Barnstable AIRPORT HYANNIS

FINAL IMMEDIATE RESPONSE ACTION PLAN MODIFICATION

Barnstable Municipal Airport
Hyannis, Massachusetts

RTN 4-26347

December 2019

Prepared for:
Barnstable Municipal Airport
480 Barnstable Road
Hyannis, MA 02840

Prepared by:
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90 Route 6A
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DRAFT IMMEDIATE RESPONSE ACTION PLAN MODIFICATION

BARNSTABLE MUNICIPAL AIRPORT
HYANNIS, MASSACHUSETTS
RTN 4-26347

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1.0 INTRODUCTION

The Horsley Witten Group, Inc. (HW) has been retained by the Barnstable Municipal Airport (the "Airport") to develop this Final Immediate Response Action (IRA) Plan Modification for its property at 480 Barnstable Road, Hyannis, Massachusetts (Figure 1). HW has prepared this Final IRA Plan Modification in accordance with the Massachusetts Contingency Plan 310 CMR 40.0000 (MCP). The Final IRA Plan Modification has also been prepared consistent with the Final Public Involvement Plan for the Airport dated September 16, 2019 (the "Final PIP"). Consistent with the Final PIP, all people identified on Table 6, Community Notification List, have been notified on the availability of the Final IRA Plan Modification. The Airport provided a 21-day review period to allow for comments from the public and Massachusetts Department of Environmental Protection ("MassDEP") on the Draft IRA Plan Modification dated October 2019 and electronically submitted to the MassDEP on October 11, 2019. The Airport accepted comments on the Draft IRA Plan Modification until November 1, 2019. Comments received by the public are described below in Section 5 and copies of the comments are included in Attachment A.

For the purpose of this report, the term "Airport" specifically refers to the Barnstable Municipal Airport property located at 480 Barnstable Road, Hyannis, Massachusetts, and the term "Disposal Site" refers to the area impacted by the release of oil and/or hazardous material (OHM) subject to Release Tracking Number (RTN) 4-26347.

This Final IRA Plan Modification is in response to the document titled *"Request for Modified Immediate Response Action Plan/Interim Deadline"* dated June 18, 2019 and issued by the MassDEP (the "Modified IRA Request"). In an email dated August 5, 2019 from Ms. Angela Gallagher of the MassDEP, the deadline for the Draft IRA Plan Modification was extended to October 11, 2019. Consistent with the FINAL PIP and the Draft IRA Plan Modification, the Final IRA Plan Modification is due by December 2, 2019. The extension for the Draft IRA Modification was provided due to a delay with the Airport receiving the Modified IRA Request. The Modified IRA Request asked that the Airport propose response actions to *"reduce infiltration of precipitation through PFAS-impacted soil, such as temporarily capping the source areas; excavating and properly disposing of the PFAS-impacted soil; or some equivalent approach".* The Airport's proposed response actions are set forth below.

2.0 POTENTIALLY RESPONSIBLE PARTY

Pursuant to 40.0424 (a), the name, address, telephone number and relationship of the person assuming responsibility for conducting the IRA is set forth below.

Ms. Katie Servis, Assistant Airport Manager
Barnstable Municipal Airport
Hyannis, Massachusetts 02601
(508) 775-2020

3.0 GENERAL DISPOSAL SITE INFORMATION

Pursuant to 40.0424 (b), a description of the release or threat of release, site conditions, and surrounding receptors is set forth below.

3.1 General Site Conditions

The Airport is located within a densely developed area of Hyannis, Massachusetts. Commercial properties including general offices, retail establishments, and commercial businesses, as well as residential homes, abut the Airport. The Airport provides scheduled airline service and general aviation services and other aviation related activities. The Airport is currently owned by the Town of Barnstable and is managed through the Barnstable Municipal Airport Commission (BMAC). The Airport began as a private airport consisting of a single grass runway before being given to the Town of Barnstable in the 1930's. With the outbreak of World War II, the airport was taken over by the federal government for wartime training and defense purposes. During the 1940's, the U.S. Navy used the Airport and expanded the airfield to include three runways. In 1946, the Airport was returned to a two-runway municipal airport (each runway has a designation at each end, being 15-33 and 6-24). In 1948, the property was conveyed by the United States government (pursuant to the Surplus Property Act of 1944) to the Town of Barnstable, acting by and through its Airport Commission, for the use and benefit of the Airport.

The Airport is comprised of approximately 645 acres of land, with approximately 140 acres that are impervious (e.g. paved areas such as parking lots, runways, taxiways, aircraft parking aprons, concrete walkways, and building rooftops). The Airport's structures include the main terminal and the Air Traffic Control Tower ("ATCT"), which are located south of the runways and taxiways, as well as several hangars used for general aviation and operations services. In addition, the Airport Rescue and Fire Fighting (ARFF) Building is in the southeast corner of the property. The Airport is in an area of Hyannis zoned for business and industrial uses.

The Airport is located within several zones of contribution (Zone II) to municipal drinking supply wells. Groundwater in the vicinity of the Airport is located approximately 23 to 27 feet below ground surface (BGS). A regional water table map prepared by the United States Geologic Survey (USGS) indicates groundwater generally flows in a southeasterly direction across the airport (Figure 2, LeBlanc, et al., 1986). Monitoring well elevation surveys and water level measurements conducted by HW also indicate groundwater flows in a southeasterly direction. On the southern portion of the airport, groundwater flows parallel to Route 132 and Runway 15-33. In the northern portion of the Airport, the flow is also to the southeast, but turns further south, with groundwater flowing from the area of Mary Dunn Pond onto Airport property and curving south towards the Maher Wellfield located near the intersection of Route 28 and Yarmouth Road (Figure 2). Geologic materials encountered in soil borings at the Airport consist of outwash sands and gravel, indicating the aquifer is moderately to highly permeable, with an estimated hydraulic conductivity of 100 to 300 feet per day.

3.2 Environmental Setting and Surrounding Receptors

According to MassGIS and the MassDEP Priority Resource Map (Figure 3), there are no Areas of Critical Environmental Concern; local, state, or federal protected open space; fish habitats; and, habitats of Species of Special Concern or Threatened or Endangered Species within 500 feet of the Airport. There is an area including Rare or Endangered species located approximately 500 feet north of the Airport boundary near Mary Dunn Pond.

As indicated above, the Airport is located within several MassDEP designated zones of contribution (Zone II) to municipal supply wells, and within an Environmental Protection Agency (EPA) Medium-Yield Sole Source Aquifer. Due to dense development of the surrounding urban areas, the Airport, and a large portion of the Zone 2 that it is located within, is also designated as a Non-Potential Drinking Water Source Area (NPDWSA).

The Maher Well Field is located hydraulically downgradient of the Airport and the Barnstable Fire Training Academy (RTN 4-26179). However, all water provided through the Hyannis Water District (the "District") meets the required state drinking water standards and guidelines for both per- and polyfluoroalkyl substances (PFAS) and 1,4-dioxane. The District has constructed treatment facilities at the Mary Dunn Wellfield to treat for PFAS (associated with a release of these contaminants from the Barnstable Fire Training Academy (RTN 4-26179), and has agreements to purchase water from the Town of Yarmouth and the Centerville, Osterville, Marstons Mills Water District. In addition, the District is in the process of installing a treatment system for both PFAS compounds and 1,4-dioxane at the Maher Wellfield.

As documented in the report titled *Phase I Report and Tier Classification Report*, dated November 2017 and prepared by HW *"no private drinking water wells at the Airport or downgradient properties were identified by HW or the Town of Barnstable Department of Public Works, Water Supply Division, and the Town of Yarmouth Health Department, as part of the previous IRA actions and during the Phase I investigation".*

3.3 Applicable Soil and Groundwater Categories

Pursuant to 310 CMR 40.0933, the applicable soil category is selected based upon the frequency, intensity of use, and accessibility of the Airport by adults and children. Based on these criteria, soil at the Airport is category S-1/GW-1 and SW-1/GW-3, which are the most stringent standard.

As indicated above, the Airport is located within several zones of contribution (Zone II) for Barnstable Village, the Hyannis Water District and the Town of Yarmouth. Zone IIs are considered current drinking water sources as defined in 310 CMR 40.0006 and groundwater located within a Current Drinking Water Source Area is considered category GW-1. As such, groundwater samples collected from the Airport are compared to the GW-1 standard, which is the most stringent category.

Groundwater located within 30 feet of an occupied building that has an average annual depth of less than 15 feet is categorized as GW-2. This is primarily a concern because of the possibility of vapor impacts to indoor air. The average annual depth to groundwater at the Airport is greater than 15 feet, therefore GW-2 do not apply. Also, all disposal sites shall be considered a potential source of discharge to surface water, and therefore categorized as GW-3. Based on these criteria, categories GW-1 and GW-3 are applicable to the Airport.

The current and proposed (2019 proposed MCP Revisions) soil and groundwater standards applicable to the Airport for PFAS and 1,4-dioxane are as follows:

PFAS*							
Current Soil Standard		Proposed Soil Standards		Current ORSG Groundwater Value***		Proposed Groundwater Standard	
S-1/GW-1	SW-1/GW-3	S-1/GW-1	SW-1/GW-3**	GW-1	GW-3	GW-1	GW-3**
None	None	0.2 ug/kg	300 ug/kg	0.07 ug/L	None	0.02 ug/L	500 - 40,000 ug/L

* PFAS is the sum of perfluorodecanoic Acid ("PFDA"), perfluoroheptanoic acid (PFHpA), perfluorohexanesulfonic acid (PFHxS), perfluorononanoic acid (PFNA), perfluorooctanesulfonic acid (PFOS), perfluorooctanoic acid (PFOA)

**The proposed S-1/GW-3 standard and the proposed GW-3 standard is not for the sum of PFAS but rather for each of the individual six PFAS compounds listed above.

***The current ORSG groundwater value for PFAS is the sum of the PFAS compounds above, excluding PFDA.

1,4-dioxane							
Current Soil Standard		Proposed Soil Standards		Current Groundwater Value		Proposed Groundwater Standard	
S-1/GW-1	SW-1/GW-3	S-1/ GW-1	SW-1/GW-3	GW-1	GW-3	GW-1	GW-3
200 ug/kg	20,000 ug/kg	No Change	No Change	0.3 ug/L	50,000 ug/L	No Change	No Change

3.4 General Release Details for 1,4-Dioxane and PFAS

The evaluation for 1,4-dioxane at the Airport began in July 2015 when the MassDEP requested samples of existing wells to evaluate the presence or absence of this compound on Airport property. In August 2016, the Airport also conducted an initial round of groundwater sampling to evaluate the presence of PFAS compounds, also at the request of MassDEP. Subsequently, a

Notice of Responsibility (NOR), dated November 10, 2016, was issued to the Airport by the MassDEP. The NOR requested that the Airport conduct additional field investigations to evaluate sources of these two types of contaminants at the Airport and on adjacent properties, and to identify potential impacts to public water supply wells operated by the Hyannis Water District at the Mary Dunn and Maher Wellfields.

Groundwater in the vicinity of historic releases from a floor drain at the former Provincetown Boston Airlines hangar (currently leased to Cape Air) had been known to contain 1,1,1-trichloroethane (1,1,1-TCA). Since 1,1,1-TCA solvent products have been known to potentially contain 1,4-dioxane, the past release of 1,1,1-TCA was investigated as part of this project as a potential source.

In July 2015, HW sampled groundwater from seven monitoring wells on and off the Airport property for analysis of 1,4-dioxane. The contaminant was detected in well OW-9DD at a concentration of 0.93 ug/L, above the 0.30 ug/L standard for 1,4-dioxane. This well is located off Airport property, within the Maher Wellfield property, and is screened from 77 to 87 feet BGS. All samples taken from the other wells at the Airport property did not contain 1,4-dioxane above laboratory reporting levels. Subsequent testing in 2017 of 11 groundwater wells only detected 1,4-dioxane at OW-9DD, OW-19D and OW-18D which are all located off Airport property and within the Maher Wellfield property. An additional well was installed at the Airport in June 2019 as a final attempt to verify that the Airport is not the source of 1,4-dioxane at the Maher Wellfield property. Sampling of this well and select off-site wells for 1,4-dioxane was conducted in August 2019. Testing of an additional six wells at the Airport for 1,4-dioxane was conduct on September 27, 2019 and 1,4-dioxane was not detected in any of these wells. The potential source(s) and nature and extent of the 1,4-dioxane are still being evaluated. Tabulated analytical data (including the recent samples collected in September) is included on Table 1 and monitoring well locations are indicated on Figure 4.

In response to the August 4, 2016 NOR/Request for Information ("RFI") the Airport conducted additional groundwater investigations and collect samples for laboratory analysis. As described in the December 2016 IRA Plan, these efforts were focused on suspected PFAS contamination locations on the Airport. Based on the results of 75 soil samples and 65 groundwater samples collected at the Airport between 2016 - 2019 and interviews with Airport staff regarding the use of aqueous film forming foam (AFFF) as required by the Federal Aviation Administration ("FAA"), PFAS has been identified in two distinct areas at the Airport. These areas are identified as the Air Rescue and Fire Fighting (ARFF) Building Area and the Deployment Area. These areas are identified with a yellow line on Figures 5 and 6, respectively. Tabulated analytical data is included on Tables 2 through 4 and sampling are indicated on Figures 4, 5 and 6.

4.0 SUMMARY OF RESPONSE ACTIONS

Pursuant to 40.0424 (c), a description of any Immediate Response Actions undertaken are set forth below.

4.1 Previous Immediate Response Actions

Between November 2016 and September 2019, the Airport conducted Immediate Response Actions to delineate the extent of 1,4-dioxane and PFAS in soil and groundwater both on and off the Airport. Details concerning the response actions are set forth below.

- The installation of groundwater monitoring wells at six locations installed in April 2017: in the vicinity of potential sources of PFAS at the ARFF Building, at the firefighting training deployment area adjacent to the East Ramp, and at upgradient locations to evaluate potential off-site sources of PFAS and 1,4-dioxane.
- The first round of groundwater samples for PFAS and 1,4-dioxane were collected on April 5-7 and April 11, 2017. Additional groundwater samples and one surface water sample were collected for analysis of PFAS on June 20, 2017.
- An initial round of three soil samples were collected on December 6, 2016 as reported in the first status report. One sample was taken from each location where it was determined that AFFF had been used at the Airport, including the site of an airplane crash in 1981, the Deployment Area, and the 1991 Drill Location along the dirt road adjacent to the Deployment Area.
- A second round of soil samples were collected on June 20, 2017 adjacent to the ARFF building and within the deployment area to begin to determine the extent of PFAS within the surface soils. Based on the results of these analyses, a third round of samples from these two locations were collected on September 26, 2017. The third round of sampling was designed to further delineate the extent of PFAS in soils both horizontally and vertically, with samples taken at the ground surface and at two and four feet BGS.
- In October 2017, three composite soil samples were taken from piles of sediment and topsoil associated with the redevelopment of Runway 15/33. These piles were located on Airport property at the site of the former Mildred's Restaurant and were analyzed for PFAS compounds to evaluate if sediment removed from the airport as part of this redevelopment contained PFAS.
- Two samples of AFFF concentrate have also been analyzed for PFAS compounds to evaluate the foam previously used at the airport and that the foam that is currently in use.
- Six PFAS soil samples were also analyzed for leaching potential using an SPLP test between September and October 2017. The chosen samples included four samples from within the boundaries of the PFAS sites at the airport and two samples from runway reconstruction soils stockpiled at the airport.
- On August 14, 2018, 24 PFAS surface soil samples were collected in proximity to the ARFF building and the Deployment Area. PFAS compounds were previously detected in these areas and additional samples were collected to determine the vertical extent of PFAS impacts in soil and to refine the Disposal Site boundary at the Airport.

- In October 2018, three soil borings (DL11, DL14 and HW-F) were advanced in the deployment area. One soil boring (ARFF3) was advanced and one surface soil sample (HW-3) was collected near the ARFF Building in order to further delineate the extent of PFAS in soils both horizontally and vertically. All soil borings were advanced using direct push methods.
- In October 2018, six monitoring wells were installed at the Airport. A cluster of three wells (HW-G(s), HW-G(m), and HW-G(d)) was installed at an upgradient location to evaluate potential off-site sources of PFAS. Three additional wells (HW-H, HW-I, and HW-J) were installed southeast of the Deployment Area adjacent to the East Ramp.
- In November 2018, six groundwater samples were collected to evaluate PFAS concentrations in the Deployment Area. Four groundwater samples and one surface water sample from Mary Dunn Pond were also collected for analysis of oxygen and hydrogen isotopes to determine the contribution of pond water from Mary Dunn Pond to the four downgradient wells.
- In December 2018, two soil samples were collected from the 1991 Drill Location to determine if PFAS detected in the area are related to background conditions.
- In December 2018, 12 groundwater samples were collected for analysis of PFAS and 13 groundwater samples were collected for analysis of oxygen and hydrogen isotopes to determine the contribution of pond water from Mary Dunn Pond to the 13 downgradient wells. Groundwater samples were also collected from four monitoring wells in the Maher Wellfield for analysis of 1,4-dioxane.
- In February 2019, three additional surface soil samples were collected to further delineate the Disposal Site boundary around the ARFF building.
- In May and June 2019, HW installed an additional nine groundwater monitoring wells to delineate the vertical and horizontal extent of PFAS at the Airport and on adjacent hydraulically upgradient properties. HW is in the process of evaluating the potential groundwater impacts from other off-site sources such as the adjacent Fire Fighting Academy that may be contributing to the detection of PFAS both at the Airport and at the downgradient well fields.
- In July and August 2019, HW collected groundwater samples from five monitoring wells located on and off the Airport for 1,4-dioxane analysis.
- In August 2019, HW collected one soil sample and one groundwater from the Deployment Area for PFAS analysis to further refine the Conceptual Site Model. HW also collected six samples of the water discharge from a fire fighting truck to determine if any residual AFFF was present in the water discharge. Results of these samples will be presented in the October 2019 IRA Status Report.
- In September 2019, HW collected groundwater samples from six monitoring wells located on the Airport for 1,4-dioxane analysis.

5.0 Soliciting Public Input

A public comment period for the Draft IRA Plan Modification begin on October 11, 2019 and extend to November 1, 2019. Comments received on the IRA Plan Modification and the Airport's responses are set forth below. Copies of the Draft IRA Plan Modification comments are included in Appendix A.

Green Cape, Cape Alliance for Pesticide Education

1. *"The amount of testing performed appears inadequate as the margins of contamination have still not been defined after several years".*

To date, the Airport has conducted several subsurface investigations that have included the collection of 75 soil samples, 62 groundwater samples, and three surface water samples to determine the nature and extent of PFAS at the Airport. The Airport has also collected an additional 25 groundwater samples for 1,4-dioxane analysis. These investigations have identified two areas (ARFFF Building Area and Deployment Area) were PFAS has been released to the ground surface at the Airport as indicted by the yellow lines on Figures 4 and 5. These areas have been identified based on Airport records going back to 2000, interviews with Airport staff who have worked at the Airport since 1980, and the collection of laboratory samples for analysis. This effort has also identified two PFAS plumes that are entering the Airport from the north and northwest. These additional plumes are not related to historic Airport operations and have resulted in additional impacts to the Airport that are not related to Airport operations. The nature and extent of the PFAS and 1,4-dioxane plumes at the Airport are still being evaluated. The evaluation is being conducted consistent with the MCP and the established timelines.

2. *"Public involvement – which remains minimal; future public meetings should be held in a location more readily accessible by Hyannis residents who drink the water".*

The Airport is providing opportunities for Public Involvement consistent with the MCP and additional notifications do not appear to be warranted at this time. Electronic copies of all reports submitted to the MassDEP can be accessed here:

https://eeaonline.eea.state.ma.us/EEA/fileviewer/Rtn.aspx?rtn=4-0026347

The Airport anticipates holding the next public meeting in the summer of 2020 prior to the issuance of the Phase II Comprehensive Site Assessment report due to MassDEP in November 2020. The Airport has historically been chosen as an easily assessable location to the residents of Barnstable. Additionally, drinking water at the Maher well field is treated for both PFAS and 1,4-dioxane and meets the current drinking water standards.

3. *"With regard to environmental receptors, the Draft IRA Plan Mod neglects meaningful sampling of water and sediment in the ponds on the Airport property and potentially*

contaminated areas off-site. It is disturbing that no sampling for PFAS in tissues of fish, shellfish, ducks, and deer is planned. These should be investigated as wild fish and game have been shown to bioaccumulate PFAS and may be a further exposure source for humans not unrelated to the contaminated water emanating from the Airport".

The Airport recently collected surface water samples from Upper Gate and Lewis Pond which were all below the proposed MassDEP PFAS standards. No evidence of fish kills, stressed vegetation or the detection of PFAS above the proposed MCP surface water standards have been detected in surface water at the Airport. Also, as indicated above, two additional PFAS plumes not related to Airport operations have been identified entering the Airport from the north and northwest. MassDEP has been informed of these findings and will determine if issuing a Notice of Responsibility and/or Request for Information to upgradient properties is necessary. Additionally, access to the Deployment Area and ARFFF Building Area by the public is restricted by fences and security staff. Fishing and hunting is also not allowed at the Airport.

4. *"In addition to the PFAS compounds tested by Con-Test, has the Airport selected the suite of PFAS they analyze only on the legacy AFFF products used at the site over decades or are the newer AFFF replacement products containing a preponderance of short chain PFAS being include?*

The Airport is exceeding the requirements for PFAS testing documented in the MassDEP Fact Sheet titled *"Interim Guidance on Sampling and Analysis for PFAS at Disposal Sites Regulated Under the Massachusetts Contingency Plan",* dated June 19, 2018. This document indicates that *"[t]he 14 analytes specified in EPA Method 537 Rev. 1.1 should be the focus of MCP site investigations".* In addition to the 14 analytes specified in the EPA Method 537 Rev. 1.1, the Airport is also including the following additional analytes:

- Perfluorobutanoic acid (PFBA);
- Perfluoropentanoic acid (PFPeA);
- Perfluoroheptanesulfonic acid (PFHpS);
- Perfluorooctanesulfonamide (FOSA);
- Perfluorodecanesulfonic acid (PFDS);
- 8:2 Fluorotelomersulfonate (8:2 FTS A); and
- 8:2 Fluorotelomersulfonate (8:2 FTS A).

5. *"The footprint of both caps is a puzzlement and not explained in the document. The Proposed caps are also not well described in the Draft IRA Plan Mod. Are they asphalt, poly sheeting, or both, possibly covered with loam and then top seeded with grass? Will the capped areas then be accessible to vehicles? A minimum of 3 inches of asphalt is acceptable if there is no traffic above the cap. Poly sheeting alone – with or without grass-is completely inadequate for this purpose.*

The cap locations have been determined based on known areas at the Airport were AFFF has been used and the results of soil and groundwater testing. The selection of either asphalt or polyethylene sheeting for temporary capping is irrelevant. Both materials will create an impervious area to isolate the impacted soil which is the purpose of the IRA Modification. As indicated below in Section 7 *"the caps will be utilized for a minimum of three years. The caps will be inspected at least once every 6-months and groundwater testing will be conducted in the area to determine the effectiveness of the caps".* This statement indicates that the caps will be considered temporary until the effectiveness is demonstrated by inspection and bi-annual groundwater monitoring for at least three years. Additionally, access to the Airport is restricted to badged personnel and care will be taken to not damage the caps. Any damage to the caps will be repaired as soon as possible. Vehicles will not drive over areas that have been loam and seeded.

Tom Cambareri, CGWP, LSP

1. *"The conceptual plan does not show where there is a preference for asphalt or poly sheeting. The proposed cap should be extended to cover the area with high PFAS soil concentrations at sampling site D7".*

The use of either asphalt, polyethylene sheeting, or a combination of the two for a temporary cap will be determined during the engineering design phase (December 23, 2019 to February 3, 2019). The cap material will be determined based on the future planned use of the capped area by the Airport (i.e., vehicle usage areas within the cap will be made of asphalt). D7 was always intended to be included within the Deployment Area cap and Figure 6 has been updated to clearly indicate this.

2. *"The design should retain all monitoring wells and address how potential remedial actions such as well installation or confirmatory sampling can be accommodated".*

All monitoring wells located within the cap areas will be retained. In areas of were an asphalt cap is used, the monitoring wells will be located within flush mounted, gasketed road boxes that are sealed into the asphalt. In areas were polyethylene sheeting is used, metal standpipes will be used, and a polyethylene boot will be fabricated to seal the standpipe to the polyethylene sheeting with a combination of adhesive and vapor barrier tape.

soil borings that require penetration through the asphalt cap after completion will be immediately repaired by placing an asphalt plug in the sample hole and asphaltic sealant around the plug. Temporary sample locations that require penetration through the polyethylene sheeting will be repaired by exposing several feet of the polyethylene sheeting, cleaning off any accumulated soil, placing overlapping polyethylene sheeting at least 6-inches on either side of the penetration, and sealing it to the existing cap with adhesive and vapor barrier tape.

3. *"The proposal indicates that the cap will be used for three years with monitoring conducted every six months. It is not clear why the cap would only be used for three years.*

The Airport is committed to reducing the concentration of PFAS in groundwater related to Airport operations. The cap will only be considered premiant after at least three years of inspections and bi-annual groundwater monitoring have concluded that the cap has successfully reduced infiltration in the area.

4. "The conceptual plan also indicates that stormwater drainage will be designed for the areas to convey stormwater away from the capped areas and into the existing Airport stormwater system. The plan should consider potential sheet flow off portions of the deployment area cap. The conceptual design correctly assumes that stormwater conveyed from the capped areas will be considered free of oil and hazardous materials since it is not in contact with the impacted soil. The request by DEP to cap the site to prevent additional leaching is a commendable goal for our Sole Source Aquifer and Public Water Supply. The Draft IRA Modification provides a well thought out conceptual plan to achieve the goal for an interim period".

Stormwater calculations will be included in the engineering design for both the Deployment Area and the ARFFF Building Area. These calculations will include sheet flow.

6.0 IRA Evaluation and Need for and IRA

Pursuant to 40.0424 (d), the evaluation of potential applicable IRA conditions (Substantial Release Migration, Critical Exposure Pathway, and Imminent Hazard) and the need for an IRA is set forth below.

6.1 Substantial Release Migration

Considering that PFAS has been detected in a downgradient public water supply wells, a condition of Substantial Release Migration, as defined by 310 CMR 40.0006, exists.

6.2 Critical Exposure Pathway

Considering that no private drinking water wells have been identified hydraulically down-gradient of the Airport, and that District is providing drinking water that meets the required state drinking water standards and guidelines for PFAS and 1,4-dioxane, a Critical Exposure Pathway as defined by 310 CMR 40.0006 is currently being prevented.

6.3 Imminent Hazard Evaluation

Considering that no private drinking water wells have been identified hydraulically down-gradient of the Airport, and that District is providing drinking water that meets the required

state drinking water standards and guidelines for PFAS and 1,4-dioxane, an imminent hazard as defined by 310 CMR 40.0006 is currently being prevented.

6.4 Need for Immediate Response Action

Considering that a Substantial Release Migration currently exists, and both a Critical Exposure Pathway and Imminent Hazard are currently being addressed by the District as detailed above, continued IRA activities are warranted at the Airport.

7.0 Proposed IRA Modification

Pursuant to 40.0424 (e), the objective(s), Specific plan(s) and proposed schedule for the Immediate Response Action, including, as appropriate, plans and/or sketches of the site and any proposed investigative and/or remedial installations.

The Airport proposes to continue the soil and groundwater investigation both on and off the Airport property to determine the extent of PFAS and 1,4-dioxane in soil and groundwater related to Airport operations. In addition to the ongoing soil and groundwater assessment, the Airport is proposing to install a soil cap over an approximate 2.25-acre portion of the ARFF Building Area and the Deployment Area as indicated on Figures 5 and 6, respectively. The proposed caps will reduce infiltration in these areas to mitigate impacts to groundwater. In general, the proposed caps will consist of either a minimum of 2-inches of asphalt, two layers of 6-mil polyethylene sheeting with one layer being reinforced polyethylene sheeting or a combination of the two. In areas were polyethylene sheeting is installed, care will be taken to remove all objects from the ground surface that could puncture the polyethylene sheeting. The polyethylene sheeting will have at least 6-inches of overlap and will be sealed with appropriate adhesive and vapor barrier tape as necessary. Six inches of screened loam free of debris or other sharp objects will be placed on top of the polyethylene sheeting and the areas seeded with a grass mix. In areas that transition from asphalt to polyethylene sheeting, the sheeting will extend a minimum of 6-inches below the asphalt and will be secured within an anchor trench below the asphalt pavement.

All monitoring wells located within the cap areas will be retained. In areas of were an asphalt cap is used, the monitoring wells will be located within flush mounted, gasketed road boxes that are sealed into the asphalt. In areas were polyethylene sheeting is used, metal standpipes will be used, and a polyethylene boot will be fabricated to seal the standpipe to the polyethylene sheeting with a combination of adhesive and vapor barrier tape.

Soil borings that require penetration through the asphalt cap after completion will be immediately repaired by placing an asphalt plug in the sample hole and asphaltic sealant around the plug. Temporary sample locations that require penetration through the polyethylene sheeting will be repaired by exposing several feet of the polyethylene sheeting, cleaning off any accumulated soil, placing overlapping polyethylene sheeting at least 6-inches

on either side of the penetration, and sealing it to the existing cap with sealant and vapor barrier tape.

In all instances, stormwater drainage will be designed for the areas to convey stormwater away from the capped areas and into the existing Airport stormwater system. Stormwater conveyed from the cap areas will be considered free of oil and/or hazardous materials since it is not in contact with impacted soil. For the purpose of the IRA Plan Modification, HW assumes that the caps will be utilized for a minimum of three years. The caps will be inspected at least once every 6-months and groundwater testing will be conducted in the area to determine the effectiveness of the caps. The Airport is committed to reducing the concentration of PFAS in groundwater related to Airport operations. The caps will only be considered premiant after at least three years of inspections and bi-annual groundwater monitoring have concluded that the caps have successfully reduced infiltration of PFAS.

No soil is planned for off-site disposal as part of the cap installation. All soil used for grading and shaping of the cap areas will be either soil from the disposal site boundary or sub-base material and/or loam free of debris obtained from an off-site source. A schedule of the proposed capping with various milestones is set forth below. The schedule assumes approval of the IRA Modification is received from the MassDEP by December 23, 2019.

Task Number	Task Description	Task Initiation	Task Completion
1	Draft IRA Plan Modification Submitted for Public Review	October 11, 2019	November 1, 2019
2	Final IRA Plan Modification Prepared for Submission to MassDEP	November 1, 2019	December 2, 2019
3	Presumptive Approval, Conditional Approval or Denial from MassDEP Within 21 Days of Submitting Final IRA Plan Modification	December 2, 2019	December 23, 2019
4	Engineering Design of Stormwater Conveyance System from Cap Areas Based on an Elevation Survey	December 23, 2019	February 3, 2020
5	Prepare Storm Water Pollution Prevention Plan for Construction, Obtain Local Building Permits, and Submit Notice of Intent to EPA for Multi-Sector General Permit	February 3, 2020	March 16, 2020
6	Solicit Construction Bids and Award Contract	March 16, 2020	April 16, 2020
7	Initiate Cap Construction and Collect Groundwater Samples from Select Wells within Proximity to Cap Areas.	May 4, 2020	June 4, 2020
8	Prepare first IRA Modification Status Report documenting cap completion and initial groundwater sampling data. Status report every 6-moths thereafter until IRA Completion and/or a Permanent Solution is obtained.	June 4, 2020	June 26, 2020
9	Perform First Post-Cap Inspection and Collect Groundwater samples from the Cap Area to Demonstrate Cap Effectiveness (Continuing every 6-months until IRA Completion and/or a Permanent Solution is Obtained).	December 2020	December 2020

8.0 Remediation Waste

Pursuant to 40.0424 (f), a statement as to whether Remediation Waste will be excavated, collected stored, treated or re-used at the site.

Remediation waste is not expected to be generated for off-site disposal. As indicated above, soil from the disposal site boundary will be graded as necessary to promote drainage. These graded soils will stay within the disposal site boundary and will be located beneath the caps.

9.0 Environmental Monitoring Plan

Pursuant to 40.0424 (g), where appropriate, a proposed environmental monitoring plan, for implementation during and/or after the Immediate Response Action.

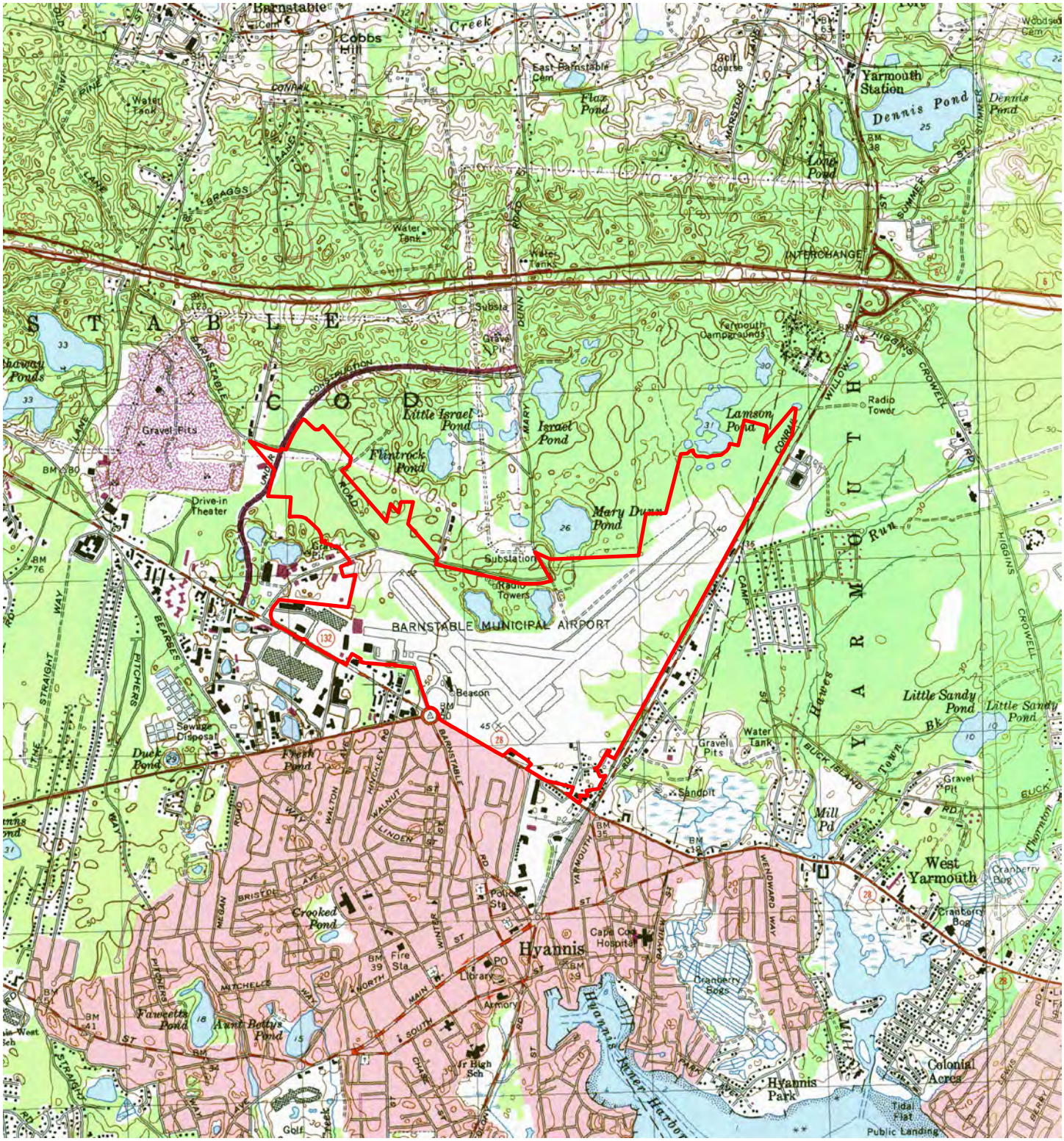
As indicated above, HW plans to inspect the soil caps every 6-moths and collect groundwater data from existing monitoring wells within proximity to the cap areas to document the effectiveness of the caps. Monitoring wells that may be sampled for this purpose include HW-E, HW-F, HW-H, HW-J, HW-I, HW-2, HW-3 and HW-302. Additionally, HW will continue to collect soil and groundwater samples as necessary to delineate the extent of PFAS and 1,4-dioxane in both soil and groundwater relating to Airport operations.

10.0 Permits

Pursuant to 40.0424 (h), a listing of federal, state or local permits that will likely be needed to conduct the Immediate Response Action.

As indicated above, HW assumes that an EPA Multi Sector General Permit and local building permits will be required for construction of the caps.

FIGURES



Document Path: H:\Projects\HYA\11072 (697 Barnstable Airport)\GIS_Maps\Maps\USGS_Locus_20130815.mxd

Legend

Airport Property Line

*Hyannis Topographic Quadrangle

N

Miles

0.5

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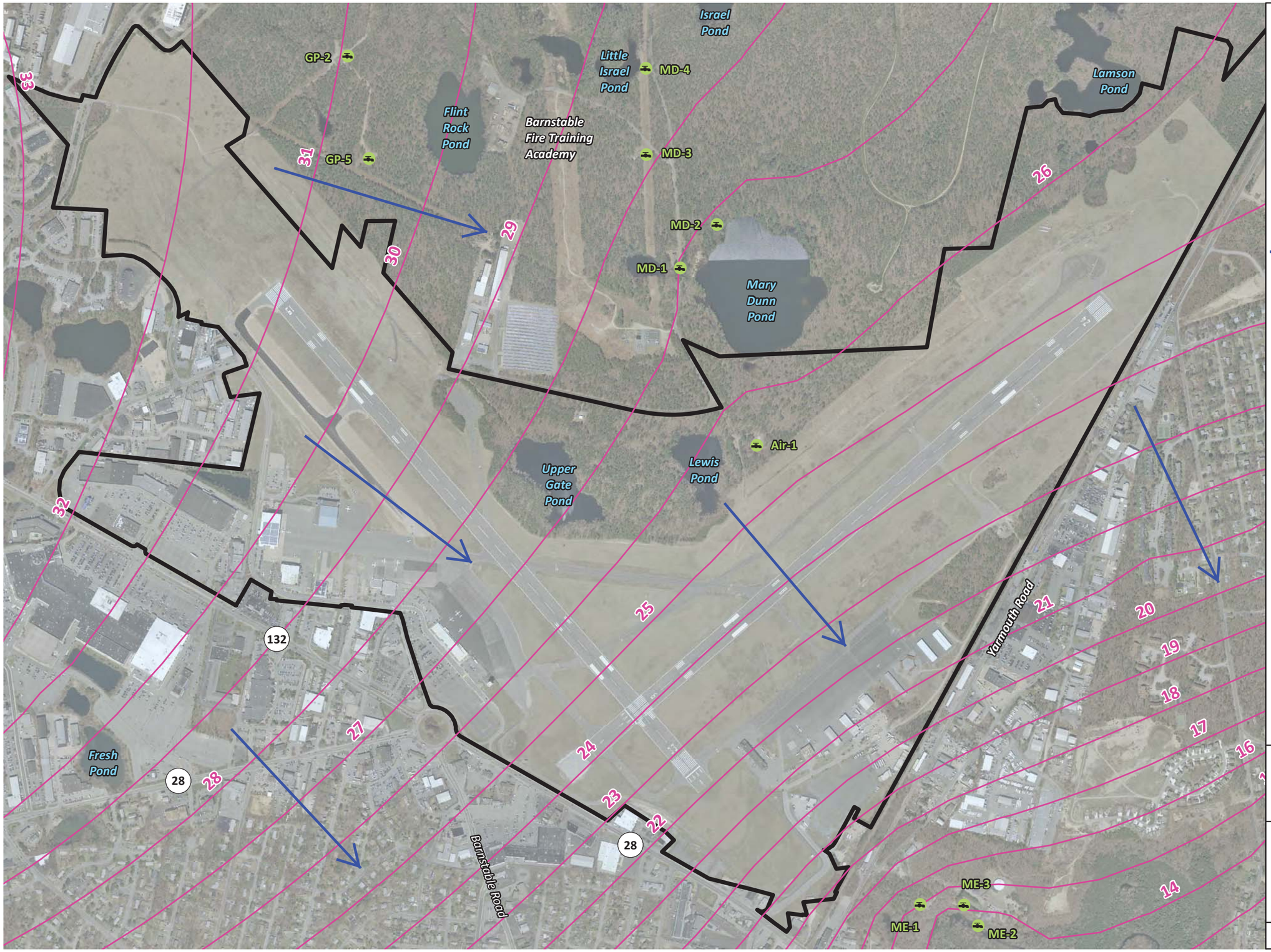
USGS Locus Map
Barnstable Municipal Airport
Hyannis, MA

Date: 4/17/2018

Figure 1



Legend

- USGS Sagamore Lens Modeled Contours
- Drinking Water Wells
- Barnstable Municipal Airport Property Boundary
- Groundwater Flow Direction

N

0 750

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USGS Sagamore Lens
Modeled Contours
Barnstable Municipal Airport
Hyannis, MA

July 1, 2019 Figure 2

*Imagery - MassGIS 2014

Path: H:\Projects\HYA\17027 BMA PFOS 1-4 IRA\GIS\Maps\Report_Maps\171108_Groundwater.mxd

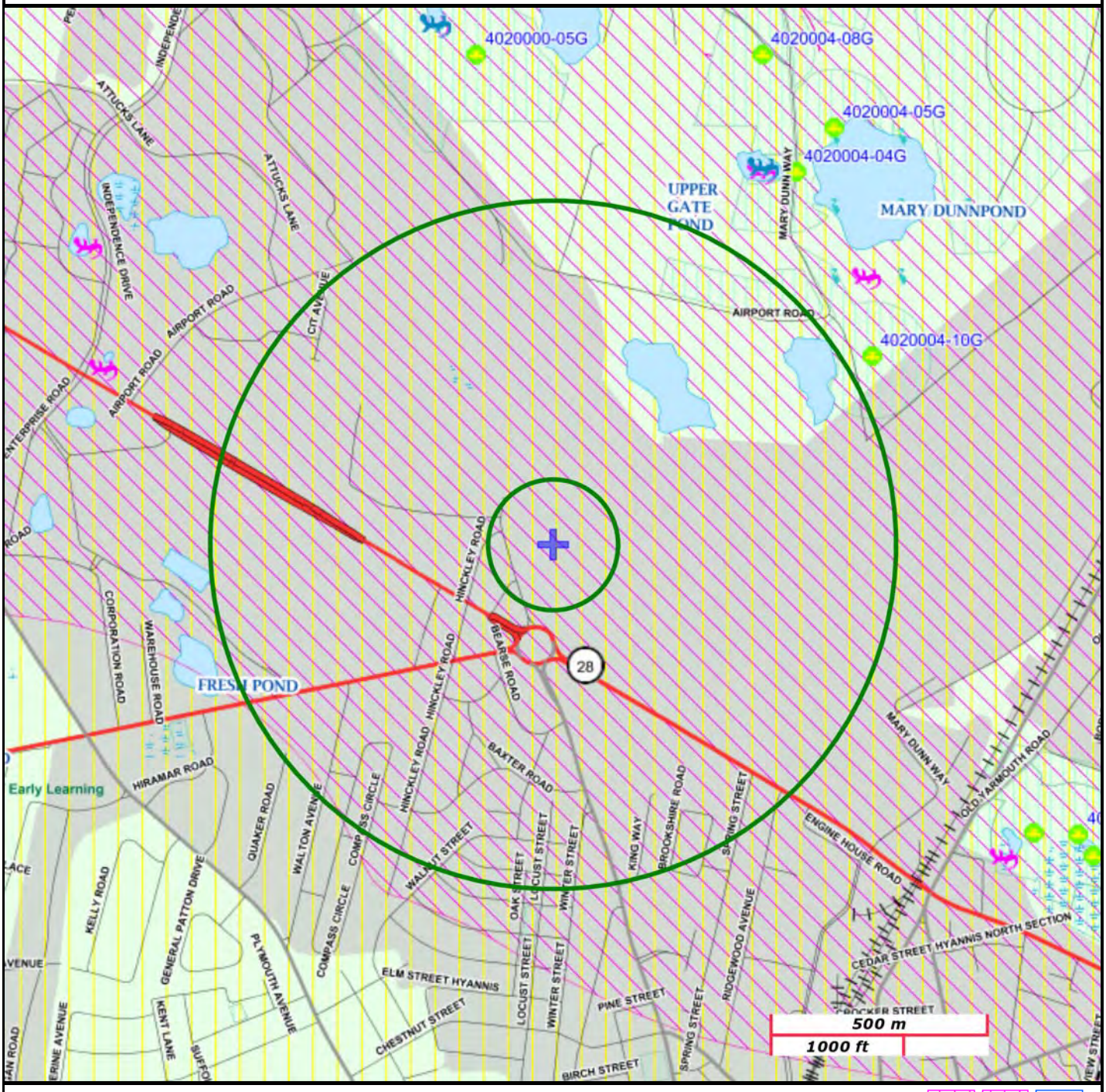
MassDEP - Bureau of Waste Site Cleanup

Phase 1 Site Assessment Map: 500 feet & 0.5 Mile Radii

Site Information:
BARNSTABLE MUNICIPAL AIRPORT
480 BARNSTABLE ROAD HYANNIS, MA
4-000026347
NAD83 UTM Meters:
4613630mN , 392871mE (Zone: 19)
November 9, 2017

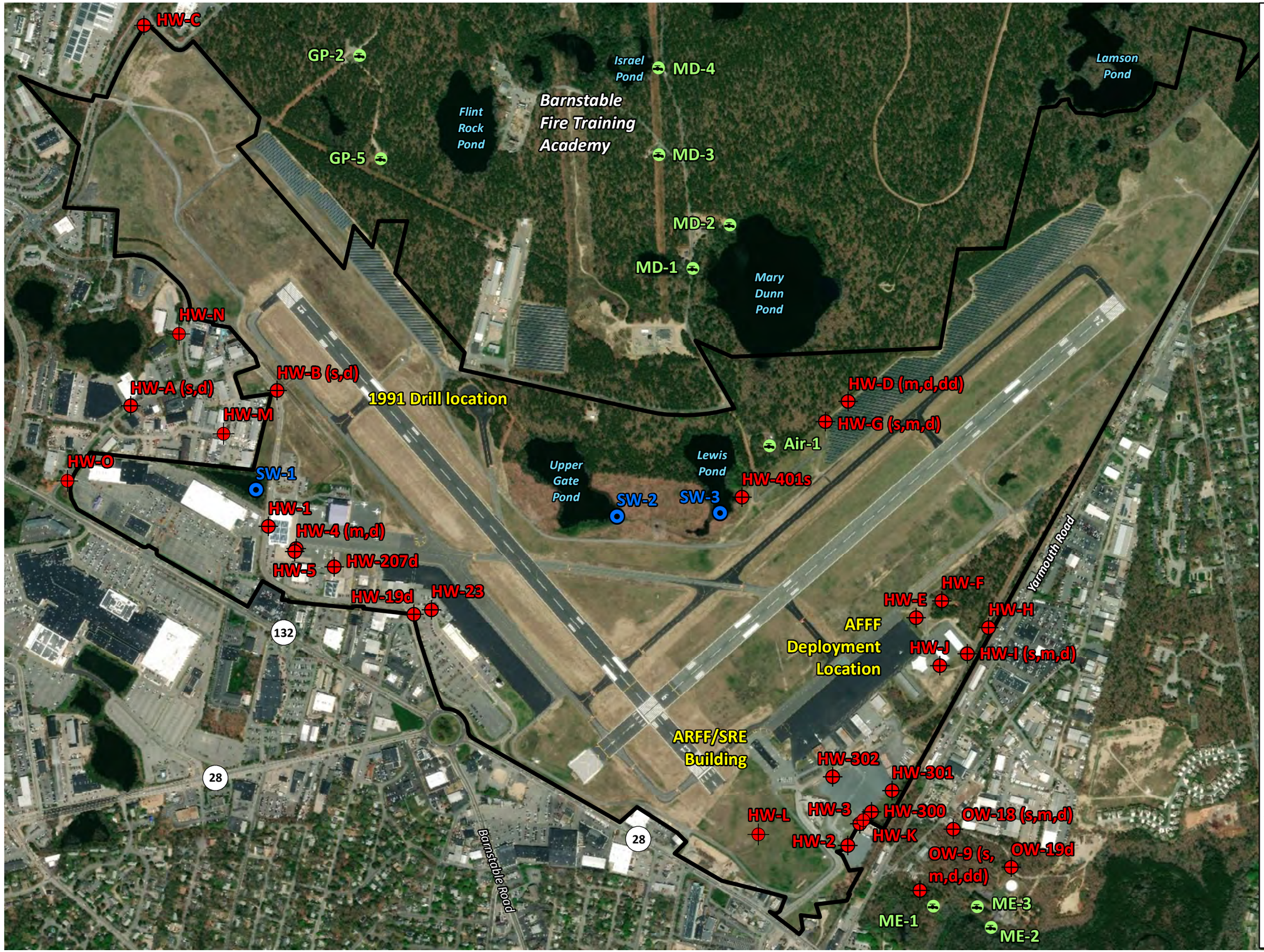
The information shown is the best available at the date of printing. However, it may be incomplete. The responsible party and LSP are ultimately responsible for ascertaining the true conditions surrounding the site. Metadata for data layers shown on this map can be found at: http://www.mass.gov/mgis/.

MassDEP
Commonwealth of Massachusetts
Department of Environmental Protection



Roads: Limited Access, Divided, Other Hwy, Major Road, Minor Road, Track, Trail
Boundaries: Town, County, DEP Region; Train; Powerline; Pipeline; Aqueduct
Basins: Major, PWS; Streams: Perennial, Intermittent, Man Made Shore, Dam
Aquifers: Medium Yield, High Yield, EPA Sole Source
Non Potential Drinking Water Source Area: Medium, High (Yield)
PWS Protection Areas: Zone II, IWPA, Zone A
Hydrography: Open Water, PWS Reservoir, Tidal Flat
Wetlands: Freshwater, Saltwater, Cranberry Bog
FEMA 100yr Floodplain; Protected Open Space; ACEC
Est. Rare Wetland Wildlife Hab; Vernal Pool: Cert., Potential
Solid Waste Landfill; PWS: Com.GW,SW, Emerg., Non-Com.

FIGURE 3 - Priority Resource Map



Legend

- Monitoring Wells
- Drinking Water Wells
- Surface Water Location
- Barnstable Municipal Airport Property Boundary

N

0 750

1 in = 750 feet

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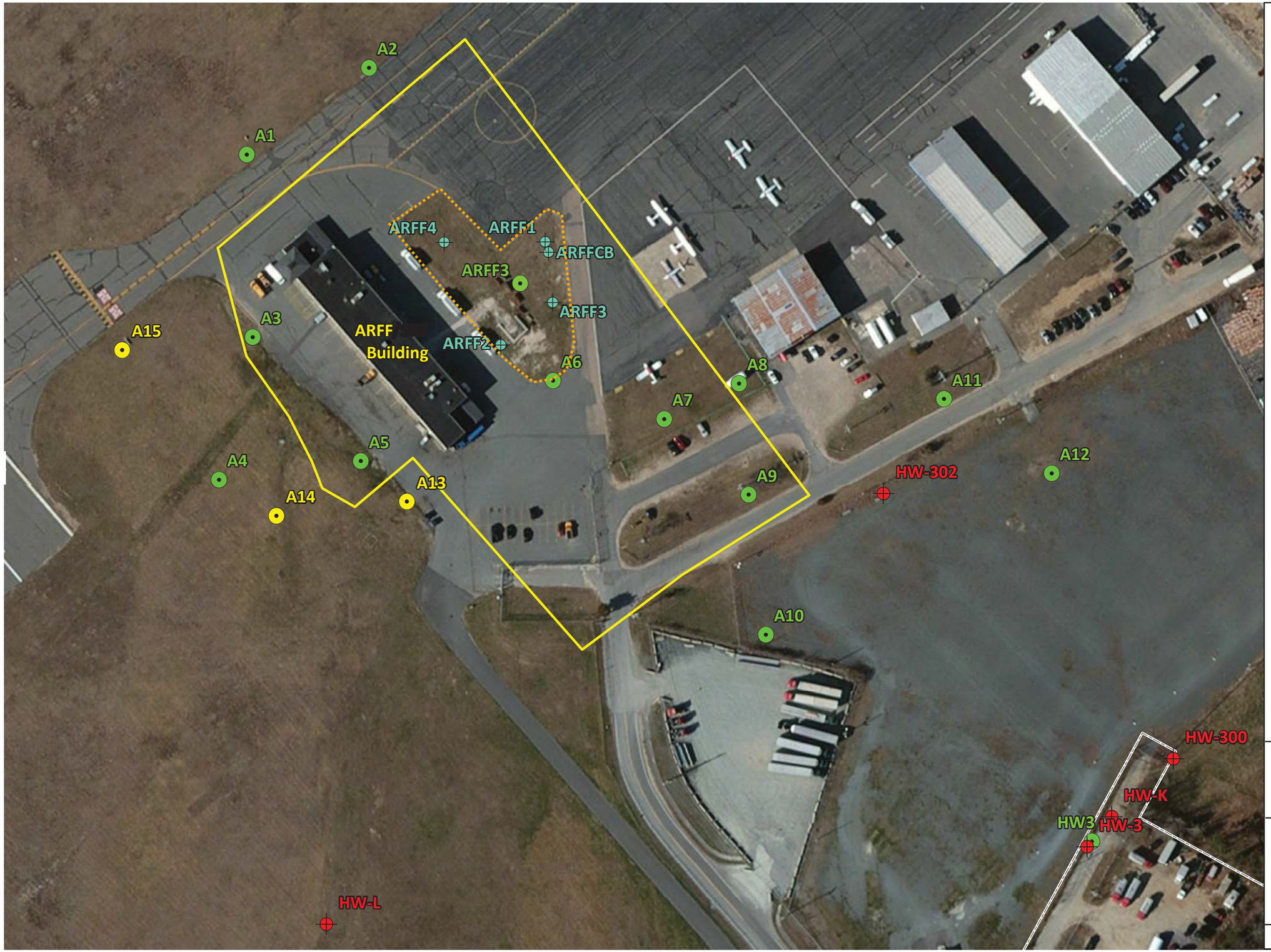
Monitoring Well Locations
Barnstable Municipal Airport
Hyannis, MA

Date: 10/2/2019 Figure 4

Path: K:\Projects\HYA\17027 BMA PFOS 1-4 IRA\GIS\Maps\190701_PFAS Well Locations.mxd



Legend

- 2017 PFAS Soil Samples
- 2018 PFAS Soil Samples
- 2019 PFAS Soil Samples
- Monitoring Wells
- Barnstable Municipal Airport Property Boundary
- Approximate Disposal Site Boundary for ARFF Building Area
- Approximate Location of Proposed Soil Cap

N

0 100 Feet

1 inch = 100 feet

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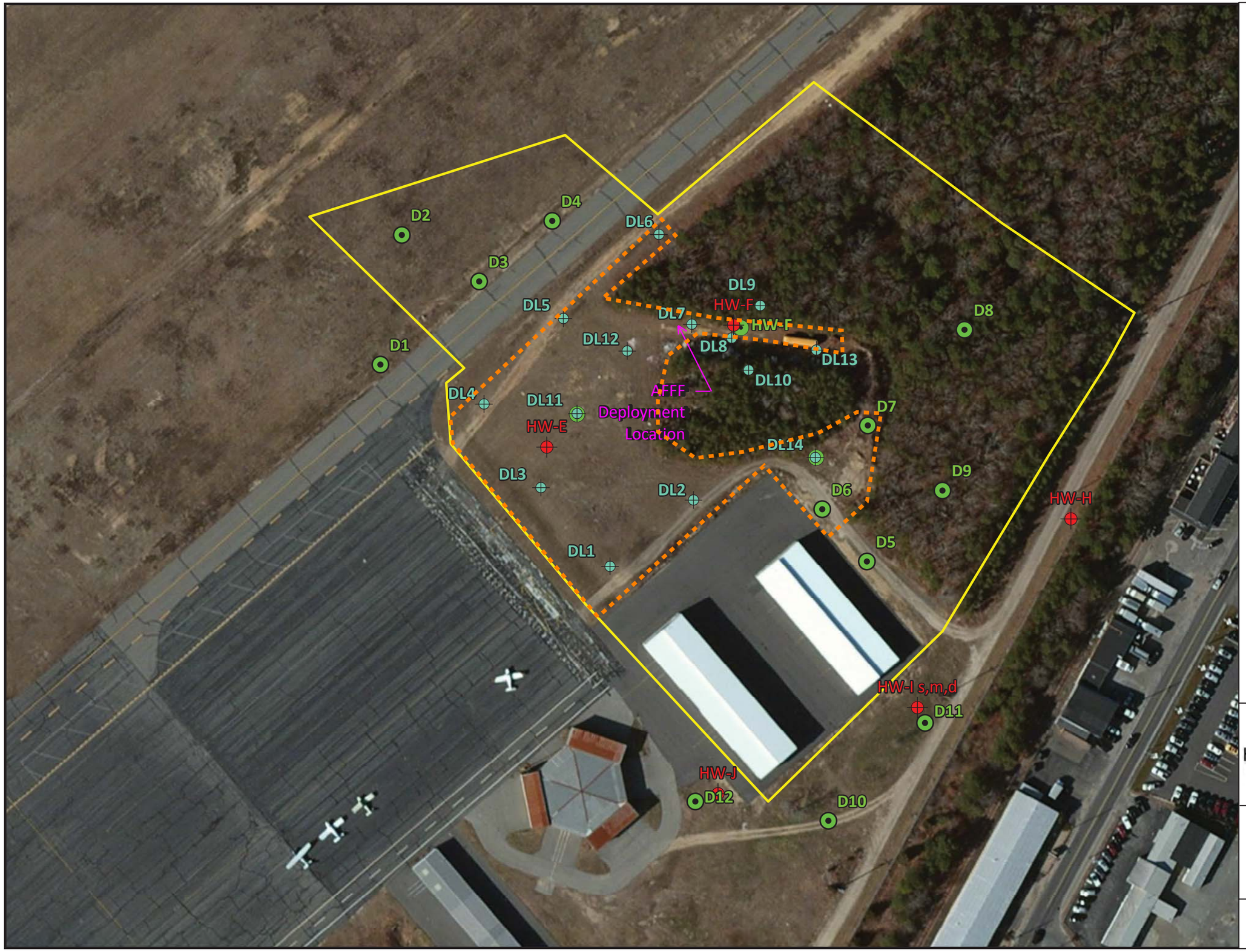
PFAS Sampling Locations
ARFF Building Area
Barnstable Municipal Airport
Hyannis, MA

October 1, 2019 Figure 5

Path: H:\Projects\HYA\17027 BMA PFOS 1-4 IRA\GIS\Maps\190701_PFOS_ARFF_SamplingLocations.mxd



Legend

- 2017 PFAS Soil Samples
- 2018 PFAS Soil Samples
- Monitoring Wells
- Barnstable Municipal Airport Property Boundary
- Approximate Disposal Site Boundary for Deployment Area
- Approximate Location of Proposed Soil Cap

N

0 100 Feet

1 inch = 100 feet

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PFAS Sampling Locations
Deployment Area
Barnstable Municipal
Airport Hyannis, MA

Date: 12/2/2019

Figure 6

Path: H:\Projects\HYA\17027 BMA PFOS 1-4 IRA\GIS\Maps\190701_PFAS_DEPLOY_Sampling Locations.mxd

TABLES

Table 1. 1,4 Dioxane Groundwater Results ug/L

	North Ramp												Airport Road					ARFF Building
Sample ID	OW-6	OW-6	HW-207S	HW-204	HW-29	HW-1	HW-4D	HW-4M	HW-207D	HW-207D	HW-19D	HW-19D	HW-A(D)	HW-B(D)	HW-N	HW-A(D)	HW-O	HW-L
Sample Date	8/5/2019	9/27/2019	9/27/2019	9/27/2019	9/27/2019	8/5/2019	4/5/2017	4/5/2017	4/5/2017	9/27/2019	4/5/2017	9/27/2019	4/5/2017	4/5/2017	8/5/2019	8/5/2019	8/5/2019	7/2/2019
1,4-Dioxane	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	<0.25	**0.727**

	Maher Well Field								
Sample ID	OW-9DD	OW-18M	OW-18D	OW-19D	OW-19M	OW-9D	OW-9DD	OW-18D	OW-19D
Sample Date	4/11/2017	4/11/2017	4/11/2017	4/11/2017	4/11/2017	12/3/2018	12/3/2018	12/7/2018	12/7/2018
1,4-Dioxane	**0.838**	<0.25	**0.552**	**0.800**	<0.25	<0.25	**0.732**	<0.25	<0.25

Notes:

Results in ug/L, micrograms per liter

< = Not detected by the laboratory above the reporting limit. Reporting limit shown.

Bold results above MassDEP GW-1 standard (0.3 ug/L)

Table 2. Soil Results for PFAS Compounds ug/kg

	ARFF Building																					
Sample ID	ARFF1 (0-1')	ARFF1 (2')	ARFF1 (4')	ARFF2 (0-1')	ARFF3 (0-1')	ARFF4 (0-1')	ARFFCB (0-1)	A1 (0-1')	A2 (0-1')	A3 (0-1')	A4 (0-1')	A5 (0-1')	A6 (0-1')	A7 (0-1')	A8 (0-1')	A9 (0-1')	A10 (0-1')	A11 (0-1')	A12 (0-1')	ARFF3 (10-12')	A13 (0-1')	A14 (0-1')	A15 (0-1')
Sample Date	6/20/2017	9/26/2017	9/26/2017	6/20/2017	9/26/2017	9/26/2017	9/26/2017	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	10/9/2018	2/27/2019	2/27/2019	2/27/2019
Perfluoroheptanoic acid (PFHpA)	0.82 J	1.8	0.66 J	0.17 U	0.60 J	0.75 J	0.60 J	0.19 U	0.19 U	0.38 J	0.19 U	1.1	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.32 J	<2.0	<1.9	<2.0
Perfluorohexanesulfonic acid (PFHxS)	0.23 U	0.23 U	0.23 U	0.23 U	0.64 J	0.23 U	0.23 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	<2.0	<1.9	<2.0
Perfluorooctanoic acid (PFOA)	0.75 J	2.6	0.75 J	0.26 U	0.78 J	0.97 J	0.90 J	0.25 U	0.25 U	0.37 J	0.30 J	1.9	0.25 U	0.25 U	0.25 U	0.34 J	0.25 U	0.25 U	0.25 U	1.9	<2.0	<1.9	<2.0
Perfluorononanoic acid (PFNA)	2.5	5.7	1.4	0.20 J	0.91 J	2.9	0.17 U	0.22 U	0.22 U	0.51 J	0.22 U	0.87 J	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U	3.1	<2.0	<1.9	<2.0
Perfluorooctane sulfonate (PFOS)	4.5	2.7	1.1	0.29 J	4.4	1.0	1.1	0.26 U	0.26 U	0.29 J	0.26 U	0.26 U	0.26 U	0.38 J	0.26 U	0.85 J	0.26 U	0.26 U	0.26 U	1.1	<2.0	<1.9	<2.0
Perfluorodecanoic Acid (PFDA)	4.4	1.2	0.62 J	0.13 U	1.6	0.85 J	0.13 U	0.28 U	0.28 U	0.42 J	0.28 U	1.4	0.28 U	0.28 U	0.28 U	0.28 U	0.33 J	0.28 U	0.28 U	0.28 U	<2.0	<1.9	<2.0
Sum of Six (PFHpA,PFHxS,PFOA, PFOS, PFNA, and PFDA)	**12.97**	**14**	**4.53**	**0.49**	**8.93**	**6.47**	**2.6**	0.28 U	0.28 U	**1.97**	**0.3**	**5.27**	0.28 U	**0.38**	0.28 U	**1.19**	**0.33**	0.28 U	0.28 U	**6.42**	<2.0	<1.9	<2.0

	Deployment Area																					
Sample ID	DL1(0-1')	DL2 (0-1')	DL2 2'	DL2 4'	DL3 (0-1')	DL3 2'	DL3 4'	DL4 (0-1')	DL4 2'	DL4 4'	DL5 (0-1')	DL5 2'	DL5 4'	DL6 (0-1')	DL7 (0-1')	DL8 (2')	DL8 (4')	DL9 (0-1')	DL10 (0-1')	DL 11 (0-1')	DL 11 (0-1')	DL12 (0-1')	DL13 (0-1')
Sample Date	6/20/2017	6/20/2017	9/26/2017	9/26/2017	6/20/2017	9/26/2017	9/26/2017	6/20/2017	9/26/2017	9/26/2017	6/20/2017	9/26/2017	9/26/2017	6/20/2017	6/20/2017	6/20/2017	9/26/2017	6/20/2017	6/20/2017	9/26/2017	8/20/2019	9/26/2017	9/26/2017
Perfluoroheptanoic acid (PFHpA)	0.30 J	1.9	1.2	0.48 J	0.84 J	0.17 U	0.17 U	0.31 J	0.17 U	0.17 U	2.5	0.40 J	0.50 J	5.0	2.5 J	2.9 J	4.7J	0.66 J	1.3	2.1	1.8	1.2	1.6
Perfluorohexanesulfonic acid (PFHxS)	0.23 U	1.8	1.3	0.59 J	0.34 J	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U	0.49 J	0.49 J	0.23 U	0.23 U	2.3 U	2.3 U	2.3 U	0.35 J	0.94 J	0.82 J	<0.9	0.23 U	0.23 U
Perfluorooctanoic acid (PFOA)	0.26 U	1.6	4.1	0.74 J	0.80 J	0.26 U	0.26 U	0.83 J	0.26 U	0.26 U	3.7	1.6	0.26 U	0.26 U	4.2 J	25	22	0.68 J	1.7	4.7	5.2	4.6	2.4
Perfluorononanoic acid (PFNA)	0.17 U	0.81 J	2.5	0.17 U	0.55 J	0.17 U	0.17 U	2.7	0.17 U	3.7	0.19 J	0.17 U	0.17 U	0.19 J	9.6 J	46	1.7 U	0.22 J	0.17 U	16	2.4	7.3	1.5
Perfluorooctane sulfonate (PFOS)	0.40 J	12	1.5	0.21 U	0.51 J	0.21 U	0.21 U	2.0	0.21 U	0.50 J	0.21 U	0.21 U	0.21 U	0.21 U	3.9 J	14	2.1 U	0.38 J	0.26 J	29	1.5	23	0.66 J
Perfluorodecanoic Acid (PFDA)	0.63 J	0.13 U	0.13 U	0.13 U	1.4	0.13 U	0.13 U	1.3	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	0.13 U	1.3 U	1.3 U	1.3 U	0.13 U	0.13 U	1.8	8.7	0.66 J	7.4
Sum of Six (PFHpA,PFHxS,PFOA, PFOS, PFNA, and PFDA)	**1.33**	**18.11**	**10.6**	**1.81**	**4.44**	0.23 U	0.23 U	**7.14**	0.23 U	**4.2**	**6.88**	**2.49**	**0.5**	**5.19**	**20.2**	**87.9**	**26.7**	**2.29**	**4.2**	**54.42**	**19.6**	**36.76**	**13.56**

	Deployment Area																					
Sample ID	DL14 (0-1')	D1 (0-1')	D2 (0-1')	D3 (0-1')	D4 (0-1')	D5 (0-1')	D6 (0-1')	D7 (0-1')	D8 (0-1')	D9 (0-1')	D10 (0-1')	D11 (0-1')	D12 (0-1')	DL11 (4-6')	DL11 (10-12')	DL11 (14-16')	DL14 (0-1')	DL14 (4-6')	DL14 (10-12')	DL14 (14-16')	HW-F (10-12')	HW-F (14-16')	HW-3 (0-1')
Sample Date	9/26/2017	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	8/14/2018	10/4/2018	10/4/2018	10/4/2018	9/26/2017	10/4/2018	10/4/2018	10/4/2018	10/4/2018	10/4/2018	10/9/2018
Perfluoroheptanoic acid (PFHpA)	4.9	0.19 U	0.21 J	0.19 U	0.95 J	0.22 J	0.25 J	7.8	1.0	2.7	0.19 U	0.19 U	0.19 U	1.3	0.31 J	0.23 J	4.9	0.36 J	0.19 U	1.4	0.32 J	1.3	0.19 U
Perfluorohexanesulfonic acid (PFHxS)	0.71 J	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.31 J	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U	0.71J	0.24 U	0.24 U	0.74 J	0.24 U	0.24 U	0.24 U
Perfluorooctanoic acid (PFOA)	23	0.25 U	0.33 J	0.25 U	1.1	0.25 U	0.28 J	14	2.2	3	0.25 U	0.25 U	0.25 U	2.9	1.9	0.50 J	23	0.58 J	0.32 J	2.9	0.25 U	1.4	0.25 U
Perfluorononanoic acid (PFNA)	10	0.22 U	0.67 J	0.22 U	0.98 J	0.22 U	0.22 U	10	0.59 J	0.83 J	0.22 U	0.22 U	0.32 J	2.5	0.22 U	0.22 U	10	0.22 U	0.22 U	10	0.22 U	0.22 U	0.22 U
Perfluorooctane sulfonate (PFOS)	7.6	0.26 U	0.66 J	0.38 J	2.9	0.26 U	0.26 U	3.4	2.1	0.67 J	0.54 J	0.91 J	0.44 J	0.26 U	0.26 U	0.26 U	7.6	0.26 U	0.26 U	2.3	0.26 U	0.26 U	0.26 U
Perfluorodecanoic Acid (PFDA)	9.6	0.28 U	0.28 U	0.28 U	0.40 J	0.28 U	0.66 J	8.6	1.3	1.6	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	9.6	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U
Sum of Six (PFHpA,PFHxS,PFOA, PFOS, PFNA, and PFDA)	**55.81**	0.28 U	**1.87**	**0.38**	**6.33**	**0.22**	**1.19**	**43.8**	**7.50**	**8.8**	**0.54**	**0.91**	**0.76**	**6.7**	**2.21**	**0.73**	**55.81**	**0.94**	**0.32**	**17.34**	**0.32**	**2.7**	0.28 U

	1991 Drill Location					
	1991A (0-1')	1991B (0-1')	1991C (0-1')	1991D (0-1')	1991A-B (3-4')	1991C-D (2-3')
	8/14/2018	8/14/2018	8/14/2018	8/14/2018	12/14/2018	12/14/2018
Perfluoroheptanoic acid (PFHpA)	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U	0.19 U
Perfluorohexanesulfonic acid (PFHxS)	0.24 U	0.66 J	0.24 U	0.24 U	0.24 U	0.24 U
Perfluorooctanoic acid (PFOA)	0.25 U	0.26 J	0.25 U	0.25 U	0.25 U	0.25 U
Perfluorononanoic acid (PFNA)	0.22 U	0.22 U	0.22 U	0.30 J	0.22 U	0.22 U
Perfluorooctane sulfonate (PFOS)	0.49 J	1.1	0.55 J	0.36 J	0.30 J	0.42 J
Perfluorodecanoic Acid (PFDA)	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U
Sum of Six (PFHpA,PFHxS,PFOA, PFOS, PFNA, and PFDA)	**0.49**	**2.02**	**0.55**	**0.66**	**0.3**	**0.42**

Notes:

< = Not detected by the laboratory above the reporting limit. Reporting limit shown.

J = Estimated concentration between the method detection limit and reporting limit.

Results in ug/kg, micrograms per kilogram.

U= Not detected by the Laboratory above the method detection limit. Method detection limit shown.

Bold results above proposed MassDEP S-1/GW-1 standard (0.2 ug/kg)

Note: Totals include estimated values and do not include non-detects (U or <)

Table 3. Groundwater and Surface Water Results for PFAS Compounds ug/L

	North Ramp											Lewis Pond Area	Airport Road Area								Surface Water			ARFF Building
Sample ID	HW-1	HW-1	HW-1	HW-4M	HW-5	HW-5	HW-5	HW-23	HW-23	HW-19D	HW-19D	HW-401S	HW-A(S)	HW-B(S)	HW-B(S)	HW-B(D)	HW-M	HW-N	HW-O	HW-C	Kmart	LP-1	UGP-1	HW-L
Sample Date	7/1/2016	6/20/2017	10/26/2018	4/5/2017	7/1/2016	4/7/2017	10/26/2018	6/20/2017	10/26/2018	6/20/2017	11/7/2018	4/7/2017	4/7/2017	4/7/2017	10/26/2018	10/26/2018	6/24/2019	6/24/2019	7/2/2019	4/7/2017	6/20/2017	7/11/19	7/11/19	6/19/2019
Perfluoroheptanoic acid (PFHpA)	0.01	0.0042 J	0.013 J	0.007 J	0.0041	0.0084 J	0.0074 U	0.0045J	0.0098 J	0.0052 J	0.0080 J	0.0043 J	0.0048 J	0.049	0.012 J	0.0074 U	0.007	0.0034	<0.002	0.0033 U	0.0033 U	<0.01	<0.02	0.0078
Perfluorohexanesulfonic acid (PFHxS)	0.018	0.065	0.018 J	0.02	0.011	0.018 J	0.0056 U	0.021	0.023	0.046	0.045	0.011 J	0.0079 J	0.044	0.047	0.0056 U	0.016	0.033	0.0043	0.0034 U	0.0034 U	<0.01	<0.02	0.033
Perfluorononanoic acid (PFNA)	<0.002	0.0057 J	0.0087 U	0.0046 U	<0.002	0.0046 U	0.0088 J	0.0038 U	0.0087 U	0.0065 J	0.0087 U	0.0046 U	0.0046 U	0.0046 U	0.0087 U	0.0087 U	<0.002	<0.002	<0.002	0.0046 U	0.0043 J	<0.01	<0.02	0.0033
Perfluorooctanoic acid (PFOA)	0.017	0.022	0.031	0.011 J	0.12	0.020 J	0.011 J	0.0046 U	0.011 J	0.017 J	0.014 J	0.0046 U	0.0026 U	0.0094 J	0.020 J	0.012 J	0.027	0.0088	0.0039	0.0026 U	0.0026 U	<0.01	<0.02	0.025
Perfluorooctane sulfonate (PFOS)	0.033	0.24	0.028	0.043	0.031	0.052	0.12	0.0079 J	0.015 J	0.061	0.069	0.012 J	0.0046 U	0.026	0.019 J	0.010 J	0.0074	0.004	0.017	0.0046 U	0.0046 U	<0.01	<0.02	0.049
Perfluorodecanoic Acid (PFDA)	NA	0.0040 U	0.0061 U	0.0040 U	NA	0.0040 U	0.0061 U	0.0040 U	0.0061 U	0.0040 U	0.0061 U	0.0040 U	0.0040 U	0.0040 U	0.0061 U	0.0061 U	<0.002	<0.002	0.0021	0.0040 U	0.0040 U	<0.01	<0.02	<0.002
Sum of Six (PFHpA,PFHxS,PFOA, PFOS, PFNA, and PFDA)	**0.078**	**0.3369**	**0.09**	**0.081**	**0.1661**	**0.0984**	**0.1398**	**0.0334**	**0.0588**	**0.1357**	**0.136**	**0.0273**	**0.0127**	**0.1284**	**0.098**	**0.022**	**0.0574**	**0.0492**	**0.0273**	<0.0046	**0.0043**	<0.01	<0.02	**0.1181**

	Solar Field						Steamship Parking Lot									Deployment Area								
Sample ID	HW-D	HW-D (d)	HW-D (dd)	HW-G(S)	HW-G(M)	HW-G(D)	HW-2	HW-3	HW-3	HW-3	HW-300	HW-301	HW-302	HW-302	HW-K	HW-I *	HW-I (m)	HW-I (d)	HW-J	HW-E	HW-E	HW-E	HW-F	HW-F	HW-H
Sample Date	4/7/2017	6/24/2019	6/24/2019	12/3/2018	12/3/2018	12/3/2018	7/1/2016	7/1/2016	4/5/2017	10/26/2018	7/1/2016	7/1/2016	7/1/2016	12/3/2018	6/19/2019	11/7/2018	6/24/2019	6/24/2019	11/7/2018	4/5/2017	11/7/2018	8/19/2019	4/5/2017	11/7/2018	11/7/2018
Perfluoroheptanoic acid (PFHpA)	0.0033 U	0.021	<0.002	0.0074 U	0.0074 U	0.0074 U	0.0071	0.016	0.1	0.10	0.0096	0.002	0.019	0.015 J	0.0051	0.2	0.0032	0.0053	0.025	0.15	0.0074 U	0.0053	0.34	0.0074 U	0.077
Perfluorohexanesulfonic acid (PFHxS)	0.0089 J	0.062	0.0092	0.0056 U	0.012 J	0.0056 U	0.0035	0.0043	0.020 J	0.012 J	0.012	0.038	0.0063	0.016 J	<0.002	0.18	0.019	0.057	0.0056 U	0.042	0.0056 U	0.0021	0.019J	0.0056 U	0.0056 U
Perfluorononanoic acid (PFNA)	0.0046 U	0.015	0.0041	0.0087 U	0.011 J	0.0087 U	<0.002	0.0063	0.027	0.023	<0.002	<0.002	0.054	0.0097 J	<0.002	0.16	<0.002	<0.002	0.028	0.0087 J	0.0087 U	<0.002	0.0046 U	0.0087 U	0.0087 U
Perfluorooctanoic acid (PFOA)	0.0046 U	0.0088	<0.002	0.0033 U	0.0033 U	0.0033 U	0.012	0.084	0.065	0.057	0.017	0.011	0.014	0.03	0.0041	0.26	0.0061	0.0047	0.026	0.053	0.0033 U	0.0047	0.075	0.0033 U	0.0050 J
Perfluorooctane sulfonate (PFOS)	0.022	0.095	0.013	0.0060 U	0.036	0.0060 U	0.0063	0.0091	0.15	0.053	0.0052	0.0037	0.033	0.031	<0.002	0.066	0.014	0.012	0.13	0.047	0.0060 U	<0.002	0.0026 U	0.0060 U	0.0060 U
Perfluorodecanoic Acid (PFDA)	0.0040 U	<0.002	<0.002	0.0061 U	0.0061 U	0.0061 U	NA	NA	0.0040 U	0.0061 U	NA	NA	NA	0.0061 U	<0.002	0.012 U	<0.002	<0.002	0.0061 U	0.0040 U	0.0061 U	<0.002	0.0040 U	0.0061 U	0.0061 U
Sum of Six (PFHpA,PFHxS,PFOA, PFOS, PFNA, and PFDA)	**0.0309**	**0.2018**	**0.0263**	0.0087 U	**0.059**	0.0087 U	**0.0289**	**0.1197**	**0.362**	**0.245**	**0.0438**	**0.0547**	**0.1263**	**0.1017**	0.0092	**0.866**	**0.0423**	**0.079**	**0.209**	**0.3007**	0.0087 U	0.0121	**0.434**	0.0087 U	**0.082**

	Maher Wells														
Sample ID	OW-9S	OW-9S	OW-9M	OW-9D	OW-9D	OW-9DD	OW-9DD	OW-18S	OW-18S	OW-18M	OW-18M	OW-18D	OW-18D	OW-18D Duplicate	OW-18D	OW-19D
Sample Date	7/5/2016	12/3/2018	12/3/2018	7/5/2016	12/3/2018	4/11/2017	12/3/2018	7/5/2016	12/7/2018	7/5/2016	12/7/2018	7/5/2016	4/11/2017	7/5/2016	12/7/2018	4/11/2017
Perfluoroheptanoic acid (PFHpA)	0.014	0.048	0.11	0.0028	0.033	0.034	0.015 J	0.0071	0.0074 U	0.0029	0.0074 U	0.0071	0.015J	0.0063	0.014 J	0.0051J
Perfluorohexanesulfonic acid (PFHxS)	<0.003	0.023	0.0056 U	0.012	0.12	0.12	0.042	0.0068	0.0056 U	0.016	0.073	0.01	0.13	0.011	0.13	0.029
Perfluorononanoic acid (PFNA)	0.0077	0.0087 U	0.044	0.0036	0.1	0.059	0.038	<0.002	0.0087 U	0.0076	0.0087 U	0.0065	0.0046 U	0.0058	0.0087 U	0.006J
Perfluorooctanoic acid (PFOA)	0.0074	0.032	0.052	0.041	0.057	0.055	0.020 J	0.0083	0.012 J	0.044	0.0060 J	0.018	0.025	0.019	0.019 J	0.0046 U
Perfluorooctane sulfonate (PFOS)	0.007	0.024	0.0081 J	0.0052	0.52	0.5	0.14	0.018	0.028	0.0058	0.24	0.0059	0.22	0.0059	0.32	0.029
Perfluorodecanoic Acid (PFDA)	NA	0.0061 U	0.0061 U	NA	0.0061 U	0.0040 U	0.0061 U	NA	0.0061 U	NA	0.0061 U	NA	0.0040 U	NA	0.0061 U	0.0040 U
Sum of Six (PFHpA,PFHxS,PFOA, PFOS, PFNA, and PFDA)	**0.0361**	**0.127**	**0.2141**	**0.0646**	**0.83**	**0.768**	**0.255**	**0.0402**	**0.04**	**0.0763**	**0.319**	**0.0475**	**0.39**	**0.048**	**0.483**	**0.0691**

Notes:

< = Not detected by the laboratory above the reporting limit. Reporting limit shown.

J = Estimated concentration between the method detection limit and reporting limit.

Results in ug/L, micrograms per liter.

U= Not detected by the Laboratory above the method detection limit. Method detection limit shown.

Bold results above proposed MassDEP GW-1 standard (0.02 ug/L)

Note: Totals include estimated values and do not include non-detects (U or <)

NA = Analyte not included in laboratory results

Table 4: Ratio of Stable Isotopes Oxygen-18 and Hydrogen-2 Laboratory Results

Sample Date	Lab Sample ID	HW Sample ID	Stable Isotope Oxygen-18			Stable Isotope Hydrogen-2		
			δ18O (V-SMOW)	Atm %	Expected Values	δ18O (V-SMOW)	Atm %	Expected Values
11/7/2018	1811299-2	HW-I	-6.92	0.20	-	-40.41	0.01494	-
			-6.77	0.20	-	-40.17	0.01495	-
	1811299-4	HW-E	-6.79	0.20	-	-38.56	0.01497	-
			-6.85	0.20	-	-38.87	0.01497	-
	1811299-5	HW-F	-6.9	0.20	-	-38.28	0.01498	-
			-6.88	0.20	-	-38.15	0.01498	-
	1811299-7	SW-2	-2.67	0.20	-	-18.65	0.01528	-
			-2.61	0.20	-	-20.42	0.01526	-
						-23.04	0.01521	-
12/3/2018	1812198-1	HW-G(S)	-6.74	0.20	-	-38.19	0.01498	-
			-6.93	0.20	-	-37.87	0.01498	-
	1812198-2	HW-G(M)	-7.53	0.20	-	-44.34	0.01498	-
			-7.57	0.20	-	-44.39	0.01498	-
	1812198-3	HW-G(D)	-7.18	0.20	-	-44.15	0.01489	-
			-7.45	0.20	-	-44.56	0.01488	-
	1812198-4	OW-9S	-7.29	0.20	-	-41.86	0.01492	-
			-7.41	0.20	-	-42.94	0.0149	-
	1812198-5	OW-9D	-7.76	0.20	-	-47.91	0.01483	-
			-7.71	0.20	-	-46.82	0.01484	-
					-	-47.20	0.01484	-
	1812198-6	OW-9DD	-7.52	0.20	-	-45.58	0.01486	-
			-7.57	0.20	-	-45.48	0.01487	-
	1812198-7	OW-9M	-7.13	0.20	-	-41.44	0.01493	-
			-7.24	0.20	-	-43.40	0.0149	-
12/7/2018	1812232-1	OW-18S	-7.58	0.20	-	-49.29	0.01481	-
			-7.54	0.20	-	-49.66	0.0148	-
	1812232-2	OW-18M	-6.95	0.20	-	-42.64	0.01491	-
			-6.89	0.20	-	-42.57	0.01491	-
	1812232-3	OW-18D	-7.28	0.20	-	-44.76	0.01488	*
			-7.36	0.20	-	-41.61	0.01493	*
QA/QC	IAEA OH-14	-	-5.64	0.20	-5.6	-37.45	0.01499	-37.70
	IAEA OH-15	-	-9.59	0.20	-9.41	-77.89	0.01436	-78
	IAEA OH-16	-	-15.72	0.20	-15.41	-	-	-113.8
	Antarc IC	-	-29.83	0.19	-30	-	-	-239.69

APPENDIX A

PUBLIC COMMENTS

Cape Alliance for Pesticide Education
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Non-Toxic Strategies for a Sustainable Cape Cod

October 31, 2019

Katie Riley Servis, Airport Manager
Barnstable Municipal Airport
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Ms. Servis-

Thank you for this opportunity to comment on the Draft Immediate Response Action Plan Modification for the Barnstable Municipal Airport--MassDEP RTN 4-26347.

Having reviewed the Draft IRA Plan Mod and being mindful of the Airport's earlier efforts despite the current unregulated federal status of PFAS compounds, it is still concerning that the soil and groundwater testing have yet to clearly define the extent of contamination of the airport and its environs. Levels of 6 PFAS above the proposed Mass DEP standards have been found in several areas on the BMA property which should be a green light for further investigation. The amount of testing performed appears inadequate as the margins of contamination have still not been defined after several years. All contributions of PFAS and 1,4 dioxane from both on and off-site should be identified, defined, and sourced back to the site of origin. The extent of PFAS in Airport ground water and soils--both horizontally and vertically-- and any related plumes needs to be delineated, mapped, and monitored indefinitely. However, even this "adequate" level of detail may prove less protective of the water supply as PFAS research continues to be published.

Our concerns expressed in the earlier PIP submission have not diminished with the publication of this draft IRA Plan Mod and relate to:

-Public Involvement-which remains minimal; future public meetings should be held in a location more readily accessible by Hyannis residents who drink the water. Full and open transparency will best serve to resolve any potential issues about the status of the contamination of the Airport site and efforts to mitigate the contamination on the site.

-With regard to environmental receptors, the Draft IRA Plan Mod neglects meaningful sampling of water and sediments in the ponds on the Airport property and potentially contaminated areas off-site. It is disturbing that no sampling for PFAS in tissues of fish, shellfish, ducks, and deer is planned. These should be initiated as wild fish and game have been shown to bioaccumulate PFAS and may be a further exposure source for humans and not unrelated to the contaminated water emanating from the Airport.

-Human Health: Lab analyses for 2019 report only 20+/- PFASs. There are 4000+ PFAS compounds in commerce. A variety of manufacturers of AFFF have incorporated many different PFASs beyond PFOS and PFOA. The GAC filters out the long chain/higher molecular weight PFAS reliably but research has shown that GAC doesn't eliminate all PFAS. Shorter chain PFAS compounds pass through the filters and even shorten the filters useful life. In addition to the PFAS compounds tested by Con-Test, has the Airport selected the suite of PFAS they analyze based only on the legacy AFFF products used at the site over decades OR are the newer AFFF replacement products containing a preponderance of short chain PFAS being included? While short chain PFAS had earlier been regarded as less toxic, ongoing research is now raising some questions about the safety of short chains. There is some evidence that short-chain PFAS can cause similar health issues as their long-chain forbears. Some emerging research shows short chain PFAS accumulating not in the bloodstream, but elsewhere in the body so a broader array of PFAS should be tested proactively as these may presage a future problem and indicate the necessity for additional treatments. Given the limited PFAS analyses, it seems premature to conclude that water post-filtration is PFAS-free, though-for now-it may meet the proposed MA drinking water standards and ORSG for six compounds. Our interest regarding this site and this Draft IRA Plan Mod primarily involves the adequacy of any proposed remedial actions with the goal of ultimately providing PFAS-free water to the residents of Hyannis. While legally there may be no impetus to conduct more than the bare minimum of tests, PFAS compounds are persistent, bio-accumulative, and toxic so exposure from any source that can be traced back to the Airport should not be ignored.

-Installation of non-permeable caps over exposed soils identified as a source of groundwater contamination in two locations will prevent further leaching of PFAS from soil to groundwater but it is not a destructive technology and will require active monitoring indefinitely—preferably more frequently than the 6 months proposed. The footprint of both caps is a puzzlement and not explained in the document. The proposed caps are also not well described in the Draft IRA Plan Mod. Are they asphalt, poly sheeting, or both, possibly

covered with loam and then top seeded with grass? Will the capped areas then be accessible to vehicles? A minimum of 3 inches of asphalt is acceptable if there is no traffic above the cap. Poly sheeting alone -with or without grass-is completely inadequate for this purpose.

Thank you again for this opportunity to comment on the draft IRA Plan Mod. for the Barnstable Municipal Airport-

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November 1, 2019

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RE: Immediate Response Action Modification RTN 4-26347

Dear Ms Servis,

I have reviewed the Draft Immediate Response Action Modification for the Barnstable Municipal Airport as prepared by Horsley-Witten Inc, dated October 19, 2019 in response to the DEP letter dated, June 18, 2019.

The Airport through its consultants is responding to the DEP request to implement a cap to prevent rainwater from infiltrating through identified PFAS contaminated soil to reduce leaching to groundwater in a public water supply area. My comments on the proposed cap and technical information are below

Site Assessment
The Draft IRA Modification submittal reports that HW has conducted 18 elements of response actions and investigation during the period of 2016-2019 including 75 soil samples and 65 groundwater samples. The assessment has identified high concentrations of PFAS contaminated soil at two locations known as the Deployment Area (DL) and the Air and Rescue Fire Fighting Building (ARFF) that are associated with PFAS groundwater contamination.

The proposed DEP soil cleanup standard for public water supply areas is 200 ng/kg for the sum of six PFAS compounds. Notable detections of PFAS in soil samples above the proposed soil standard collected from the identified areas are listed below.

DL14	55,810 ng/kg	ARFF1-1	12,970 ng/kg
D7	43,800 ng/kg	ARFF1-4	4,530 ng/kg
DL11	54,420 ng/kg	ARFF3	8,930 ng/kg
DL2	18,110 ng/kg		
DL8	87,900 ng/kg		
DL8-4	26,700 ng/kg		
DL12	36,760 ng/kg		

The DEP has taken public comment on the Draft soil cleanup standards for PFAS and will be finalizing them this Winter. According to the updated IRTC Fact sheet for PFAS, the soil standards/guidance values in US States for PFOS ranges from 530 ng/kg to 5,200 ng/kg, so many of the detections in the identified Airport areas are above that range as well.

Site Capping Measures

The objective of DEP's request to cap is to prevent infiltration of precipitation through the PFAS - contaminated soil. The extent of soil contamination has been identified through the IRA Assessments. Scientific leaching rate calculations indicate the PFAS contamination in the soil will continue to leach concentrations of PFAS above the draft 20 ng/l MCP standards for drinking water.

The Draft IRA Mod provides a conceptual design for installing 2.25 acres of a practical cap over the Deployment and Air Rescue Fire Fighting Building areas.

The proposed design includes options for either a minimum of 2 inches of asphalt, two layers of 6 mil polyethylene sheeting with one layer being reinforced polyethylene sheeting or a combination of th e two. The conceptual plan does not show where there is a preference for asphalt or poly sheeting. The proposed cap should be extended to cover the area with high PFAS soil concentrations at sampling site D7. The design should retain all monitoring wells and address how potential future remedial actions such as well installation or confirmatory sampling can be accommodated. The proposal indicates that the cap will be used for 3 years with monitoring of conditions every six months. It is not clear why the cap would only be used for 3 years.

The conceptual plan also indicates that stormwater drainage will be designed for the areas to convey stormwater away from the capped areas and into the existing Airport stormwater system. The plan should consider potential sheet flow off portions of the deployment area cap. The conceptual design correctly assumes that stormwater conveyed from the capped areas will be considered free of oil and hazardous materials since it is not in contact with the impacted soil.

The request by DEP to cap the site to prevent additional leaching is a commendable goal for our Sole Source Aquifer and Public Water Supply. The Draft IRA Modification provides a well thought out conceptual plan to achieve the goal for an interim period.

I hope these comments and suggestions are helpful. I am available and would welcome the opportunity to constructively discuss them.

Sincerely,

Tom Cambareri
CGWP, LSP
Sole Source Consulting LLC

Cc: Bryan Massa LSP, Horsley Witten Inc