr. Zieroff directed a pumping test of dewatering wells to determine yield requirements for dewatering a carbonate rock quarry. The dewatering program included a determination of offsite impacts to local ground-water users. Mr. Zieroff developed an offsite monitoring program to document and protect local users during the quarry dewatering process.

Burning Tree Country Club, Greenwich, CT

Mr. Zieroff directed an in-situ percolation test to determine recharge rates for a proposed upgrade to the facility septic system. The project included compilation of slug test data and software analysis to determine K values.

MARK JEPSEN

ENVIRONMENTAL SCIENTIST

Mark Jepsen is an Environmental Scientist in AKRF's Hazardous Materials group. He has a great deal of experience in both environmental science and natural resources, including environmental remediation and consulting, groundwater quality and soil science, hydrology, and geology.

Since Joining AKRF at the beginning of 2014, Mr. Jepsen has overseen a wide variety of environmental investigations. He has performed oversight at large scale construction sites entailing complex remediation techniques. He has performed various Phase I site visits and reports. Additionally, Mr. Jepsen has followed up these Phase I investigations with performing Phase II remedial investigations including soil, groundwater, and soil vapor sampling. Also, Mr. Jepsen has a great deal of experience creating environmental reports discussing results found during the preliminary and supplemental investigations, Remedial Action Work Plans (RAWPs), Construction Health and Safety Plans (CHASP), Remedial Closure Reports, Environmental Bid Specifications and Design Coordination. Mr. Jepsen has a knowledgeable background in environmental issues and challenges pertaining to the New York metropolitan area and technical guidelines. Mr. Jepsen has a great deal of experience working on projects involved with multiple governmental regulators including NYSDEC, NJDEP, NYCDEP, and NYCOER.

Before joining AKRF, Mr. Jepsen worked for Bluestone Environmental Services in Somerset, New Jersey. He was responsible for performing a wide array of field work activities including groundwater sampling, monitoring well gauging, soil sampling, and more for Bluestone's various clients including: ExxonMobil, International-Matex Tank Terminals (IMTT) and various gas stations. He was responsible for maintaining an understanding of large and active remediation sites and dealing with an extensive groundwater monitoring well network, as well as acting as an on-site safety supervisor for all Bluestone employees and subcontractors.

BACKGROUND

Education
B.S., Environmental Science, The Ohio State University, 2012

New Jersey Regulatory Seminars
Combined Sewer Outfalls (CSO) for LSRPs: Remediation Alternatives to Better Manage Storm Water

Certifications
40 Hour OSHA HAZWOPER – annual refresher every year
10 Hour OSHA Construction Training
Gold Certified Brownfield Professional by New York City Office of Environmental Remediation
Transportation Worker Identification Credential (TWIC)
NYSDEC Erosion and Sediment Control Inspector
Boating license

Years of Experience
Date started at AKRF: March 2014
Prior industry experience: Bluestone Environmental Services (NJ) – January 2013 to March 2014

RELEVANT AKRF EXPERIENCE

432 East 14th Street, Environmental Management Specifications, Design Coordination and Pre-Characterization of Soil for Off-site Disposal, New York, NY

Mr. Jepsen supported AKRF's preparation of Environmental Management Specifications and Design Coordination, and collection and laboratory analysis of soil samples to pre-characterize soil beneath the Site for off-site disposal. Mr. Jepsen also performed the Phase II remedial investigation of this site which included soil, groundwater, and soil vapor sampling. Mr. Jepsen was also responsible for construction oversight during the foundation excavation for the proposed building. Following completion of excavation, Mr. Jepsen was responsible for inspecting the vapor barrier system installed as an engineering control for the proposed building. He has also been involved with creating the Remedial Closure Report.

77 Commercial Street, Environmental Services, Greenpoint, NY

Mr. Jepsen supported AKRF's environmental services, including Preparation of a Remedial Investigation (Phase II) Work Plan; Remedial Investigation (RI) and Report; Preparation of a Remedial Action Work Plan (RAWP) and Construction Health and Safety Plan (CHASP); Pre-Characterization of Soil for Off-site Disposal; Environmental Monitoring; Remedial Closure Report; and Environmental Bid Specifications and Design Coordination.

Bronx Pro 2264-2272 Morris Avenue, Environmental Consulting Services, Bronx, NY

Mr. Jepsen is supporting AKRF's environmental consulting services for this site including, Phase I Environmental Site Assessment (ESA) and update, Phase II remedial site investigations and subsurface sampling, ongoing construction oversight and vapor barrier inspections.

Memorial Sloan Kettering Cancer Center Hospital 74th Street, Environmental Services, New York, NY

Mr. Jepsen supported AKRF's environmental services, including construction oversight and air monitoring, groundwater sampling, and monitoring well decommissioning. Also, Mr. Jepsen has overseen large scale UST closure and removal at this site. Mr. Jepsen was responsible for the on-site implementation of AKRF's Remedial Action Work Plan (RAWP) and Construction Health and Safety Plan (CHASP). He has also been involved with creating the Remedial Closure Report.

School Construction Authority, New York, NY

Under an on-call contract, AKRF provides the New York City School Construction Authority (NYCSCA) with hazardous materials consulting services. Mr. Jepsen is involved with various due diligence and environmental assessment projects including Phase I Environmental Site Assessments (ESAs); Phase II (Subsurface) Environmental Site Investigations (soil, groundwater and soil vapor intrusion investigations); Indoor Air Quality (IAQ) Assessments; Underground Storage Tank (UST) and Aboveground Storage Tank (AST) inspections relating to boiler conversions; and peer review of other consultant's due diligence reports.

Indoor Air Quality Monitoring, New York, NY

Mr. Jepsen has performed a variety of indoor air quality investigations and surveys at sites including educational institutions and various residential buildings. Mr. Jepsen performed interviews pertaining to environmental site conditions and background with property owners and operators.

11 Greene Street, Environmental Consulting Services, New York, NY

Investigation and remediation of the Site is being conducted to satisfy NYC Office of Environmental Remediation (NYCOER) requirements under the Voluntary Clean-Up Program (VCP) and CEQR. Mr. Jepsen is supporting AKRF's environmental consulting services for this site including Waste Classification testing and delineation, preparation of a Remedial Investigation (Phase II) Work Plan; Remedial Investigation (RI) and Report; Preparation

of a NYCDEP Dewatering Application and Permit; Preparation of a Remedial Action Work Plan (RAWP) and Construction Health and Safety Plan (CHASP); Pre-Characterization of Soil for Off-site Disposal; Environmental Monitoring; and Environmental Bid Specifications and Design Coordination.

3200 Jerome Avenue, Environmental Consulting Services, Bronx, New York

AKRF conducted a Phase I ESA and an Indoor Air Quality Survey of this property in the Bronx during due diligence investigations for the NYCSCA which identified levels of trichloroethene (TCE) in indoor air that exceeded the New York State Department of Health (NYSDOH) standards. NYCSCA subsequently terminated its lease of the site and discontinued its use as a school. Following the termination of NYCSCA's lease of the site, AKRF was retained by the owner to conduct an investigation and cleanup. Mr. Jepsen helped to conduct groundwater sampling requirements set by the NYSDEC as part of the Brownfield Cleanup Agreement for the project site. Mr. Jepsen is supporting the ongoing operations and maintenance of an active sub-slab depressurization system installed beneath the building. Mr. Jepsen has also overseen in-situ chemical oxidation (ISCO) groundwater treatment injection activities performed on-site.

98-100 Franklin Street, Manhattan, NY

AKRF completed a Phase I Environmental Site Assessment (ESA), Phase II ESI, prepared a Remedial Action Work Plan, a NYCDEP Dewatering Application and Permit, and performed soil waste classification sampling (which required the preparation of a NYC Transit Subsurface Investigation Permit to perform the associated soil borings) for the proposed redevelopment for a 29,564-square foot, eight-story mixed-use building with a cellar. As the assistant project manager, Mr. Jepsen coordinated with the client and contactors and performed oversight of on-site remediation activities.

NYSDOT/NYSTA Tappan Zee Hudson River Crossing, Rockland and Westchester Counties, NY

AKRF completed an EIS for this project on a fast-track schedule. Findings of the study were utilized to develop numerous documents prepared to guide the construction team, including a Remedial Action Plan and a Construction Health and Safety Plan for the five-year bridge replacement project. As part of the findings of the study, additional mitigation was required to ensure safety of endangered species inhabiting the Hudson River. Mr. Jepsen has been responsible for captaining and assisting in vessel-based monitoring of endangered species within and surrounding the marine construction zone of the new Tappan Zee Bridge located in Tarrytown and Nyack, NY on the Hudson River.

Previous Experience

International-Matex Tank Terminals (IMTT) and ExxonMobil, Environmental Consulting Services, Bayonne, NJ

Mr. Jepsen was responsible for conducting operations and maintenance of an extensive groundwater monitoring well network at an active storage tank terminal located in Bayonne, NJ. Mr. Jepsen also conducted site investigation field activities; including soil, groundwater sampling, and monitoring well installation. Mr. Jepsen aided with the operation and maintenance of active remedial systems, including oil recovery skimming systems and water treatment and discharge systems. Mr. Jepsen was responsible for maintaining client relationships and acting as an on-site safety supervisor for all Bluestone employees and subcontractors. Mr. Jepsen assisted with relevant compliance reporting requirements, remedial work plans, and general work permitting

Various Gas Stations, Environmental Consulting Services, Various Locations, NJ

Mr. Jepsen conducted site investigation field activities, including groundwater sampling and monitoring well installation at various gas stations with open petroleum spills reported the NJDEP. Mr. Jepsen acted as an on-site safety supervisor for all Bluestone employees and subcontractors. Mr. Jepsen assisted with relevant compliance reporting requirements.

STEPHEN SCHMID

ENVIRONMENTAL SCIENTIST

Stephen Schmid is an Environmental Scientist in AKRF's Hazardous Materials Department with two years of experience. He has experience in Phase I and II site assessments and construction/remediation oversight which have included water, soil and air sampling. Mr. Schmid is a 2011 graduate from the University of New Hampshire, where he studied marine and freshwater biology, and environmental conservation. Prior to joining AKRF Mr. Schmid conducted fieldwork, water sampling and analysis in addition to assisting in a study of lakes in the North Eastern United States.

BACKGROUND

Education

BS Marine & Freshwater Biology, University of New Hampshire, Durham, NH

Minor: Environmental Conservation Studies, University of New Hampshire, Durham, NH

Licenses/Certifications

40 Hour OSHA HAZWOPER

Asbestos Project Monitor, Air Technician and Inspector

Years of Experience

Year started in company: 2012

Year started in industry: 2011

RELEVANT EXPERIENCE

New York City School Construction Authority (SCA), Environmental Consulting Hazardous Materials Services

AKRF has undertaken various assignments under two consecutive hazardous materials on-call contract, including environmental assessment, remedial design, and plumbing disinfection consulting tasks. For potential new school sites, assignments include initial due diligence, Phase I environmental site assessments (ESAs) and multi-media subsurface investigation of soil, groundwater, and soil vapor to determine the suitability of a site for development as a school, likely remediation requirements, and associated costs. For sites undergoing design and development, assignments include preparation of remediation plans, design of sub-slab depressurization systems (SSDS) and contract specifications, and construction oversight. The work has also included conducting Phase I ESAs and indoor air quality testing, preparation of specifications, supervision of storage tank removals, and investigation and remediation of spills for existing schools. Due to the sensitivity of school sites, work under this contract is often conducted on short notice and during non-school hours. Mr. Schmid has provided oversight during plumbing disinfections, storage tank removals and spill remediation.

25 Broad Street, Manhattan, NY

AKRF has been contracted by LCOR during the demolition of a residential building on a property which will eventually be redeveloped. AKRF has been responsible for creating and implementing a community air monitoring program during demolition activities. Mr. Schmid has been the on-site monitor responsible for calibrating equipment and monitoring levels of volatile organic compounds and particulate matter for the surrounding area and construction personnel. Reports of the daily activity including data collected throughout the day were prepared for submittal to the client.

164 Kent Avenue, Brooklyn, NY (AKA Northside Piers and 1 North 4th Place)

The project was a multi-phase development consisting of a large waterfront block in the Williamsburg Rezoning Area. The project site has been developed with a mixed-use residential-commercial high rise towers with an esplanade and a pier along the East River. AKRF provided acquisition and development support, including performing Phase I and II environmental site assessments, and preparation of Remedial Action Plans (RAPs) and Construction Health and Safety Plan (CHASPs) for approval by DEP and OER. Mr. Schmid provided assistance with construction oversight during soil handling activities and managing the Community Air Monitoring Plan (CAMP) activities. To date, closure reports have been prepared and occupancy achieved for three of the four buildings.

The Home Depot, Rego Park, NY

AKRF has designed, installed and performed upgrades to an air sparging and soil vapor extraction system being used to remediate tetrachloroethene contamination at this site under the NYSDEC Voluntary Cleanup Program. Mr. Schmid has performed low flow, indoor air and effluent sampling as part of ongoing monitoring activities to assess the progress of the cleanup.

250 North 10th Street, LLC., Residential Redevelopment Site, Brooklyn, NY

AKRF was retained to investigate and remediate this former industrial property in the Williamsburg section of Brooklyn, New York in connection with site redevelopment. The site is approximately 50,000 square feet, and redevelopment included a six story residential building and parking garage. The work was completed to satisfy the requirements of the NYC E-designation Program and NYC Voluntary Cleanup Program (NYC VCP). AKRF completed a Remedial Investigation (RI) to evaluate the nature and extent of site contamination, and developed a Remedial Action Work Plan (RAWP) to properly address site contamination during redevelopment. Remediation included removal of underground storage tanks, more than 7,500 tons of contaminated soil, and installation of a vapor barrier and site cap across the entire property. The remediation was completed under oversight of the NYC Office of Environmental Remediation (OER), and in a manner that has rendered the Site protective of public health and the environment consistent with residential use of the property. Mr. Schmid conducted construction oversight and community air monitoring during the removal of contaminated soil.

AP-Williamsburg, LLC, 50 North 5th Street Development, Brooklyn, NY

AKRF directed the remedial program at a 55,000-square foot site located in the Williamsburg section of Brooklyn, New York. The site had an industrial and manufacturing history for over 100 years that included a barrel making factory, use of kilns, and a carpet and flooring materials warehouse. AKRF completed a Remedial Investigation (RI) to evaluate the nature and extent of site contamination, and developed a Remedial Action Work Plan (RAWP) to properly address site contamination during redevelopment. Remediation included removal of more than 5,000 tons of contaminated soil, and installation of a vapor barrier and sub-slab depressurization system (SSDS) beneath the site building. The remediation was completed in a manner that has rendered the Site protective of public health and the environment consistent with commercial and residential use of the property, and in accordance with the requirements of the NYC OER E-designation program. The site includes a seven story residential apartment

building with street level retail space and a parking garage. Mr. Schmid provided oversight and community air monitoring during construction activities.

Gedney Way Leaf and Yard Waste Composting Facility, White Plains, NY

AKRF directed the remediation and landfill closure project at ths existing composting facility. The project included investigation to document disposal history, extent of landfill materials and a solvent plume, preparation of a landfill closure plan, and management of landfill closure and cap construction. The landfill investigation and closure activities were completed to satisfy the requirements of a New York State Department of Environmental Conservation's (NYSDEC) consent order, and were completed in compliance with NYSDEC DER-10 and 6NYCRR Part 360. Mr. Schmid performed construction oversight and low-flow groundwater sampling during construction activities.

NYCEDC Office of Environmental Remediation (OER) On-Call Environmental Consulting Services

- **Second Farms, Bronx, NY**

  AKRF, Inc. was contracted by OER to conduct a subsurface investigation of a 1.12-acre parcel in the Bronx, New York under the United States Environmental Protection Agency (USEPA) Brownfield Assessment Grant program. Mr. Schmid assisted in the investigation which included a geophysical survey and utility mark-outs, and the collection and analysis of soil, groundwater, soil vapor, indoor air and ambient air samples.

- **Former Nelson Foundry, Long Island City, NY**

  AKRF, Inc. was contracted by OER to conduct a subsurface investigation around the perimeter of a former foundry property in Long Island City, New York under the USEPA Brownfield Assessment Grant program. The work included preparation of a rigorous investigation work plan, Quality Assurance Project Plan, and Health and Safety Plan. The investigation will include a geophysical survey and utility mark-outs and the collection and analysis of soil, groundwater, soil vapor, and ambient air samples. The project also requires careful coordination of investigation-derived waste due to lack of on-site storage and daily drum pick-ups. Mr. Schmid conducted low flow sampling for the analysis of groundwater.

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Personnel Resume

Carl Armbruster
QA Manager

Qualifications Summary

Mr. Armbruster has over 30 years of experience in the environmental laboratory and engineering industry that includes extensive technical, management/leadership experience in all aspects of the laboratory business. He is an action-oriented manager dedicated to ensuring the laboratory maintains a quality program that holds the highest credentials in PT scores, accreditations and customer satisfaction. His unique experience lends itself to working successfully with employees, managers and clients at all levels.

Professional Experience

Quality Assurance Manager – TestAmerica Edison - 2005 to Present

Mr. Armbruster is responsible for establishing and implementing the quality assurance program at the Edison facility; and for interfacing with the corporate Quality Assurance Director to ensure adherence with the overall Quality Management Plan. He is also responsible for monitoring implementation and compliance with NELAC and TestAmerica's QMP, conducting annual management system audits and data audits, as well as providing regulatory updates and technical support to the Laboratory Director, Operations Manager, Client Services and Sales department.

Project Manager/Assistant Technical Director – STL Edison --2000 to 2005

Laboratory Director − STL Whippany − 1998 to 2000

Account Manager − Clean Harbors Environmental Services − 1997 to 1998

Laboratory Manager − Waste Management Inc., and Chemical Waste Management Inc − 1988 to 1997

Environmental Scientist − ICF Technology − 1987 to 1988

Analytical Chemist − IT Corporation – 1985 to 1987

Analytical Chemist − Hess Environmental Laboratories – 1983 to 1985

Education

- MS in Biology – East Stroudsburg University, 1984
- BS in Environmental Studies - East Stroudsburg University, 1980

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

Personnel Resume

Melissa Haas
Project Manager II

Qualifications Summary

Ms. Haas has over 20 years of experience in the environmental laboratory industry which includes project management, inorganic chemistry department management, LIMS implementation, human resources, and data reporting. She has a proven ability to handle multiple projects and tasks and a passion for the highest achievable level of quality and customer service.

Professional Experience

Project Manager – TestAmerica - 2012 to Present

Ms. Haas coordinates and manages clients' projects through all phases of the laboratory operations, ensuring fulfillment of TestAmerica's commitments to client requirements and on-time delivery. She maintains communications with clients and account executives and serves as a liaison between clients and laboratory operations to meet clients' needs. She reviews contractual documents and Quality Assurance Project Plans (QAPPs) to ensure certification and laboratory analytical requirements. Ms. Haas assists clients in identifying project requirements and manages project setup on behalf of the laboratory. She also develops business relationships with clients to further enhance client service and sales. She ensures accuracy and on-time delivery of client reports.

Laboratory Information Management (LIMS) Implementor – TestAmerica − 2011 to 2012

Ms. Haas was responsible for method and reference data setup for laboratories that were scheduled to implement the TALS LIMs system. She communicated with laboratory personnel to acquire information about standard operating procedures to ensure that methods and reference data were set up to meet the needs of the laboratory. She also provided on-site support for laboratories during the Go-Live period of the implementation and was the primary lead for the newly developed Certification Module. She trained laboratory and corporate personnel on the specifications of the software. She also provided remote data review assistance for laboratories to aid in the validation of the methods and reference data setup as well as the accuracy of the analysts' review process.

Metals Department Manager – TestAmerica – 2009-2011

Ms. Haas managed the operational activities of the metals department, including managing staff through clearly setting goals and providing performance reviews and feedback. She monitored the daily laboratory workload and ensured resources and staff were in place to complete projects on time. She prepared inorganic chemistry data packages and reviewed data for accuracy while prioritizing work to ensured timely delivery of quality data packages to clients. She oversaw the quality control of the department including demonstration of capabilities, method detection limit studies, SOP updates, audit responses, and performance evaluation responses.

Human Resources Coordinator – TestAmerica – 2007-2009

Ms. Haas provided support to the laboratory and Corporate Human Resources by implementing and administering Human Resources programs and procedures. She advised managers on Human Resources-related issues and managed the interview process for laboratory hires. She also served as a resource to the lab employees with HR-related issues and coordinated employee recognition programs and special events to promote employee satisfaction.

Wet Chemistry Department Manager – TestAmerica – 2001-2007

Ms. Haas managed the operational activities of the wet chemistry department and supervised a staff of eight analysts. She was responsible for data review, training, and quality control for the department. She increased productivity levels by providing key contributions toward automation of laboratory.

Wet Chemistry Analyst – Severn Trent Labs/AEN – 1997-2001

Veterinary Technician− Mobile Veterinary Clinic − 1994-1997

Campus Organizer –NJ Public Interest Research Group − 1990-1993

Education

- Rutgers University, New Brunswick, NJ 1986-1990, Bachelor of Science, Animal Science

L.A.B. Validation Corp., 14 West Point Drive, East Northport, New York 11731

Lori A. Beyer

SUMMARY: General Manager/Laboratory Director with a solid technical background combined with Management experience in environmental testing industry. Outstanding organizational, leadership, communication and technical skills. Customer focused, quality oriented professional with consistently high marks in customer/employee satisfaction.

EXPERIENCE:

1998-Present L.A.B. Validation Corporation, 14 West Point Drive, East Northport, NY
President

- Perform Data Validation activities relating to laboratory generated Organic and Inorganic Environmental Data.

1998-Present American Analytical Laboratories, LLC. 56 Toledo Street, Farmingdale, NY
Laboratory Director/Technical Director

- Plan, direct and control the operation, development and implementation of programs for the entire laboratory in order to meet AAL's financial and operational performance standards.
- Ensures that all operations are in compliance with AAL's QA manual and other appropriate regulatory requirements.
- Actively maintains a safe and healthy working environmental that is demanded by local laws/regulations.
- Monitors and manages group's performance with respect to data quality, on time delivery, safety, analyst development/goal achievement and any other key performance indices.
- Reviews work for accuracy and completeness prior to release of results to customers.

1996-1998 Nytest Environmental, Inc. (NEI) Port Washington, New York
General Manager

- Responsible for controlling the operation of an 18,000 square foot facility to meet NEI's financial and operational performance standards.
- Management of 65 FTEs including Sales and Operations
- Ensure that all operations are in compliance with NEI's QA procedures
- Ensures that productivity indicators, staffing levels and other cost factors are held within established guidelines
- Maintains a quantified model of laboratory's capacity and uses this model as the basis for controlling the flow of work into and through the lab so as to ensure that customer requirements and lab's revenue and contribution targets are achieved.

1994-1996 Nytest Environmental, Inc. (NEI) Port Washington, New York
Technical Project Manager

- Responsible for the coordination and implementation of environmental testing programs requirements between NEI and their customers
- Supervise Customer Service Department
- Assist in the development of major proposals
- Complete management of all Federal and State Contracts and assigned commercial contracts
- Provide technical assistance to the customer, including data validation and interpretation
- Review and implement Project specific QAPP's.

1995-1996 Nytest Environmental, Inc. (NEI) Port Washington, New York
Corporate QA/QC Officer

- Responsible for the implementation of QA practices as required in the NJDEP and EPA Contracts
- Primary contact for NJDEP QA/QC issues including SOP preparation, review and approval
- Responsible for review, verification and adherence to the Contract requirements and NEI QA Plan

1992-1994 Nytest Environmental, Inc. (NEI) Port Washington, New York
Data Review Manager

- Responsible for the accurate compilation, review and delivery of analytical data to the company's customers. Directly and effectively supervised a department of 22 personnel.
- Managed activities of the data processing software including method development, form creation, and production
- Implement new protocol requirements for report and data management formats
- Maintained control of data storage/archival areas as EPA/CLP document control officer

1987-1991 Nytest Environmental, Inc. (NEI) Port Washington, New York
Data Review Specialist

- Responsible for the review of GC, GC/MS, Metals and Wet Chemistry data in accordance with regulatory requirements
- Proficient with USEPA, NYSDEC, NJDEP and NEESA requirements
- Review data generated in accordance with SW846, NYSDEC ASP, EPA/CLP and 40 CFR Methodologies

1986-1987 Nytest Environmental, Inc (NEI) Port Washington, New York
GC/MS VOA Analyst

EDUCATION:

1982-1985 State University of New York at Stony Brook, New York; BS Biology/Biochemistry
1981-1982 University of Delaware; Biology/Chemistry
5/91 Rutgers University; Mass Spectral Data Interpretation Course, GC/MS Training
8/92 Westchester Community College; Organic Data Validation Course
9/93 Westchester Community College; Inorganic Data Validation Course

Westchester Community College

Professional Development Center

Awards this Certificate of Achievement To

LORI BEYER

for Successfully Completing

ORGANIC DATA VALIDATION COURSE (35 HOURS)

Dr. John Samuelian

Date AUGUST 1992

Assistant Dean
Professional Development Center

President

The Professional
Development Center

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

Westchester Community College

Professional Development Center

Awards this Certificate of Achievement To

LORI BEYER

for Successfully Completing

INORGANIC DATA VALIDATION

Instructor: Dale Boshart

Date MARCH 1993

Assistant Dean
Professional Development Center

President

The Professional
Development Center

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Thomas C. Jorling
Commissioner

July 8, 1992

Ms. Elaine Sall
Program Coordinator
Westchester Community College
Valhalla, NY 10595-1698

Dear Elaine,

Thank you for your letter of June 29, 1992. I have reviewed the course outline for organic data validation, qualifications for teachers and qualifications for students. The course that you propose to offer would be deemed equivalent to that which is offered by EPA. The individuals who successfully complete the course and pass the final written exam would be acceptable to perform the task of organic data validation for the Department of Environmental Conservation, Division of Hazardous Waste Remediation.

As we have discussed in our conversation of July 7, 1992, you will forward to me prior to the August course deadline, the differences between the EPA SOW/90 and the NYSDEC ASP 12/91. You stated these differences will be compiled by Mr. John Samulian.

I strongly encourage you to offer an inorganic data validation course. I anticipate the same list of candidates would be interested in an inorganic validation course as well, since most of the data to be validated consists of both organic and inorganic data.

Thank you for you efforts and please contact me if I can be of any further assistance.

Sincerely,

Maureen P. Serafini

Maureen P. Serafini
Environmental Chemist II
Division of Hazardous Waste
Remediation

The Professional
Development Center
AT
WESTCHESTER COMMUNITY COLLEGE

914 285-6619

October 2, 1992

Ms. Lori Beyer
3 sparkill Drive
East Northport, NY 11731

Dear Ms. Beyer:

Congratulations upon successful completion of the Organic Data Validation course held August 17 - 21, 1992, through Westchester Community College, Professional Development Center. This course has been deemed by New York State Department of Environmental Conservation as equivalent to EPA's Organic Data Validation Course.

Enclosed is your Certificate. Holders of this Certificate are deemed competent to perform organic data validation for the New York State DEC Division of Hazardous Waste Remediation.

The Professional Development Center at Westchester Community College plans to continue to offer courses and seminars which will be valuable to environmental engineers, chemists and related personnel. Current plans include a TCLP seminar on November 17th and a conference on Environmental Monitoring Regulations on November 18th.

We look forward to seeing you again soon at another environmental program or event. Again, congratulations.

Very truly yours,

Passing Grade is 70%
Your Grade is 99%

Elaine Sall
Program Coordinator

ES/bf

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

The Professional
Development Center
AT
WESTCHESTER COMMUNITY COLLEGE

914 285-6619

June 21, 1993

Dear Ms. Beyer:

Enclosed is your graded final examination in the Inorganic Data Validation course you completed this past March. A score of 70% was required in order to receive a certificate of satisfactory completion. Persons holding this certificate are deemed acceptable to perform Inorganic Data Validation for the New York State Department of Environmental Conservation, Division of Hazardous Waste Remediation.

I am also enclosing a course evaluation for you to complete if you have not already done so. The information you provide will greatly aid us in structuring further courses. We wish to make these course offerings as relevant, targeted and comprehensive as possible. Your evaluation is vital to that end.

Congratulations on your achievement. I look forward to seeing you again at another professional conference or course. We will be co-sponsoring an environmental monitoring conference on October 21, 1993 with the New York Water Pollution Control Association, Lower Hudson Chapter, at IBM's Yorktown Heights, NY site. Information regarding this event will be going out in August.

Very truly yours,

Elaine Sall

Elaine Sall
Program Coordinator

ES/bf

Enclosures

SUNY
WESTCHESTER COMMUNITY COLLEGE
Valhalla, New York 10595

ATTACHMENT B

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION – GUIDELINES FOR SAMPLING AND ANALYSIS OF PFAS – OCTOBER 2020 (REVISED JANUARY 2021 AND JUNE 2021)

NEW YORK STATE OF OPPORTUNITY.

Department of Environmental Conservation

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS)

Under NYSDEC's Part 375 Remedial Programs

April 2023



www.dec.ny.gov

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ERRATA SHEET for

SAMPLING, ANALYSIS, AND ASSESSMENT OF PER- AND POLYFLUOROALKYL SUBSTANCES (PFAS) Under NYSDEC's Part 375 Remedial Programs Issued January 17, 2020

Citation and Page Number	Current Text	Corrected Text	Date
Title of Appendix I, page 32	Appendix H	Appendix I	2/25/2020
Document Cover, page 1	Guidelines for Sampling and Analysis of PFAS	Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs	9/15/2020
Data Assessment and Application to Site Cleanup Page 3	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published	Until such time as Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published	3/28/2023
Water Sample Results Page 3	PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water if PFOA or PFOS is detected in any water sample at or above 10 ng/L (ppt) and is determined to be attributable to the site, either by a comparison of upgradient and downgradient levels, or the presence of soil source areas, as defined below.	NYSDEC has adopted ambient water quality guidance values for PFOA and PFOS. Groundwater samples should be compared to the human health criteria of 6.7 ng/l (ppt) for PFOA and 2.7 ng/l (ppt) for PFOS. These guidance values also include criteria for surface water for PFOS applicable for aquatic life, which may be applicable at some sites. Drinking water sample results should be compared to the NYS maximum contaminant level (MCL) of 10 ng/l (ppt).Analysis to determine if PFOA and PFOS concentrations are attributable to the site should include a comparison between upgradient and downgradient levels, and the presence of soil source areas, as defined below.	3/28/2023
Soil Sample Results Page 3	Soil cleanup objectives for PFOA and PFOS have been proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values:	NYSDEC will delay adding soil cleanup objectives for PFOA and PFOS to 6 NYCRR Part 375-6 until the PFAS rural soil background study has been completed. Until SCOs are in effect, the following are to be used as guidance values:	3/28/2023
Protection of Groundwater Page 3	PFOA (ppb) 1.1 PFOS (ppb) 3.7	PFOA (ppb) 0.8 PFOS (ppb) 1.0	3/28/2023

Citation and Page Number	Current Text	Corrected Text	Date
Footnote 2 Page 3	The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	The Protection of Groundwater values are based on the above referenced ambient groundwater guidance values. Details on that calculation are available in the following document, prepared for the February 2022 proposed changes to Part 375 (https://www.dec.ny.gov/docs/remediation_hudson_pdf/part375techsupport.pdf). The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	3/28/2023
Testing for Imported Soil Page 4	If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable.	If the concentrations of PFOA and PFOS in leachate are at or above the ambient water quality guidance values for groundwater, then the soil is not acceptable.	3/28/2023
Routine Analysis, page 9	"However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1 or ISO 25101."	"However, laboratories analyzing environmental samples…PFOA and PFOS in drinking water by EPA Method 537, 537.1, ISO 25101, or Method 533."	9/15/2020
Additional Analysis, page 9, new paragraph regarding soil parameters	None	"In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (EPA Method 9060), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils."	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Data Assessment and Application to Site Cleanup Page 10	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFAS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Target levels for cleanup of PFAS in other media, including biota and sediment, have not yet been established by the DEC.	Until such time as Ambient Water Quality Standards (AWQS) and Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.	9/15/2020
Water Sample Results Page 10	PFAS should be further assessed and considered as a potential contaminant of concern in groundwater or surface water (…) If PFAS are identified as a contaminant of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	PFOA and PFOS should be further assessed and considered as potential contaminants of concern in groundwater or surface water (…) If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Soil Sample Results, page 10	"The extent of soil contamination for purposes of delineation and remedy selection should be determined by having certain soil samples tested by Synthetic Precipitation Leaching Procedure (SPLP) and the leachate analyzed for PFAS. Soil exhibiting SPLP results above 70 ppt for either PFOA or PFOS (individually or combined) are to be evaluated during the cleanup phase."	"Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6. Until SCOs are in effect, the following are to be used as guidance values. " [Interim SCO Table] "PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP. As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf. "	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Testing for Imported Soil Page 11	Soil imported to a site for use in a soil cap, soil cover, or as backfill is to be tested for PFAS in general conformance with DER-10, Section 5.4(e) for the PFAS Analyte List (Appendix F) using the analytical procedures discussed below and the criteria in DER-10 associated with SVOCs. If PFOA or PFOS is detected in any sample at or above 1 µg/kg, then soil should be tested by SPLP and the leachate analyzed for PFAS. If the SPLP results exceed 10 ppt for either PFOA or PFOS (individually) then the source of backfill should be rejected, unless a site-specific exemption is provided by DER. SPLP leachate criteria is based on the Maximum Contaminant Levels proposed for drinking water by New York State's Department of Health, this value may be updated based on future Federal or State promulgated regulatory standards. Remedial parties have the option of analyzing samples concurrently for both PFAS in soil and in the SPLP leachate to minimize project delays. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above 10 ppt (the Maximum Contaminant Levels established for drinking water by the New York State Department of Health), then the soil is not acceptable. PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.	9/15/2020

Citation and Page Number	Current Text	Corrected Text	Date
Footnotes	None	[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances. [2] The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the soil cleanup objective for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).	9/15/2020
Additional Analysis, page 9	In cases… soil parameters, such as Total Organic Carbon (EPA Method 9060), soil…	In cases… soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil…	1/8/2021
Appendix A, General Guidelines, fourth bullet	List the ELAP-approved lab(s) to be used for analysis of samples	List the ELAP- certified lab(s) to be used for analysis of samples	1/8/2021
Appendix E, Laboratory Analysis and Containers	Drinking water samples collected using this protocol are intended to be analyzed for PFAS by ISO Method 25101.	Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101	1/8/2021
Water Sample Results Page 9	"In addition, further assessment of water may be warranted if either of the following screening levels are met: a. any other individual PFAS (not PFOA or PFOS) is detected in water at or above 100 ng/L; or b. total concentration of PFAS (including PFOA and PFOS) is detected in water at or above 500 ng/L"	Deleted	6/15/2021

Citation and Page Number	Current Text	Corrected Text	Date
Routine Analysis, Page XX	Currently, New York State Department of Health's Environmental Laboratory Approval Program (ELAP)… criteria set forth in the DER's laboratory guidelines for PFAS in non-potable water and solids (Appendix H - Laboratory Guidelines for Analysis of PFAS in Non-Potable Water and Solids).	Deleted	5/31/2022
Analysis and Reporting, Page XX	As of October 2020, the United States Environmental Protection Agency (EPA) does not have a validated method for analysis of PFAS for media commonly analyzed under DER remedial programs (non-potable waters, solids). DER has developed the following guidelines to ensure consistency in analysis and reporting of PFAS.	Deleted	5/31/2022
Routine Analysis, Page XX	LC-MS/MS analysis for PFAS using methodologies based on EPA Method 537.1 is the procedure to use for environmental samples. Isotope dilution techniques should be utilized for the analysis of PFAS in all media.	EPA Method 1633 is the procedure to use for environmental samples.	
Soil Sample Results, Page XX	Soil cleanup objectives for PFOA and PFOS will be proposed in an upcoming revision to 6 NYCRR Part 375-6	Soil cleanup objectives for PFOA and PFOS have been proposed in an upcoming revision to 6 NYCRR Part 375-6	
Appendix A	"Include in the text… LC-MS/MS for PFAS using methodologies based on EPA Method 537.1"	"Include in the text ….EPA Method 1633"	
Appendix A	"Laboratory should have ELAP certification for PFOA and PFOS in drinking water by EPA Method 537, 537.1, EPA Method 533, or ISO 25101"	Deleted	
Appendix B	"Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1"	"Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633"	

Citation and Page Number	Current Text	Corrected Text	Date
Appendix C	"Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1"	"Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633"	
Appendix D	"Samples collected using this protocol are intended to be analyzed for PFAS using methodologies based on EPA Method 537.1"	"Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633"	
Appendix G		Updated to include all forty PFAS analytes in EPA Method 533	
Appendix H		Deleted	
Appendix I	Appendix I	Appendix H	
Appendix H	"These guidelines are intended to be used for the validation of PFAS analytical results for projects within the Division of Environmental Remediation (DER) as well as aid in the preparation of a data usability summary report."	"These guidelines are intended to be used for the validation of PFAS using EPA Method 1633 for projects within the Division of Environmental Remediation (DER)."	
Appendix H	"The holding time is 14 days…"	"The holding time is 28 days…"	
Appendix H, Initial Calibration	"The initial calibration should contain a minimum of five standards for linear fit…"	"The initial calibration should contain a minimum of six standards for linear fit…"	
Appendix H, Initial Calibration	Linear fit calibration curves should have an R^2 value greater than 0.990.	Deleted	
Appendix H, Initial Calibration Verification	Initial Calibration Verification Section	Deleted	
Appendix H	secondary Ion Monitoring Section	Deleted	
Appendix H	Branched and Linear Isomers Section	Deleted	

Sampling, Analysis, and Assessment of Per- and Polyfluoroalkyl Substances (PFAS) Under NYSDEC's Part 375 Remedial Programs

Objective

New York State Department of Environmental Conservation's Division of Environmental Remediation (DER) performs or oversees sampling of environmental media and subsequent analysis of PFAS as part of remedial programs implemented under 6 NYCRR Part 375. To ensure consistency in sampling, analysis, reporting, and assessment of PFAS, DER has developed this document which summarizes currently accepted procedures and updates previous DER technical guidance pertaining to PFAS.

Applicability

All work plans submitted to DEC pursuant to one of the remedial programs under Part 375 shall include PFAS sampling and analysis procedures that conform to the guidelines provided herein.

As part of a site investigation or remedial action compliance program, whenever samples of potentially affected media are collected and analyzed for the standard Target Analyte List/Target Compound List (TAL/TCL), PFAS analysis should also be performed. Potentially affected media can include soil, groundwater, surface water, and sediment. Based upon the potential for biota to be affected, biota sampling and analysis for PFAS may also be warranted as determined pursuant to a Fish and Wildlife Impact Analysis. Soil vapor sampling for PFAS is not required.

Field Sampling Procedures

DER-10 specifies technical guidance applicable to DER's remedial programs. Given the prevalence and use of PFAS, DER has developed "best management practices" specific to sampling for PFAS. As specified in DER-10 Chapter 2, quality assurance procedures are to be submitted with investigation work plans. Typically, these procedures are incorporated into a work plan, or submitted as a stand-alone document (e.g., a Quality Assurance Project Plan). Quality assurance guidelines for PFAS are listed in Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS.

Field sampling for PFAS performed under DER remedial programs should follow the appropriate procedures outlined for soils, sediments, or other solids (Appendix B), non-potable groundwater (Appendix C), surface water (Appendix D), public or private water supply wells (Appendix E), and fish tissue (Appendix F).

QA/QC samples (e.g. duplicates, MS/MSD) should be collected as specified in DER-10, Section 2.3(c). For sampling equipment coming in contact with aqueous samples only, rinsate or equipment blanks should be collected. Equipment blanks should be collected at a minimum frequency of one per day per site or one per twenty samples, whichever is more frequent.

Analysis and Reporting

The investigation work plan should describe analysis and reporting procedures, including laboratory analytical procedures for the methods discussed below. As specified in DER-10 Section 2.2, laboratories should provide a full Category B deliverable. In addition, a Data Usability Summary Report (DUSR) should be prepared by an independent, third-party data validator. Electronic data submissions should meet the requirements provided at: https://www.dec.ny.gov/chemical/62440.html.

DER has developed a *PFAS Analyte List* (Appendix G) for remedial programs to understand the nature of contamination at sites. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. If lab and/or matrix specific issues are encountered for any analytes, the DER project manager, in consultation with the DER chemist, will make case-by-case decisions as to whether certain analytes may be temporarily or permanently discontinued from analysis at each site. As with other contaminants that are analyzed for at a site, the *PFAS Analyte List* may be refined for future sampling events based on investigative findings.

Routine Analysis

EPA Method 1633 is the procedure to use for environmental samples. Reporting limits for PFOA and PFOS in aqueous samples should not exceed 2 ng/L. Reporting limits for PFOA and PFOS in solid samples should not exceed 0.5 µg/kg. Reporting limits for all other PFAS in aqueous and solid media should be as close to these limits as possible. If laboratories indicate that they are not able to achieve these reporting limits for the entire *PFAS Analyte List*, site-specific decisions regarding acceptance of elevated reporting limits for specific PFAS can be made by the DER project manager in consultation with the DER chemist. Data review guidelines were developed by DER to ensure data comparability and usability (Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids).

Additional Analysis

Additional laboratory methods for analysis of PFAS may be warranted at a site, such as the Synthetic Precipitation Leaching Procedure (SPLP) and Total Oxidizable Precursor Assay (TOP Assay).

In cases where site-specific cleanup objectives for PFOA and PFOS are to be assessed, soil parameters, such as Total Organic Carbon (Lloyd Kahn), soil pH (EPA Method 9045), clay content (percent), and cation exchange capacity (EPA Method 9081), should be included in the analysis to help evaluate factors affecting the leachability of PFAS in site soils.

SPLP is a technique used to determine the mobility of chemicals in liquids, soils and wastes, and may be useful in determining the need for addressing PFAS-containing material as part of the remedy. SPLP by EPA Method 1312 should be used unless otherwise specified by the DER project manager in consultation with the DER chemist.

Impacted materials can be made up of PFAS that are not analyzable by routine analytical methodology. A TOP Assay can be utilized to conceptualize the amount and type of oxidizable PFAS which could be liberated in the environment, which approximates the maximum concentration of perfluoroalkyl substances that could be generated if all polyfluoroalkyl substances were oxidized. For example, some polyfluoroalkyl substances may degrade or transform to form perfluoroalkyl substances (such as PFOA or PFOS), resulting in an increase in perfluoroalkyl substance concentrations as contaminated groundwater moves away from a source. The TOP Assay converts, through oxidation, polyfluoroalkyl substances (precursors) into perfluoroalkyl substances that can be detected by routine analytical methodology.[1]

[1] TOP Assay analysis of highly contaminated samples, such as those from an AFFF (aqueous film-forming foam) site, can result in incomplete oxidation of the samples and an underestimation of the total perfluoroalkyl substances.

Commercial laboratories have adopted methods which allow for the quantification of targeted PFAS in air and biota. The EPA's Office of Research and Development (ORD) is currently developing methods which allow for air emissions characterization of PFAS, including both targeted and non-targeted analysis of PFAS. Consult with the DER project manager and the DER chemist for assistance on analyzing biota/tissue and air samples.

Data Assessment and Application to Site Cleanup

Until such time as Soil Cleanup Objectives (SCOs) for PFOA and PFOS are published, the extent of contaminated media potentially subject to remediation should be determined on a case-by-case basis using the procedures discussed below and the criteria in DER-10. Preliminary target levels for cleanup of PFOA and PFOS in other media, including biota and sediment, have not yet been established by the DEC.

Water Sample Results

NYSDEC has adopted ambient water quality guidance values for PFOA and PFOS. Groundwater samples should be compared to the human health criteria of 6.7 ng/l (ppt) for PFOA and 2.7 ng/l (ppt) for PFOS. These human health criteria should also be applied to surface water that is used as a water supply. This guidance also includes criteria for surface water for PFOS applicable for aquatic life, which may be applicable at some sites. Drinking water sample results should be compared to the NYS maximum contaminant level (MCL) of 10 ng/l (ppt). Analysis to determine if PFOA and PFOS concentrations are attributable to the site should include a comparison between upgradient and downgradient levels, and the presence of soil source areas, as defined below.

If PFOA and/or PFOS are identified as contaminants of concern for a site, they should be assessed as part of the remedy selection process in accordance with Part 375 and DER-10.

Soil Sample Results

NYSDEC will delay adding soil cleanup objectives for PFOA and PFOS to 6 NYCRR Part 375-6 until the PFAS rural soil background study has been completed. Until SCOs are in effect, the following are to be used as guidance values:

Guidance Values for Anticipated Site Use	PFOA (ppb)	PFOS (ppb)
Unrestricted	0.66	0.88
Residential	6.6	8.8
Restricted Residential	33	44
Commercial	500	440
Industrial	600	440
Protection of Groundwater[2]	0.8	1.0

PFOA and PFOS results for soil are to be compared against the guidance values listed above. These guidance values are to be used in determining whether PFOA and PFOS are contaminants of concern for the site and for determining remedial action objectives and cleanup requirements. Site-specific remedial objectives for protection of groundwater can also be presented for evaluation by DEC. Development of site-specific remedial objectives for protection of groundwater will require analysis of additional soil parameters relating to leachability. These

[2] The Protection of Groundwater values are based on the above referenced ambient groundwater guidance values. Details on that calculation are available in the following document, prepared for the February 2022 proposed changes to Part 375 (https://www.dec.ny.gov/docs/remediation_hudson_pdf/part375techsupport.pdf). The movement of PFAS in the environment is being aggressively researched at this time; that research will eventually result in more accurate models for the behaviors of these chemicals. In the meantime, DEC has calculated the guidance value for the protection of groundwater using the same procedure used for all other chemicals, as described in Section 7.7 of the Technical Support Document (http://www.dec.ny.gov/docs/remediation_hudson_pdf/techsuppdoc.pdf).

additional analyses can include any or all the parameters listed above (soil pH, cation exchange capacity, etc.) and/or use of SPLP.

As the understanding of PFAS transport improves, DEC welcomes proposals for site-specific remedial objectives for protection of groundwater. DEC will expect that those may be dependent on additional factors including soil pH, aqueous pH, % organic carbon, % Sand/Silt/Clay, soil cations: K, Ca, Mg, Na, Fe, Al, cation exchange capacity, and anion exchange capacity. Site-specific remedial objectives should also consider the dilution attenuation factor (DAF). The NJDEP publication on DAF can be used as a reference: https://www.nj.gov/dep/srp/guidance/rs/daf.pdf.

Testing for Imported Soil

Testing for PFAS should be included any time a full TAL/TCL analyte list is required. Results for PFOA and PFOS should be compared to the applicable guidance values. If PFOA or PFOS is detected in any sample at or above the guidance values then the source of backfill should be rejected, unless a site-specific exemption is provided by DER based on SPLP testing, for example. If the concentrations of PFOA and PFOS in leachate are at or above the ambient water quality guidance values for groundwater, then the soil is not acceptable.

PFOA, PFOS and 1,4-dioxane are all considered semi-volatile compounds, so composite samples are appropriate for these compounds when sampling in accordance with DER-10, Table 5.4(e)10. Category B deliverables should be submitted for backfill samples, though a DUSR is not required.

Appendix A - Quality Assurance Project Plan (QAPP) Guidelines for PFAS

The following guidelines (general and PFAS-specific) can be used to assist with the development of a QAPP for projects within DER involving sampling and analysis of PFAS.

General Guidelines in Accordance with DER-10

- Document/work plan section title – Quality Assurance Project Plan
- Summarize project scope, goals, and objectives
- Provide project organization including names and resumes of the project manager, Quality Assurance Officer (QAO), field staff, and Data Validator
    - The QAO should not have another position on the project, such as project or task manager, that involves project productivity or profitability as a job performance criterion
- List the ELAP certified lab(s) to be used for analysis of samples
- Include a site map showing sample locations
- Provide detailed sampling procedures for each matrix
- Include Data Quality Usability Objectives
- List equipment decontamination procedures
- Include an "Analytical Methods/Quality Assurance Summary Table" specifying:
    - Matrix type
    - Number or frequency of samples to be collected per matrix
    - Number of field and trip blanks per matrix
    - Analytical parameters to be measured per matrix
    - Analytical methods to be used per matrix with minimum reporting limits
    - Number and type of matrix spike and matrix spike duplicate samples to be collected
    - Number and type of duplicate samples to be collected
    - Sample preservation to be used per analytical method and sample matrix
    - Sample container volume and type to be used per analytical method and sample matrix
    - Sample holding time to be used per analytical method and sample matrix
- Specify Category B laboratory data deliverables and preparation of a DUSR

Specific Guidelines for PFAS

- Include in the text that sampling for PFAS will take place
- Include in the text that PFAS will be analyzed by EPA Method 1633
- Include the list of PFAS compounds to be analyzed (*PFAS Analyte List*)
- Include the laboratory SOP for PFAS analysis
- List the minimum method-achievable Reporting Limits for PFAS
    - Reporting Limits should be less than or equal to:
        - Aqueous – 2 ng/L (ppt)
        - Solids – 0.5 µg/kg (ppb)
- Include the laboratory Method Detection Limits for the PFAS compounds to be analyzed
-
- Include detailed sampling procedures
    - Precautions to be taken
    - Pump and equipment types
    - Decontamination procedures
    - Approved materials only to be used
- Specify that regular ice only will be used for sample shipment
- Specify that equipment blanks should be collected at a minimum frequency of 1 per day per site for each matrix

Appendix B - Sampling Protocols for PFAS in Soils, Sediments and Solids

General

The objective of this protocol is to give general guidelines for the collection of soil, sediment and other solid samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Containers

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in to contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel spoon
- stainless steel bowl
- steel hand auger or shovel without any coatings

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Sampling is often conducted in areas where a vegetative turf has been established. In these cases, a pre-cleaned trowel or shovel should be used to carefully remove the turf so that it may be replaced at the conclusion of sampling. Surface soil samples (e.g. 0 to 6 inches below surface) should then be collected using a pre-cleaned, stainless steel spoon. Shallow subsurface soil samples (e.g. 6 to ~36 inches below surface) may be collected by digging a hole using a pre-cleaned hand auger or shovel. When the desired subsurface depth is reached, a pre-cleaned hand auger or spoon shall be used to obtain the sample.

When the sample is obtained, it should be deposited into a stainless steel bowl for mixing prior to filling the sample containers. The soil should be placed directly into the bowl and mixed thoroughly by rolling the material into the middle until the material is homogenized. At this point the material within the bowl can be placed into the laboratory provided container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A soil log or sample log shall document the location of the sample/borehole, depth of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix C - Sampling Protocols for PFAS in Monitoring Wells

General

The objective of this protocol is to give general guidelines for the collection of groundwater samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including plumbers tape and sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel inertia pump with HDPE tubing
- peristaltic pump equipped with HDPE tubing and silicone tubing
- stainless steel bailer with stainless steel ball
- bladder pump (identified as PFAS-free) with HDPE tubing

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Monitoring wells should be purged in accordance with the sampling procedure (standard/volume purge or low flow purge) identified in the site work plan, which will determine the appropriate time to collect the sample. If sampling using standard purge techniques, additional purging may be needed to reduce turbidity levels, so samples contain a limited amount of sediment within the sample containers. Sample containers that contain sediment may cause issues at the laboratory, which may result in elevated reporting limits and other issues during the sample preparation that can compromise data usability. Sampling personnel should don new nitrile gloves prior to sample collection due to the potential to contact PFAS containing items (not related to the sampling equipment) during the purging activities.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Additional equipment blank samples may be collected to assess other equipment that is utilized at the monitoring well
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A purge log shall document the location of the sample, sampling equipment, groundwater parameters, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix D - Sampling Protocols for PFAS in Surface Water

General

The objective of this protocol is to give general guidelines for the collection of surface water samples for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Samples collected using this protocol are intended to be analyzed for PFAS using EPA Method 1633.

The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include: stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer.

A list of acceptable equipment is provided below, but other equipment may be considered appropriate based on sampling conditions.

- stainless steel cup

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Where conditions permit, (e.g. creek or pond) sampling devices (e.g. stainless steel cup) should be rinsed with site medium to be sampled prior to collection of the sample. At this point the sample can be collected and poured into the sample container.

If site conditions permit, samples can be collected directly into the laboratory container.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- Collect one equipment blank per day per site and minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers
- Request appropriate data deliverable (Category B) and an electronic data deliverable

Documentation

A sample log shall document the location of the sample, sampling equipment, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate. Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appropriate rain gear (PVC, polyurethane, or rubber rain gear are acceptable), bug spray, and sunscreen should be used that does not contain PFAS. Well washed cotton coveralls may be used as an alternative to bug spray and/or sunscreen.

PPE that contains PFAS is acceptable when site conditions warrant additional protection for the samplers and no other materials can be used to be protective. Documentation of such use should be provided in the field notes.

Appendix E - Sampling Protocols for PFAS in Private Water Supply Wells

General

The objective of this protocol is to give general guidelines for the collection of water samples from private water supply wells (with a functioning pump) for PFAS analysis. The sampling procedure used should be consistent with Sampling Guidelines and Protocols – Technological Background and Quality Control/Quality Assurance for NYS DEC Spill Response Program – March 1991 (http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf), with the following limitations.

Laboratory Analysis and Container

Drinking water samples collected using this protocol are intended to be analyzed for PFAS by EPA Method 537, 537.1, 533, or ISO Method 25101. The preferred material for containers is high density polyethylene (HDPE). Pre-cleaned sample containers, coolers, sample labels, and a chain of custody form will be provided by the laboratory.

Equipment

Acceptable materials for sampling include stainless steel, HDPE, PVC, silicone, acetate, and polypropylene. Additional materials may be acceptable if pre-approved by New York State Department of Environmental Conservation's Division of Environmental Remediation.

No sampling equipment components or sample containers should come in contact with aluminum foil, low density polyethylene, glass, or polytetrafluoroethylene (PTFE, Teflon™) materials (e.g. plumbers tape), including sample bottle cap liners with a PTFE layer.

Equipment Decontamination

Standard two step decontamination using detergent (Alconox is acceptable) and clean, PFAS-free water will be performed for sampling equipment. All sources of water used for equipment decontamination should be verified in advance to be PFAS-free through laboratory analysis or certification.

Sampling Techniques

Locate and assess the pressure tank and determine if any filter units are present within the building. Establish the sample location as close to the well pump as possible, which is typically the spigot at the pressure tank. Ensure sampling equipment is kept clean during sampling as access to the pressure tank spigot, which is likely located close to the ground, may be obstructed and may hinder sample collection.

Prior to sampling, a faucet downstream of the pressure tank (e.g., washroom sink) should be run until the well pump comes on and a decrease in water temperature is noted which indicates that the water is coming from the well. If the homeowner is amenable, staff should run the water longer to purge the well (15+ minutes) to provide a sample representative of the water in the formation rather than standing water in the well and piping system including the pressure tank. At this point a new pair of nitrile gloves should be donned and the sample can be collected from the sample point at the pressure tank.

Sample Identification and Logging

A label shall be attached to each sample container with a unique identification. Each sample shall be included on the chain of custody (COC).

Quality Assurance/Quality Control

- Immediately place samples in a cooler maintained at 4 ± 2º Celsius using ice
- Collect one field duplicate for every sample batch, minimum 1 duplicate per 20 samples. The duplicate shall consist of an additional sample at a given location
- Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, minimum 1 MS/MSD per 20 samples. The MS/MSD shall consist of an additional two samples at a given location and identified on the COC
- If equipment was used, collect one equipment blank per day per site and a minimum 1 equipment blank per 20 samples. The equipment blank shall test the new and decontaminated sampling equipment utilized to obtain a sample for residual PFAS contamination. This sample is obtained by using laboratory provided PFAS-free water and passing the water over or through the sampling device and into laboratory provided sample containers.
- A field reagent blank (FRB) should be collected at a rate of one per 20 samples. The lab will provide a FRB bottle containing PFAS free water and one empty FRB bottle. In the field, pour the water from the one bottle into the empty FRB bottle and label appropriately.
- Request appropriate data deliverable (Category B) and an electronic data deliverable
- For sampling events where multiple private wells (homes or sites) are to be sampled per day, it is acceptable to collect QC samples at a rate of one per 20 across multiple sites or days.

Documentation

A sample log shall document the location of the private well, sample point location, owner contact information, sampling equipment, purge duration, duplicate sample, visual description of the material, and any other observations or notes determined to be appropriate and available (e.g. well construction, pump type and location, yield, installation date). Additionally, care should be performed to limit contact with PFAS containing materials (e.g. waterproof field books, food packaging) during the sampling process.

Personal Protection Equipment (PPE)

For most sampling Level D PPE is anticipated to be appropriate. The sampler should wear nitrile gloves while conducting field work and handling sample containers.

Field staff shall consider the clothing to be worn during sampling activities. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFAS materials should be avoided. All clothing worn by sampling personnel should have been laundered multiple times.

Appendix F - Sampling Protocols for PFAS in Fish

This appendix contains a copy of the current SOP developed by the Division of Fish and Wildlife (DFW) entitled "General Fish Handling Procedures for Contaminant Analysis" (Ver. 8). This SOP should be followed when collecting fish for contaminant analysis. Note, however, that the Bureau of Ecosystem Health will not be supplying bags or tags. All supplies are the responsibility of the collector

Procedure Name: General Fish Handling Procedures for Contaminant Analysis

Number: FW-005

Purpose: This procedure describes data collection, fish processing and delivery of fish collected for contaminant monitoring. It contains the chain of custody and collection record forms that should be used for the collections.

Organization: Environmental Monitoring Section
Bureau of Ecosystem Health
Division of Fish and Wildlife (DFW)
New York State Department of Environmental Conservation (NYSDEC)
625 Broadway
Albany, New York 12233-4756

Version: 8

Previous Version Date: 21 March 2018

Summary of Changes to this Version: Updated bureau name to Bureau of Ecosystem Health. Added direction to list the names of all field crew on the collection record. Minor formatting changes on chain of custody and collection records.

Originator or Revised by: Wayne Richter, Jesse Becker

Date: 26 April 2019

Quality Assurance Officer and Approval Date: Jesse Becker, 26 April 2019

NEW YORK STATE
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

GENERAL FISH HANDLING PROCEDURES FOR CONTAMINANT ANALYSES

A. Original copies of all continuity of evidence (i.e., Chain of Custody) and collection record forms must accompany delivery of fish to the lab. A copy shall be directed to the Project Leader or as appropriate, Wayne Richter. All necessary forms will be supplied by the Bureau of Ecosystem Health. Because some samples may be used in legal cases, it is critical that each section is filled out completely. Each Chain of Custody form has three main sections:

   1. The top box is to be filled out **and signed** by the person responsible for the fish collection (e.g., crew leader, field biologist, researcher). This person is responsible for delivery of the samples to DEC facilities or personnel (e.g., regional office or biologist).

   2. The second section is to be filled out **and signed** by the person responsible for the collections while being stored at DEC, before delivery to the analytical lab. This may be the same person as in (1), but it is still required that they complete the section. Also important is the **range of identification numbers** (i.e., tag numbers) included in the sample batch.

   3. Finally, the bottom box is to record any transfers between DEC personnel and facilities. Each subsequent transfer should be **identified, signed, and dated**, until laboratory personnel take possession of the fish.

B. The following data are required on each **Fish Collection Record** form:

   1. Project and Site Name.

   2. DEC Region.

   3. All personnel (and affiliation) involved in the collection.

   4. Method of collection (gill net, hook and line, etc.)

   5. Preservation Method.

C. The following data are to be taken on each fish collected and recorded on the **Fish Collection Record** form:

   1. Tag number - Each specimen is to be individually jaw tagged at time of collection with a unique number. Make sure the tag is turned out so that the number can be read without opening the bag. Use tags in sequential order. For small fish or composite samples place the tag inside the bag with the samples. The Bureau of Ecosystem Health can supply the tags.

   2. Species identification (please be explicit enough to enable assigning genus and species). Group fish by species when processing.

   3. Date collected.

   4. Sample location (waterway and nearest prominent identifiable landmark).

   5. Total length (nearest mm or smallest sub-unit on measuring instrument) and weight (nearest g or

smallest sub-unit of weight on weighing instrument). Take all measures as soon as possible with calibrated, protected instruments (e.g. from wind and upsets) and prior to freezing.

6. Sex - fish may be cut enough to allow sexing or other internal investigation, but do not eviscerate. Make any incision on the right side of the belly flap or exactly down the midline so that a left-side fillet can be removed.

D. General data collection recommendations:

1. It is helpful to use an ID or tag number that will be unique. It is best to use metal striped bass or other uniquely numbered metal tags. If uniquely numbered tags are unavailable, values based on the region, water body and year are likely to be unique: for example, R7CAY11001 for Region 7, Cayuga Lake, 2011, fish 1. If the fish are just numbered 1 through 20, we have to give them new numbers for our database, making it more difficult to trace your fish to their analytical results and creating an additional possibility for errors.

2. Process and record fish of the same species sequentially. Recording mistakes are less likely when all fish from a species are processed together. Starting with the bigger fish species helps avoid missing an individual.

3. If using Bureau of Ecosystem Health supplied tags or other numbered tags, use tags in sequence so that fish are recorded with sequential Tag Numbers. This makes data entry and login at the lab and use of the data in the future easier and reduces keypunch errors.

4. Record length and weight as soon as possible after collection and before freezing. Other data are recorded in the field upon collection. An age determination of each fish is optional, but if done, it is recorded in the appropriate “Age” column.

5. For composite samples of small fish, record the number of fish in the composite in the Remarks column. Record the length and weight of each individual in a composite. All fish in a composite sample should be of the same species and members of a composite should be visually matched for size.

6. Please submit photocopies of topographic maps or good quality navigation charts indicating sampling locations. GPS coordinates can be entered in the Location column of the collection record form in addition to or instead for providing a map. These records are of immense help to us (and hopefully you) in providing documented location records which are not dependent on memory and/or the same collection crew. In addition, they may be helpful for contaminant source trackdown and remediation/control efforts of the Department.

7. When recording data on fish measurements, it will help to ensure correct data recording for the data recorder to call back the numbers to the person making the measurements.

E. Each fish is to be placed in its own individual plastic bag. For small fish to be analyzed as a composite, put all of the fish for one composite in the same bag but use a separate bag for each composite. It is important to individually bag the fish to avoid difficulties or cross contamination when processing the fish for chemical analysis. Be sure to include the fish’s tag number inside the bag, preferably attached to the fish with the tag number turned out so it can be read. Tie or otherwise secure the bag closed. **The Bureau of Ecosystem Health will supply the bags.** If necessary, food grade bags may be procured from a suitable vendor (e.g., grocery store). It is preferable to redundantly label each bag with a manila tag tied between the knot and the body of the bag. This tag should be labeled with the project name, collection location, tag number, collection date, and fish species. If scales are collected, the scale envelope should be labeled with

the same information.

F. Groups of fish, by species, are to be placed in one large plastic bag per sampling location. **The Bureau of Ecosystem Health will supply the larger bags.** Tie or otherwise secure the bag closed. Label the site bag with a manila tag tied between the knot and the body of the bag. The tag should contain: project, collection location, collection date, species and **tag number ranges**. Having this information on the manila tag enables lab staff to know what is in the bag without opening it.

G. Do not eviscerate, fillet or otherwise dissect the fish unless specifically asked to. If evisceration or dissection is specified, the fish must be cut along the exact midline or on the right side so that the left side fillet can be removed intact at the laboratory. If filleting is specified, the procedure for taking a standard fillet (SOP PREPLAB 4) must be followed, including removing scales.

H. Special procedures for PFAS: Unlike legacy contaminants such as PCBs, which are rarely found in day to day life, PFAS are widely used and frequently encountered. Practices that avoid sample contamination are therefore necessary. While no standard practices have been established for fish, procedures for water quality sampling can provide guidance. The following practices should be used for collections when fish are to be analyzed for PFAS:

No materials containing Teflon.
No Post-it notes.
No ice packs; only water ice or dry ice.
Any gloves worn must be powder free nitrile.
No Gore-Tex or similar materials (Gore-Tex is a PFC with PFOA used in its manufacture).
No stain repellent or waterproof treated clothing; these are likely to contain PFCs.
Avoid plastic materials, other than HDPE, including clipboards and waterproof notebooks.
Wash hands after handling any food containers or packages as these may contain PFCs.
Keep pre-wrapped food containers and wrappers isolated from fish handling.
Wear clothing washed at least six times since purchase.
Wear clothing washed without fabric softener.
Staff should avoid cosmetics, moisturizers, hand creams and similar products on the day of sampling as many of these products contain PFCs (Fujii et al. 2013). Sunscreen or insect repellent should not contain ingredients with “fluor” in their name. Apply any sunscreen or insect repellent well downwind from all materials. Hands must be washed after touching any of these products.

I. All fish must be kept at a temperature <45° F (<8° C) immediately following data processing. As soon as possible, freeze at -20° C ± 5° C. Due to occasional freezer failures, daily freezer temperature logs are required. The freezer should be locked or otherwise secured to maintain chain of custody.

J. In most cases, samples should be delivered to the Analytical Services Unit at the Hale Creek field station. Coordinate delivery with field station staff and send copies of the collection records, continuity of evidence forms and freezer temperature logs to the field station. For samples to be analyzed elsewhere, non-routine collections or other questions, contact Wayne Richter, Bureau of Ecosystem Health, NYSDEC, 625 Broadway, Albany, New York 12233-4756, 518-402-8974, or the project leader about sample transfer. Samples will then be directed to the analytical facility and personnel noted on specific project descriptions.

K. A recommended equipment list is at the end of this document.

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
DIVISION OF FISH AND WILDLIFE
FISH COLLECTION RECORD

Project and Site Name _____ DEC Region _____

Collections made by (include all crew) _____

Sampling Method: □Electrofishing □Gill netting □Trap netting □Trawling □Seining □Angling □Other _____

Preservation Method: □Freezing □Other _____ Notes (SWFDB survey number): _____

FOR LAB USE ONLY- LAB ENTRY NO.	COLLECTION OR TAG NO.	SPECIES	DATE TAKEN	LOCATION	AGE	SEX &/OR REPROD. CONDIT	LENGTH ( )	WEIGHT ( )	REMARKS

richter: revised 2011, 5/7/15, 10/4/16, 3/20/17; becker: 3/23/17, 4/26/19

NEW YORK STATE DEPARTMENT OF ENVIRONMENTAL CONSERVATION
CHAIN OF CUSTODY

I, _____, of _____ collected the
(Print Name) (Print Business Address)

following on _____, 20____ from _____
(Date) (Water Body)

in the vicinity of _____
(Landmark, Village, Road, etc.)

Town of _____, in _____ County.

Item(s) _____

_____

Said sample(s) were in my possession and handled according to standard procedures provided to me prior to collection. The sample(s) were placed in the custody of a representative of the New York State Department of Environmental Conservation on _____, 20_____.

_____ _____
Signature Date

I, _____, received the above mentioned sample(s) on the date specified and assigned identification number(s) _____ to the sample(s). I have recorded pertinent data for the sample(s) on the attached collection records. The sample(s) remained in my custody until subsequently transferred, prepared or shipped at times and on dates as attested to below.

_____ _____
Signature Date

SECOND RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
THIRD RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
FOURTH RECIPIENT (Print Name)	TIME & DATE	PURPOSE OF TRANSFER
SIGNATURE	UNIT	
RECEIVED IN LABORATORY BY (Print Name)	TIME & DATE	REMARKS
SIGNATURE	UNIT	
LOGGED IN BY (Print Name)	TIME & DATE	ACCESSION NUMBERS
SIGNATURE	UNIT	

richter: revised 21 April 2014; becker: 23 March 2017, 26 April, 2019

NOTICE OF WARRANTY

By signature to the chain of custody (reverse), the signatory warrants that the information provided is truthful and accurate to the best of his/her ability. The signatory affirms that he/she is willing to testify to those facts provided and the circumstances surrounding the same. Nothing in this warranty or chain of custody negates responsibility nor liability of the signatories for the truthfulness and accuracy of the statements provided.

HANDLING INSTRUCTIONS

On day of collection, collector(s) name(s), address(es), date, geographic location of capture (attach a copy of topographic map or navigation chart), species, number kept of each species, and description of capture vicinity (proper noun, if possible) along with name of Town and County must be indicated on reverse.

Retain organisms in manila tagged plastic bags to avoid mixing capture locations. Note appropriate information on each bag tag.

Keep samples as cool as possible. Put on ice if fish cannot be frozen within 12 hours. If fish are held more than 24 hours without freezing, they will not be retained or analyzed.

Initial recipient (either DEC or designated agent) of samples from collector(s) is responsible for obtaining and recording information on the collection record forms which will accompany the chain of custody. This person will seal the container using packing tape and writing his signature, the time and the date across the tape onto the container with indelible marker. Any time a seal is broken, for whatever purpose, the incident must be recorded on the Chain of Custody (reason, time, and date) in the purpose of transfer block. Container then is resealed using new tape and rewriting signature, with time and date.

EQUIPMENT LIST

Scale or balance of appropriate capacity for the fish to be collected.

Fish measuring board.

Plastic bags of an appropriate size for the fish to be collected and for site bags.

Individually numbered metal tags for fish.

Manila tags to label bags.

Small envelops, approximately 2” x 3.5”, if fish scales are to be collected.

Knife for removing scales.

Chain of custody and fish collection forms.

Clipboard.

Pens or markers.

Paper towels.

Dish soap and brush.

Bucket.

Cooler.

Ice.

Duct tape.

Appendix G – PFAS Analyte List

Group	Chemical Name	Abbreviation	CAS Number
Perfluoroalkyl sulfonic acids	Perfluorobutanesulfonic acid	PFBS	375-73-5
	Perfluoropentanesulfonic acid	PFPeS	2706-91-4
	Perfluorohexanesulfonic acid	PFHxS	355-46-4
	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanesulfonic acid	PFOS	1763-23-1
	Perfluorononanesulfonic acid	PFNS	68259-12-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
	Perfluorododecanesulfonic acid	PFDoS	79780-39-5
Perfluoroalkyl carboxylic acids	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
	Perfluorooctanoic acid	PFOA	335-67-1
	Perfluorononanoic acid	PFNA	375-95-1
	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUnA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTeDA	376-06-7
Per- and Polyfluoroether carboxylic acids	Hexafluoropropylene oxide dimer acid	HFPO-DA	13252-13-6
	4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
	Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1
	Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5
	Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6
Fluorotelomer sulfonic acids	4:2 Fluorotelomer sulfonic acid	4:2-FTS	757124-72-4
	6:2 Fluorotelomer sulfonic acid	6:2-FTS	27619-97-2
	8:2 Fluorotelomer sulfonic acid	8:2-FTS	39108-34-4
Fluorotelomer carboxylic acids	3:3 Fluorotelomer carboxylic acid	3:3 FTCA	356-02-5
	5:3 Fluorotelomer carboxylic acid	5:3 FTCA	914637-49-3
	7:3 Fluorotelomer carboxylic acid	7:3 FTCA	812-70-4
Perfluorooctane sulfonamides	Perfluorooctane sulfonamide	PFOSA	754-91-6
	N-methylperfluorooctane sulfonamide	NMeFOSA	31506-32-8
	N-ethylperfluorooctane sulfonamide	NEtFOSA	4151-50-2
Perfluorooctane sulfonamidoacetic acids	N-methylperfluorooctane sulfonamidoacetic acid	N-MeFOSAA	2355-31-9
	N-ethylperfluorooctane sulfonamidoacetic acid	N-EtFOSAA	2991-50-6
Perfluorooctane sulfonamide ethanols	N-methylperfluorooctane sulfonamidoethanol	MeFOSE	24448-09-7
	N-ethylperfluorooctane sulfonamidoethanol	EtFOSE	1691-99-2

Group	Chemical Name	Abbreviation	CAS Number
Ether sulfonic acids	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (F-53B Major)	9Cl-PF3ONS	756426-58-1
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (F-53B Minor)	11Cl-PF3OUdS	763051-92-9
	Perfluoro(2-ethoxyethane) sulfonic acid	PFEESA	113507-82-7

Appendix H - Data Review Guidelines for Analysis of PFAS in Non-Potable Water and Solids

General

These guidelines are intended to be used for the validation of PFAS using EPA Method 1633 for projects within the Division of Environmental Remediation (DER). Data reviewers should understand the methodology and techniques utilized in the analysis. Consultation with the end user of the data may be necessary to assist in determining data usability based on the data quality objectives in the Quality Assurance Project Plan. A familiarity with the laboratory's Standard Operating Procedure may also be needed to fully evaluate the data. If you have any questions, please contact DER's Quality Assurance Officer, Dana Barbarossa, at dana.barbarossa@dec.ny.gov.

Preservation and Holding Time

Samples should be preserved with ice to a temperature of less than 6°C upon arrival at the lab. The holding time is 28 days to extraction for aqueous and solid samples. The time from extraction to analysis for aqueous samples is 28 days and 40 days for solids.

Temperature greatly exceeds 6ºC upon arrival at the lab*	Use professional judgement to qualify detects and non-detects as estimated or rejected
Holding time exceeding 28 days to extraction	Use professional judgement to qualify detects and non-detects as estimated or rejected if holding time is grossly exceeded

*Samples that are delivered to the lab immediately after sampling may not meet the thermal preservation guidelines. Samples are considered acceptable if they arrive on ice or an attempt to chill the samples is observed.

Initial Calibration

The initial calibration should contain a minimum of six standards for linear fit and six standards for a quadratic fit. The relative standard deviation (RSD) for a quadratic fit calibration should be less than 20%.

The low-level calibration standard should be within 50% - 150% of the true value, and the mid-level calibration standard within 70% - 130% of the true value.

%RSD >20%	J flag detects and UJ non detects

Continuing Calibration Verification

Continuing calibration verification (CCV) checks should be analyzed at a frequency of one per ten field samples. If CCV recovery is very low, where detection of the analyte could be in question, ensure a low level CCV was analyzed and use to determine data quality.

CCV recovery <70 or >130%	J flag results

Blanks

There should be no detections in the method blanks above the reporting limits. Equipment blanks, field blanks, rinse blanks etc. should be evaluated in the same manner as method blanks. Use the most contaminated blank to evaluate the sample results.

Blank Result	Sample Result	Qualification
Any detection	<Reporting limit	Qualify as ND at reporting limit
Any detection	>Reporting Limit and >10x the blank result	No qualification
>Reporting limit	>Reporting limit and <10x blank result	J+ biased high

Field Duplicates

A blind field duplicate should be collected at rate of one per twenty samples. The relative percent difference (RPD) should be less than 30% for analyte concentrations greater than two times the reporting limit. Use the higher result for final reporting.

RPD >30%	Apply J qualifier to parent sample

Lab Control Spike

Lab control spikes should be analyzed with each extraction batch or one for every twenty samples. In the absence of lab derived criteria, use 70% - 130% recovery criteria to evaluate the data.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects

Matrix Spike/Matrix Spike Duplicate

One matrix spike and matrix spike duplicate should be collected at a rate of one per twenty samples. Use professional judgement to reject results based on out of control MS/MSD recoveries.

Recovery <70% or >130% (lab derived criteria can also be used)	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only
RPD >30%	Apply J qualifier to detects and UJ qualifier to non detects of parent sample only

Extracted Internal Standards (Isotope Dilution Analytes)

Problematic analytes (e.g. PFBA, PFPeA, fluorotelomer sulfonates) can have wider recoveries without qualification. Qualify corresponding native compounds with a J flag if outside of the range.

Recovery <50% or >150%	Apply J qualifier
Recovery <25% or >150% for poor responding analytes	Apply J qualifier
Isotope Dilution Analyte (IDA) Recovery <10%	Reject results

Signal to Noise Ratio

The signal to noise ratio for the quantifier ion should be at least 3:1. If the ratio is less than 3:1, the peak is discernable from the baseline noise and symmetrical, the result can be reported. If the peak appears to be baseline noise and/or the shape is irregular, qualify the result as tentatively identified.

Reporting Limits

If project-specific reporting limits were not met, please indicate that in the report along with the reason (e.g. over dilution, dilution for non-target analytes, high sediment in aqueous samples).

Peak Integrations

Target analyte peaks should be integrated properly and consistently when compared to standards. Ensure branched isomer peaks are included for PFAS where standards are available. Inconsistencies should be brought to the attention of the laboratory or identified in the data review summary report.

APPENDIX C
TECHNICAL SPECIFICATION SHEETS

AquaGate®+FLUORO-SORB®

AquaGATE+ FLUORO-SORB®

Background

AquaGate+Fluoro-Sorb is a patented, composite-aggregate technology resembling small stones typically comprised of a dense aggregate core, clay or clay-sized materials, polymers, and a fine-grained additive layer of Fluoro-Sorb.

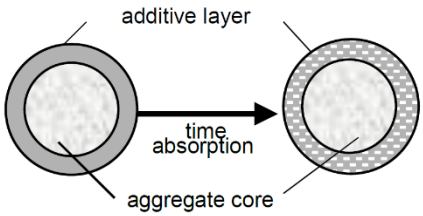


Figure 1. Configuration of FLUORO-SORB-coated particle.



AquaGate+Fluoro-Sorb serves as a delivery mechanism to reliably place reactive materials to address PFAS contamination in challenging environments.

Product Specifications

Aggregate:	Nominal AASHTO #8 (1/4-3/8”) or custom-sized to meet project-specific needs * Limestone or non-calcareous substitute, as deemed project-appropriate
Fluoro-Sorb:	CETCO Fluoro-Sorb-P® PFAS Adsorbent ** 15 - 30% by weight, varies by formulation*
Binder:	Cellulosic polymer
Permeability:	1×10^{-2} to 1×10^{0} cm/sec (Variations will exist and permeability can be influenced by particle size distribution, placement, and cover materials – surcharge load)
Dry Bulk Density:	75 – 85 lbs/ft^3
Moisture:	10 – 20% (maximum)

Fluoro-Sorb is a Registered Trademark of Specialty Minerals (Michigan) Inc.

AquaBlok® Composite Particle System

For more information, contact AquaBlok, Ltd.

Phone: (419) 825-1325
Email: services@aquablok.com
Web: www.aquablok.com

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Last Revised: September 2022

AquaBlok 2080FW

AquaBlok – 2080FW

General Description

AquaBlok is a patented, composite-aggregate technology resembling small stones that is typically comprised of a dense aggregate core. In this application of the technology, a powdered high-swell sodium bentonite coating is utilized (Figure 1) with varying percentages of additive (bentonite) layer by percent of total weight.

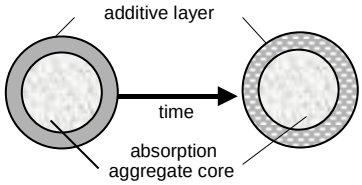


Figure 1. Configuration of AquaBlok-coated particle.





AquaBlok – 2080FW is a freshwater formulation which is approximately 20% Bentonite by weight based on the total quantity of material used in production. This product will provide a low permeability seal in the water without mechanical compaction.

Product Specifications

Aggregate:	Nominal AASHTO #8 (1/4-3/8”) or custom-sized to meet project-specific need * Limestone or non-calcareous substitute, as deemed project-appropriate
Bentonite:	Powdered – Approximate 200 Mesh ⊙ Bentonite Clay; High swell Wyoming Sodium Natural Mineral (Montmorillonite) ⊙ Light Grey Powder; Odorless Manufacturers – Product Designation ⊙ Bentonite Performance Minerals – Barakade Standard ⊙ Others that are deemed to meet the manufacturer specification ⊙ *Formulation Range from 15 –25% by weight (average)*
Binder:	Cellulosic polymer
Permeability:	1×10^{-7} to 1×10^{-9} cm/sec
Dry Bulk Density:	75 – 85 lbs/ft^3
Moisture:	10 – 20% (maximum)

AquaBlok® Composite Particle System

For more information, Contact AquaBlok, Ltd. at:

Phone: (800) 688-2649
Email: services@aquablok.com
Web: www.aquablok.com

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Last Revised: January 7, 2015

AquaGate®+FLUORO-SORB®

AquaGATE+ FLUORO-SORB®

Background

AquaGate+Fluoro-Sorb is a patented, composite-aggregate technology resembling small stones typically comprised of a dense aggregate core, clay or clay-sized materials, polymers, and a fine-grained additive layer of Fluoro-Sorb.

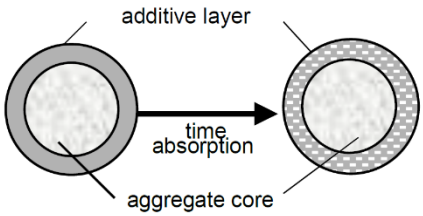


Figure 1. Configuration of FLUORO-SORB-coated particle.



AquaGate+Fluoro-Sorb serves as a delivery mechanism to reliably place reactive materials to address PFAS contamination in challenging environments.

Product Specifications

Aggregate:	Nominal AASHTO #8 (1/4-3/8”) or custom-sized to meet project-specific needs * Limestone or non-calcareous substitute, as deemed project-appropriate
Fluoro-Sorb:	CETCO Fluoro-Sorb-P® PFAS Adsorbent ** 15 - 30% by weight, varies by formulation*
Binder:	Cellulosic polymer
Permeability:	1×10^{-2} to 1×10^{0} cm/sec (Variations will exist and permeability can be influenced by particle size distribution, placement, and cover materials – surcharge load)
Dry Bulk Density:	75 – 85 lbs/ft^3
Moisture:	10 – 20% (maximum)

Fluoro-Sorb is a Registered Trademark of Specialty Minerals (Michigan) Inc.

AquaBlok® Composite Particle System

For more information, contact AquaBlok, Ltd.

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Web: www.aquablok.com

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Last Revised: September 2022

AquaGate®+RemBind 10%

AquaGATE+ RemBind®

Background

AquaGate+RemBind is a patented, composite-aggregate technology resembling small stones typically comprised of a dense aggregate core, clay or clay-sized materials, polymers, and a fine-grained additive layer – RemBind, by Ziltek.

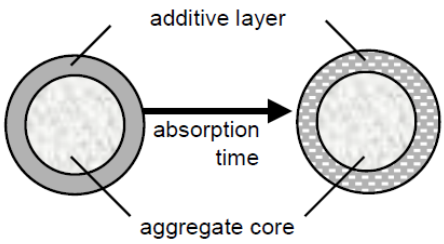


Figure 1. Configuration of Remind-coated particle.



AquaGate+RemBind serves as a delivery mechanism to reliably and uniformly place reactive materials into aquatic and other challenging environments.

Product Specifications

Aggregate:	Nominal AASHTO #8 (1/4-3/8”) or custom-sized to meet project-specific needs * Limestone or non-calcareous substitute, as deemed project-appropriate
Clay:	Attapulgite ** Typically 15% by weight*
RemBind:	RemBind™ Plus Filter Media ** Target 10% by weight - Range of 7.5 – 12.5% by weight*
Binder:	Cellulosic polymer
Permeability:	1×10^{-3} to 1×10^{-6} cm/sec (Variations will exist and permeability can be influenced by particle size distribution, placement, and cover materials – surcharge load)
Dry Bulk Density:	70 – 80 lbs/ft^3
Moisture:	10 – 12% (maximum)

RemBind is a Trademark of Ziltek Pty Ltd.

AquaBlok® Composite Particle System

For more information, contact AquaBlok, Ltd. at:

Phone: (419) 825-1325
Email: services@aquablok.com
Web: www.aquablok.com

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Last Revised: July 2020

PlumeStop® Liquid Activated Carbon™ Technical Description

PlumeStop Liquid Activated Carbon is an innovative groundwater remediation technology designed to rapidly remove and permanently degrade groundwater contaminants. PlumeStop is composed of very fine particles of activated carbon (1-2µm) suspended in water through the use of unique organic polymer dispersion chemistry. Once in the subsurface, the material behaves as a colloidal biomatrix, binding to the aquifer matrix, rapidly removing contaminants from groundwater, and expediting permanent contaminant biodegradation.

This unique remediation technology accomplishes treatment with the use of highly dispersible, fast-acting, sorption-based technology, capturing and concentrating dissolved-phase contaminants within its matrix-like structure. Once contaminants are sorbed onto the regenerative matrix, biodegradation processes achieve complete remediation at an accelerated rate.



Distribution of PlumeStop in water

To see a list of treatable contaminants with the use of PlumeStop, view the Range of Treatable Contaminants Guide.

Chemical Composition

- Water - CAS# 7732-18-5
- Colloidal Activated Carbon ≤2.5 - CAS# µm 7440-44-0
- Proprietary Additives

Properties

- Physical state: Liquid
- Form: Aqueous suspension
- Color: Black
- Odor: Odorless
- pH: 8 - 10

Storage and Handling Guidelines

Storage
Store in original tightly closed container
Store away from incompatible materials
Protect from freezing

Handling
Avoid contact with skin and eyes
Avoid prolonged exposure
Observe good industrial hygiene practices
Wash thoroughly after handling
Wear appropriate personal protective equipment

PlumeStop® Liquid Activated Carbon™ Technical Description

Applications

PlumeStop is easily applied into the subsurface through gravity-feed or low-pressure injection.

Health and Safety

Wash hands after handling. Dispose of waste and residues in accordance with local authority requirements. Please review the Material Safety Data Sheet for additional storage, usage, and handling requirements here: PlumeStop SDS.

REGENESIS

www.regenesis.com
1011 Calle Sombra, San Clemente CA 92673
949.366.8000

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All other trademarks are the property of their respective owners.

SourceStop®

Specification Sheet

Solid Formulation

Storage

- Store in original tightly closed container
- Store away from incompatible materials
- Do not allow material to get wet
- Store in temperatures between 40°F and 95°F

Handling

- Avoid contact with skin and eyes
- Avoid prolonged exposure
- Observe good industrial hygiene practices
- Wash thoroughly after handling
- Wear appropriate personal protective equipment

Health and Safety

Product is non-hazardous. Dispose of waste and residues in accordance with local authority requirements. Please review the Safety Data Sheet for additional storage, usage, and handling requirements.

Technical Description



The solid formulation of SourceStop® consists of engineered conglomerates made from Colloidal Activated Carbon (1-2 µm) and Powdered Activated Carbon (20 µm), with a particulate size range of 0.5 to 2.0mm diameter. These aggregate composites immobilize organic chemical contaminants, such as PFAS, in the soils of contaminated source areas.

SourceStop Solid is mixed into *in situ* or *ex situ* soils using standard yellow-iron-type/soil mixing equipment. It is designed to be low-dust and easy to handle. When mixed the aggregate composite quickly disintegrates coating the soils in activated carbon. The colloidal activated carbon is released, enhancing distribution and penetration, to reduce mixing time and ensure effective treatment.

SourceStop Solid will stabilize the PFAS contamination within the soils, rapidly and significantly reducing contaminant leachability. The further discharge of PFAS into the groundwater is prevented, allowing attenuation of the downgradient plume.

> **Note:** SourceStop is a product supplied in two formulations. For details on the Liquid Formulation, please see separate specification sheet.

Application

SourceStop Solid is mixed into *in situ* or *ex situ* soils using standard yellow-iron-type/soil mixing equipment.

Chemical Composition

Colloidal activated carbon ≤2.5 µm	CAS No. 7440-44-0
Powdered activated carbon 20 µm	CAS No. 7440-44-0

Properties

Physical State	Solid
Form	Aggregate composites of colloidal activated carbon (CAC) particles and powdered activated carbon (PAC)
Color	Black
Granule size	6 x 50 Mesh
Density	550 g/L (927 lb/cubic yard)
Packaging	1,000 lb sacks

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REGENESIS®

RemBind is a Binding Agent for PFAS Remediation in Soil and Water

RemBind is an adsorbent for the remediation of contaminated soil and groundwater. The product binds permanently to contaminants preventing them from leaching and causing environmental harm.

RemBind contains a patented blend of naturally occurring ingredients including aluminium hydroxide, carbon and clays.

Since 2011, RemBind has been used commercially to treat a wide variety of organic contaminants including PFAS, TPH, PAH, pesticides, herbicides and mercury. The product has been successfully applied in USA, Europe and Australia.



RemBind®

Applications

Soil Remediation

The RemBind 100 series of powdered products are specifically designed to treat organic contaminants in soil. The product is added to the soil at 1% to 5% using conventional equipment and binding is complete within 24 hours.



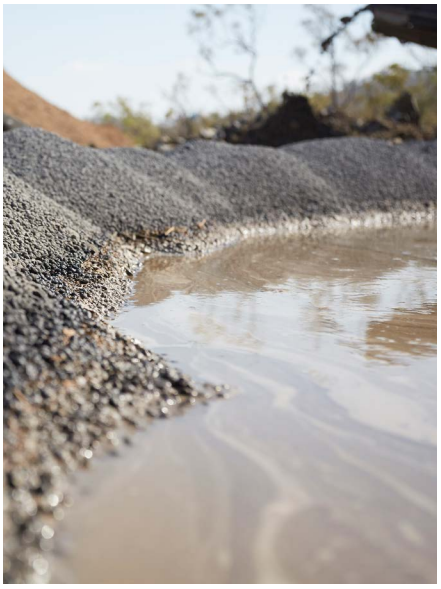
Soil Remediation

Waste Water Remediation

The RemBind 200 series of powdered products are designed to treat waste water in batch treatment systems where high contaminant removal rates are required. The product is generally added at 0.2% to 1%, stirred for 1 hour, and then separated.

Sediment, Groundwater and Surface Water Remediation

AquaGate+RemBind is a composite particle consisting of an aggregate core coated with RemBind powders.
This unique design facilitates the accurate placement of RemBind for the passive remediation of PFAS in water using permeable reactive barriers (PRBs). The PRBs can be installed *in-situ* for groundwater remediation or above ground in surface water drains.



Leachate control from stockpiles

Benefits

- Cost-effective
- Quick and easy to apply
- Proven long term stability - US EPA 1320
- Independently validated by industry
- Developed with government R&D organization, CSIRO www.csiro.au

Z070-15 02/20