Draft Explanation of Significant Differences for Per- and Polyfluoroalkyl Substances at Fire Training Area-1 (Operable Unit 15), Joint Base Cape Cod, MA (ESD 2)

May 2026

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ACRONYMS AND ABBREVIATIONS

°F	Fahrenheit
µg/L	Microgram(s) per liter
AFCEC	Air Force Civil Engineer Center
AFCEE	Air Force Center for Engineering and the Environment
AFFF	Aqueous film-forming foam
ARAR	Applicable or relevant and appropriate requirement
AV	Ashumet Valley
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CMR	Code of Massachusetts Regulations
COC	Contaminant of Concern
CS	Chemical Spill
CSM	Conceptual site model
DoD	Department of Defense
EPA	U.S. Environmental Protection Agency
ESD	Explanation of Significant Differences
ETD	Extraction, treatment, and discharge
ETI	Extraction, treatment, and infiltration
FFA	Federal Facility Agreement
FS	Feasibility study
FTA-1	Fire Training Area-1
GAC	Granular activated carbon
gpm	Gallons per minute
HA	Health advisory
HFPO-DA	hexafluoropropylene oxide dimer acid (referred to as GenX)
HHRS	Human health risk screening
HI	Hazard index
HQ	Hazard quotient
IRP	Installation Restoration Program
ITRC	Interstate Technology and Regulatory Council
IX	Ion exchange
JBCC	Joint Base Cape Cod
kg	Kilogram
lb(s)	Pound(s)

LTM	Long-term monitoring
LUC	Land use control
MA	Massachusetts
MassDEP	Massachusetts Department of Environmental Protection
MCL	Maximum contaminant level
MDPH	Massachusetts Department of Public Health
MMCL	Massachusetts maximum contaminant level
MMR	Massachusetts Military Reservation
MNA	Monitored natural attenuation
NCP	National Oil and Hazardous Substances Contingency Plan
NPL	National Priorities List
OU	Operable unit
PCE	Tetrachloroethene
PFAS	Per- and polyfluorinated alkyl substances
PFBS	Perfluorobutane Sulfonic Acid
PFC	Perfluorinated compounds
PFDA	Perfluorodecanoic acid
PFHpA	Perfluoroheptanoic acid
PFHxS	Perfluorohexane sulfonic acid
PFNA	Perfluorononanoic acid
PFOA	Perfluorooctanoic acid
PFOS	Perfluorooctane sulfonic acid
RAO	Remedial action objective
RCRA	Resource Conservation and Recovery Act
RI	Remedial investigation
ROD	Record of Decision
RSL	Regional screening level
SD	Storm drain
SPEIM	System Performance and Ecological Impact Monitoring
SR	Sandwich Road
SRTF	Sandwich Road Treatment Facility
STP	Sewage Treatment Plant
TBC	To be considered
TCE	Trichloroethene
USAF	U.S. Air Force
VOC	Volatile organic compound

1. INTRODUCTION

This *Draft Explanation of Significant Differences for Per- and Polyfluoroalkyl Substances at Fire Training Area-1, Joint Base Cape Cod, MA* (ESD 2) has been prepared to document proposed changes to the remedy for the Fire Training Area-1 (FTA-1), Operable Unit 15 (OU-15) of the Otis Air National Guard Base/Cape Edwards (currently referred to as Joint Base Cape Cod) Site (the Site) (Figures 1 and 2). The cleanup of the Site is regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 United State Code (USC) § 9601, *et seq*. The CERCLA Information System number for the Site is MA2570024487.

The proposed draft ESD 2 would significantly modify the OU-15 remedy as follows:

- the remedy's *final* groundwater remedy is changed to an *interim* remedy to account for ongoing U.S. Air Force (USAF) investigations of per- and polyfluoroalkyl substances (PFAS) which need to be completed before developing remedial alternatives that will achieve groundwater cleanup to drinking water standards throughout OU-15;
- adds a number of PFAS, specifically perfluorooctane sulfonic acid (PFOS), perfluorooctanoic acid (PFOA), perfluorohexane sulfonic acid (PFHxS), and perfluorononanoic acid (PFNA) as contaminants of concern (COCs) to the remedy;
- adds federal Maximum Contaminant Levels (MCLs) and more stringent Massachusetts MCLs for these PFAS as Applicable or Relevant and Appropriate Requirements (ARARs) to the remedy, modifies the OU-15 Record of Decision's (ROD) ARARs to address the change in the groundwater remedy from a final remedy to an interim remedy, and revises or modifies other ARARs identified in the ROD based on federal and state regulatory/statutory changes since the ROD was issued;
- adds additional Remedial Action Objectives (RAOs) to prevent residential exposure[1] to PFAS exceeding ARAR or risk-based standards in OU15 groundwater;
- adds a management of migration RAO for PFAS;
- adds an RAO to prevent human consumption of fish from Ashumet and Johns Ponds due to PFOS contamination;

[1] The term "residential exposure" has been used in all JBCC groundwater decision documents and accounts for all human populations potentially exposed to groundwater.

- adds an interim action to modify and operate parts of the current OU-14 and OU-15 groundwater treatment systems (in place to treat legacy groundwater contaminants) to treat PFAS in portions of the OU-15 plume;

- establishes land use controls (LUC) to prevent human consumption of fish from Ashumet and Johns Ponds;

- expands the groundwater LUC boundary to encompass any exceedances of federal or more stringent state ARARs as an interim LUC until a final groundwater remedy is established;

- adds a requirement to mitigate exposure to residential drinking water wells, not addressed by previous removal actions, with PFAS COC concentrations exceeding the federal MCLs or MMCLs and attributable to the FTA-1 PFAS plume;

- ensures that municipal water supply treatment systems installed as part of the CERCLA removal actions (described in Section 3.3) remain adequate to protect users from OU-15-related contamination;

- expands the groundwater and surface water monitoring program to address new RAOs until a final groundwater remedy is established; and

- significantly adds to the estimated cost of the CERCLA remedy over the original estimated cost.

The Final Record of Decision (ROD) for Ashumet Valley (AV)[2] OU-15, which documented the selection of the remedy to address the four legacy groundwater COCs (tetrachloroethene [PCE], trichloroethene [TCE], thallium, and manganese.) was signed in June 2009 by the Air Force Center for Engineering and the Environment (AFCEE)[3] and the U.S. Environmental Protection Agency (EPA) and modified by a September 2011 Explanation of Significant Differences (ESD) entitled "*Explanation of Significant Differences for the Installation Restoration Program Groundwater Plumes at the Massachusetts Military Reservation*" (ESD 1), collectively referred to as the "CERCLA Remedy". FTA-1 is one of the Installation Restoration Program (IRP)[4] sites at Joint

[2] Operable Unit 15 also encompasses the area referred to as FTA-1. FTA-1 is one of the source areas for the AV chlorinated solvent plume and it is the primary source of the PFAS contamination within OU-15. The PFAS groundwater contamination from the operable unit is called FTA-1 (instead of the legacy Ashumet Valley term for the solvent plume).
[3] In October 2012, AFCEE adopted a new organizational name, AFCEC. Therefore, the AFCEE and AFCEC acronyms refer to the same entity but are used in this document in relation to the date of a specific topic or document.
[4] The IRP is designed to identify, investigate, and cleanup contamination associated with past USAF activities at Department of Defense installations.

Base Cape Cod (JBCC)[5]; formerly known as the Massachusetts Military Reservation (MMR), located on Cape Cod, Massachusetts (Figures 1 and 2). A final remedial action for OU-15 groundwater will be implemented in a future CERCLA decision document.

A *Supplemental Remedial Investigation Report for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances at Fire Training Area-1, Joint Base Cape Cod* (Supplemental RI) (AFCEC 2024a) determined the nature and extent of 1,4-dioxane and PFAS contamination at FTA-1, evaluated its fate and transport, and determined if potentially unacceptable risks to human health and the environment exist from exposure to 1,4-dioxane and PFAS in groundwater, soil, sediment, and surface water that would warrant remedial action. 1,4-Dioxane is not addressed in this ESD since the Supplemental RI determined it would not need to be addressed as a COC at FTA-1 because it was found that 1,4-dioxane levels did not exceed CERCLA risk standards.

The Massachusetts Maximum Contaminant Level (MMCL) of 0.02 micrograms per liter (µg/L)[6] (310 Code of Massachusetts Regulations [CMR] 22) for the sum of the concentrations of six PFAS (PFAS6) consisting of PFOS, PFOA, PFHxS, PFNA, perfluoroheptanoic acid (PFHpA), and perfluorodecanoic acid (PFDA) was issued in October 2020 (MassDEP 2020a and 2020b) and Supplemental RI field activities were expanded in order to define the extent of groundwater contamination to the PFAS6 MMCL of 0.02 µg/L (AFCEC 2023d). Since the Supplemental RI identified unacceptable risk for PFOS, PFOA, PFHxS, and PFNA in groundwater (along with a leaching threat from PFAS-contaminated soil to groundwater), remedial alternatives for PFAS were evaluated in a *Draft Supplemental Feasibility Study Report for Per- and Polyfluoroalkyl Substances at Fire Training Area-1, Joint Base Cape Cod, MA*. The Draft Supplemental Feasibility Study (FS) will undergo significant revisions as part of developing a final groundwater remedial action and is not available in the Administrative Record. Specific information from the Draft Supplemental FS used to support this Draft ESD 2 has been documented in a *Memorandum to the File Alternative Analysis to Limit Migration of Per- and Polyfluoroalkyl Substances at Fire*

[5] In July 2013, the MMR adopted a new name, the JBCC. Therefore, the MMR and JBCC acronyms refer to the same location but are used in this document in relation to the date of the specific topic or document.
[6] 0.02 µg/L is equivalent to 20 parts per trillion (ppt)

Training Area-1 (Operable Unit 15) Groundwater, Joint Base Cape Cod, MA (AFCEC 2025a) which is available in the Administrative Record.

On April 26, 2024 (after completion of the FTA-1 Supplemental RI and issuance of an initial draft of the Draft Supplemental FS), the EPA published a final National Primary Drinking Water Regulation (NPDWR) establishing nationwide drinking water standards for certain PFAS under the Safe Drinking Water Act (SDWA) 42 USC § 300f *et seq*.

EPA's drinking water rule includes enforceable maximum contaminant levels (MCL), 40 Code of Federal Regulations (CFR) 141.61(c)(2), for five PFAS: PFOS, PFOA, PFNA, hexafluoropropylene oxide dimer acid (HFPO-DA, commonly known as GenX), and PFHxS. It also includes a Hazard Index (HI) MCL[7], for a mixture of at least two or more of PFHxS, PFNA, perfluorobutane sulfonic acid (PFBS), and HPFO-DA (GenX) chemicals.

- Individual MCLs in parts per trillion (ppt):
  - PFOS = 4 ppt (or 0.004 µg/L)
  - PFOA = 4 ppt
  - PFNA = 10 ppt (or 0.010 µg/L)
  - HFPO-DA = 10 ppt
  - PFHxS = 10 ppt
- HI MCL for PFHxS, PFNA, PFBS, and HFPO-DA = 1 (unitless)

The *Memorandum to the File Alternative Analysis to Limit Migration of Per- and Polyfluoroalkyl Substances at Fire Training Area-1 (Operable Unit 15) Groundwater, Joint Base Cape Cod, MA* (AFCEC 2025a) integrated the newly promulgated federal PFAS standards and assessed three interim groundwater alternatives to mitigate impacts from the FTA-1 PFAS plume. Two of those interim alternatives, Optimizing the AV Remedial System with Additional Infrastructure and

[7] SDWA regulations at 40 CFR 141.2 defines "Hazard Index (HI)" as "the sum of component hazard quotients (HQs), which are calculated by dividing the measured regulated PFAS component contaminant concentration in water (e.g., expressed as ppt or nanograms per liter (ng/l)) by the associated health-based water concentration (HBWC) expressed in the same units as the measured concentration (e.g., ppt or ng/l).

Adding Infrastructure Along Sandwich Road (described in Section 3.5.2), are included as components of the interim remedy described in this ESD 2.

This Draft ESD 2 proposes to adopt the updated federal MCLs and Massachusetts MCLs for PFAS as relevant and appropriate performance standards for assessing the implementation of an interim groundwater treatment remedy for portions of the FTA-1 PFAS plume and for delineating an expanded OU 15 LUC boundary to encompass the entire FTA-1 PFAS plume.

This Draft ESD 2 was prepared in accordance with *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents* (EPA 1999). In accordance with Executive Order 12580, the USAF is the lead agency for CERCLA remedial actions at the MMR and this document is being issued by the USAF as the lead agency. The site was added to the National Priorities List (NPL) in 1989 as "Otis Air National Guard/Camp Edwards" which was subsequently referred to as the MMR. A Federal Facility Agreement (FFA), which provided the legal framework for investigating and remediating numerous operable units at the MMR, was signed in 1991 (EPA et al. 1991). In 1996, the FFA was amended to add the USAF as the lead agency for the cleanup at MMR (EPA et al. 2002). The FFA, as amended, requires the USAF to implement CERCLA requirements at MMR/JBCC. In addition to the USAF, the EPA and National Guard Bureau are parties to the FFA for the MMR/JBCC. The Massachusetts Department of Environmental Protection (MassDEP) is not a signatory of the FFA but is an active participant in the clean-up process and provides guidance and direction to the remedy selection and oversight process.

1.1 STATEMENT OF PURPOSE

The AFCEC is issuing this ESD in accordance with §117(c) of CERCLA and 40 CFR Section 300.435(c)(2)(i) of the National Contingency Plan (NCP) which requires the publication of an ESD to document significant changes to the OU-15 remedy. As required by Section 300.825(a)(2) of the NCP, this ESD will become part of the Administrative Record for the Ashumet Valley Groundwater Plume operable unit (OU 15) at the JBCC. The Administrative Record is available for public review by appointment at the AFCEC IRP Office (199 Falmouth-Sandwich Road, Mashpee, Massachusetts, 02649) Monday - Friday, 8 a.m. to 4 p.m., excluding federal and state holidays, and is also available on-line at https://ar.cce.af.mil (select Joint Base Cape Cod, MA).

1.2 AUTHORIZING SIGNATURES

The following signatures represent the decision to authorize this ESD for the FTA-1 groundwater site at the JBCC.

U.S. AIR FORCE

_____ Date: _____
TAMMY O'NEILL
Director, Environmental Management
Air Force Civil Engineer Center

U.S. ENVIRONMENTAL PROTECTION AGENCY

_____ Date: _____
BRYAN OLSON
Director
Superfund and Emergency Management Division EPA Region 1

2. SITE HISTORY, SITE CONTAMINATION, AND SELECTED REMEDY

This section presents background and historical information on the FTA-1 (AV) IRP site, including an overview of the source area and groundwater contamination, interim remedial actions, and the selected remedies in the 2009 OU 15 ROD (AFCEE 2009) and subsequent modification by the 2011 ESD (ESD 1) (AFCEE 2011), collectively referred to as the "CERCLA Remedy."

2.1 INSTALLATION LOCATION AND HISTORY

The JBCC, listed on the NPL as Otis Air National Guard/Camp Edwards, is located on upper Cape Cod, Massachusetts (Figure 1). The JBCC comprises approximately 22,000 acres on Cape Cod and provides facilities for several operating command units: the Massachusetts Air National Guard, the Massachusetts Army National Guard, the U.S. Space Command, the U.S. Coast Guard, and the U.S. Department of Veterans Affairs. Past military training, maneuvers, and aircraft operations, maintenance and support activities and disposal of materials via landfilling at the JBCC have resulted in releases of hazardous substances, wastes, and materials that contaminated soil in source areas and generated plumes of contaminated groundwater in the unconfined sand and gravel aquifer that underlies the JBCC and the surrounding towns.

2.2 FTA-1 (ASHUMET VALLEY) SITE HISTORY, CONTAMINATION, AND REMEDIAL ACTIONS

This section presents a summary of the site history, a description of the FTA-1 source area and the adjacent former MMR sewage treatment plant (STP) source area (the two source areas for the AV chlorinated solvent groundwater plume), the existing remedy for the AV chlorinated solvent plume presented in the OU-15 ROD, subsequent ESD, and the current remedial status for the AV chlorinated solvent plume.

2.2.1 Site History Summary

Recognition of the AV chlorinated solvent plume began in 1979 when the Massachusetts Department of Environmental Quality Engineering (predecessor agency to MassDEP) ordered the Town of Falmouth to shut down the Ashumet municipal well due to the presence of methylene-blue-active-substances (i.e., detergents) (AFCEE 2009). Sources of the AV chlorinated solvent plume were identified as the former FTA-1 and the former MMR STP, where fuels and solvents

were released, and an RI was completed in 1995 (ABB 1995). Implementation of an interim remedy which consisted of groundwater extraction and treatment with granular activated carbon (GAC) began in 1999 (AFCEE 2002), and a ROD was issued in 2009 (AFCEE 2009) that specified the final remedy for the AV groundwater COCs (PCE, TCE, thallium, and manganese). Analytical data for the AV plume have been collected through the System Performance and Ecological Impact Monitoring (SPEIM) program since startup of the treatment system in 1999. The SPEIM program was developed to monitor plume changes, to ensure the effective operation of the groundwater remediation systems, and to identify potential optimization opportunities. Several remedial system optimizations have been completed since system startup in 1999 and they are summarized in Section 2.2.4.2.

The initial recommendation to perform sampling for 1,4-dioxane and PFAS (previously referred to as perfluorinated compounds [PFCs]) at the AV groundwater plume was presented in the *Final 4th Five Year Review, 2007-2012 Massachusetts Military Reservation (MMR) Superfund Site Otis Air National Guard Base, MA* (AFCEC 2013). 1,4-Dioxane is not addressed in this ESD since the Supplemental RI determined it would not need to be addressed as a COC at FTA-1 because it was found that 1,4-dioxane levels did not exceed CERCLA risk standards. (AFCEC 2024a).

PFAS are found in aqueous film-forming foam (AFFF), a firefighting foam used by the USAF in fire training exercises, suppressing aircraft and other vehicle fires, and in aircraft hangar fire suppression systems since 1970. One of the sources of the AV plume was the former FTA-1 where firefighter training exercises were held from 1958 to 1985. During this time, flammable waste liquids were burned and extinguished on the ground surface at FTA-1 and AFFF was used by the USAF between approximately 1970 and 1985 (AFCEC 2015). Another source of the AV plume, which is also a source of PFAS, is the former MMR STP. Prior to 1995, wastewater was released at the former MMR STP infiltration beds located to the south of FTA-1 (Figure 2) and during this timeframe AFFF handled at hangars or fire stations located along the Flight Line Area could have been released into the wastewater collection system (AFCEC 2021a). PFAS contamination at these flight line sites is currently being investigated as part of the Flight Line OU RI (AFCEC 2022b).

Further details on the history of the FTA-1 and Former MMR STP source areas and a description of the AV chlorinated solvent groundwater plume (and thallium and manganese long term

monitoring (LTM) areas) remedy and status are presented in the following sections. PFAS are mentioned in the following sections where its presence is integral to the historical discussion.

2.2.2 FTA-1 Source Area

The FTA-1 source area is located in the southeast portion of JBCC (Figure 2). Firefighter-training exercises were held from 1958 to 1985 at the former FTA-1, during which time flammable waste liquids such as chlorinated solvents and/or petroleum products were burned and extinguished. AFFF was used at FTA-1 by the USAF since 1970 (AFCEC 2015). Fuel and solvent-related contaminated soil was excavated from the FTA-1 site for on-site thermal treatment between 1995 and 1997; approximately 49,000 tons of contaminated soil was treated, stockpiled, and subsequently backfilled into the site (AFCEE 2000). Thermal treatment temperatures of up to 350 degrees Fahrenheit (°F) effectively addressed the fuels and solvents (including 1,4-dioxane) in the FTA-1 soils; however, the treatment temperature was not sufficiently high to treat the PFAS contamination in the soil. The thermal treatment of PFAS in soil requires temperatures in the range of 1,100 to 1,800°F. A fire that occurred at the thermal treatment unit on 26 February 1997 (AFCEE 2000) was extinguished with AFFF by the base fire department, constituting an additional potential source of PFAS contamination at the FTA-1 site.

2.2.3 Former MMR STP Source Area

The former MMR STP, which operated from 1936 to 1995, released treated wastewater to a series of sand infiltration beds (Figure 2). De-watered sewage sludge was also disposed of in a nearby wooded area. Contaminants (including PFAS and/or chlorinated solvents such as PCE and TCE) were introduced to the subsurface as part of these activities, migrated vertically through the vadose zone, and eventually dissolved into groundwater and contributed to the AV chlorinated solvent plume (along with the releases at FTA-1). In 1995, a new wastewater treatment plant started operations and the treated wastewater is discharged to sand infiltration beds located in the northwest portion of JBCC adjacent to the Cape Cod Canal (AFCEC 2021a).

2.2.4 Existing Remedy for the AV Chlorinated Solvent Plume

The former FTA-1 and the former MMR STP are the sources of the AV chlorinated solvent plume which is a dilute dissolved-phase groundwater plume currently defined as the extent of

groundwater containing the AV COCs PCE and TCE at concentrations exceeding the federal MCL of 5 µg/L for each compound (AFCEC 2024b). The AV plume is detached from the on-base source areas and is located entirely off-base, approximately two to four miles south of the JBCC. The maximum historic PCE and TCE concentrations detected at AV were 109 µg/L in 1998 and 83 µg/L in 1997, respectively, and the maximum PCE and TCE concentrations detected at AV in 2023 were 9.9 µg/L and 3.8 µg/L, respectively (AFCEC 2024b). Based on groundwater monitoring data collected in 2023, the remaining AV PCE/TCE plume consists of three disconnected zones of contamination (Figure 3). Although not released at the source areas, thallium and manganese are also COCs in groundwater at AV. Reducing conditions in groundwater related to wastewater discharge from the former STP mobilized these naturally occurring inorganic compounds. Detections of these compounds above cleanup levels have been limited to an area immediately downgradient of the former source areas and to the west of Ashumet Pond (referred to as the Manganese LTM area) (Figure 3) and these contaminants are expected to decrease below cleanup levels through natural attenuation as the aquifer becomes reoxygenated over time. The cleanup level for thallium is the MCL of 2 µg/L; the cleanup level for manganese is the EPA health advisory (HA) of 300 µg/L. Sampling completed in 2011 indicated that thallium was no longer detected; therefore, groundwater monitoring for thallium is no longer conducted (AFCEE 2012). Monitoring for manganese is conducted every three years within the LTM area.

The FTA-1 PFAS groundwater plume (which is not addressed in the current CERCLA remedy) formed due to PFAS releases at FTA-1 and the STP source areas as described earlier. Further discussion of the FTA-1 PFAS groundwater plume is presented in Section 3.

The following RAOs were developed for the AV plume as presented in the 2009 ROD (AFCEE 2009):

- Prevent residential exposure[8] to AV groundwater with TCE concentrations greater than the MCL of 5 µg/L.
- Prevent residential exposure to AV groundwater with PCE concentrations greater than the MCL of 5 µg/L.

[8] The term "residential exposure" has been used in all JBCC groundwater decision documents and accounts for all human populations potentially exposed to groundwater.

- Prevent residential exposure to groundwater located between Kittridge Road and the western shore of Ashumet Pond that has been impacted by the AV plume and that contains manganese concentrations greater than the lifetime HA of 300 µg/L.
- Prevent residential exposure to groundwater located between Kittridge Road and the western shore of Ashumet Pond that has been impacted by the AV plume and that contains thallium concentrations greater than the MCL of 2 µg/L.
- Restore usable groundwaters to their beneficial uses wherever practicable, within a time frame that is reasonable given the particular circumstances of the site.

The selected remedy in the ROD (AFCEE 2009) consists of the following:

- Continued operation of the existing AV remedial system that was installed under the interim ROD (AFCEE 2002) and treatment via GAC. Additionally, the final remedy included a new extraction well installed in the southern portion of the plume (95EW0704) to improve mass capture in that area.
- Implementation of LUCs with the performance objectives of:

  − preventing access to, or use of, contaminated groundwater from the AV plume until the groundwater no longer poses an unacceptable risk, and

  − maintaining the integrity of the current or future remedial or monitoring system such as the treatment systems and monitoring wells.
- Chemical and hydraulic monitoring of the plume, as long as active remediation continues, and chemical monitoring of the plume until the RAOs are met. The chemical monitoring program will include LTM for manganese at wells in an area west of Ashumet Pond. The objective of this manganese LTM program is to confirm that the concentrations of this COC are decreasing and determine when cleanup goals have been reached. Monitoring for thallium was discontinued in 2012 since it was not detected during the 2011 sampling event (AFCEE 2012).

Since the groundwater remedy was selected in 2009, a 2011 ESD for the IRP groundwater plumes (AFCEE 2011) clarified the inclusion of monitored natural attenuation (MNA) as a component of the selected remedy for AV and added text regarding the JBCC three-step process to achieve site closure. The JBCC three-step process is intended to demonstrate that the RAOs have been met, the site meets a condition of No Significant Risk for unlimited use/unrestricted exposure, and to evaluate the feasibility of approaching or achieving background conditions (which is based on the State regulatory process) (MassDEP 2004).

2.2.4.1 Land Use Controls

LUCs currently in place for the AV volatile organic compound (VOC) plume protect area residents that are located within the existing AV LUC area (Figure 3) from exposure to groundwater contamination and maintain integrity of the treatment systems and monitoring wells. The LUCs include:

- Falmouth Board of Health Water Well Regulations which require a permit for new drinking water wells.
- JBCC prohibition on new drinking water wells serving 25 or fewer customers.
- MassDEP permitting process for drinking water wells serving more than 25 customers.
- Dig Safe program where the USAF monitors for digging activities and marks its infrastructure components to prevent damage.
- Private well verification program throughout a designated AV LUC area.

During the Supplemental RI, AFCEC administratively imposed LUCs in an expanded outreach area that encompassed the FTA-1 PFAS plume (based on exceedances of the PFAS MMCLs) and areas downgradient. The FTA-1 PFAS groundwater plume extent presented in the Supplemental RI has been updated based on the federal PFAS MCLs (promulgated in April 2024) (Figure 2). The expanded outreach area was first documented in the LUC Letter Report for 2016 and 2017 (AFCEC 2019a) and was reported in subsequent LUC Letter Reports (AFCEC 2019b, 2020b, 2021b, 2022a, 2023b, 2025b) and Land Use Control Implementation Plan updates (AFCEC 2020a, 2023a). A screening evaluation in this outreach area identified select private drinking water wells located outside the current AV LUC area that were within or near the FTA-1 PFAS plume boundary (AFCEC 2023d). These private wells were sampled, and response actions were completed at locations (including municipal water supply wells) impacted by FTA-1 PFAS (further described in Section 3.3). The Draft ESD2 proposes that the private well verification program required for the legacy AV LUC area be expanded to apply to the FTA-1 LUC area depicted in Figure 2 as the FTA-1 LUC Area[9]. Appendix B includes the complete AV LUC language with updates based on the actions proposed in this ESD.

[9] This area has been called the "FTA-1 Outreach Area" in documents and figures produced before this ESD.

2.2.4.2 AV ETI System

The AV extraction, treatment, and infiltration (ETI) remedial system began operation on 22 November 1999 as part of the interim remedy to address the PCE/TCE plume with three extraction wells, two treatment plants, and two infiltration trenches. The extraction wells (95EW0701, 95EW0702, and 95EW0703) shown on Figure 4 are located along the axis of the plume between Route 151 and Hayway Road and were designed to extract 1,200 gallons per minute (gpm) from the aquifer. The two treatment plants are located along Sandwich Road (SR), and each contain two 20,000-pound (lb) GAC vessels, arranged in series operation, to remediate the PCE and TCE contamination in the extracted groundwater. The two infiltration trenches are aligned parallel to the long axis of the plume, with each designed to return 600 gpm of treated water to the aquifer. One infiltration trench is located along SR and the other trench is located on Currier Road.

As part of the CERCLA remedy and as described in the OU-15 ROD (AFCEE 2009), the remedial system was expanded by adding treatment at the leading edge of the plume (Figure 4). On 24 August 2009, the new leading-edge extraction, treatment, and discharge (ETD) remedial system began operation which consisted of an extraction well (95EW0704) pumping at 175 gpm, a mobile treatment unit housing a GAC system to treat PCE and TCE, and a discharge bubbler that returned treated water to the Backus River.

AV extraction wells 95EW0701 and 95EW0702 (installed as part of the interim remedy for AV) were turned off prior to the OU-15 ROD as the result of a remedial system optimization on 18 May 2007 (AFCEE 2007). Extraction well 95EW0704 and the ETD system were shut down on an interim basis on 28 February 2014 based on the results of a data gap investigation and an optimization evaluation (AFCEC 2014b). Performance monitoring data demonstrated that the aquifer had been restored for COCs in the area near 95EW0704 and permanent shutdown was approved on 19 December 2018 although the extraction well had not operated since 2014 (AFCEC 2022c).

Data gathered during the Supplemental RI for 1,4-dioxane and PFAS indicated these emerging contaminants had at times passed through the GAC treatment at the AV treatment facilities and were released through the infiltration systems (AFCEC 2017). As a mitigation action to reduce or eliminate the exposure to 1,4-dioxane and PFAS contamination to the residents located near the

Currier Road infiltration trench, AFCEC, with regulatory agency concurrence, ceased discharging treatment plant effluent to the Currier Road infiltration trench on 29 September 2015 and began redirecting all ETI system effluent to the SR infiltration trench where there were no private wells. The flow rate at 95EW0703 (the only AV extraction well still operating at the time) was reduced from 350 gpm to 215 gpm, which was determined through flow testing to be the maximum flow rate that can be discharged through the SR infiltration trench without ponding at the ground surface. The AV groundwater model was used to determine that the predicted hydraulic capture zone at 215 gpm was sufficient to capture the AV PCE/TCE plume in the vicinity of extraction well 95EW0703 (AFCEC 2017).

The predicted remedial system shutdown date (when the last AV extraction well is shut off) presented in the ROD was approximately 2019, and the expected aquifer restoration timeframe (when PCE and TCE concentrations drop below the MCL throughout the plume) was approximately 2021 (AFCEE 2009). Performance monitoring data indicated that the system could be shut down and the last AV extraction well was taken offline on 12 January 2022 (AFCEC 2022c). LTM data indicate that manganese concentrations are generally declining but the predicted restoration timeframe for this portion of the aquifer is uncertain and may exceed the timeframe for the PCE/TCE plume (AFCEE 2012). Since the remedial system is located over 10,000 ft downgradient from the LTM area, operation of the system has no influence on the natural attenuation of the manganese concentrations which were above the HA of 300 µg/L when last sampled in 2022 (AFCEC 2023e).

3. BASIS FOR THE DOCUMENT

This section summarizes the FTA-1 PFAS information that prompted and supports the significant differences from the current CERCLA remedy including a summary of the PFAS investigation and conceptual site model (CSM), risk assessment results, removal actions conducted, and alternatives developed and analyzed in the *Memorandum to the File Alternative Analysis to Limit Migration of Per- and Polyfluoroalkyl Substances at Fire Training Area-1 (Operable Unit 15) Groundwater, Joint Base Cape Cod, MA* (AFCEC 2025a).

3.1 PFAS INVESTIGATION AND CONCEPTUAL SITE MODEL

A presence/absence (CERCLA Site Inspection equivalent) field investigation for PFAS was completed between October 2013 and September 2014 at Ashumet Valley due to a confirmed release of AFFF at the FTA-1 source area. At the time of this initial investigation, there were no federal MCLs or MMCLs for PFAS compounds, but there were EPA provisional HAs for drinking water of 0.2 µg/L for PFOS and 0.4 µg/L for PFOA. The results of this PFAS investigation confirmed a release of PFAS above the EPA provisional health advisories to the environment at AV and additional investigation, in the form of a Supplemental RI, was recommended (AFCEC 2014a).

The initial scope of work for the Supplemental RI at AV was to evaluate the nature and extent of PFAS contamination in groundwater and surface water. It was assumed that the PFAS contamination would be generally contiguous with the existing extent of the AV PCE and TCE groundwater contamination. It was also assumed, given the high solubility of PFAS, that these contaminants would be detached from the source areas. This approach was presented in the *Final Supplemental Remedial Investigation/Feasibility Study Work Plan for 1,4-Dioxane and Perfluorinated Compounds at Ashumet Valley, Joint Base Cape Cod, MA* (AFCEC 2016). However, based on an initial assessment of the characterization data collected under the Supplemental RI it became evident that the extent of PFAS contamination was more widespread than originally anticipated and additional data collection was necessary (AFCEC 2017).

The *Ashumet Valley Emerging Contaminants Conceptual Site Model Technical Memorandum* (AFCEC 2017) was submitted in March 2017 and included a summary of the nature and extent of the emerging contaminants based on the Supplemental RI data collected through December 2016.

The Technical Memorandum indicated PFAS have been detected in surface water sampled from both Ashumet and Johns ponds due to PFAS-contaminated groundwater discharging to Ashumet Pond from the AV source areas. Since both Ashumet and Johns ponds recharge the aquifer on the southeast side of the ponds, the contaminated pond water is being recharged into the aquifer and impacting downgradient residential and municipal drinking water supply wells (AFCEC 2017). The Technical Memorandum also identified the data gaps that would need to be addressed to complete the Supplemental RI. The *Final Supplemental Remedial Investigation Data Gap Work Plan for 1,4-Dioxane and Perfluorinated Compounds at Ashumet Valley, Joint Base Cape Cod, MA* (AFCEC 2018b) was submitted in January 2018.

A *Supplemental Remedial Investigation Report for 1,4-Dioxane and Per- and Polyfluoroalkyl Substances at Fire Training Area-1, Joint Base Cape Cod* (Supplemental RI) (AFCEC 2024a) determined the nature and extent of 1,4-dioxane and PFAS contamination at FTA-1, evaluated its fate and transport, and determined if potentially unacceptable risks to human health and the environment exist from exposure to 1,4-dioxane and PFAS in groundwater, soil, sediment, fish tissue, and surface water that would warrant remedial action. 1,4-Dioxane is not addressed in this ESD since the Supplemental RI determined it would not need to be addressed as a COC at FTA-1 because it was found that 1,4-dioxane levels did not exceed CERCLA risk standards.

3.1.1 Soil

The Supplemental RI identified PFAS (primarily PFOS) in soil at FTA-1 and the former STP source areas in exceedance of EPA regional screening levels (RSL) in place at the time of the data assessment. The EPA RSLs are human health screening values for direct contact exposure scenarios (i.e., child residential ingestion and dermal contact) and do not consider leaching from soil to groundwater. The EPA Soil RSL used in the Supplemental RI data assessment was 12.6 µg/kg for PFOS. To account for leaching, a preliminary estimated soil-to-groundwater screening value of 4 µg/kg for PFOS (using the PFAS6 MMCL as the target groundwater concentration) was established. The highest PFOS concentration at FTA-1 soil was 630 µg/kg in a composite sample taken from 10-20 ft bgs, while the highest PFOS concentration at the former STP soil was 30 µg/kg in a sample taken from 0 to 3 ft bgs. Applying the preliminary estimated soil-to-groundwater

screening value of 4 µg/kg to the soil datasets resulted in an estimated impacted area of 14.2 acres (at least 40 ft deep) at FTA-1 and 12.7 acres (up to 15 ft deep) at the former STP (AFCEC 2024a).

3.1.2 Surface Water

The Supplemental RI identified PFAS (primarily PFOS) in surface water impacted by the FTA-1 PFAS plume. The highest PFOS concentrations were found in Ashumet and Johns Ponds and the Quashnet River (which receives surface water from Johns Pond). PFOS concentrations ranged from 0.054 to 0.2 µg/L in the Ashumet Pond surface water samples and from 0.078 to 0.13 µg/L in the Johns Pond surface water samples. PFOS concentrations in the Quashnet River ranged from 0.084 to 0.21 µg/L. These PFOS concentrations in surface water exceed the EPA site-specific screening level (SSL) of 0.038 µg/L for a child Recreational Swimmer exposure scenario but PFOS was not identified as a COC in surface water based on the human health risk assessment described in Section 3.2.1 (AFCEC 2024a).

3.1.3 Sediment

Collocated surface water and sediment samples (0 to 1 ft bgs) were collected from two locations in Ashumet Pond: near the public beach at the boat ramp/swimming area and offshore. PFOS and PFOA concentrations in the sediment sample collected at the boat ramp/swimming area were 0.39 J µg/kg and not detected, respectively. PFOS (1.1 µg/kg) and PFOA (0.15 J µg/kg) concentrations were slightly higher in the sediment sample collected offshore. These concentrations are well below the SSLs for child recreator ingestion and dermal (i.e., direct contact) exposure scenarios for PFOS and PFOA (AFCEC 2024a).

3.1.4 Fish Tissue

Fin fish from waterbodies in the FTA-1 site were not collected and analyzed for PFAS by the Air Force as part of the Supplemental RI. However, a Massachusetts Department of Public Health (MDPH) investigation evaluated PFAS concentrations in fish tissue from Johns Pond. For the MDPH study of PFAS in surface water and fish, six different fish species were sampled at Johns Pond (bluegill, chain pickerel, largemouth bass, pumpkinseed, white perch, and yellow perch). PFOS was detected at an average concentration per species ranging from 73.37 µg/kg in largemouth bass to 144.33 µg/kg in bluegill, and an average concentration for all fish sampled at Johns Pond of 97.76 µg/kg. The maximum detected PFOS concentration in a fish sample from

Johns Pond was 170 µg/kg (MDPH 2021). A fish tissue evaluation for PFAS was also conducted for Ashumet Pond (MassDEP 2023) which reported the mean detected concentration of PFOS in Ashumet Pond fish tissue was 187.78 µg/kg.

3.1.5 Groundwater

Groundwater with PFAS concentrations exceeding the MCL originates at the water table beneath the FTA-1 source area and extends approximately five miles from the source area to the south of Mill Pond at the southwestern end of the FTA-1 PFAS groundwater plume (Figure 2). The location of Ashumet and Johns ponds and their interaction with regional groundwater flow has played a significant role in the migration of the FTA-1 PFAS plume. Groundwater/surface water interaction combined with the low volatility and lack of biodegradation of PFAS has resulted in groundwater contamination in the area downgradient of the ponds. Surface water containing PFAS discharges from the ponds, recharges the aquifer, and continues to migrate southwesterly and southeasterly, downgradient of the ponds (Figure 2). The FTA-1 PFAS groundwater plume covers approximately 6,452 acres and extends from the western edge near the Backus River and Mill Pond to the east past the Quashnet River toward the Mashpee River and encompasses Ashumet and Johns ponds.

The FTA-1 PFAS groundwater plume extent presented in the Supplemental RI has been updated based on the federal PFAS MCLs (promulgated in April 2024) (Figure 2) and CSM discussions presented in the following sections integrate an analysis of the data in comparison to the federal PFAS MCLs. Alternatives to address the entire FTA-1 plume will be developed in a future FS for FTA-1 PFAS groundwater and be based on updated groundwater data.

3.1.5.1 FTA-1/STP to Ashumet Pond Groundwater CSM

The highest concentrations in the FTA-1 PFAS groundwater plume are located near the water table directly below the FTA-1 source area (PFOS detected at 130 µg/L in a sample collected at the water table in 2018). The groundwater data and soil sampling results indicate that PFAS contaminated soils (dominated by PFOS, PFOA, and PFHxS) are acting as an ongoing source of groundwater contamination throughout most of the FTA-1 source area and within smaller isolated areas within the Former MMR STP.

PFAS concentrations in the source area are highest at the water table and are generally lower with increasing depth from the water table. Contamination is up to 100 ft thick below the water table in the area between the source area and the northern shore of Ashumet Pond and PFAS concentrations are lower near the northern shore of Ashumet Pond. The shallower portion of the PFAS plume discharges to Ashumet Pond and flows through the aquifer in the isthmus between the ponds and then discharges to Johns Pond. PFAS contaminated surface water from Johns Pond then recharges the aquifer on the southeast side of the pond (i.e., south of the Johns Pond hinge line) and PFAS contamination continues to migrate from southwesterly to southeasterly, downgradient of the ponds. The deeper portion of the PFAS plume near the northern shore of Ashumet Pond flows under the western edge of Ashumet Pond in a south-south westerly direction towards the AV ETI system following a similar flow path as the AV VOC plume.

3.1.5.2 AV Legacy VOC Plume/ETI System Area Groundwater CSM

The highest PFAS concentrations in the AV legacy VOC plume/ETI system area were detected at monitoring well 30MW0585B (PFOS concentration of 2.6 µg/L in 2015) which is located southwest of Ashumet Pond, within the trailing edge of the AV VOC plume boundary (Figure 2). Monitoring well 30MW0585B was resampled in September 2019 and the PFOS concentration decreased to 0.68 µg/L.

PFHxS is the predominant PFAS in this area and PFHxS concentrations were higher than PFOS concentrations in over 60% of the groundwater samples collected. Contamination above the PFAS MCL is over 180 ft thick in this area (AFCEC 2024a). PFAS concentrations are lower and plume thickness decreases with distance from this area as it approaches the leading edge near Mill Pond.

3.1.5.3 Ashumet and Johns Pond Area Groundwater CSM

Groundwater in and downgradient of the Ashumet and Johns ponds area has been impacted by surface water containing PFAS discharging from the ponds and recharging the aquifer. PFAS concentrations in this area are lower than in the FTA-1 source area and the AV ETI area due to attenuation of the plume downgradient of the source area and dilution from clean groundwater entering the ponds (AFCEC 2024a). The highest PFOS concentration (0.464 µg/L) in the Ashumet and Johns ponds area was detected in the sample collected from 40 ft below the water table at boring 95DP4019 (Figure 2 – eastern shore of Johns Pond). The extent of PFAS contamination

decreases in vertical thickness with distance from Johns Pond from over 220 ft thick at boring 95DP4013, located near Johns Pond, to approximately 40 ft of contamination located in three separate 10 ft intervals at downgradient boring 95DP4040 (Figure 2 - south of Mashpee Turner Road Well #2).

PFAS detections were generally observed at the water table, even with distance from the ponds. Near the leading edge of the plume boundary PFAS MCL exceedances were located less than 20 ft below the water table, indicating that a large accretionary wedge of clean water below the water table does not develop with distance from the source areas or ponds for PFAS as is generally observed with the other JBCC groundwater contaminants. The depth to the top of the plume was deeper downgradient of the AV ETI system; however, this is likely a result of increased recharge from the infiltration trenches.

3.2 RISK ASSESSMENT RESULTS

3.2.1 Human Health Risk

In accordance with USAF policy, a human health risk screening (HHRS) was completed as part of the FTA-1 Supplemental RI (AFCEC 2024a) for the five PFAS (PFOS, PFOA, PFHxS, PFNA, and PFBS) for which Tier 3 toxicity data was available in the EPA regional screening levels (RSL) tables or RSL calculator (U.S. EPA 2022a and 2022b).

The HHRS indicated that while there is no estimated unacceptable human health risk from direct exposure to PFAS in source areas soils, PFAS concentrations in FTA-1 and possibly Former MMR STP soils do represent an ongoing leaching threat to groundwater, resulting in a potential risk to future residents through a drinking water exposure pathway (AFCEC 2024a).

There is no estimated unacceptable human health risk from direct exposure (recreator scenario) to PFAS in the surface water bodies sampled. While both PFOS and PFOA concentrations in surface water at Ashumet Pond exceeded recreator screening values based on a conservative hazard quotient (HQ) of 0.1, the risk ratio screening conducted in the HHRS applied a target HQ of 1. The calculated total Hazard Index (HI) for both PFOS and PFOA in surface water at Ashumet Pond was 0.6 (the acceptable HI risk range is a result less than 1). It is noted that the MDPH evaluated these PFAS concentrations and also concluded that there was no risk of harm for

recreational use of Ashumet Pond which is the pond where the highest PFAS concentrations were detected in surface water (AFCEC 2024a).

Based on the results of the HHRS using the maximum detected concentrations in groundwater, PFOS, PFOA, PFHxS, and PFNA were identified as COCs for site-wide groundwater (for a residential potable use scenario) since the HI and chemical-specific hazard quotients exceeded 1 (AFCEC 2024a). The interim action to be documented in this Draft ESD 2 adopts the groundwater COCs identified in the FTA-1 Supplemental RI.

The HHRS also evaluated risk from fish ingestion (AFCEC 2024a). A MDPH investigation (MDPH 2021) evaluated PFAS concentrations in fish tissue from Johns Pond. Using the maximum detected concentration of PFOS in Johns Pond fish tissue (170 µg per kilogram [µg/kg]) from the MDPH investigation, fish ingestion risks were estimated for an adult and child receptor (i.e., fish consumers). The risk estimates were calculated using EPA's RSL calculator (EPA 2022b). The noncancer hazard estimates for the adult and child fish consumers (HI = 24 and HI = 33, respectively) exceed the HI target of 1; therefore, PFOS was identified as a COC for fish ingestion.

A fish tissue evaluation for PFAS was also conducted for Ashumet Pond (MassDEP 2023) which reported the mean detected concentration of PFOS in Ashumet Pond fish tissue was 187.78 µg/kg. This mean concentration exceeds the *maximum* detected concentration of PFOS in Johns Pond fish used in the HHRS (AFCEC 2024a). As such, the noncancer hazard estimates for the adult and child fish consumers at Ashumet Pond will also exceed the HI target of 1 indicating PFOS in Ashumet Pond is also a COC for fish ingestion.

The MDPH's Freshwater Fish Consumption Advisory List published in May 2024 (MDPH 2024) now includes a state advisory to not eat any fish from Ashumet Pond for both sensitive and general populations due to PFAS and mercury. Earlier state advisories were for mercury only and advised limited consumption of fish from Ashumet Pond. Similarly, the MDPH's May 2024 advisory list for Johns Pond includes an advisory for sensitive populations to not eat any fish and general populations to eat limited fish from Johns Pond.

3.2.2 Ecological Risk

A complete exposure pathway exists for terrestrial receptors exposed to surface soil in the immediate vicinity of the FTA-1 source area and Former MMR STP locations. PFAS concentrations in surface soils were below direct-exposure benchmarks, and risks to lower trophic level receptors including plants and invertebrates was negligible. Estimated dietary exposure risks for terrestrial receptors, based on conservative exposure assumptions, were negligible for all wildlife receptor groups assessed except for mammalian invertivores (short-tailed shrew), mammalian carnivore (long-tailed weasel), and avian invertivores (American woodcock). Further assessment of these three wildlife feeding groups resulted in a conclusion of negligible risk to the long-tailed weasel. Concentrations of PFOS in individual samples at the FTA-1 source area presented a low risk to American woodcock and moderate risk for short-tailed shrew. However, risks to all receptors were negligible at the Former MMR STP.

Aquatic and semi-aquatic receptors may be exposed to concentrations of PFAS in freshwater surface water and sediments in waterbodies downgradient of the release locations. Dietary risks from exposure to sediments (collected from Ashumet Pond) are negligible as estimated exposure doses were below the screening thresholds for all aquatic wildlife receptors. Risks to aquatic and semi-aquatic receptors from dietary exposure to surface water were identified as negligible for avian herbivores (mallard) and insectivores (spotted sandpiper), and several piscivores (osprey, herring gull, belted kingfisher). Risks to mammalian piscivores (mink and river otter) were negligible when more commonly used effects values and available fish tissue concentrations were considered (AFCEC 2024a).

3.3 PFAS REMOVAL ACTIONS

During the Supplemental RI, PFOS and PFOA were detected above the 2016 EPA lifetime HA (0.07 µg/L for PFOA and PFOS, individually or combined: this HA has since been rescinded by EPA but was used as the basis for the removal actions conducted in 2017/2018), downgradient of the FTA-1 source area, in several private drinking water wells in Falmouth and Mashpee, one (1) public drinking water supply well serving a trailer park in Mashpee, and one (1) municipal drinking water supply well in Mashpee. Removal actions were undertaken to address PFOS/PFOA above

0.07 µg/L in drinking water at these locations as part of a time-critical removal action (AFCEC 2018a) as follows:

- The private residential well owners were notified and bottled water was delivered by the USAF until subsequent mitigation measures (i.e., continued bottled water, whole-house water filtration systems, or connection to municipal drinking water) if required, were conducted.

- The impacted public water supply well serviced 73 residences at a trailer park (Lakeside Estates) and is shown on Figure 2. Those residences were provided bottled water until all 93 trailer park units (including 20 vacant units) were connected to the Mashpee Water District's municipal drinking water supply by the USAF in December 2017.

- The impacted municipal drinking water supply well, the Mashpee Village Well shown on Figure 2, is operated by the Mashpee Water District and was shut down in February 2017. The Mashpee Village Well restarted operation in February 2020 after the USAF constructed a wellhead treatment system using GAC.

MassDEP promulgated a MMCL (0.02 µg/l) for PFAS6 in October 2020. Subsequent removal actions conducted by the USAF were based on a September 2021 decision to apply a draft Department of Defense (DoD) policy to conduct removal actions at drinking water wells with detections above the PFAS6 MMCL but below the now-rescinded EPA HA of 0.07 µg/L if other drinking water wells in the hydrologically connected plume had PFOS/PFOA detections above 0.07 µg/L (which is the case).

The USAF identified thirteen (13) residential wells that exceeded the PFAS6 MMCL. Through two Time Critical Removal Actions (issued as Emergency Action Memorandums), these thirteen (13) residences were provided with bottled water until 1) other measures are selected to offer an alternative water supply at these residences or 2) PFAS concentrations at the residences are consistently below the PFAS6 MMCL and groundwater data in the area indicate PFOS and PFOA concentrations are below 0.07 µg/L for PFOA and PFOS, individually or combined, in accordance with DoD policy (AFCEC 2022e and 2022f).

Additionally, the USAF conducted non-time critical removal actions in 2022-2023 (AFCEC 2022d) and in 2024 (AFCEC 2023c) which included the following removal actions:

- Connected eight (8) private residences with residential wells that exceeded the PFAS6 MMCL in Mashpee and Falmouth (four [4] in Falmouth and four [4] in Mashpee). These residences were previously receiving bottled water either from MassDEP or the USAF.

- Constructed a non-permanent ion exchange (IX) wellhead treatment system at the Fresh Pond municipal water supply well operated by the Town of Falmouth. This system was started in June 2022 (Figure 2).

- Constructed a permanent GAC wellhead treatment system at the Turner Road municipal water supply wells (Wells #2 and #5) operated by the Mashpee Water District. This system was started in November 2023 (Figure 2).

- Installed a whole-house GAC filtration system on a residence that had been receiving bottled water.

The USAF continues to conduct residential drinking water well sampling as part of the previously described removal actions associated with the FTA-1 PFAS groundwater plume. The determination to 1) continue, discontinue, or reinstate PFAS-related removal actions (bottled water or treatment systems) at residences that were not connected to municipal water, or 2) connect residences to municipal water, is now based on data compared to the PFAS6 MMCL or PFAS levels stipulated in DoD's 3 Sep 2024 memorandum *Prioritization of Department of Defense Cleanup Actions to Implement the Federal Drinking Water Standards for Per-and Polyfluoroalkyl Substances Under the Defense Environmental Restoration Program* (DoD 2024) which was issued after EPA promulgated PFAS MCLs on 26 Apr 2024 (discussed in Section 1). The DoD memorandum requires PFAS concentrations to be at or above three times the MCL values to conduct removal actions at residential drinking water supply wells. Currently (Dec 2025), one residential drinking water supply well associated with the FTA-1 PFAS groundwater plume meets the DoD criteria (in addition to exceeding the PFAS MMCL) and has a treatment system in place (installed by the USAF). As of Dec 2025, four residential drinking water supply wells associated with the FTA-1 PFAS groundwater plume exceed the PFOS and/or PFOA MCL but do not exceed DoD's three times the MCL criteria and no removal actions are in place for these four wells (additionally, these locations do not exceed the PFAS6 MMCL).

Upon finalization of this Draft ESD 2 and resultant implementation of the FTA-1 PFAS interim remedial action the criteria for residential drinking water supply well mitigation will change from that used during the above-described removal actions and the USAF will mitigate exposure to

residential drinking water wells with PFAS COC concentrations exceeding the federal MCLs or MMCLs and attributable to the FTA-1 PFAS plume as described in Appendix B.

3.4 REMEDIAL ACTION OBJECTIVES FOR INTERIM REMEDY ESTABLISHED IN ESD 2

This section provides a discussion of the RAOs developed for the interim remedy proposed in this Draft ESD 2. The proposed interim remedy adds RAOs to address human exposure to PFAS in groundwater and fish tissue and to reduce contaminant mass and reduce migration of PFAS in groundwater.

3.4.1 Groundwater Exposure RAOs for Legacy COCs

The following RAOs that were developed for the AV chlorinated solvent groundwater plume final CERCLA remedy (AFCEE 2009 and 2011) presented in Section 2.2.4 still apply for the interim remedy proposed in this ESD:

- Prevent residential exposure to AV groundwater with TCE concentrations greater than the MCL of 5 µg/L.
- Prevent residential exposure to AV groundwater with PCE concentrations greater than the MCL of 5 µg/L.
- Prevent residential exposure to groundwater located between Kittridge Road and the western shore of Ashumet Pond that has been impacted by the AV plume and that contains manganese concentrations greater than the lifetime HA of 300 µg/L.
- Prevent residential exposure to groundwater located between Kittridge Road and the western shore of Ashumet Pond that has been impacted by the AV plume and that contains thallium concentrations greater than the MCL of 2 µg/L.

3.4.2 Groundwater Exposure RAOs for PFAS COCs

Based on the presence of PFOS, PFOA, PFHxS, and PFNA within the FTA-1 site (which includes the AV chlorinated solvent plume) at concentrations that exceed regulatory standards and pose a potential risk to future residents through a drinking water exposure pathway (Section 3.2), additional RAOs were developed for these new COCs (PFOS, PFOA, PFHxS, and PFNA) for groundwater. Federal PFAS MCLs and Massachusetts MCLs (PFAS6) have been promulgated and are considered proposed ARARs at FTA-1 (Appendix A), therefore, the new proposed RAOs for residential exposure to PFAS in groundwater are as follows:

- Prevent residential exposure to FTA-1 groundwater with PFOS or PFOA concentrations greater than the federal MCL of 0.004 μg/L.

- Prevent residential exposure to FTA-1 groundwater with PFHxS or PFNA concentrations greater than the federal MCL of 0.010 μg/L.

- Prevent residential exposure to FTA-1 groundwater with mixtures containing two or more of PFHxS, PFNA, PFBS, and HFPO-DA at concentrations resulting in more protective standard of either: 1) a Hazard Index (HI) ≥ 1, as the term "HI" is defined under the SDWA; 2) have a non-carcinogenic risk HI > 1, as the term "HI" is defined under CERCLA; or 3) would result in a total excess lifetime cancer risk greater than the target risk range of 1×10^{-4} to 1×10^{-6}, as defined under CERCLA.

- Prevent residential exposure to FTA-1 groundwater with PFAS concentrations greater than the PFAS6 MMCL of 0.02 μg/L. The PFAS6 concentration consists of the sum of the PFOS, PFOA, PFHxS, PFNA, PFHpA, and PFDA concentrations.

3.4.3 Groundwater Restoration RAO for Existing COCs

The groundwater restoration RAO from the final CERCLA remedy (AFCEE 2009, 2011) will apply to the existing COCs (TCE, PCE, manganese, thallium) as part of the interim remedy being proposed in this ESD:

- Restore usable groundwaters to their beneficial uses wherever practicable, within a time frame that is reasonable given the particular circumstances of the site.

3.4.4 Groundwater Migration Management RAO for PFAS COCs

The following migration management RAO will apply for PFAS COCs (updated restoration timeframes and RAOs for FTA-1 [OU-15] will be established in a future decision document):

- Reduce contaminant mass and limit migration of groundwater from the contaminated groundwater source zone upgradient of Sandwich Road and in the AV legacy VOC Plume/ETI system area that contain PFAS COCs at concentrations that exceed ARARs or EPA's acceptable carcinogenic risk range of 1×10^{-4} and 1×10^{-6} or have a non-carcinogenic risk greater than an HI of 1.

3.4.5 Fish Consumption RAO for PFOS

RAOs to address the reduction of PFOS concentrations in fish in Ashumet and Johns Ponds (that may facilitate the relaxation of the current fish consumption advisories) will be established in future decision documents. In the interim, this ESD includes an RAO to address exposure to PFOS in fish at Ashumet and Johns Ponds:

- Prevent human consumption of fish from Ashumet and Johns Ponds with PFOS concentrations that have a non-carcinogenic risk greater than an HI of 1.

3.5 GROUNDWATER ALTERNATIVE DEVELOPMENT AND ANALYSIS FROM MEMORANDUM TO THE FILE TO ADDRESS PFAS

A groundwater alternatives analysis was conducted in the *Memorandum to the File Alternative Analysis to Limit Migration of Per- and Polyfluoroalkyl Substances at Fire Training Area-1 (Operable Unit 15) Groundwater, Joint Base Cape Cod, MA* (AFCEC 2025a) which is herein called the "Memorandum to the File". This Draft ESD 2 for an interim action focuses on the three alternatives evaluated in the Memorandum to the File. These three alternatives included the existing groundwater remedy for legacy COCs with the addition of active treatment for PFAS in groundwater. These three alternative evaluations are described in the following sections.

3.5.1 Basis for Alternative Development for Groundwater

The Memorandum to the File applied a response action strategy for groundwater developed over many years by the JBCC IRP that utilized groundwater extraction via wells for *ex situ* treatment to remove contaminants to acceptable concentrations and then return of treated water to the aquifer via reinjection or infiltration as well as LUCs to prevent exposure to contaminated groundwater.

LUCs, as described in Appendix B, are a component of the remedies for all the IRP groundwater plumes at JBCC that follow a LUC implementation, monitoring, and reporting program that is well developed, very effective, and is documented in the *Land Use Control Implementation Plan Update for IRP and MMRP Sites at the Joint Base Cape Cod* (AFCEC 2023a).

Evaluation methods to predict contaminant fate and transport in groundwater to support alternatives evaluation using groundwater modeling are well developed and available to the JBCC

IRP team. In addition, as identified by the Interstate Technology and Regulatory Council (ITRC), *ex situ* treatment technologies for PFAS in extracted groundwater are well-developed and available (ITRC 2021). This technology has been applied to a number of water supply situations throughout Massachusetts, as well as in the communities near JBCC to address VOCs and other contaminants and have also proven to be successful in addressing PFAS. These include sorption technologies such as GAC and IX resins. GAC may be reactivated and certain IX resins may be regenerated, either off-site or on-site, should PFAS loading justify reuse. The technologies may be applied to groundwater remediation as well as water supply situations.

The ITRC categorizes *ex situ* treatment involving sorption technologies, including GAC, IX resin, and reverse osmosis as a field implemented technology (i.e., implemented by "multiple parties at multiple sites and the results have been documented well in the peer reviewed literature") (ITRC 2021). *Ex situ* treatment using GAC was the selected technology for the active treatment alternatives discussed in Section 3.5.2. This technology allows the USAF to use treatment infrastructure that has already been constructed for legacy contaminants.

3.5.2 Remedial Alternatives for Groundwater

Three groundwater remedial alternatives evaluated in the Memorandum to the File to address PFAS are discussed in this Draft ESD 2. Two alternatives included active groundwater remediation in the AV ETI area, and one alternative included active groundwater remediation between the source area and Ashumet Pond (along Sandwich Road). Each of the three active groundwater remediation alternatives also include site-wide LUCs described in Appendix B, monitoring, and mitigation of exposure to residential drinking water wells, not addressed by previous removal actions, with PFAS COC concentrations exceeding the federal MCLs or MMCLs and attributable to the FTA-1 PFAS plume.

Groundwater Alternative – Existing Remedy, Including Adding PFAS as COCs, and Optimizing the AV Remedial System

This alternative would include continued implementation of the existing CERCLA remedy for the AV plume legacy COCs, adding PFAS (PFOS, PFOA, PFHxS, and PFNA) as COCs, expanding LUC boundaries to encompass groundwater exceeding PFAS regulatory standards, and restarting and optimizing the AV remedial system to target capture of higher concentration PFAS

contaminated groundwater detected in the AV legacy VOC Plume/ETI system area. The AV remedial system would be restarted and optimized to capture and treat PFAS contamination using extraction wells 95EW0702 and 95EW0703 and converting 95EW0701 into a reinjection well to reinject water that was treated for PFAS by GAC at the AV treatment plant (Figure 5). The two infiltration trenches would no longer be used. For this alternative, 95EW0702 and 95EW0703 were simulated at a flow rate of 250 gpm each to assess remedial performance. A monitoring program would be implemented for PFAS to provide data to assess the performance of the remedy. Treatment plant samples would be collected to ensure compliance with the effluent discharge criteria for PFAS. This alternative includes applying existing LUCs detailed in the earlier decision documents (AFCEE 2009 and 2011) to a larger area (i.e., FTA-1 LUC Area depicted in Figure 2) to prevent exposure to PFAS contaminated groundwater.

Groundwater Alternative – Existing Remedy, Including Adding PFAS as COCs, and Optimizing the AV Remedial System with Additional Infrastructure

This alternative includes the same components as the alternative described in the previous paragraph with two new additional deep screened reinjection wells installed at the northern and southern ends of the Currier Road infiltration trench (Figure 6). The AV remedial system would be restarted and optimized to capture and treat PFAS contamination using extraction wells 95EW0701, 95EW0702, and 95EW0703. For this alternative, 95EW0701, 95EW0702, and 95EW0703 were simulated at a flow rate of 400 gpm, 500 gpm, and 500 gpm, respectively, to assess remedial performance. Groundwater would be treated for PFAS by GAC at the AV treatment plants and effluent was simulated at a reinjection flow rate of 700 gpm at each of the new two reinjection wells. The two infiltration trenches would no longer be used. The addition of two new reinjection wells allows for a higher system flow rate which increases the extent of the hydraulic capture zone under this scenario. The placement of the reinjection wells along the Currier Road trench also assists in hydraulic control of the PFAS groundwater contamination located within the former footprint of the AV plume as it migrates downgradient. A similar monitoring program as described in the previous alternative would be implemented for PFAS to provide data to assess performance of the remedy. Treatment plant samples would be collected to ensure compliance with the effluent discharge criteria for PFAS. This alternative includes applying existing LUCs detailed in the earlier decision documents (AFCEE 2009 and 2011) to a larger area

(i.e., FTA-1 LUC Area depicted in Figure 2) to prevent exposure to PFAS contaminated groundwater.

Groundwater Alternative – Existing Remedy, Including Adding PFAS as COCs, and Adding Remedial Infrastructure Along Sandwich Road

This alternative includes the installation of seven new shallow extraction wells and three new reinjection wells in the area between the FTA-1 source area and Ashumet Pond to reduce the amount of PFAS groundwater contamination that is currently discharging into Ashumet Pond. The seven new extraction wells will be installed along Sandwich Road, mostly to the south of the existing Chemical Spill-10 (CS-10) SR extraction well system, to intercept upgradient PFAS groundwater contamination that would otherwise discharge into Ashumet Pond or migrate to the south into the AV plume area (Figure 7). Simulated extraction rates range from 100 gpm to 250 gpm for each extraction well, with a total extraction flow rate of 1,350 gpm. Groundwater would be treated for PFAS by GAC at the Sandwich Road Treatment Facility (SRTF) and the treated water would be reinjected into the aquifer using the current CS-10 SR and Storm Drain-5 North (SD-5N) reinjection wells and three new reinjection wells located along SR farther to the southwest to provide a hydraulic barrier to southward PFAS migration from the source area and to divert PFAS migration northeastward toward the new extraction wells. A similar monitoring program as described in the first two alternatives would be implemented for PFAS to provide data to assess performance of the remedy and to confirm that PFAS groundwater contaminant concentrations within the FTA-1 PFAS plume decrease due to the operation of the new remedial system. Treatment plant samples would be collected to ensure compliance with the effluent discharge criteria for PFAS. This alternative includes applying existing LUCs detailed in the earlier decision documents (AFCEE 2009 and 2011) to a larger area (i.e., FTA-1 LUC Area depicted in Figure 2) to prevent exposure to PFAS contaminated groundwater.

3.5.3 Summary of Alternatives Analysis

The NCP at 40 CFR 300.430(e)(9)(iii) establishes the nine (9) criteria against which remedial alternatives must be evaluated and compared.

- Overall protection of human health and the environment;
- Compliance with ARARs;
- Long-term effectiveness and permanence;

- Reduction of toxicity, mobility, or volume through treatment;
- Short-term effectiveness;
- Implementability;
- Cost;
- State acceptance;
- Community acceptance.

The first two criteria, overall protection of human health and the environment and compliance with ARARs, are threshold criteria that represent basic requirements any remediation alternative must satisfy. Therefore, each alternative must meet these minimum requirements in order to be eligible for selection. The next five criteria: long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost are primary balancing criteria. The last two criteria, state acceptance and community acceptance, are modifying criteria and are typically evaluated during a public comment period (EPA 1988 and 1999).

A comparative analysis of the three groundwater alternatives described in Section 3.5.2 against the NCP criteria is included in Table 1. This analysis was a key component of selecting the additional active treatment portion of the interim remedy documented in this Draft ESD 2. The selected alternative for the proposed interim remedy documented in this Draft ESD 2 is a combination of two alternatives described in Section 3.5.2: Existing Remedy, Including Adding PFAS as COCs, and:

- Optimizing the AV Remedial System with Additional Infrastructure, and
- Adding Remedial Infrastructure Along Sandwich Road.

4. DESCRIPTION OF SIGNIFICANT DIFFERENCES AND EXPECTED OUTCOMES

The remedial investigation of the nature and extent of the FTA-1 PFAS groundwater plume combined with the groundwater remedial alternative development and evaluation process described in Section 3 form the basis for the proposed interim remedial action selected in this Draft ESD 2. The DoD *Memorandum for Taking Interim Action to Address Per- and Polyfluoroalkyl Substances Migration from DoD Installations and National Guard Facilities* dated 11 July 2023 directs DoD components to evaluate the data gathered during remedial investigations to prioritize implementation of interim actions as expeditiously as possible to mitigate further PFAS plume migration or on-going impacts to groundwater (DOD 2023). The implementation of groundwater extraction using the existing AV ETI system with additional infrastructure and additional extraction wells along Sandwich Road proposed in this Draft ESD 2 will significantly mitigate migration and on-going impacts from the FTA-1 PFAS groundwater plume.

This section describes the significant differences between the current CERCLA remedy and the interim actions now proposed and the changes in the expected outcomes that result from this ESD.

4.1 SIGNIFICANT DIFFERENCES FROM THE SELECTED REMEDY

4.1.1 Convert Previous Final Remedy to an Interim Remedy

The AV/FTA-1 (OU-15) final groundwater remedy is changed to an interim groundwater remedy to account for ongoing USAF PFAS investigations which need to be completed before developing remedial alternatives that will achieve groundwater cleanup to drinking water standards throughout OU-15. A final remedy for OU-15 groundwater will be established in a future decision document.

4.1.2 Additional Contaminants of Concern (COCs)

The ESD adds four additional COCs (**bolded**) to the AV/FTA-1 (OU-15) groundwater CERCLA remedy:

- **PFOS,**
- **PFOA,**
- **PFHxS,**
- **PFNA,**
- PCE,
- TCE,
- manganese, and
- thallium.

4.1.3 Additional Remedial Action Objectives (RAOs)

The following list includes all the RAOs that are applicable to the interim remedy proposed in this ESD (see discussion at Section 3.4). The ESD adds additional RAOs (**bolded**) to the AV/FTA-1 (OU-15) groundwater CERCLA remedy:

- **Prevent residential exposure to FTA-1 groundwater with PFOS or PFOA concentrations greater than the federal MCL of 0.004 µg/L.**

- **Prevent residential exposure to FTA-1 groundwater with PFHxS or PFNA concentrations greater than the federal MCL of 0.010 µg/L.**

- **Prevent residential exposure to FTA-1 groundwater with mixtures containing two or more of PFHxS, PFNA, PFBS, and HFPO-DA at concentrations resulting in more protective standard of either: 1) a Hazard Index (HI) ≥ 1, as the term "HI" is defined under the SDWA; 2) have a non-carcinogenic risk HI > 1, as the term "HI" is defined under CERCLA; or 3) would result in a total excess lifetime cancer risk greater than the target risk range of 1 x 10^{-4} to 1 x 10^{-6}, as defined under CERCLA.**

- **Prevent residential exposure to FTA-1 groundwater with PFAS concentrations greater than the PFAS6 MMCL of 0.02 µg/L. The PFAS6 concentration consists of the sum of the PFOS, PFOA, PFHxS, PFNA, PFHpA, and PFDA concentrations.**

- Prevent residential exposure to AV groundwater with TCE concentrations greater than the MCL of 5 µg/L.

- Prevent residential exposure to AV groundwater with PCE concentrations greater than the MCL of 5 µg/L.

- Prevent residential exposure to groundwater located between Kittridge Road and the western shore of Ashumet Pond that has been impacted by the AV plume and that contains manganese concentrations greater than the lifetime HA of 300 µg/L.

- Prevent residential exposure to groundwater located between Kittridge Road and the western shore of Ashumet Pond that has been impacted by the AV plume and that contains thallium concentrations greater than the MCL of 2 µg/L.

- For existing COCs (TCE, PCE, manganese, thallium), restore usable groundwaters to their beneficial uses wherever practicable, within a time frame that is reasonable given the particular circumstances of the site.

- **Reduce contaminant mass and limit migration of groundwater from the contaminated groundwater source zone upgradient of Sandwich Road and in the AV legacy VOC Plume/ETI system area that contain PFAS COCs at concentrations that exceed ARARs or the acceptable carcinogenic risk range of 1 x 10^{-4} and 1 x 10^{-6} or have a non-carcinogenic risk greater than an HI of 1**.

- **Prevent human consumption of fish from Ashumet and Johns Ponds with PFOS concentrations that have a non-carcinogenic risk greater than an HI of 1.**

4.1.4 Applicable or Relevant and Appropriate Requirement (ARARs) and To Be Considered (TBC) Guidances

This proposed ESD adds regulations establishing federal MCLs and more stringent Massachusetts MCLs for four PFAS COCs as ARARs to the remedy, modifies the OU-15 ROD ARARs to address the change in the groundwater remedy from a final remedy to an interim remedy, and revises or modifies other ARARs identified in the ROD based on federal and state regulatory/statutory changes since the ROD was issued. The proposed ARARs and TBCs for the modified OU 15 remedy are identified in tables located in Appendix A, with the changes from the OU 15 ROD bolded and italicized.

4.1.5 Scope

This Draft ESD 2 proposes to change the remedy's *final* groundwater remedy to an *interim* remedy and adds COCs and RAOs for the interim groundwater remedy. The change in scope is required because the USAF needs to conduct additional PFAS investigations before a final OU 15 groundwater remedy can be developed. This ESD also adds an interim action to implement alternatives from the Memorandum to the File which expand the LUC and groundwater treatment areas and adds an estimated seven (7) extraction and five (5) reinjection wells to address PFAS in FTA-1 groundwater (Figures 2, 6, and 7). While the treatment process (GAC) will not be changed, the treatment capacity will be increased by integrating GAC treatment trains housed in the SRTF to treat extracted groundwater from the new SR extraction wells. The LUCs are in place and are functioning as intended for the existing AV groundwater COCs and will be expanded to include a significantly greater area where there are exceedances of regulatory standards for the PFAS COCs as delineated in the FTA-1 LUC boundary as shown on Figure 2. To meet LUC performance objectives and DoD and USAF policy (DoD 2024), the USAF will mitigate exposure to drinking water wells with PFAS COC concentrations exceeding the federal MCLs or MMCLs and attributable to the FTA-1 PFAS plume, to include measures necessary to ensure that the Town of Falmouth and Mashpee Water District municipal water supply treatment systems installed as part of the CERCLA removal actions (described previously in Section 3.3) remain adequate to protect users of their water supplies from OU-15-related contamination. A LUC to address human

consumption of fish in Ashumet and Johns Ponds will also be added. Appendix B contains the updated LUC performance objectives and LUC requirements proposed in this ESD 2.

4.1.6 Performance

4.1.6.1 Long-Term Effectiveness and Permanence

The performance of the groundwater remedy, being an interim remedial action, would not be permanent and only needs to maintain effectiveness until a final groundwater remedy is established. Nonetheless, the groundwater treatment component of the interim remedy will provide a relative degree of contribution toward long-term effectiveness in decreasing contaminant mass and limiting migration.

The interim groundwater remedy would provide protection to human receptors from drinking contaminated water and consuming fish from Ashumet and Johns Ponds once institutional controls are in place, but long-term effectiveness requires compliance monitoring and enforcement, as required, over a larger area than established by the ROD remedy until a final groundwater remedy is established.

4.1.6.2 Short-Term Effectiveness

Implementation of the interim groundwater remedy will be effective in the short-term through limited treatment to reduce PFAS contamination in groundwater and limit migration, as well as the establishment of an expanded LUC area to prevent community impacts from exposure to contaminated groundwater. Performance criteria regarding the protection of community and workers during remediation and environmental impacts will not be significantly changed by the additional operation and maintenance of the groundwater treatment system to address PFAS and any additional remedial construction (including monitoring well installation) that may be required.

4.1.7 Cost

The cost for the CERCLA remedy will significantly increase as a result of this ESD. The estimated cost cited in the 2009 AV Groundwater ROD was $18M for the selected alternative (AFCEE 2009). With the significant remedy changes established through this ESD, the estimated cost is

increased by $84.1M (AFCEC 2025a). Additional information regarding estimated costs of the interim remedy can be found in Table 1.

4.2 EXPECTED OUTCOMES

The LUCs established in this interim remedy will reduce the risk of 1) exposure to contaminated groundwater in the FTA-1 plume, 2) consumption of fish from Ashumet and Johns Ponds, and 3) accidental damage to infrastructure associated with the active treatment systems.

The interim remedy with active treatment systems proposed in this ESD addresses contaminant reduction and management of migration, but not full groundwater restoration. A final groundwater remedy that addresses FTA-1 groundwater restoration will be established as part of a future CERCLA decision document. The following sections describe the estimated mass removal and migration management outcomes for the active treatment systems included as part of the interim remedy proposed in this ESD. Although the referenced figures are based on the PFAS6 Massachusetts MCL, the overall remedy performance and effectiveness assessment results presented below may vary based on more stringent federal PFAS MCL requirements and will be evaluated in the implementation of the final remedy.

4.2.1 AV Remedial System Area

This alternative restarts and optimizes the AV remedial system to capture and treat PFAS contamination using the existing extraction wells (95EW0701, 95EW0702, and 95EW0703). Groundwater would be treated for PFAS by GAC at the existing AV treatment plants and effluent would be directed to two new reinjection wells (Figure 6).

Figure 8 shows frames for ten different years from the plume migration animation in the AV remedial system area. This figure assumes system start-up in 2024 and indicates the extraction wells will target higher concentration areas (shown in red and bright green) while a lower concentration area (shown in blue and green) beyond the capture zone will remain relatively immobile and will be addressed by the final remedial action, as required.

Figure 9 plots extraction well performance versus time for this alternative. The cumulative mass removal curves show asymptotic flattening and inefficient operation as the influent concentration

drops over time. At the year 2080, an estimated total of 18.7 lbs of PFAS will have been removed from the aquifer.

4.2.2 New Extraction Wells Along Sandwich Road

This alternative uses seven new extraction wells along Sandwich Road to cut off advection to Ashumet Pond and three new reinjection wells to the southwest to create a hydraulic barrier. Groundwater would be treated for PFAS at SRTF and returned to the aquifer using existing CS-10 SR and SD-5N reinjection wells along with the three new reinjection wells (Figure 7).

Figure 10 shows frames for ten different years from the plume migration animation for this alternative in the Source Area to Ashumet Pond area. Figure 11 plots estimated influent concentration versus time and Figure 12 plots estimated cumulative mass removal versus time for each extraction well that would be installed along Sandwich Road as part of this alternative. The cumulative mass removal curves show asymptotic flattening and inefficient operation as the influent concentration drops over time.

Figure 13 depicts the estimated PFAS extent and concentrations that discharge into Ashumet Pond over time (mass that is not captured by the Sandwich Road extraction wells). The discharge pattern and concentrations are predicted to decline over time. Cumulative PFAS mass removal by the treatment system through 2052 would be approximately 31.7 lbs, mass that would otherwise discharge primarily to the pond, where it would maintain current contamination levels in the pond and then re-enter the groundwater system as a continuing source to the PFAS contamination downgradient of the pond (AFCEC 2025a).

5. STATUTORY DETERMINATION

This Draft ESD 2 proposes to modify the OU 15 CERCLA Remedy as follows:

- the remedy's *final* groundwater remedy is changed to an *interim* remedy to account for ongoing USAF investigations of PFAS which need to be completed before developing remedial alternatives that will achieve groundwater cleanup to drinking water standards throughout OU-15;

- adds a number of PFAS, specifically PFOS, PFOA, PFHxS, and PFNA as COCs to the remedy;

- adds federal MCLs and more stringent Massachusetts MCLs for these PFAS as ARARs to the remedy, modifies the OU-15 ROD ARARs to address the change in the groundwater remedy from a final remedy to an interim remedy, and revises or modifies other ARARs identified in the ROD based on federal and state regulatory/statutory changes since the ROD was issued;

- adds additional RAOs to prevent residential exposure to PFAS exceeding ARAR or risk-based standards in OU15 groundwater;

- adds a management of migration RAO for PFAS calling for reduction in contaminant mass and limiting migration of PFAS-contaminated groundwater from the contaminated groundwater source zone upgradient of Sandwich Road and in the AV legacy VOC Plume/Extraction, Treatment, and Infiltration (ETI) remedial system area;

- adds an RAO to prevent human consumption of fish in Ashumet and Johns Ponds due to PFAS contamination;

- adds an interim action to modify and operate parts of the current OU-14 and OU-15 groundwater treatment systems (in place to treat legacy groundwater contaminants) to treat PFAS in portions of the OU-15 plume;

- establishes a LUC to prevent human consumption of fish from Ashumet and Johns Ponds;

- expands the groundwater LUC boundary to encompass any exceedances of federal or more stringent state ARARs as an interim LUC until a final groundwater remedy is established;

- adds a requirement to mitigate exposure to residential drinking water wells, not addressed by previous removal actions, with PFAS COC concentrations exceeding the federal MCLs or MMCLs and attributable to the FTA-1 PFAS plume;

- ensures that municipal water supply treatment systems installed as part of the CERCLA removal actions (described in Section 3.3) remain adequate to protect users from OU-15-related contamination;

- expands the groundwater and surface water monitoring program to address new RAOs until a final groundwater remedy is established; and

- significantly adds to the estimated cost of the CERCLA remedy over the original estimated cost.

This interim action is protective of human health and the environment in the short term and is intended to provide adequate protection until a final decision document to address PFAS at OU 15 groundwater is signed, complies with those federal and Commonwealth of Massachusetts requirements that are legally applicable or relevant and appropriate for this limited scope action, and is cost-effective. Although this interim action is not intended to address fully the statutory mandate for permanence and treatment to the maximum extent practicable, this interim action does utilize treatment and thus supports that statutory mandate. Because this action does not constitute the final remedy for OU 15, the statutory preference for remedies that employ treatment that reduces toxicity, mobility, or volume as a principal element, although partially addressed in this interim remedy, will be addressed by the final response action. Subsequent actions are planned to address fully the threats posed by conditions at OU 15.

6. STATE AGENCY COMMENTS AND PUBLIC PARTICIPATION ACTIVITIES

As part of the ESD review process, the State (MassDEP) and the public will be given the opportunity to comment on this Draft ESD. Depending on the responses received the AFCEC may choose to finalize this document as the final ESD, modify the draft before finalizing, or choose not to issue the ESD. State and public comments will be addressed in writing by the AFCEC in a responsiveness summary to be attached to the final ESD, if issued, in Appendix F.

6.1 CONCURRENCE FROM THE MASSACHUSETTS DEPARTMENT OF ENVIRONMENTAL PROTECTION

If the State chooses to concur with the final ESD, if issued, their concurrence letter will be added as Attachment G to the final ESD.

6.2 PUBLIC PARTICIPATION ACTIVITIES

In accordance with Section 117(d) of CERCLA, 42 USC §9617(D), AFCEC published a notice in the local newspapers describing this ESD and its availability in the Administrative Record on [placeholder for future date]. In accordance with 40 CFR Section 300.435(c)(2)(i)(A) and 300.825(a)(2), this ESD and all documents that support the changes and clarifications are contained in the Administrative Record for the IRP at JBCC.

A 30-day public comment period will be held from 22 May 2026 to 20 June 2026. A summary of comments received, and the AFCEC's written responses, will be included in Appendix F of the final ESD, if issued.

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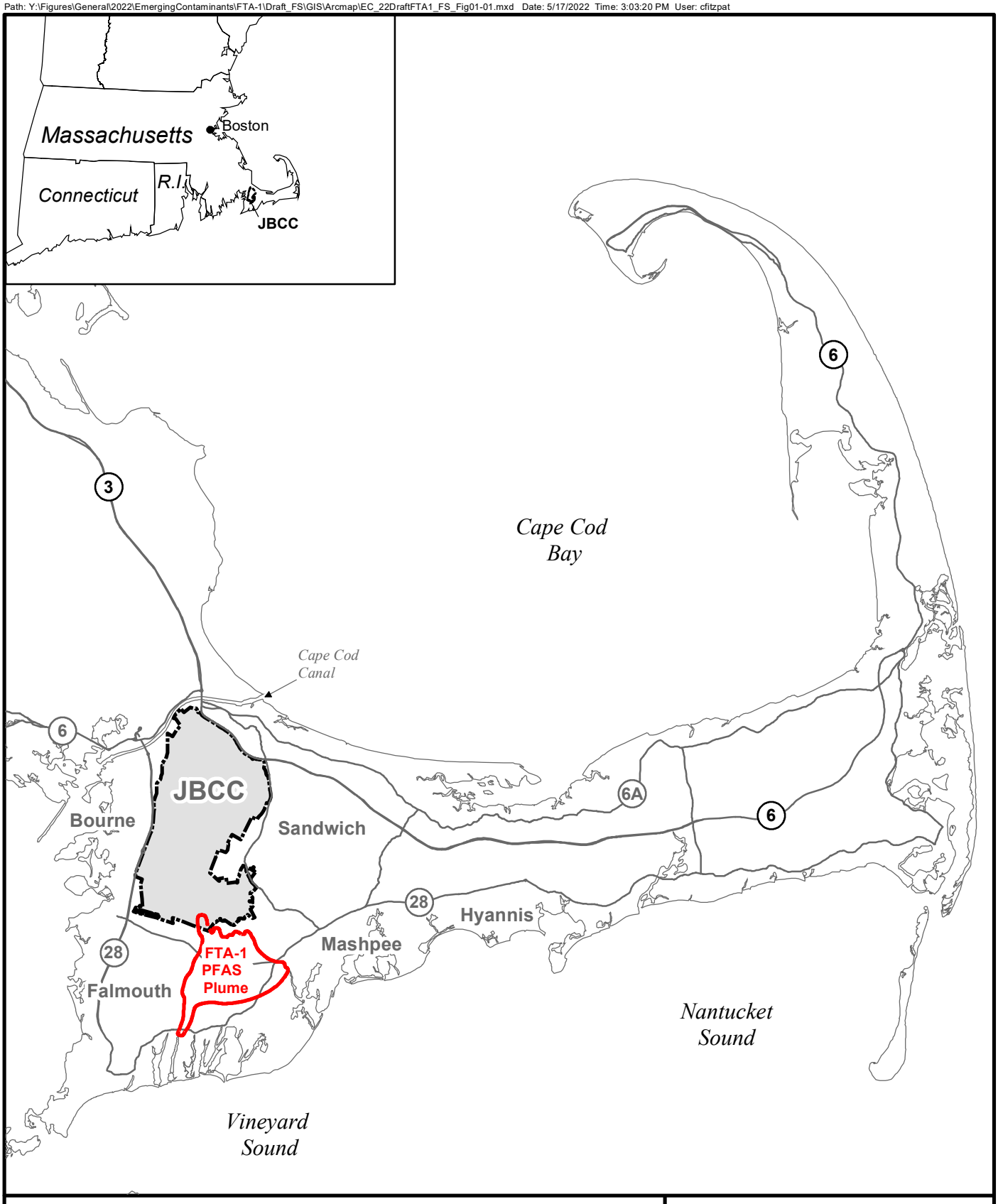
Figures



Legend

- Joint Base Cape Cod
- FTA-1 PFAS Plume (Dashed Where Inferred)

Data Source: AFCEC, May 2022
JBCC Boundary From Massachusetts Air National Guard 2011

0 2.5 5 Miles

FIGURE 1

JOINT BASE CAPE COD, MASSACHUSETTS

AFCEC - Joint Base Cape Cod
Explanation of Significant Differences for PFAS at FTA-1 (Operable Unit 15), JBCC, MA

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Joint Base Cape Cod

Wakeby Pond

Mashpee Pond

FTA-1 Source Area

JBCC Boundary

Former MMR Sewage Treatment Plant

Ashumet Pond

Ashumet Valley Plume

Mashpee Village Public Water Supply Well #6
Offline in February 2017; AFCEC installed Granular Activated Carbon wellhead treatment and returned well to service in February 2020

Lakeside Estates Community Wells
Both primary and backup wells disconnected; municipal connection to 93 units in 2018

Sea Mist Resort Non-Community Water Supply Wells

Mashpee Turner Road Well Public Water Supply Well #5
Taken offline in February 2019; Granular Activated Carbon wellhead treatment installed; returned to service November 2023

Mashpee Turner Road Well Public Water Supply Well #2
Taken offline in July 2020; Granular Activated Carbon wellhead treatment installed; returned to service November 2023

Falmouth Fresh Pond Public Water Supply Well
Taken offline in April 2017 due to perchlorate contamination; PFAS detected above PFAS6 MMCL in May 2019; Ion Exchange Resin wellhead treatment installed and well returned to service on 16 June 2022

Rock Landing Public Water Supply Well #3

Rock Landing Public Water Supply Well #2

Notes:
Multiple screen depths at locations ending in 'XXX.'
PFAS MCL: https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations#PFAS
PFAS6 MMCL: https://www.mass.gov/doc/supporting-documentation-for-drinking-water-standards-and-guidelines/download#page=262

0 1,600 3,200 Feet

Legend

- Joint Base Cape Cod Boundary
- Ashumet Valley PCE/TCE Plume Boundary
- Revised FTA-1 PFAS Plume Boundary (Dashed Where Inferred)
- Treatment System Pipeline
- Infiltration Trench
- Abandoned Sewage Treatment Beds
- Wampanoag-Owned Parcel
- Bog/Wetland
- Public Water Supply Well
- Extraction Well
- Irrigation Well
- Private Community Water Supply Well
- Proposed FTA-1 LUC Boundary

Data Source: AFCEC, October 2024
JBCC Boundary from Massachusetts Air National Guard 2011

PFAS Detections in Groundwater:
- No Detection for All PFAS of Concern
- Detection Below the PFAS6 MMCL and the PFAS MCL
- Exceedance of the PFAS6 MMCL or the PFAS MCL

* Above PFAS MCLs (Contamination Not Related To JBCC)
MCL = Maximum Contaminant Level
MMCL = Massachusetts Maximum Contaminant Level

FIGURE 2

FTA-1 PFAS DETECTIONS IN GROUNDWATER

AFCEC - Joint Base Cape Cod
Explanation of Significant Differences for PFAS at FTA-1 (Operable Unit 15), JBCC, MA

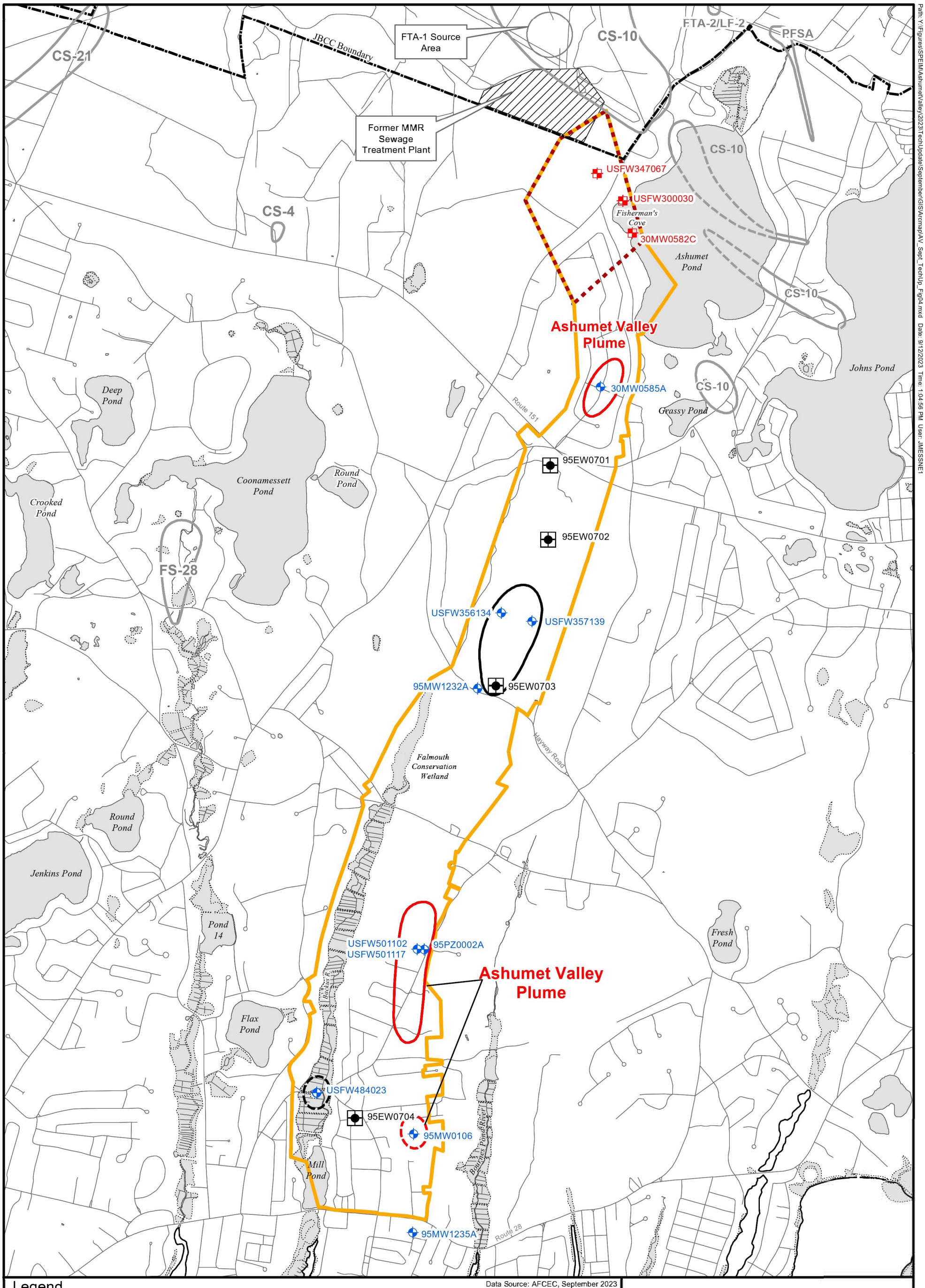

FIGURE 3

ASHUMET VALLEY 2023 PLUME BOUNDARY

AFCEC - Joint Base Cape Cod

Explanation of Significant Differences for PFAS at FTA-1 (Operable Unit 15), JBCC, MA

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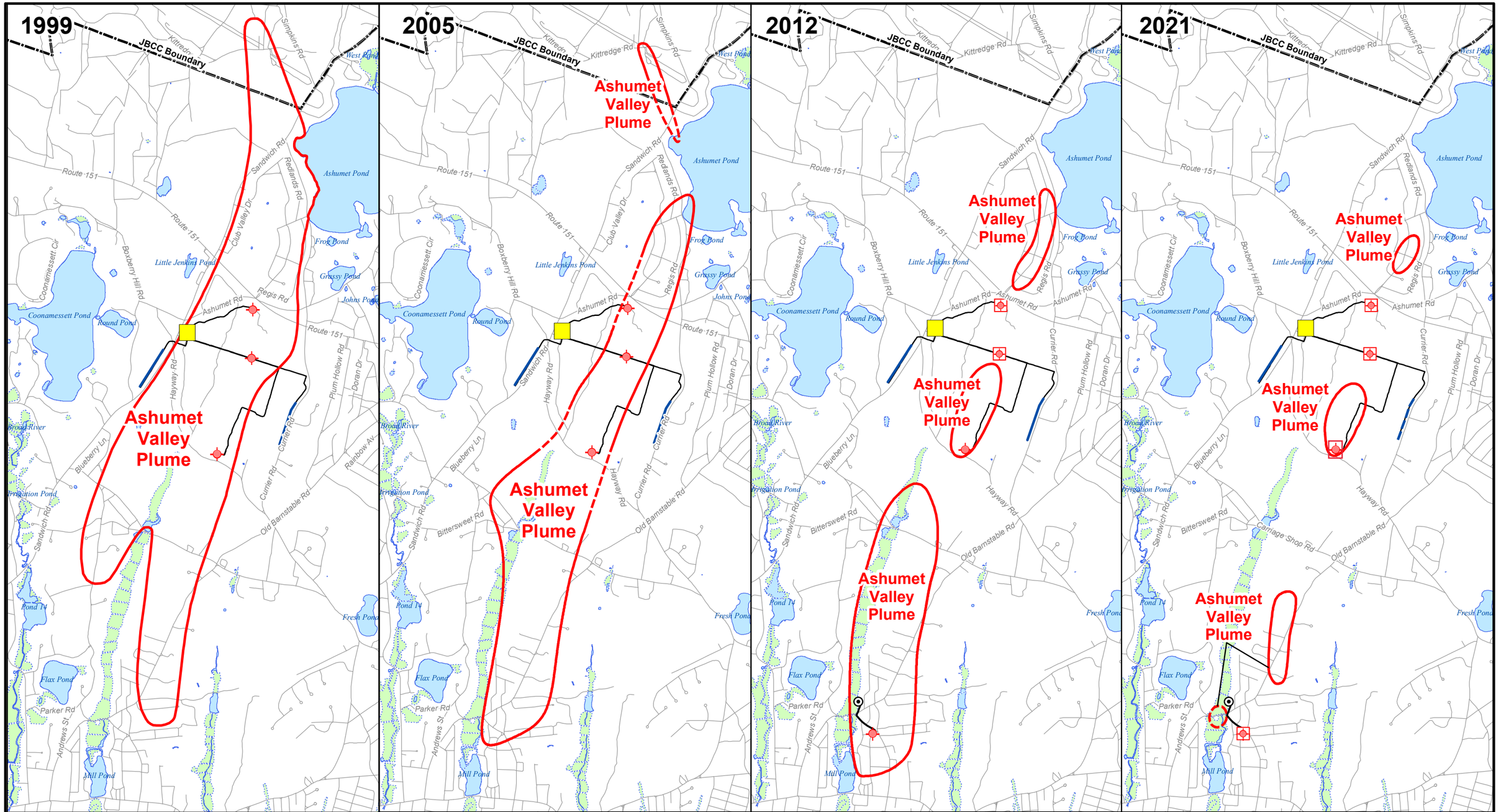


Legend

- Plume Boundary (Dashed Where Inferred)
- Treatment System Piping
- Infiltration Trench
- Joint Base Cape Cod Boundary
- Bog/Wetland
- Extraction Well (On)
- Extraction Well (Off)
- Treatment Facility
- Outflow Bubbler

Data Source: AFCEC, March 2022
JBCC Boundary from Massachusetts Air National Guard 2011

N

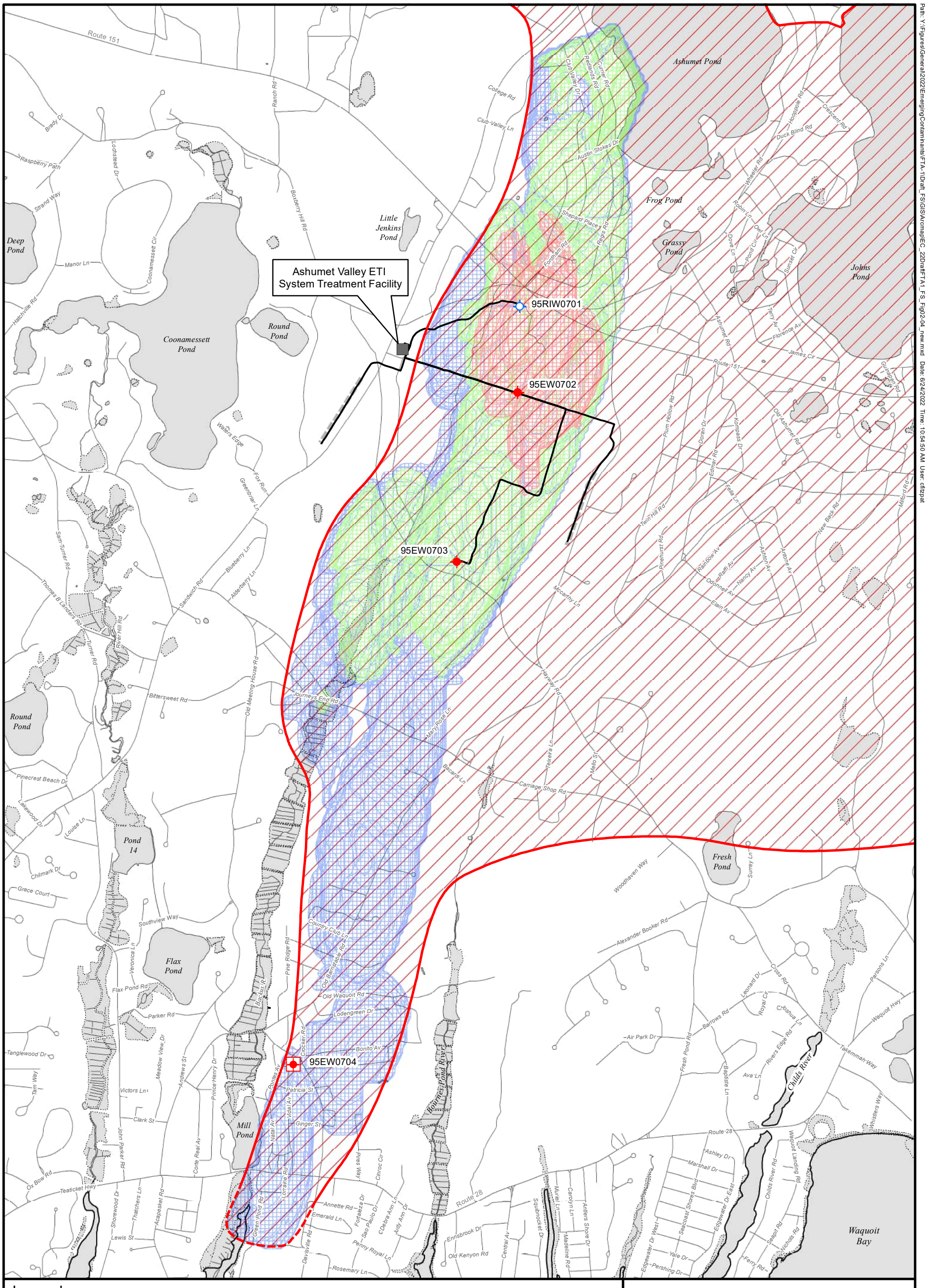
0 1,600 3,200
Feet

FIGURE 4

ASHUMET VALLEY PLUME BOUNDARY TEMPORAL CHANGES

AFCEC - Joint Base Cape Cod

Explanation of Significant Differences for PFAS at FTA-1 (Operable Unit 15), JBCC, MA



Legend

- FTA-1 PFAS6 Plume (Dashed Where Inferred)
- Bog/Wetland
- Treatment System Pipeline
- Infiltration Trench (Offline)
- Extraction Well (Off)
- Extraction Well (On)
- Proposed Conversion of an Extraction Well to a Reinjection Well

PFAS6 Plume Shell Isosurfaces:

- PFAS6 Isosurface: 0.02 µg/L
- PFAS6 Isosurface: 0.2 µg/L
- PFAS6 Isosurface: 2.0 µg/L

Data Source: AFCEC, June 2022

0 780 1,560 Feet

FIGURE 5

CONCEPTUAL LAYOUT FOR ALTERNATIVE WHICH OPTIMIZES AV REMEDIAL SYSTEM

AFCEC - Joint Base Cape Cod
Explanation of Significant Differences for PFAS at FTA-1
(Operable Unit 15), JBCC, MA

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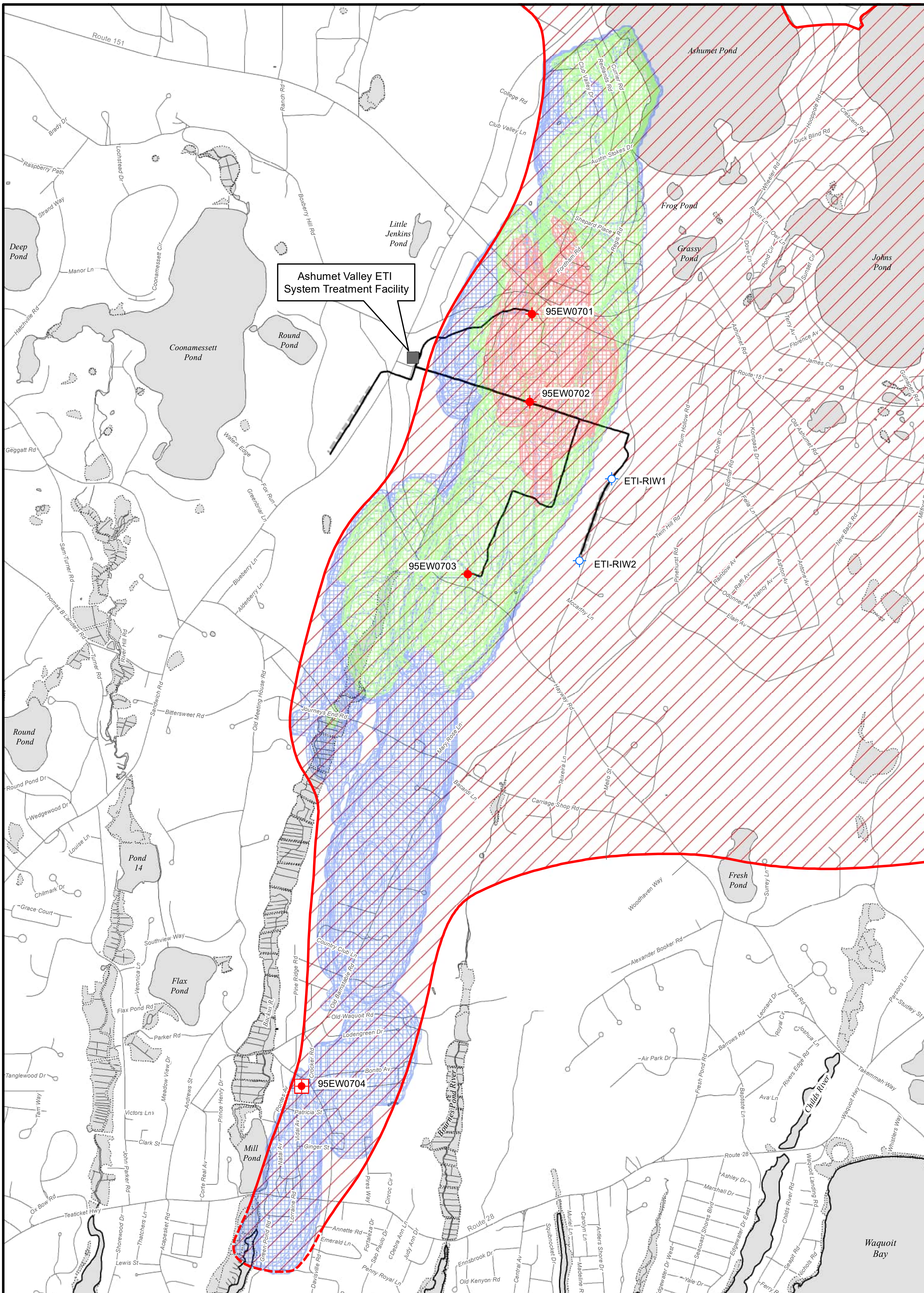
Ashumet Valley ETI
System Treatment Facility
95EW0701
95EW0702
95EW0703
95EW0704
ETI-RIW1
ETI-RIW2
Ashumet Pond
Frog Pond
Grassy Pond
Johns Pond
Little Jenkins Pond
Deep Pond
Coonamessett Pond
Round Pond
Round Pond
Pond 14
Flax Pond
Mill Pond
Fresh Pond
Waquoit Bay
Childs River
Bournes Pond River
Backus R.
Route 151
Route 28
Teaticket Hwy
Ranch Rd
Brady Dr
Lochstead Dr
Raspberry Path
Strand Way
Manor Ln
Coonamessett Cir
Boxberry Hill Rd
Hatchville Rd
Geggatt Rd
Waters Edge
Fox Run
Greenbriar Ln
College Rd
Club Valley Ln
Club Valley Dr
Redlands Rd
Currier Rd
Austin Stokes Dr
Shepard Place
Regis Rd
Fordham Rd
Hooppole Rd
Crescent Rd
Duck Blind Rd
Wheeler Rd
Robin Ln
Owl Ln
Dove Ln
Pond Cir
Sunset Cir
Terry Av
Florence Av
James Cir
Ashumet Rd
Guinapen Rd
Old Ashumet Rd
Plum Hollow Rd
Doran Dr
Kompass Dr
Edmar Rd
Fella Ln
Milford Rd
Twin Hill Rd
New Back Rd
Pinehurst Rd
Rainbow Av
Raffi Av
Ashton Av
Antone Av
Nancy Av
Odonnell Av
Elain Av
Mccarthy Ln
Hayway Rd
Teixeira Ln
Mello St
Carriage Shop Rd
Bacardi Ln
Mary Rose Ln
Journeys End Rd
Sam Turner Rd
Thomas B Landers Rd
River Hill Rd
Turner Rd
Blueberry Ln
Alderberry Ln
Sandwich Rd
Bittersweet Rd
Old Meeting House Rd
Round Pond Dr
Wedgewood Dr
Louise Ln
Chilmark Dr
Grace Court
Southview Way
Veronica Ln
Flax Pond Rd
Parker Rd
Pine Ridge Rd
Country Club Ln
Old Barnstable Rd
Old Waquoit Rd
Lodengreen Dr
Crocker Rd
Bonito Av
Pontes Av
Patricia St
Vidal Av
Ginger St
Natal Av
Lorraine Rd
Green Pond Rd
Tanglewood Dr
Tam Way
Victors Ln
Meadow View Dr
Andrews St
Prince Henry Dr
Clark St
John Parker Rd
Corte Real Av
Ox Bow Rd
Shorewood Dr
Thatchers Ln
Acapesket Rd
Lewis St
Annette Rd
Emerald Ln
Davisville Rd
Fortaleza Dr
Sao Paulo Dr
Debra Ann Ln
Judy Ann Dr
Pires Way
Cinroc Cir
Penny Royal Ln
Rosemary Ln
Woodhaven Way
Surrey Ln
Alexander Booker Rd
Cross Rd
Leonard Dr
Royal Cir
Joshua Ln
Parsons Ln
Studley St
Barrows Rd
Air Park Dr
Fresh Pond Rd
Rivers Edge Rd
Baptiste Ln
Ava Ln
Takemmah Way
Waquoit Hwy
Whistlers Way
Ashley Dr
Marshall Dr
Seacoast Shores Blvd
Edgewater Dr East
Edgewater Dr West
Yale Dr
Childs River Rd
Waquoit Landing Rd
Seapit Rd
Nichols Rd
Ferry Rd
Ennsbrook Dr
Old Kenyon Rd
Central Av
Squibnocket Dr
Muriel Ln
Carolyn Ln
Madeline Rd
Antlers Shore Dr

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Legend

- FTA-1 PFAS6 Plume (Dashed Where Inferred)
- Bog/Wetland
- Treatment System Pipeline
- Infiltration Trench (Offline)
- Extraction Well (Off)
- Extraction Well (On)
- Proposed Reinjection Well

PFAS6 Plume Shell Isosurfaces:

- PFAS6 Isosurface: 0.02 µg/L
- PFAS6 Isosurface: 0.2 µg/L
- PFAS6 Isosurface: 2.0 µg/L

Data Source: AFCEC, June 2022

0 790 1,580 Feet

FIGURE 6

CONCEPTUAL LAYOUT FOR ALTERNATIVE WITH AV REMEDIAL SYSTEM AND ADDITIONAL INFRASTRUCTURE

AFCEC - Joint Base Cape Cod

Explanation of Significant Differences for PFAS at FTA-1 (Operable Unit 15), JBCC, MA

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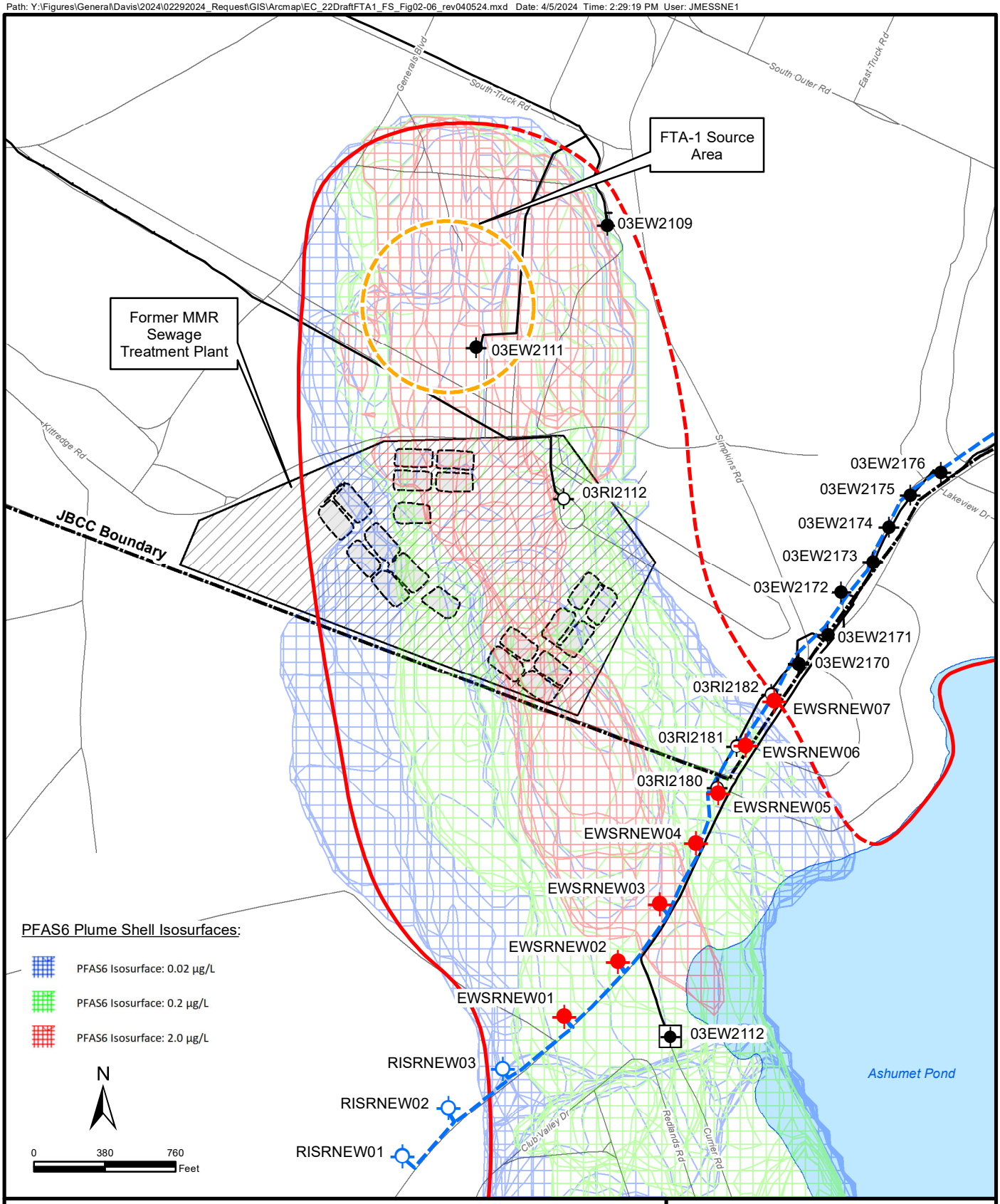

Legend

- Joint Base Cape Cod
- Proposed Remedial System Pipeline
- Treatment System Pipeline
- FTA-1 PFAS6 Plume Boundary (Dashed Where Inferred)
- Existing Extraction Well (On)
- Proposed Extraction Well
- Existing Extraction Well (Off)
- Existing Reinjection Well (On)
- Proposed Reinjection Well
- Abandoned Sewage Treatment Beds

Data Source: AFCEC, April 2024
JBCC Boundary from Massachusetts Air National Guard 2011

FIGURE 7

CONCEPTUAL LAYOUT FOR ALTERNATIVE WHICH ADDS REMEDIAL INFRASTRUCTURE ALONG SANDWICH ROAD

AFCEC - Joint Base Cape Cod

Explanation of Significant Differences for PFAS at FTA-1 (Operable Unit 15), JBCC, MA

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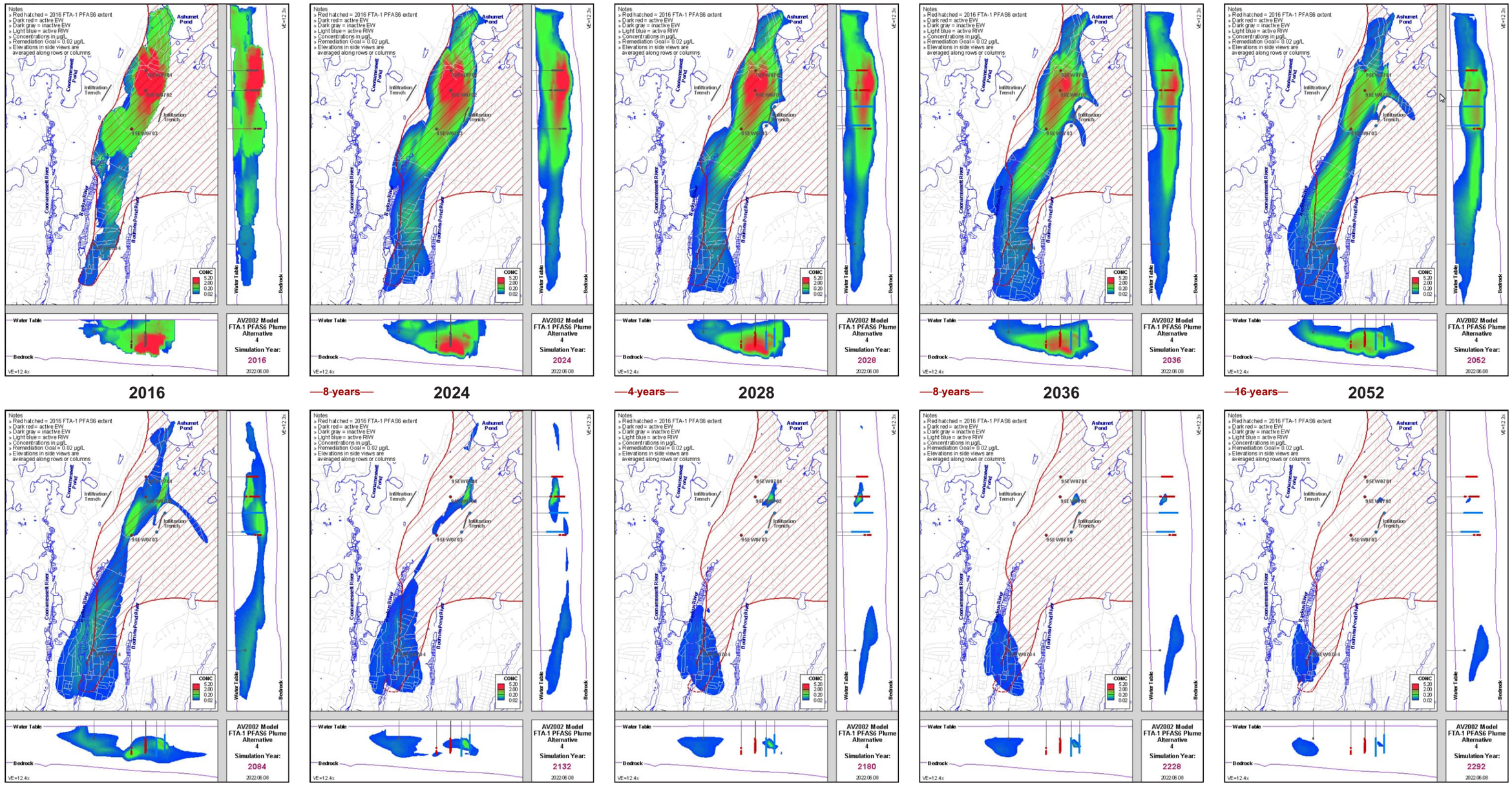

PFAS6 Concentration (µg/L)

5.20
2.00
0.20
0.02

Notes
- Concentrations are in µg/L
- PFAS > Federal MCLs extend beyond PFAS6 plume depicted in these graphics.
- Elevations in side views are averaged along rows or columns within layers
- Concentrations in all views are maximum values in the strings of cells perpendicular to the view

Data Source: AFCEC, June 2022

N

8,000 feet

12.4x vertical exaggeration

FIGURE 8

PFAS MIGRATION FOR ALTERNATIVE WITH AV REMEDIAL SYSTEM AND ADDITIONAL INFRASTRUCTURE

AFCEC - Joint Base Cape Cod
Explanation of Significant Differences for PFAS at FTA-1 (Operable Unit 15), JBCC, MA

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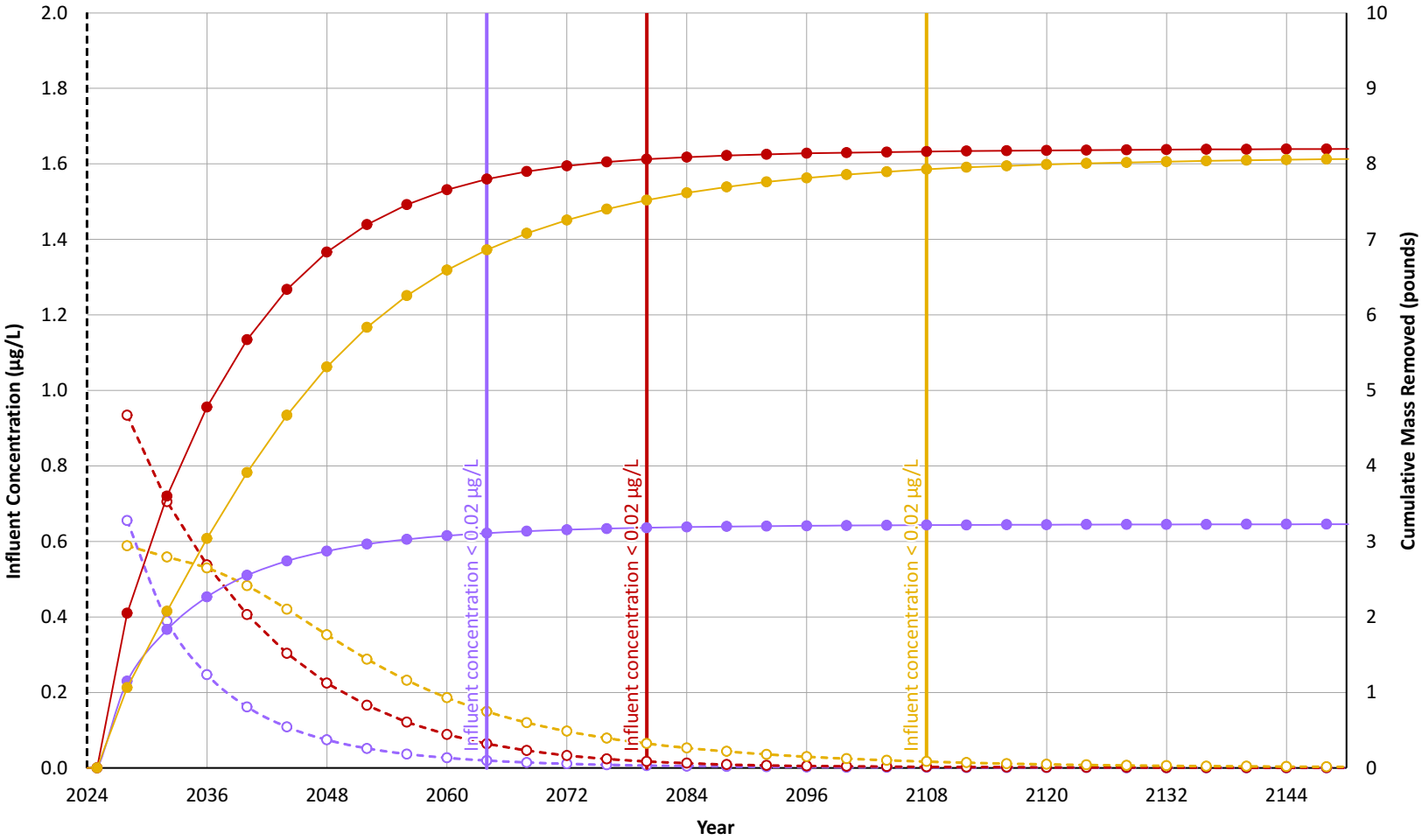

Legend

- 95EW0701 influent concentration
- 95EW0701 mass removal
- 95EW0702 influent concentration
- 95EW0702 mass removal
- 95EW0703 influent concentration
- 95EW0703 mass removal

Data Source: AFCEC, June 2022

95EW0701 pumping rate = 400 gpm
95EW0702 and 95EW0703 pumping rate = 500 gpm

Note:
The MMCL for PFAS6 is 0.02 µg/L (MassDEP 2020)

FIGURE 9

EXTRACTION WELL PERFORMANCE FOR ALTERNATIVE WITH AV REMEDIAL SYSTEM AND ADDITIONAL INFRASTRUCTURE

AFCEC - Joint Base Cape Cod
Explanation of Significant Differences for PFAS at FTA-1 (Operable Unit 15), JBCC, MA

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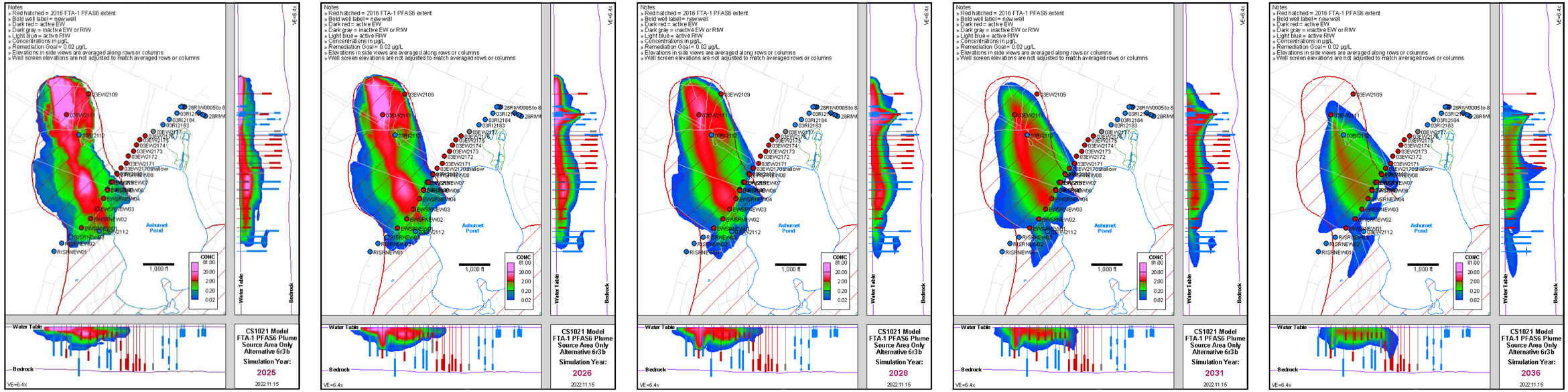
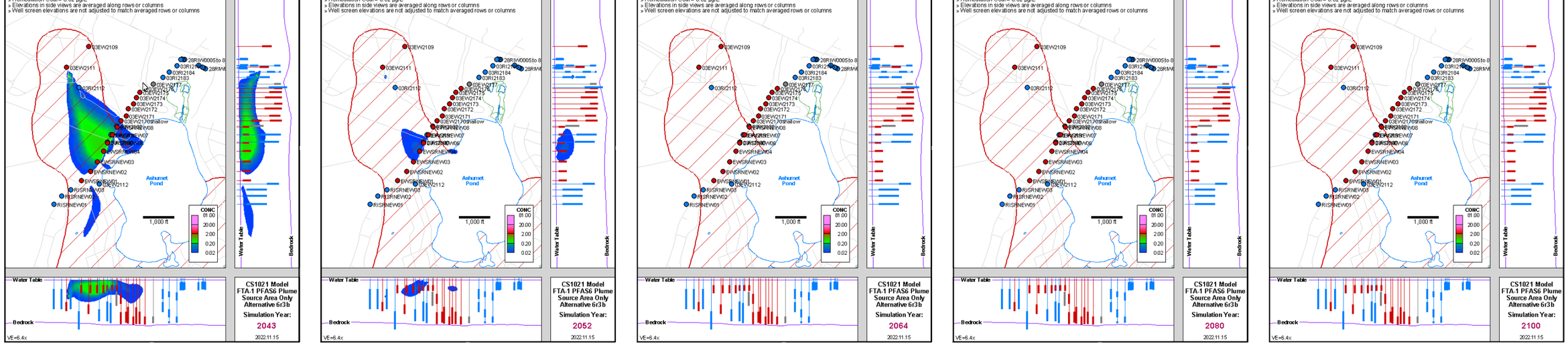


2025 — 1 year → **2026** — 2 years → **2028** — 3 years → **2031** — 5 years → **2036**



2043 — 7 years → **2052** — 9 years → **2064** — 12 years → **2080** — 16 years → **2100** — 20 years →

PFAS6 Concentration (µg/L)

81.00
20.00
2.00
0.20
0.02

Notes
- Concentrations are in µg/L
- PFAS > Federal MCLs extends beyond PFAS6 plume depicted in these graphics.
- Elevations in side views are averaged along rows or columns within layers
- Concentrations in all views are maximum values in the strings of cells perpendicular to the view

Data Source: AFCEC, November 2022

N

4,000 feet

12.4x vertical exaggeration

FIGURE 10

PFAS MIGRATION FOR ALTERNATIVE WHICH ADDS REMEDIAL INFRASTRUCTURE ALONG SANDWICH ROAD

AFCEC - Joint Base Cape Cod
Explanation of Significant Differences for PFAS at FTA-1 (Operable Unit 15), JBCC, MA

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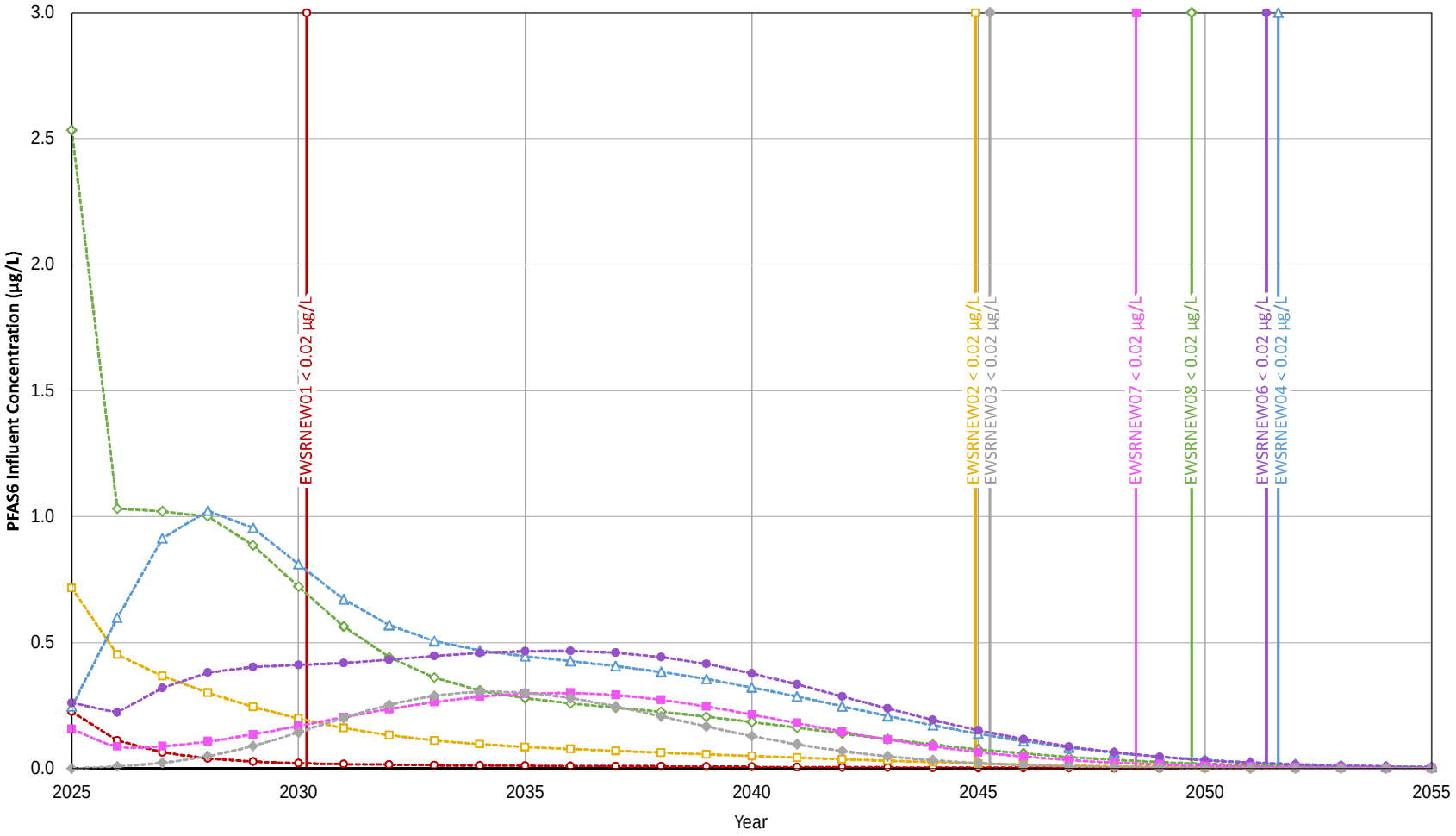

Data Source: AFCEC, November 2022

EWSRNEW01 (200 gpm)
EWSRNEW02 (250 gpm)
EWSRNEW03 (250 gpm)
EWSRNEW04 (200 gpm)
EWSRNEW06 (100 gpm)
EWSRNEW07 (150 gpm)
EWSRNEW08 (200 gpm)

Note:
The MMCL for PFAS6 is 0.02 µg/L (MassDEP 2020)

FIGURE 11

EXTRACTION WELL INFLUENT CONCENTRATIONS FOR ALTERNATIVE WHICH ADDS REMEDIAL INFRASTRUCTURE ALONG SANDWICH ROAD

AFCEC - Joint Base Cape Cod
Explanation of Significant Differences for PFAS at FTA-1 (Operable Unit 15), JBCC, MA

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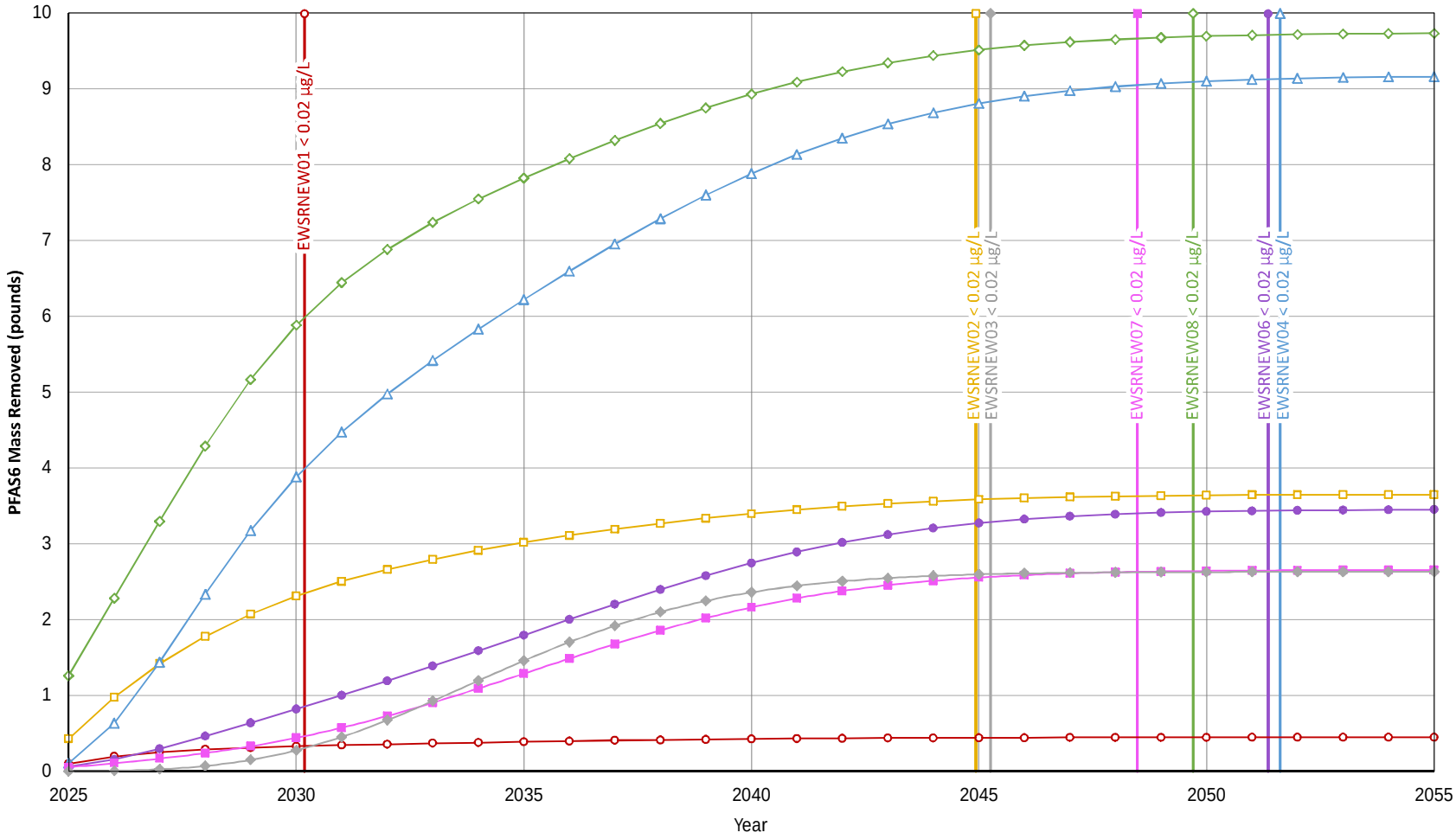

Data Source: AFCEC, November 2022

- EWSRNEW01 (200 gpm)
- EWSRNEW02 (250 gpm)
- EWSRNEW03 (250 gpm)
- EWSRNEW04 (200 gpm)
- EWSRNEW06 (100 gpm)
- EWSRNEW07 (150 gpm)
- EWSRNEW08 (200 gpm)

Note:
The MMCL for PFAS6 is 0.02 µg/L (MassDEP 2020)

FIGURE 12

EXTRACTION WELL MASS REMOVALFOR ALTERNATIVE WHICH ADDS REMEDIAL INFRASTRUCTURE ALONG SANDWICH ROAD

AFCEC - Joint Base Cape Cod
Explanation of Significant Differences for PFAS at FTA-1 (Operable Unit 15), JBCC, MA

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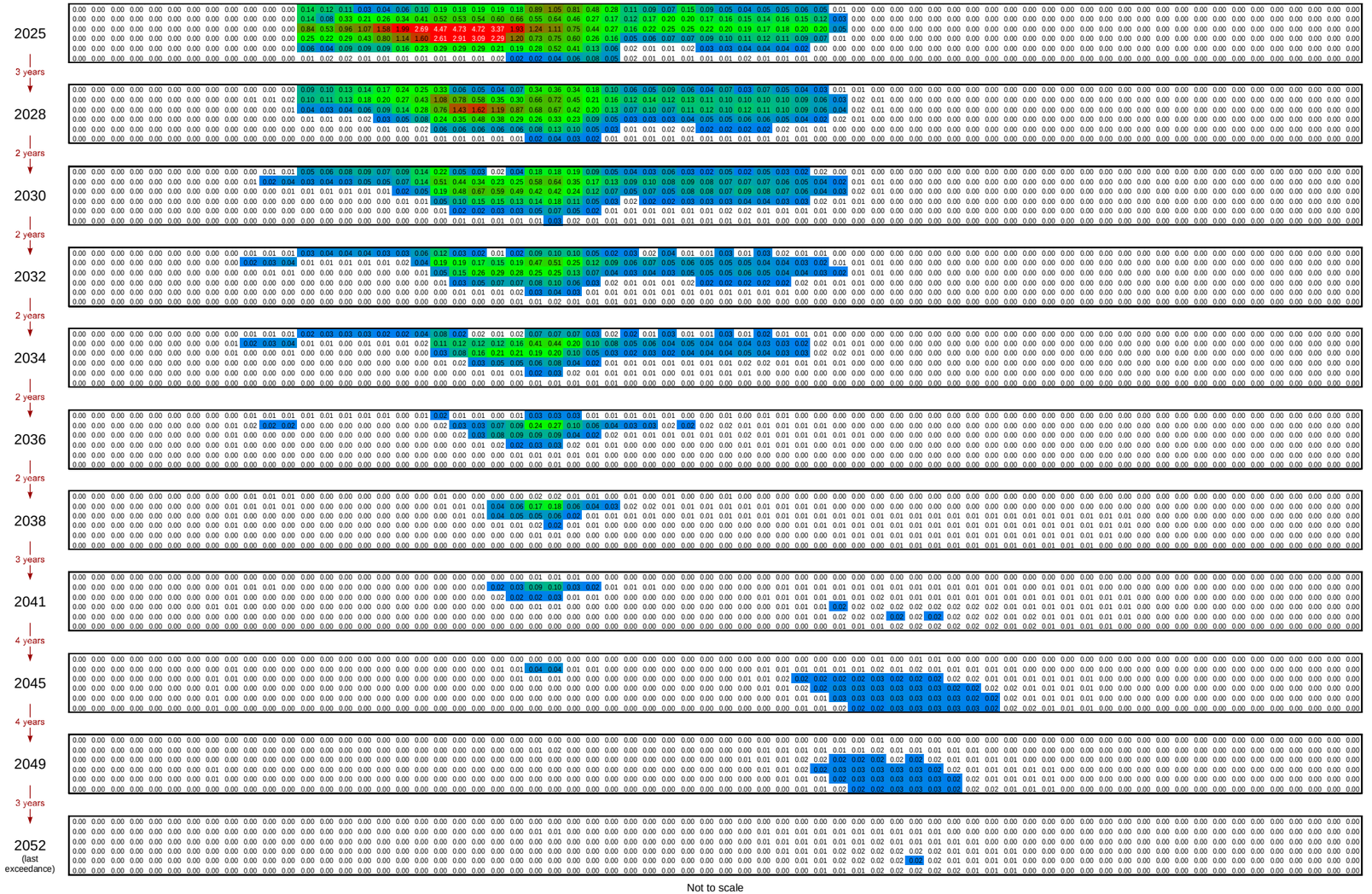
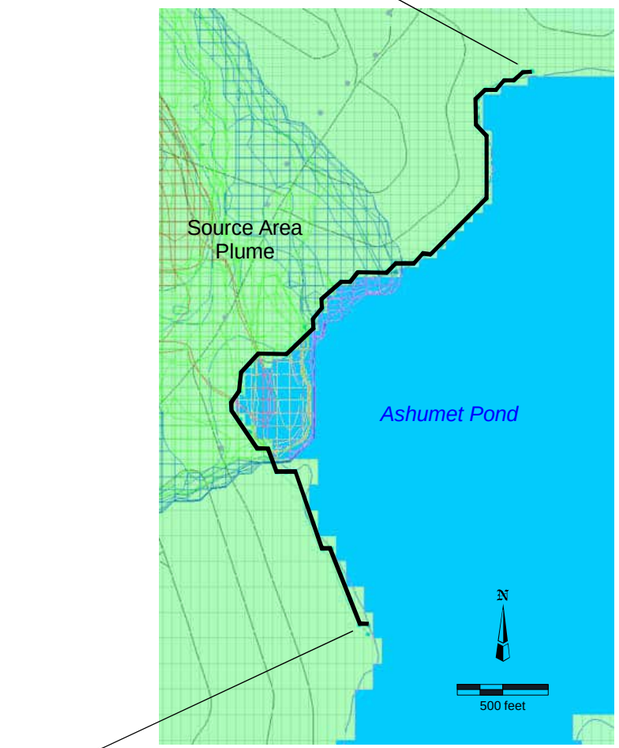
View Looking West of Simulated PFAS6 Concentration Versus Time



Not to scale



PFAS6 Concentration (µg/L)

4.73
2.00
0.20
0.02

Data Source: AFCEC, November 2022

Notes

- Cell concentrations in model layers 1 through 6 are shown for the indicated year.
- PFAS6 concentrations exceeding 2 µg/L are shown with a white font.

FIGURE 13

PFAS DISCHARGE TO ASHUMET POND FOR ALTERNATIVE WHICH ADDS REMEDIAL INFRASTRUCTURE ALONG SANDWICH ROAD

AFCEC - Joint Base Cape Cod

Explanation of Significant Differences for PFAS at FTA-1 (Operable Unit 15), JBCC, MA

Tables

Table 1
Detailed Analysis of Interim Groundwater Alternatives for PFAS
Selected Remedies Highlighted in Gray
Explanation of Significant Differences for PFAS at FTA-1
(Operable Unit 15), JBCC, MA

EVALUATION CRITERIA[1]	Existing Remedy, Including Adding PFAS as COCs, and Optimizing the AV Remedial System	Existing Remedy, Including Adding PFAS as COCs, and Optimizing the AV Remedial System with Additional Infrastructure	Existing Remedy, Including Adding PFAS as COCs, and Adding Remedial Infrastructure Between FTA-1 Source Area and Ashumet Pond
Protection of Human Health	▪ This alternative, a 500 gpm pump and treat remedy also including LUCs, involves restart of the AV remedial system in 2025. Extraction wells 95EW0702 and 95EW0703 would operate at 250 gpm each and 95EW0701 would be repurposed for reinjection, refer to Figure 5 for the wellfield layout. ▪ Groundwater in the plume exceeds PFAS MCLs. ▪ Captured groundwater would be treated for PFAS by GAC at the existing AV plants, achieving PFAS MCLs prior to reinjection. Reinjected water would promote natural attenuation within the plume footprint. ▪ Known drinking water exposures to the FTA-1 PFAS plume have been addressed in previous removal actions. For this alternative, additional exposure protection would be provided to current and future workers and residents through implementation and monitoring of LUCs as described in Appendix B.	▪ This alternative, a 1,400 gpm pump and treat remedy also including LUCs, involves restart of the AV remedial system in 2025. Extraction wells 95EW0701, 95EW0702, and 95EW0703 would be operated at 400 gpm, 500 gpm, and 500 gpm, respectively. Two (2) reinjection wells would be installed within the area of the Currier Road infiltration trench, refer to Figure 6 for the wellfield layout. ▪ Groundwater in the plume exceeds PFAS MCLs. ▪ Captured groundwater would be treated for PFAS by GAC at the existing AV plants, achieving PFAS MCLs prior to reinjection. Reinjected water would promote natural attenuation within the plume footprint and provide additional hydraulic control of the plume on the east. ▪ Known drinking water exposures to the FTA-1 PFAS plume have been addressed in previous removal actions. For this alternative, additional exposure protection would be provided to current and future workers and residents through implementation and monitoring of LUCs as described in Appendix B.	▪ This alternative, a 1,350 gpm pump and treat remedy also including LUCs, involves seven new Sandwich Road extraction wells operating at 100 to 250 gpm that would be connected to the existing SRTF. They would be located along Sandwich Road between the FTA-1 source area and Ashumet Pond. Reinjection would occur at the existing CS-10 Sandwich Road reinjection wells, at three new reinjection wells along Sandwich Road that provide additional hydraulic control, and at the SD-5 North wellfield. Refer to Figure 7 for the wellfield layout. ▪ Known drinking water exposures to the FTA-1 PFAS plume have been addressed in previous removal actions. For this alternative, additional exposure protection would be provided to current and future workers and residents through implementation and monitoring of LUCs as described in Appendix B.
Environmental Protection	▪ Relies on existing infrastructure. Minor modifications to AV remedial system subsurface piping to utilize 95EW0701 as a reinjection well.	▪ Would require limited construction of two (2) reinjection wells and connections to the existing infiltration trench effluent header and associated site work near Currier Road infiltration trench.	▪ Would require construction of seven extraction wells and three reinjection wells and associated piping and site work to tie into the CS-10 Sandwich Road remedial system header.
Chemical-Specific (Not applicable to Interim Actions)			
Location-Specific	▪ Complies with location-specific ARARs, refer to Appendix A.	▪ Complies with location-specific ARARs, refer to Appendix A.	▪ Complies with location-specific ARARs, refer to Appendix A.
Action-Specific	▪ Complies with action-specific ARARS, refer to Appendix A.	▪ Complies with action-specific ARARS, refer to Appendix A.	▪ Complies with action-specific ARARS, refer to Appendix A.
Magnitude of Residual Risk	▪ Currently unacceptable residual risk with PFAS plume > MCL. However, interim remedial action is expected to reduce PFAS concentrations and mitigate plume migration. Protectiveness will be maintained through LUCs while interim remedial actions are implemented.	▪ Currently unacceptable residual risk with PFAS plume > MCL. However, interim remedial action is expected to reduce PFAS concentrations to below MCL and mitigate plume migration. Protectiveness will be maintained through LUCs while interim remedial actions are implemented.	▪ Currently unacceptable residual risk with PFAS plume > MCL. However, interim remedial action is expected to reduce PFAS concentrations to below MCL and mitigate plume migration. Protectiveness will be maintained through LUCs while interim remedial actions are implemented.
Adequacy and Reliability of Controls	▪ Alternative includes monitoring of groundwater extraction and treatment and compliance with proven LUCs during the implementation of the interim remedy to demonstrate protectiveness.	▪ Alternative includes monitoring of groundwater extraction and treatment and compliance with proven LUCs during the implementation of the remedy to demonstrate protectiveness.	▪ Alternative includes monitoring of groundwater extraction and treatment and compliance with proven LUCs during the implementation of the remedy to demonstrate protectiveness.
Treatment Process Used and Materials Treated	▪ Groundwater treatment involving GAC will be conducted at the existing treatment plants connected to the existing wellfield designed to address the AV VOC plume.	▪ Groundwater treatment involving GAC will be conducted at the existing treatment plants connected to the existing wellfield designed to address the AV VOC plume.	▪ Groundwater treatment involving GAC will occur at the existing SRTF.

Table 1
Detailed Analysis of Interim Groundwater Alternatives for PFAS
Selected Remedies Highlighted in Gray
Explanation of Significant Differences for PFAS at FTA-1
(Operable Unit 15), JBCC, MA

EVALUATION CRITERIA[1]	Existing Remedy, Including Adding PFAS as COCs, and Optimizing the AV Remedial System	Existing Remedy, Including Adding PFAS as COCs, and Optimizing the AV Remedial System with Additional Infrastructure	Existing Remedy, Including Adding PFAS as COCs, and Adding Remedial Infrastructure Between FTA-1 Source Area and Ashumet Pond
Amount of Hazardous Materials Destroyed or Treated	▪ Alternative relies on active extraction and treatment targeting plume mass upgradient of Hayway Road by the existing AV remedial system with optimization. Monitoring will support the evaluation of the effectiveness of the active interim remediation.	▪ Alternative relies on active extraction and treatment targeting plume mass upgradient of Hayway Road by the existing AV remedial system with optimization. Monitoring will support the evaluation of the effectiveness of the active interim remediation.	▪ Alternative relies on active extraction and treatment targeting plume mass between FTA-1 and Ashumet Pond with the objective of reducing plume discharge to surface water. Monitoring will support the evaluation of the effectiveness of the active interim remediation.
Expected Reduction in Toxicity, Mobility, or Volume	▪ Groundwater containing PFAS is extracted and treated by GAC sorption filter media. This filter media then periodically requires off-site thermal reactivation prior to reuse. The reactivation process is capable of destroying the adsorbed PFAS.	▪ Groundwater containing PFAS is extracted and treated by GAC sorption filter media. This filter media then periodically requires off-site thermal reactivation prior to reuse. The reactivation process is capable of destroying the adsorbed PFAS.	▪ Groundwater containing PFAS is extracted and treated by on GAC sorption filter media. This media then periodically requires off-site thermal reactivation prior to reuse. The reactivation process is capable of destroying the adsorbed PFAS.
Irreversibility of Treatment	▪ GAC filtration and reactivation results in irreversible destruction (mineralization) of PFAS.	▪ GAC filtration and reactivation results in irreversible destruction (mineralization) of PFAS.	▪ GAC filtration and reactivation results in irreversible destruction (mineralization) of PFAS.
Type and Quantity of Treatment Residual	▪ PFAS mass would be captured from influent and sorbed by GAC media filters. ▪ Adsorbed PFAS is destroyed during the thermal reactivation process.	▪ PFAS mass would be captured from influent and sorbed by GAC media filters. ▪ Adsorbed PFAS is destroyed during the thermal reactivation process.	▪ PFAS mass would be captured from influent and sorbed by GAC media filters. ▪ Adsorbed PFAS is destroyed during the thermal reactivation process.
Protection of Community during Remedial Action	▪ Low impacts to the community are anticipated. Increased truck and vehicular traffic would occur during restart of the existing remedial system. ▪ Work would be primarily conducted within the existing treatment plants; minor subsurface piping work to utilize 95EW0701 as a reinjection well. ▪ Fugitive dust emissions from site would be negligible. ▪ Noise can be controlled through engineering controls.	▪ Low impacts to the community are anticipated. Increased truck and vehicular traffic would occur during restart of the existing remedial system and installation of the two (2) reinjection wells within the existing Currier Road infiltration trench area. ▪ Work would be primarily conducted within the existing treatment plants and near Currier Road. ▪ Fugitive dust emissions from site would be negligible. ▪ Noise can be controlled through engineering controls.	▪ Low impacts to the community are anticipated. Increased truck and vehicular traffic would occur during installation of the new wells and piping connected to the existing CS-10 remedial system header to the SRTF. ▪ Fugitive dust emissions from site would be negligible. ▪ Noise can be controlled through engineering controls.
Protection of Workers During Remedial Action	▪ Risks to workers are expected to be low.	▪ Risks to workers are expected to be moderate with reinjection well drilling and piping installation.	▪ Risks to workers are expected to be moderate with extraction well drilling and piping installation.
Environmental Impacts	▪ No permanent adverse impacts to the environment are anticipated relating to system construction. ▪ Emissions from on-site equipment during the construction period are a consideration but not considered to be significant.	▪ No permanent adverse impacts to the environment are anticipated relating to system construction. ▪ Emissions from on-site equipment during the construction period are a consideration but not considered to be significant	▪ No permanent adverse impacts to the environment are anticipated relating to system construction. ▪ Emissions from on-site equipment during the construction period are a consideration but not considered to be significant.
Sustainability	▪ A moderate amount of energy would be needed to support construction. However, long-term system operation would consume an estimated 40,900 MWh of electricity over the lifetime of the interim remedy and produce associated air emissions. In addition, there would be energy use associated with transportation related to system maintenance and spent GAC reactivation.	▪ A moderate amount of energy would be needed to support construction. However, long-term system operation would consume an estimated 195,000 MWh of electricity over the lifetime of the interim remedy and produce associated air emissions. In addition, there would be energy use associated with transportation related to system maintenance and spent GAC reactivation.	▪ A moderate amount of energy would be needed to support construction. However, long-term system operation would consume an estimated 66,737 MWh of electricity over the lifetime of the interim remedy and produce associated air emissions. In addition, there would be energy use associated with transportation related to system maintenance and spent GAC reactivation.
Technical Feasibility of Operation and Construction	▪ Restart of existing systems, limited site work, restoration, operations, and decommissioning utilize standard construction methods.	▪ Drilling, excavation, site work, restoration, operations, and decommissioning utilize standard construction methods.	▪ Drilling, excavation, site work, restoration, operations, and decommissioning utilize standard construction methods.

Table 1
Detailed Analysis of Interim Groundwater Alternatives for PFAS
Selected Remedies Highlighted in Gray
Explanation of Significant Differences for PFAS at FTA-1
(Operable Unit 15), JBCC, MA

EVALUATION CRITERIA[1]	**Existing Remedy, Including Adding PFAS as COCs, and Optimizing the AV Remedial System**	**Existing Remedy, Including Adding PFAS as COCs, and Optimizing the AV Remedial System with Additional Infrastructure**	**Existing Remedy, Including Adding PFAS as COCs, and Adding Remedial Infrastructure Between FTA-1 Source Area and Ashumet Pond**
Reliability of Technology	▪ Reliable and proven technology for groundwater extraction and media filtration with GAC. ▪ Thermal reactivation of GAC is theoretically capable of complete destruction (mineralization) of PFAS. Empirical evidence demonstrating proof of process is being collected and reported by GAC manufacturers. ▪ Long-term monitoring is reliable for evaluation of groundwater quality.	▪ Reliable and proven technology for groundwater extraction and media filtration with GAC. ▪ Thermal reactivation of GAC is theoretically capable of complete destruction (mineralization) of PFAS. Empirical evidence demonstrating proof of process is being collected and reported by GAC manufacturers. ▪ Long-term monitoring is reliable for evaluation of groundwater quality.	▪ Reliable and proven technology for groundwater extraction and media filtration with GAC. ▪ Thermal reactivation of GAC is theoretically capable of complete destruction (mineralization) of PFAS. Empirical evidence demonstrating proof of process is being collected and reported by GAC manufacturers. ▪ Long-term monitoring is reliable for evaluation of groundwater quality.
Availability of Services and Material	▪ Easily implemented. ▪ Materials readily available. ▪ Off-site treatment and/or disposal options are currently limited and expensive.	▪ Easily implemented. ▪ Materials readily available. ▪ Off-site treatment and/or disposal options are currently limited and expensive.	▪ Easily implemented. ▪ Materials readily available. ▪ Off-site treatment and/or disposal options are currently limited and expensive.
Capital Costs	**$ 403,000**	**$ 1,499,000**	**$ 4,772,000**
O&M Costs (Present Worth)[2]	**$ 19,222,341**	**$ 48,800,085**	**$ 21,736,590**
Monitoring and Reporting Cost	**$ 7,237,040**	**$ 7,283,164**	**$ 6,329,161**
Total Present Worth Costs[2,3]	**$ 26,459,381**	**$ 56,083,250**	**$ 28,065,750**

Selected Remedies Highlighted in Gray

Notes:
1. Evaluation criteria from *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final*, EPA/540/G-89/004, OSWER Directive 9355.3-01, October 1988.
2. Assumed discount (interest) rate, per OMB Circular No. A-94 Revised (December 2020) is -0.3% for net present value costs.
3. Comparative cost projections for these alternatives are limited to a 100-year period from 2025 through 2125.

Key:
ARAR = applicable or relevant and appropriate requirement
AV = Ashumet Valley
CERCLA = comprehensive Environmental Response, Compensation, and Liability Act
COC = contaminant of concern
CS-10 = Chemical Spill-10
FTA-1 = Fire Training Area-1
GAC = granular activated carbon
gpm = gallons per minute
JBCC = Joint Base Cape Cod
LUC = land use control
MCL = Maximum Contaminant Level
MWh= megawatt hour
OMB = White House Office of Management and Budget
O&M = operations and maintenance
OSWER = Office of Solid Waste and Emergency Response
PFAS = per- and polyfluoroalkyl substances
SD-5 = Storm Drain-5
SRTF = Sandwich Road Treatment Facility
TMV -= toxicity, mobility, or volume
VOC = volatile organic compound
μg/L = microgram per liter

Appendix A

OU 15 (Ashumet Valley and FTA-1 Groundwater) Applicable or Relevant and Appropriate Requirements (ARARs) and To Be Considered (TBCs) Guidances

Appendix A –ARARs/TBCs for the Interim Groundwater Remedy
Operable Unit 15, FTA-1, Joint Base Cape Cod

Table A-1
Chemical-Specific ARARs/TBCs[1]

Media	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Groundwater	FEDERAL – SDWA MCLs (40 CFR 141.61-141.63)	MCLs have been promulgated for organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies but are also considered relevant and appropriate for CERCLA groundwater response actions where the groundwater aquifer is used or classified for use as drinking water.	***These standards will be used to determine when residential well mitigations are necessary to include operational decisions (e.g., carbon exchange) for point of use or point of entry treatment systems. These standards will also be used to determine if water supply treatment systems installed by the Air Force on Town of Falmouth and Mashpee Water District municipal wells remain adequate to protect users of their water supplies. There are no Chemical-Specific ARARs for the PFAS treatment components of the Interim Remedy. For the treatment components of the Interim Remedy these regulations are cited as Action-Specific ARARs utilized to establish Performance Standards for PFAS treatment.***	Relevant and Appropriate
Groundwater	STATE – MA Drinking Water Regulations (310 CMR 22. 05-22.09)	These standards establish state MCLs for public drinking water systems but are also considered relevant and appropriate for CERCLA groundwater response actions. When state MCLs are more stringent than federal levels, state levels must be used. ***These regulations were revised on 02 October 2020 to include the new PFAS6 MMCL.***	***These standards will be used to determine when residential well mitigations are necessary to include operational decisions (e.g., carbon exchange) for point of use or point of entry treatment systems. These standards will also be used to determine if water supply treatment systems installed by the Air Force on Town of Falmouth and Mashpee Water District municipal wells remain adequate to protect users of their water supplies. There are no Chemical-Specific ARARs for the PFAS treatment components of the Interim Remedy. For the treatment components of the Interim Remedy these regulations are cited as Action-Specific ARARs utilized to establish Performance Standards for PFAS treatment.***	Relevant and Appropriate

1. The Chemical-Specific ARARs were taken from Table 2-30 of the Final Record of Decision for Ashumet Valley Groundwater prepared for the Air Force Center for Engineering and the Environment Installation Restoration Program at the Massachusetts Military Reservation by Jacobs Engineering Group, Inc., March 2009 and have been updated in ***bold and italicized font*** where necessary for ESD 2.

Appendix A –ARARs/TBCs for the Interim Groundwater Remedy
Operable Unit 15, FTA-1, Joint Base Cape Cod
Table A-2
Location-Specific ARARs/TBCs[1]

Media	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Endangered Species	***FEDERAL – Endangered Species Act of 1973 (16 USC 1538(a)(1)(B); 50 CFR Part 17)***	***Must identify whether threatened or endangered species or critical habitat is affected by proposed action or take mitigation measures so that action does not affect species/habitat. Federal agencies must consult with the U.S. Fish and Wildlife Service to ensure that the actions they authorize, fund, or carry out will not jeopardize listed species. The Northern long-eared bat (Myotis septentrionalis), which was listed as a federally endangered species after the issuance of the ROD, has been documented at the Base.***	***To the extent the remedial action impacts any potential bat habitat off-Base, these provisions will be complied with regard to protecting the Northern Long-Eared Bat and its critical habitat.***	***Applicable***
Historic, archeological, and Native American artifacts and resources	FEDERAL – National Historic Preservation Act (**54 USC § *306131***; 36 CFR 800) ***Statutory citation has changed from that cited in the ROD.***	Federal requirements for identifying, evaluating, and protecting federally- regulated historic and archaeological resources.	Historic properties have not been identified within the area requiring active remedial action, although some historic properties may be located in areas where LUCs are required. It is not anticipated that the LUCs would impact historic resources. However, if it is later determined that the remedial action, such as the installation/maintenance of monitoring wells may cause irreparable loss or destruction of historic properties, AFCEC will consult with federal, tribal and State officials and implement preservation and/or mitigation measures, as necessary. Specifically, after consultation with the Wampanoag Indian Tribes and the SHPO, the parties may determine that a cultural resources survey is needed to discover and identify objects and artifacts in the response action area, particularly Native American artifacts of the Wampanoag Indian Tribes. If LTM or extraction wells need to be sited in areas that may have such resources, all such resources discovered during a survey or inadvertently discovered during on-site	Applicable

Appendix A –ARARs/TBCs for the Interim Groundwater Remedy
Operable Unit 15, FTA-1, Joint Base Cape Cod
Table A-2
Location-Specific ARARs/TBCs[1]

Media	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
			remedial activities will be secured and protected as required by law and in accordance with the consulting parties memorandum of agreement.	
Historic, archeological, and Native American artifacts and resources	FEDERAL - Archaeological and Historical Preservation Act (16 USC 469a-c)	When a Federal agency finds, or is notified, that its activities in connection with a Federal construction project may cause irreparable loss or destruction of significant scientific, prehistorical, historical, or archaeological data, the Act mandates measures be implemented to prevent activities that may cause irreparable loss or destruction of significant scientific, pre-historical, historical, archeological data.	Pre-historical, historical, and/or archeological sites have not been identified within the area requiring active remedial action, although some protected sites may be located in areas where LUCs are required. It is not anticipated that the LUCs would impact protected sites. However, if it is later determined that the remedial action, such as the installation/ maintenance of monitoring wells may cause irreparable loss or destruction of protected sites, AFCEC will consult with federal, tribal and State officials and implement preservation and/or mitigation measures, as necessary.	Applicable
Historic, archeological, and Native American artifacts and resources	FEDERAL - Archeological Resources Protection Act (***54 USC § 312502, 312508***; 43 CFR 7) ***Statutory citation has changed from that cited in the ROD.***	The Act regulates the excavation or removal any archaeological resource located on public lands or tribal lands and to carry out activities associated with such excavation or removal.	Archeological resources have not been identified within the area requiring active remedial action. However, if it is later determined that this alternative will require removal of archeological resources AFCEC will consult with federal, tribal, and State officials and implement preservation and/or mitigation measures, as necessary.	Relevant and Appropriate

Appendix A –ARARs/TBCs for the Interim Groundwater Remedy
Operable Unit 15, FTA-1, Joint Base Cape Cod
Table A-2
Location-Specific ARARs/TBCs[1]

Media	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Historic, archeological, and Native American artifacts and resources	FEDERAL - Native American Graves Protection and Repatriation Act (25 USC § 3001, 3002, 3005, 3009);43 CFR 10)	The Act regulates the excavation or removal Native American remains or cultural items located on public lands or tribal lands and to carry out activities associated with such excavation or removal.	Native American remains or cultural items have not been identified within the area requiring active remedial action. However, if it is later determined that this alternative will require excavation or removal of Native American remains or cultural items AFCEC will consult with federal and tribal officials regarding compliance measures to be taken.	Relevant and Appropriate
Wetlands	FEDERAL – Fish and Wildlife Coordination Act (16 USC 661 *et seq*.)	This act and regulations require federal agencies to take into consideration the effect that water- related projects would have on fish and wildlife, and to consult with the U.S. Fish and Wildlife Service and the state to develop measures to prevent, mitigate, or compensate for project- related losses to fish and wildlife.	The response action will be designed and implemented to minimize and/or compensate for adverse effects to fish and wildlife in any water bodies including wetland areas. Relevant federal and state agencies will be contacted, if indicated, to help analyze the effects of the response action on fish and wildlife in water bodies including wetlands in and around the site.	Applicable
Endangered and threatened species and their habitats	STATE – MA Endangered Species Act (321 CMR 10.00 part II, IV, and V.)	Actions that jeopardize state-listed endangered or threatened species or species of special concern or their habitats must be avoided, or appropriate mitigation measures must be taken.	The response action will be designed and implemented to minimize effects to endangered or threatened species on the within the remedial area. Several state-listed species have been identified on or near the MMR. The Camp Edwards Natural Resource Office (http://www.eandrc.org/rarespecies.htm) continues to search for, identify, and map locations of rare species on the MMR and provides this information to the Massachusetts Division of Fisheries and Wildlife.	Applicable

Appendix A –ARARs/TBCs for the Interim Groundwater Remedy
Operable Unit 15, FTA-1, Joint Base Cape Cod
Table A-2
Location-Specific ARARs/TBCs[1]

Media	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Historic, archeological, and Native American artifacts and resources	STATE – MA Historic Preservation Act (MGL Ch. 9 Sections 26-27C; MGL Ch. 7, Section 38A; MGL Ch. 38 Sections 6B- 6C; and 950 CMR 70.13 & 71.00)	The MHC is the state historic preservation office and is authorized by Massachusetts law to identify, evaluate and protect the Commonwealth's important historic and archaeological resources. The MHC administers state and federal preservation programs, including planning, review and compliance.	After consultation with the Wampanoag Indian Tribes and the SHPO, the parties may determine that a cultural resources survey is needed to discover and identify objects and artifacts in the response action area, particularly Native American artifacts of the Wampanoag Indian Tribes. If LTM or extraction wells need to be sited in areas that may have such resources, all such resources discovered during a survey or inadvertently discovered during on-site remedial activities will be secured and protected as required by law and in accordance with the consulting parties' memorandum of agreement.	Applicable

Appendix A –ARARs/TBCs for the Interim Groundwater Remedy
Operable Unit 15, FTA-1, Joint Base Cape Cod
Table A-2
Location-Specific ARARs/TBCs[1]

Media	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Wetlands	STATE – MassDEP Wetlands Protection Act (MGL Ch. 131, Section 40) and regulations (310 CMR 10.00)	This regulation outlines performance standards that must be met to work within 100 feet of a coastal or inland wetland resource area and within 200 feet of a river. It governs all work involving the filling, dredging, or alteration of wetlands, banks, land under water bodies, waterways, land subject to flooding and riverfront areas.	The operation and maintenance of the remedial system and/or LTM well system and construction of any new wells, if needed, will be designed and implemented to meet the performance standards in 310 CMR 10.21 through 10.60 to minimize adverse effects to any nearby wetlands.	Applicable
Floodplains	STATE – MassDEP Wetland Protection Act (MGL Ch. 131, Section 40) and regulations (310 CMR 10.00)	Governs work proposed within land subject to flooding (100-year floodplain) and coastal storm flow. Compensatory flood storage is required for any loss of floodplain area.	These requirements are ARARs only if new wells are needed and are sited in floodplains. If the placement of any such well is needed, these requirements will be complied with if the location is within or will affect a floodplain.	Applicable

Key:

ARAR	applicable or relevant and appropriate requirement
CFR	*Code of Federal Regulations*
CMR	*Code of Massachusetts Regulations*
CWA	Clean Water Act
EO	Executive Order
USC	*United States Code*
MA	Massachusetts
MassDEP	Massachusetts Department of Environmental Protection
MGL	Massachusetts General Law
MHC	Massachusetts Historic Commission
MMR	Massachusetts Military Reservation
SHPO	State Historic Preservation Officer

1. The Location-Specific ARARs were taken from Table 2-31 of the Final Record of Decision for Ashumet Valley Groundwater prepared for the Air Force Center for Engineering and the Environment Installation Restoration Program at the Massachusetts Military Reservation by Jacobs Engineering Group, Inc., March 2009 and have been updated in ***bold and italicized font*** where necessary for ESD 2.

Appendix A – ARARs/TBCs for the Interim Groundwater Remedy
Operable Unit 15, FTA-1, Joint Base Cape Cod
Table A-3
Action-Specific ARARs/TBCs[1]

Media	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Groundwater	***FEDERAL – SDWA MCLs (40 CFR 141.61-141.63)*** ***Moved from the Chemical-Specific ARAR Table 2-30 in the ROD. MCLs for PFAS were added to the regulations since the ROD and apply to this remedy.***	***MCLs have been promulgated for organic and inorganic contaminants. These levels regulate the concentration of contaminants in public drinking water supplies but are also considered relevant and appropriate for CERCLA groundwater response actions where the groundwater aquifer is used or classified for use as drinking water.***	***These standards will be used as performance standards for assessing the effectiveness of the treatment component of the remedy, for establishing the required LUC boundary and for monitoring groundwater throughout the plume area. The interim remedy's groundwater treatment systems will use granular activated carbon which can achieve the Federal MCLs.***	***Relevant and Appropriate***
Groundwater	***FEDERAL - SDWA Non-Zero MCLGs (40 CFR 141.50-141.51)*** ***Moved from the Chemical-Specific ARAR Table 2-30 in the ROD.***	***MCLGs have been promulgated for organic and inorganic contaminants. Non-zero MCLGs are nonenforceable health goals for public water systems. MCLGs are set at levels that would result in no known or expected adverse health effects with an adequate margin of safety. Non-zero MCLGs are also considered relevant and appropriate for CERCLA groundwater response actions where the groundwater aquifer is used or classified for use as drinking water.***	***These standards will be used as performance standards for assessing the effectiveness of the treatment component of the remedy, for establishing the required LUC boundary, and for monitoring groundwater throughout the plume area.***	***Relevant and Appropriate***
Groundwater	FEDERAL – Underground Injection Control Program (40 CFR 144.1, 144.3, 144.4, 144.11 – 144.14, 144.82, 146.10 – 146.72, 147.1100, 148.1 – 148.18)	These regulations outline minimum program and performance standards for underground injection wells and prohibit any injection that may cause a violation of any primary drinking water regulation under 40 CFR 142 in the aquifer. The state program has been authorized by EPA and takes effect through the state requirements listed below.	Monitoring well sample water and groundwater will be treated to levels at or below the most stringent federal and state primary drinking water standards prior to release to ***reinjection wells and/or infiltration galleries*** to ensure that releases will not cause any violation of drinking water standards in the receiving aquifer.	Applicable

Appendix A – ARARs/TBCs for the Interim Groundwater Remedy
Operable Unit 15, FTA-1, Joint Base Cape Cod
Table A-3
Action-Specific ARARs/TBCs[1]

Media	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Discharge to surface water	FEDERAL – National Pollutant Discharge Elimination System (40 CFR 122)	Establishes requirements for point source discharges to water of the U.S. Requires that all such discharges not result in a violation of the applicable surface water quality standards in the receiving stream.	Levels of contaminants in untreated groundwater currently discharging to surface water bodies are below applicable surface water quality standards. Discharge of treated groundwater to the Backus River by a surface water bubbler under Alternative 7 modified will be at levels that will not cause a violation of applicable surface water quality standards in the receiving water body.	Applicable
Stormwater runoff	FEDERAL – CWA NPDES Stormwater Discharge Requirements (40 CFR 122.26)	Establishes requirements for stormwater discharges associated with construction activities that create a land disturbance of equal to or greater than one acre of land. The requirements include good construction management techniques; phasing of construction projects; minimal clearing; and sediment, erosion, structural, and vegetative controls to be implemented to mitigate stormwater run-on and runoff.	If stormwater runoff associated with remedial action construction, operation, and maintenance activities discharges to a surface water body, including wetlands, and the area of disturbance is greater than one acre of land, it will be controlled in accordance with these requirements.	Applicable
Hazardous waste	FEDERAL – Subtitle C Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities (40 CFR 264 *et seq.*)	These requirements establish minimum national standards that define the acceptable management of hazardous waste. Massachusetts has been delegated the authority to administer these RCRA standards through its state hazardous waste management regulations	Because Massachusetts has been authorized to run the RCRA base program, hazardous materials will be managed according to the state requirements listed below.	Applicable
Air	***FEDERAL - Clean Air Act, Hazardous Air Pollutants; National Emission Standards for Hazardous Air Pollutants; 42 USC §112(b)(1); 40 CFR Part 61***	***The regulations establish emissions standards for 189 hazardous air pollutants. Includes control requirements for dust contaminated with hazardous air pollutant***	***Dust and emissions will be managed to meet the state requirements during response activities. Site remedial work and water treatment operations will be managed and performed in accordance with these regulations. Air emissions from the treatment systems will not be at a level high enough to trigger the standards for hazardous waste incinerators, organic materials, or VOCs***	***Applicable***

Appendix A – ARARs/TBCs for the Interim Groundwater Remedy
Operable Unit 15, FTA-1, Joint Base Cape Cod
Table A-3
Action-Specific ARARs/TBCs[1]

Media	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Groundwater	*FEDERAL – Cancer Slope Factors (CSFs)* *Moved from the Chemical-Specific ARAR Table 2-30 from the ROD.*	*These are guidance values used in risk assessment to evaluate the potential carcinogenic hazard caused by exposure to contaminants. CSFs represent the most- up-to-date information on cancer risk.*	*This guidance will be used to develop carcinogenic risk-based performance standards for assessing the effectiveness of the treatment component of the remedy and for monitoring groundwater throughout the plume area.*	*TBC*
Groundwater	*FEDERAL – Guidelines for Carcinogen Risk Assessment - EPA/630/P-3/001F* *(March 2005)* *Moved from the Chemical-Specific ARAR Table 2-30 from the ROD.*	*These guidelines are used to perform human health risk assessments.*	**This guidance will be used to develop carcinogenic risk-based performance standards for assessing the effectiveness of the treatment component of the remedy and for monitoring groundwater throughout the plume area.**	*TBC*
Groundwater	*FEDERAL – Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens - EPA/630/R-03/003F* *(March 2005)* *Moved from the Chemical-Specific ARAR Table 2-30 from the ROD.*	*These guidelines are used to perform human health risk assessments.*	*This guidance will be used to develop carcinogenic risk-based performance standards for assessing the effectiveness of the treatment component of the remedy and for monitoring groundwater throughout the plume area.*	*TBC*

Appendix A – ARARs/TBCs for the Interim Groundwater Remedy
Operable Unit 15, FTA-1, Joint Base Cape Cod
Table A-3
Action-Specific ARARs/TBCs[1]

Media	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Groundwater	*FEDERAL – EPA Risk Reference Doses (RfDs)* *Moved from the Chemical-Specific ARAR Table 2-30 from the ROD.*	*RfDs are considered the levels unlikely to cause significant adverse health effects associated with a threshold mechanism of action in human exposure to non-carcinogenic contaminants for a lifetime. The RfD for PFOS is 0.000002 milligrams/kilogram-day (mg/kg-day) based on developmental effects. The RfD for PFOA and PFNA is 0.000003 mg/kg- day based on developmental effects. The RfD for PFHxS is 0.00002 mg/kg-day based on endocrine system effects.*	*This guidance will be used to develop non-carcinogenic risk-based performance standards for assessing the effectiveness of the treatment component of the remedy and for monitoring groundwater throughout the plume area. This guidance was also used by the Massachusetts Department of Health to develop human consumption risk-based standards for PFOS in fish tissue and will be used to develop monitoring standards for Ashumet and Johns Ponds.*	*TBC*
Groundwater	*FEDERAL - EPA Health Advisories (HAs) and Drinking Water Equivalent Levels (DWELs)* *Moved from the Chemical-Specific ARAR Table 2-30 from the ROD.*	*Lifetime HAs establish the concentration of a chemical in drinking water that is not expected to cause any adverse noncarcinogenic effect over a lifetime of exposure with a margin of safety DWELs establish the same concentrations but are based on an assumption that all of the exposure to a contaminant is from drinking water. The lifetime HA for manganese is set at 0.3 mg/L and the DWEL at 1.6 mg/L.*	*This guidance will be used to develop risk-based performance standards for assessing the effectiveness of the treatment component of the remedy and for monitoring groundwater throughout the plume area.*	*TBC*
Surface Water	*National Recommended Water Quality Criteria (NRWQC); EPA-822-R-02-047*	*National water quality criteria established to protect human health and aquatic life. Recommended criteria Incorporated into Massachusetts water quality regulations.*	*Levels of contaminants in untreated groundwater currently discharging to surface water bodies are below applicable surface water quality standards. Discharge to the Backus River by a surface water bubbler will be at levels that will not cause a violation of applicable surface water quality standards in the receiving water body. Will be used as monitoring standards in Ashumet and Johns Ponds.*	*TBC*
Investigation-Derived Wastes	*FEDERAL Guide to Management of Investigation-Derived Waste (USEPA OSWER 9345.303FS, (January 1992))*	*Investigation-derived wastes (IDW) generated from remedial activities (e.g., drilling muds, purged water, etc.) are required to be properly stored, managed, and disposed. Guidance given in the publication includes waste material containment, collection labeling, etc.*	*Investigation-derived wastes (IDW) generated from remedial activities (e.g., drilling muds, purged water, etc. from installing, maintaining and sampling monitoring wells) will be stored, managed, and disposed of based on these guidance standards.*	*TBC*

Appendix A – ARARs/TBCs for the Interim Groundwater Remedy
Operable Unit 15, FTA-1, Joint Base Cape Cod
Table A-3
Action-Specific ARARs/TBCs[1]

Media	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Groundwater	***STATE – MA Drinking Water Regulations (310 CMR 22. 05-22.09)*** ***Moved from the Chemical-Specific ARAR Table 2-30 in the ROD. MMCLs for PFAS were added to the regulations since the ROD and apply to this remedy.***	***These standards establish state MCLs for public drinking water systems but are also considered relevant and appropriate for CERCLA groundwater response actions. When state MCLs are more stringent than federal levels, state levels must be used. These regulations were revised on 02 October 2020 to include the new PFAS6 MMCL.***	***These standards will be used as performance standards for assessing the effectiveness of the treatment component of the remedy, for establishing the required LUC boundary and for monitoring groundwater throughout the plume area when the standards are more stringent than federal ARAR or risk-based standards.***	***Relevant and Appropriate***
Groundwater	**STATE – MA Groundwater Discharge Permit Program (310 CMR 5.10(3)(a-b) & 5.11** ***MA Groundwater Quality Standards cited as Chemical-Specific ARAR in the ROD were withdrawn and replaced with the Groundwater Discharge Permit Program regulations that are now cited as an Action-Specific ARAR.***	**Establishes groundwater effluent limitations that may be used also as groundwater monitoring standards. The minimum criteria for groundwater applicable to all ground waters of the Commonwealth are the effluent limitations set forth in 314 CMR 5.10(3)(a) and (b).**	***These standards will be used as performance standards for assessing the effectiveness of the treatment component of the remedy, for establishing the required LUC boundary and for monitoring groundwater throughout the plume area when the standards are more stringent than federal ARAR or risk-based standards.***	Applicable

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Media	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Groundwater	STATE – MA Underground **Injection Control** (310 CMR 27.00 *et seq.*)	These regulations prohibit the injection of fluid containing any pollutant into underground sources of drinking water where such pollutant will or is likely to cause a violation of any state drinking water regulations under 310 CMR 22.00 or adversely affect the health of persons.	Monitoring well sample water and groundwater will be treated to levels at or below the most stringent federal and state primary drinking water standards prior to release to ***reinjection wells and/or infiltration galleries*** to ensure that releases will not cause any violation of drinking water standards in the receiving aquifer.	Applicable
Discharge to surface water	STATE – Surface Water Discharge Permit Program (314 CMR 3.10, 3.11, and 3.19)	Establishes requirements for point source discharges to surface waters of the Commonwealth through the MPDES program. Requires that all such discharges not result in a violation of the applicable MA surface water quality standards (314 CMR 4.00 et seq.) in the receiving stream or the MA groundwater quality standards (314 CMR 6.00 et seq.) in the receiving water body.	Levels of contaminants in untreated groundwater currently discharging to surface water bodies are below applicable surface water quality standards. Discharge of treated groundwater to the Backus River by a surface water bubbler under Alternative 7 modified will be at levels that will not cause a violation of applicable surface water quality standards in the receiving water body.	Applicable
Surface water	STATE – Surface Water Quality Standards (314 CMR 4.00)	These standards limit the concentration of certain materials allowed in classified Massachusetts surface waters. The surface water surrounding the MMR has been classified as Class SA and SB coastal waters and Class B inland water.	Levels of contaminants in untreated groundwater currently discharging to surface water bodies are below applicable surface water quality standards. Discharge to the Backus River by a surface water bubbler will be at levels that will not cause a violation of applicable surface water quality standards in the receiving water body. Will be used as monitoring standards in Ashumet and Johns Ponds.	Applicable

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Media	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Air	STATE – MA Air Pollution Control Regulations (310 CMR 7.06, 7.08 – 7.10, 7.14, and 7.18 – 7.24)	Establishes the standards and requirements for air pollution control in the Commonwealth. Potentially relevant sections include those pertaining to: visible emissions (7.06); dust, odor, construction and demolition (7.09); and noise (7.10). The regulations also contain air pollutant emission standards for, among other things, hazardous waste incinerators, organic materials, and VOCs.	Dust, noise, and visible emissions will be managed to meet the state requirements during response activities. Site remedial work and water treatment operations will be managed and performed in accordance with these regulations. Air emissions from the treatment systems will not be at a level high enough to trigger the standards for hazardous waste incinerators, organic materials, or VOCs.	Applicable
Stormwater runoff	STATE – Stormwater Discharge Requirements (314 CMR 3.04 and 314 CMR 3.19)	Requires that stormwater discharges associated with construction activities be managed in accordance with the general permit conditions of 314 CMR 3.19 so as not to cause a violation of Massachusetts surface water quality standards in the receiving surface water body (including wetlands).	If stormwater runoff associated with remedial action construction, operation and maintenance activities discharges to a surface water body, including wetlands, and the area of disturbance is greater than one acre of land, it will be controlled in accordance with these requirements.	Applicable
Hazardous waste	STATE – RCRA Identification and Listing of Hazardous Waste (310 CMR 30.120-125)	These requirements identify the concentrations of contaminants at or above which the waste would be considered characteristically hazardous waste.	RCRA status of groundwater samples, soils, and other materials generated during response actions will be determined based on prescribed test methods. If results exceed the standards in 310 CMR 30.120-125, the material will be managed in accordance with hazardous waste regulations.	Applicable
Hazardous waste	STATE – MA HWMR Requirements for Generators of Hazardous Waste (310 CMR 30.300 – 30.305, 310 CMR 30.351)	A generator of solid waste must determine whether that waste is hazardous using various methods, including the TCLP method, or application of knowledge of hazardous characteristics of the waste. If waste is determined to be hazardous, it must be managed in accordance with the applicable Massachusetts generator requirements, which require management in accordance with 310 CMR 30.000 *et seq*.	Hazardous materials generated during the remedial action will be managed in accordance with these regulations and disposed of off-site in a RCRA-permitted treatment, storage, and disposal facility.	Applicable

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Media	Requirements	Requirement Synopsis	Action to be Taken to Attain Requirements	Status
Solid Waste	***STATE Solid Waste Management Facility Regulations (319 CMR 19.00)***	***The regulations contain requirements for disposal of solid wastes.***	***Any wastes generated by remedial activity that are determined to not be hazardous wastes will be managed in accordance with this regulation.***	***Applicable***
Groundwater/ Wells	STATE – MassDEP Drinking Water Program, Private Well Guidelines (2008), available at http://www.mass.gov/dep/water/laws/prwellgd.doc	These are guidelines concerning private well location, design, construction, development, water quality testing, operation, maintenance, and decommissioning.	These guidelines will be used in locating, designing, constructing, developing, testing, operating, maintaining, and decommissioning monitoring wells, extraction wells, and reinjection wells, and testing and decommissioning private water supply wells.	TBC
Stormwater runoff	STATE – Stormwater Management Program Policy (18 November 1996)	Provides policies and guidance on complying with the state's stormwater discharge requirements.	If stormwater runoff associated with remedial action construction, operation and maintenance activities discharges to a surface water body, including wetlands, it will be controlled in accordance with these requirements.	TBC
Stormwater runoff	***STATE – MA Stormwater Handbook Vol. 2 (2008)***	***Guidance on best management practices to address stormwater management.***	***During construction activities stormwater will be managed with best management practices.***	***TBC***
Soil	STATE – MA Erosion and Sediment Control Guidelines for Urban and Suburban Areas (May 2003)	Provides guidance and best management practices regarding erosion and sediment control.	***Construction, operation, and maintenance of the remedial system components*** will be performed in accordance with this guidance as appropriate.	TBC

Appendix A – ARARs/TBCs for the Interim Groundwater Remedy
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Table A-3
Action-Specific ARARs/TBCs[1]

Key:

ARAR	applicable or relevant and appropriate requirement
CFR	*Code of Federal Regulations*
CMR	*Code of Massachusetts Regulations*
CSF	Cancer Slope Factor
CWA	Clean Water Act
DWEL	Drinking Water Equivalent Level
EPA	U.S. Environmental Protection Agency
GWQS	Groundwater Quality Standard
HA	health advisory
HWMR	Hazardous Waste Management Regulation
LTM	long term monitoring
MA	Massachusetts
MCL	Maximum Contaminant Level
MCLG	MCL Goal
Mg/kg	milligram per kilogram
MMCL	Massachusetts MCL
MMR	Massachusetts Military Reservation
MNA	monitored natural attenuation
NPDES	National Pollutant Discharge Elimination System
PFAS	per- and polyfluoroalkyl substances
PFAS6	sum of the concentration of 6 PFAS with MMCLs
PFHxS	perfluorohexane sulfonic acid
PFOA	Perfluorooctanoic Acid
PFOS	Perfluorooctane Sulfonic Acid
RCRA	Resource Conservation and Recovery Act
RfD	Risk Reference Dose
SDWA	Safe Drinking Water Act
TBC	to be considered (guidance)
VOC	volatile organic compound
µg/L	microgram per liter

1. The Action-Specific ARARs were taken from Table 2-32 of the Final Record of Decision for Ashumet Valley Groundwater, except for certain groundwater standards that were moved from the Chemical-Specific ARAR Table 2-30 from the ROD. prepared for the Air Force Center for Engineering and the Environment Installation Restoration Program at the Massachusetts Military Reservation by Jacobs Engineering Group, Inc., March 2009 and have been updated in ***bold and italicized font*** where necessary for ESD 2.

APPENDIX B

OU 15 (ASHUMET VALLEY AND FTA-1 GROUNDWATER)

UPDATED LAND USE CONTROL REQUIREMENTS

(Changes from 2009 ROD in Gray)

LAND USE CONTROL REQUIREMENTS
ASHUMET VALLEY AND FTA-1 (OPERABLE UNIT 15) INTERIM REMEDY

1.0 INTRODUCTION

The following text describes the LUCs that will be implemented for the Ashumet Valley and FTA-1 groundwater selected interim remedy. The Ashumet Valley and FTA-1 contaminated groundwater currently poses an unacceptable risk to human health if used for household purposes (i.e., ingestion, dermal contact, and inhalation of vapors released during household use of water). Additionally, FTA-1 contaminated groundwater enters the surface water in Ashumet and Johns Ponds resulting in an unacceptable risk to human health from the ingestion of fish from the ponds.

The Ashumet Valley and FTA-1 contaminated groundwater is located in the southern part of the ~~MMR~~ JBCC cantonment area, and ~~all of~~ a majority of the contaminated groundwater has migrated past the ~~MMR~~ JBCC boundary into the neighboring towns of Falmouth and Mashpee. Therefore, administrative and/or legal controls that minimize the potential for human exposure to contamination by limiting land or resource use, known as "LUCs," must be established for the Ashumet Valley and FTA-1 groundwater to avoid the risk of exposure to Ashumet Valley or FTA-1 groundwater or impacted fish in Ashumet and Johns Ponds. These LUCs are needed both on-base and off-base, within the towns of Falmouth and Mashpee, until the Ashumet Valley and FTA-1 contaminated groundwater and its impact on fish no longer pose an unacceptable risk.

The performance objectives of the LUCs are to:

- Performance Object #1: Prevent access to or use of the groundwater from the Ashumet Valley or FTA-1 contaminated groundwater until the groundwater no longer poses an unacceptable risk;

- Performance Objective #2: Maintain the integrity of the current or future remedial or monitoring system such as the treatment systems and monitoring wells.; and

- Performance Objective #3: Prevent human consumption of fish from Ashumet and Johns Ponds until the fish no longer pose an unacceptable risk.

2.0 LUCS TO ACHIEVE PERFORMANCE OBJECTIVES #1 AND #2

The LUCs will encompass the area including the Ashumet Valley and FTA-1 contaminated groundwater and surrounding areas to reduce the risk from exposure to contaminated groundwater (Figure 2~~-14~~). The on-base area of concern is controlled and operated by the Air Force, who leases this land from the Commonwealth of Massachusetts. It is expected that this entity (U.S. Air Force) will control the on-base area of concern and the surrounding area for the duration of this ~~ROD~~ CERCLA remedy. As a result, the Air Force will coordinate with the Commonwealth of Massachusetts as the Air Force fulfills its responsibility to establish, monitor, maintain, and report on the LUCs for this site. For the off-base areas of concern the Air Force will coordinate with the State and municipal entities with regulatory authority over the area.

Each LUC will be maintained until either (1) the concentrations of COCs in the groundwater are at such levels as to allow unrestricted use and exposure, or (2) the Air Force, with the prior approval of the EPA and MassDEP, modifies or terminates the LUC in question.

The Air Force is responsible for ensuring that the following ~~two~~ three LUCs are established, monitored, maintained, and reported on as part of this ~~final~~ interim remedy to ensure protection of human health and the environment in accordance with CERCLA and the NCP for the duration of the ~~final~~ CERCLA remedy selected in ~~this~~ the 2009 ROD, 2011 ESD 1, and this ESD 2. The Town of Falmouth has enforcement authority on the first LUC. The Town of Mashpee has enforcement authority on the second LUC. The Commonwealth of Massachusetts only has enforcement authority regarding the ~~second~~ third LUC. In the event that the Town of Falmouth fails to promptly enforce the first LUC and/or the Town of Mashpee fails to properly enforce the second LUC, or the Commonwealth of Massachusetts fails to promptly enforce the ~~second~~ third LUC, the Air Force will act in accordance with the third ~~to last~~ paragraph in ~~this section~~ Section 4.0. For purposes of the preceding sentence, "promptly enforce" means if the violation or potential violation is imminent or on-going, enforce to prevent or terminate the violation within 10 days from the enforcing agency's (i.e., the Town or the Commonwealth) discovery of the violation or potential violation; otherwise, enforce as soon as possible.

(1) The Falmouth BOH requires a permit for the installation and use of all wells, including drinking water wells, irrigation wells, and monitoring wells. If a permit to install a drinking water well is approved, the Falmouth BOH will not approve the use of that well until its water has been tested and the BOH has determined that the water is potable. The Falmouth BOH Water Well Regulations do not apply to use of existing drinking water wells and irrigation wells. The regulations, which are reproduced in Appendix C, cover documented and anticipated areas of contamination from the Ashumet Valley and FTA-1 plumes. To assist the Town of Falmouth in the implementation of this LUC, the Air Force will meet with the BOH on an annual basis, or more frequently if needed, to provide and discuss plume maps that document the current and projected location of the Ashumet Valley and FTA-1 plumes within the town of Falmouth. Plume maps will include PFAS plumes based on federal MCL or more stringent State MCL exceedances. While Figure 2~~-14~~ shows the current area of LUCs in the town, the Falmouth BOH may modify the areas where the BOH may require additional well testing, and this LUC will apply to such areas even if they differ from the area shown in Figure 2~~-14~~.

(2) To better protect the public health and welfare of its citizens, the Mashpee BOH, adopted a moratorium on residential wells on 23 April 1998, amended 29 July 1999, in the town of Mashpee. The moratorium, as amended, applies to existing wells and potential future wells, and restricts any and all uses of groundwater (Appendix D). The areas where well use is excluded are defined by the Mashpee BOH, and include documented areas of contamination and anticipated areas of contamination from the FTA-1 contaminated groundwater. To assist the Mashpee BOH in the implementation of this LUC, the Air Force will meet with the BOH on an annual basis, or more frequently if needed, to provide and discuss plume maps that document the current and projected location of the FTA-1 contaminated groundwater within the town of Mashpee. Plume maps will include PFAS plumes based on federal MCL or more stringent State MCL exceedances. While Figure 2 shows the current area of LUCs in the town, the Mashpee BOH may modify the areas subject to the moratorium or where the BOH may require additional well testing, and this LUC will apply to such areas even if they differ from the area shown in Figure 2.

(3) In addition to the towns of Falmouth and Mashpee BOH regulations, which generally ~~applies~~ apply to small water supply wells, existing LUCs also prevent the possible creation of a large potable water supply well. The MassDEP administers a permitting process for any new drinking water supply wells in Massachusetts that propose to service more than 25 customers or exceed a withdrawal rate of 100,000 gallons per day. This permitting process, which serves to regulate the use of the Ashumet Valley or FTA-1 contaminated groundwater for any withdrawals of groundwater for drinking water purposes, constitutes

an additional LUC for this final remedy. This LUC applies to both on-base and off-base portions of the Ashumet Valley and FTA-1 plumes.

The Air Force has provided municipal water supply hook-ups, bottled water, or point of use treatment systems for all known impacted residences in areas of current or anticipated groundwater contamination. In conjunction with the Falmouth and Mashpee BOH Water Well Regulations, the municipal water supply hook-ups significantly reduce the likelihood of exposure to contaminated groundwater from existing wells and from any future wells installed in areas of anticipated contamination. Additionally, the Air Force is responsible for ensuring that the following LUCs are established, monitored, maintained, reported on, and enforced as part of this final remedy to ensure protection of human health and the environment in accordance with CERCLA and the NCP for the duration of the ~~is final~~ CERCLA remedy selected in ~~this~~ the 2009 ROD, 2011 ESD 1, and this ESD 2.

(1) For the on-base area of concern, a prohibition on new drinking water wells serving 25 or fewer customers has been established and placed on file with the planning and facilities offices for the Massachusetts Air and Army National Guard and USCG (major tenants at the ~~MMR~~ JBCC). The prohibition will be applied to future land use planning per Air National Guard Instruction (ANGI) 32-1003, Facilities Board, Army National Guard Regulation 210-20, Real Property Development Planning for the Army National Guard, and Commandant Instruction Manual 11010.14, Shore Facility Project Development Manual.

~~(2) For the on-base area of concern, the Air National Guard has administrative processes and procedures that require approval for all projects involving construction or digging/subsurface soil disturbance, currently set forth in ANGI 32- 1001, Operations Management. This procedure is a requirement of the Army National Guard and the USCG by the Air National Guard through Installation Support Agreements. The Air National Guard requires a completed AF Form 103, Base Civil Engineer Work Clearance Request (also known as the base digging permit), prior to allowing any construction, digging, or subsurface soil disturbance activity. All such permits are forwarded to the IRP for concurrence before issuance. An AF Form 103 will not be processed without a Dig Safe permit number (see next paragraph).~~

(2) The Dig Safe program implemented in Massachusetts provides an added layer of protection to prevent the installation of water supply wells in the Ashumet Valley and FTA-1 groundwater areas and to protect monitoring wells and the treatment system's infrastructure. This program requires, by law, anyone conducting digging activities (e.g., well drilling) to request clearance through the Dig Safe network. The Air Force at the ~~MMR~~ JBCC is a member utility of Dig Safe. The Ashumet Valley and FTA-1 groundwater plumes ~~is~~ are encompassed by a geographical area identified by the Air Force as a notification region within the Dig Safe program. Through the Dig Safe process, the Air Force will be electronically notified at least 72 hours prior to any digging within this area. The notification will include the name of the party contemplating, and the nature of, the digging activity. The Air Force will review each notification and if the digging activity is intended to provide a well, which has not been approved via the procedures above, the Air Force will immediately notify the project sponsor (of the well drilling), the EPA, the Falmouth BOH or the Mashpee BOH, and the MassDEP in order to curtail the digging activity. If the Dig Safe notification indicates proposed work near monitoring wells or the treatment system infrastructure, the Air Force will mark its components to prevent damage due to excavation. This LUC applies to both on-base and off-base portions of the Ashumet Valley and FTA-1 plumes. The extent of the Air Force's enforcement of this LUC does not address off-base parties failing to file a Dig Safe request nor Dig Safe improperly processing a notification, but if incidents do occur, the Air Force is responsible for ensuring remedy integrity and, if necessary, repairing damage caused by third parties to the remedial system infrastructure or monitoring wells.

The LUCs are intended to prevent exposure to groundwater impacted by the Ashumet Valley and FTA-1 plumes; however, to insure that the LUCs obtain the LUC performance objectives the Air Force has or will take the following action.

As already completed for the area of the Ashumet Valley plume and, to be conducted within seven years of the signing of this ESD 2, for the area of the FTA-1 plume the Air Force has/will ~~Within three years of the signing of the 2009 ROD for the Ashumet Valley plume and within seven years of the signing of this ESD 2 for the FTA-1 plume, the Air Force shall~~:

a. Document all private wells (i.e., non-decommissioned wells, including wells not currently in use) that are above or within the projected path of the Ashumet Valley or FTA-1 plume.

b. Demonstrate and document that the private well is not capable of drawing contaminated groundwater originating from the Ashumet Valley or FTA-1 plume, or test the private well for

~~contamination~~ COCs and demonstrate the private well to be safe for human use. The Air Force will continue such testing, on an appropriate frequency as determined in coordination with the EPA, until the plume no longer presents a threat to that well as determined in coordination with EPA.

c. If the Air Force identifies a well containing COCs, the Air Force shall assess the risk that current and potential future non-drinking uses of such a well pose to human health. The Air Force shall submit a draft version of any such risk assessment to EPA for review and approval.

d. If neither b nor c is able to confirm that the identified well is safe for human use based on COC concentrations attributable to the Ashumet Valley or FTA-1 plume, the Air Force will offer the owner decommissioning of the well. If accepted, the Air Force will document such action with the appropriate BOH. If the decommissioning is not accepted, the Air Force will take other steps to insure protectiveness ~~to~~ which may include, but not be limited to, requesting assistance from the appropriate BOH to issue health warnings to the property owner and any other person with access to the well (such as a lessee or licensee), connecting affected facilities to municipal water, installing and maintaining point of use or point of entry treatment systems at affected facilities, or offering bottled water (if well is used for drinking) ~~or installing treatment systems on affected wells~~. In each instance, the Air Force shall submit a schedule subject to EPA concurrence, outlining and including time limitations for the completion of steps sufficient to prevent exposure to concentrations of contaminated groundwater from the Ashumet Valley or FTA-1 plume having chemicals of concern in excess of ARARs (i.e., MCLs, MMCLs, non-zero MCLGs), and prevent exposure to groundwater from the Ashumet Valley or FTA-1 plume that poses a cancer risk in excess of the EPA target risk range of 10^{-4} to 10^{-6} or which presents a non-carcinogenic HI greater than one.

3.0 LUC TO ACHIEVE PERFORMANCE OBJECTIVE #3

The LUC will encompass the area including Ashumet and Johns Ponds to reduce the risk from exposure to contaminated fish (Figure 2).

This LUC will be maintained until either (1) the concentrations of COCs in the fish in Ashumet and Johns Ponds are at such levels that MassDPH removes the fish consumption advisories or (2) the Air Force, with the prior approval of the EPA and MassDEP, modifies or terminates the LUC in question.

The Air Force is responsible for ensuring that the following LUC is established, monitored, maintained, and reported on as part of this interim remedy to ensure protection of human health in accordance with CERCLA and the NCP for the duration of the interim CERCLA remedy selected in this ESD 2.

(1) The Massachusetts Department of Public Health (MADPH), Bureau of Climate and Environmental Health has issued a *Freshwater Fish Consumption Advisory List* which includes meal advisories for fish from Ashumet and Johns Ponds. This advisory list is included in Appendix E. To assist MADPH in the communication of this LUC, the Air Force will monitor (and replace as necessary) signs installed by MADPH and install (and replace as necessary) additional signs at key locations where MADPH does not already have signs installed. Additionally, the Air Force will develop a communication protocol regarding this LUC as part of its Land Use Control Implementation Plan to ensure other communication means (i.e., public meetings, tribal contact, town websites) are employed to their full advantage to make the fish advisory known.

4.0 GENERAL LUC MONITORING AND REPORTING

Monitoring of the environmental use restrictions and controls will be conducted annually by the Air Force. The monitoring results will be included in a separate report or as a section of another environmental report, if appropriate, and provided to the EPA and MassDEP for informational purposes. The annual monitoring reports will be used in preparation of the five-year review to evaluate the effectiveness of the final remedy.

The annual monitoring report, submitted to the regulatory agencies by the Air Force, will evaluate the status of the LUCs and how any LUC deficiencies or inconsistent uses have been addressed. The annual evaluation will address (i) whether the use restrictions and controls referenced above were effectively communicated; (ii) whether the operator, owner, and state and local agencies were notified of the use restrictions and controls affecting the property; and (iii) whether use of the property has conformed with such restrictions and controls and, in the event of any violations, summarize what actions have been taken to address the violations.

The Air Force shall notify the EPA and MassDEP 45 days in advance of any proposed land changes that would be inconsistent with the LUC objectives or the final remedy. If the Air Force discovers a proposed or ongoing activity that would be or is inconsistent with the LUC objectives or use restrictions, or any other action (or failure to act) that may interfere with the effectiveness of the LUCs, it will address this activity or action as soon as practicable, but in no case will the process be initiated later than 10 days after the Air Force becomes aware of this breach. The Air Force will notify the EPA and MassDEP as soon as practicable, but no later than 10 days after the discovery of any activity that is inconsistent with the LUC objectives or use restrictions, or any other action that may interfere with the effectiveness of the LUCs. The Air Force will notify the EPA and MassDEP regarding how the Air Force has addressed or will address the breach within 10 days of sending the EPA and MassDEP notification of the breach.

For the LUCs identified and selected for this ~~ROD~~CERCLA remedy, the Air Force will provide notice to the EPA and MassDEP at least six months prior to relinquishing the lease to the Ashumet Valley and FTA-1 groundwater area so the EPA and MassDEP can be involved in discussions to ensure that appropriate provisions are included in the transfer terms or conveyance documents to maintain effective LUCs. If it is not possible for the Air Force to notify the EPA and MassDEP at least six months prior to any transfer or sale, then the Air Force will notify the EPA and MassDEP as soon as possible, but no later than 60 days prior to the transfer or sale of any property, subject to LUCs.

The Air Force shall not modify or terminate LUCs, implementation actions, or modify land use without approval by the EPA and MassDEP. The Air Force, in coordination with other agencies using or controlling the Ashumet Valley and FTA-1 plume area, shall seek prior concurrence before taking any anticipated action that may disrupt the effectiveness of the LUCs or any action that may alter or negate the need for LUCs. The Air Force will provide EPA and MassDEP 30 days' notice of any changes to the internal procedures for maintaining LUCs which may affect Ashumet Valley or FTA-1.

Appendix C

Falmouth BOH Regulations

Purpose

The Falmouth Board of Health recognizes that there is a sole source groundwater aquifer on Cape Cod, a portion of which is under the Town of Falmouth. Certain areas of the groundwater aquifer beneath Falmouth have been identified as contaminated by activities associated with the Massachusetts Military Reservation and others, and that not all areas of groundwater contamination have been identified. There are risks associated with exposure to ground water contaminants through direct ingestion, dermal contact, inhalation, irrigation of lawns and food crops, or watering of animals that are later to be consumed.

In order to protect the public from exposure to potentially contaminated groundwater, the Falmouth Board of Health adopts the following regulation for the permitting, installation and use of water wells, under the authority of Massachusetts General Laws Chapter 111, Section 30.

These regulations and the testing requirements, herein, reflect prudent means of minimizing, but not eliminating the risk from exposure to groundwater contamination. Persons withdrawing water for drinking or irrigation are encouraged to stay informed about newly identified contaminant that may be contained in the groundwater they use, and to exercise prudence in all aspects of water withdrawal.

Section 1. Definitions:

A. Drinking Water Well – Any private source of groundwater for human use, including but not limited to, a source approved for such by the Falmouth Board of Health or Massachusetts Department of Environmental Protection (DEP) in accordance with GL 11 sec 122A or 310 CMR 22.00.
B. Irrigation Well – Any water supply well not approved as a drinking water supply used for the watering of plants and livestock or for commercial or industrial use.
C. Monitoring Well – A well installed for the express purpose of monitoring water quality or water level in an area. Excluded from these requirements are wells less than twenty feet deep used for purposes of determining groundwater elevations associated with the installation of a septic system and which are removed at the time of septic system installation or when they are no longer needed.
D. Contaminant – any compound, including but not limited to volatile organic compounds, pharmaceuticals, pesticides, radionuclides and metals for which a regulatory limit for the maximum allowable contaminant level in drinking water has been established by the Environmental Protection Agency and or the Massachusetts Department of Environmental Protection. Contaminant shall also include any compound for which a recommended health advisory has been promulgated by the Environmental Protection Agency and or the Massachusetts Department of Environmental Protection.
E. Professionally Prepared Plan – a scaled plan prepared by a surveyor or civil engineer or other qualified professional showing lot lines, location of existing structures, septic systems and proposed location of the well.

F. Subsurface Irrigation – a network of valves, pipes, tubing, and emitters that applies water directly into the root zones.

Section 2. Permits Required

A permit from the Board of Health shall be required for the installation, abandonment, changes in use, conversion of all wells, including Drinking Water Wells, Irrigation Wells, and Monitoring Wells within the Town of Falmouth. A permit granted under these regulations that is not exercised within one year may be renewed annually for up to two additional years.

A. Drinking Water Well – A permit application for a Drinking Water Well shall include a professionally prepared plan of the lot on which the Drinking Water Well is to be located showing the location of any septic system within 150 feet of the proposed Drinking Water Well, the location of any house or any permanent structure (existing or proposed), and a description of the proposed well that includes the latitude and longitude of the proposed location, construction material, anticipated screen depth of the well, and the maximum anticipated withdrawal rate in gallons per minute. The application shall also include proof that all abutters within 100 feet of the property have been notified by receipted mail using a form of letter approved by the Board of Health. In the case of new construction, well location and description may be shown on the same plan submitted under the requirements for the Board of Health approval of the septic system. Replacement of a Drinking Water Well within 5 feet of the original location shall not require a new permit under these regulations.
B. Irrigation Well – a permit application for an Irrigation Well shall include a professionally prepared plan of the lot on which the Irrigation Well is to be to be located showing the location of any septic system within 150 feet of the proposed Irrigation Well, the location of any house or any permanent structure (existing or proposed), and a description of the proposed well that includes the latitude and longitude of the proposed location, construction material, anticipated screen depth of the well, and the maximum anticipated withdrawal rate in gallons per minute and all proposed faucets and discharge points.
C. This permit does not relieve the applicant from being required to secure any and all additional permits that may be required by the State under the Water Management Act or any other pertinent regulations.
D. Monitoring Well – a permit for a Monitoring Well shall include an exact location at which the Monitoring Well is to be located in degrees latitude and longitude, a description of the Monitoring Well that includes the construction material and depth, a statement of purpose for which the Monitoring Well is being installed and its proposed length of service. The name, address, and telephone number of a contact person shall be included in the application. Permits for monitoring wells shall be granted for a period requested or any period deemed appropriate by the Board of Health.

Section 3 Requirements for use

A. Drinking Water Wells – All Drinking Water Wells shall be located: 1) to maintain a minimum lateral distance from the well to the nearest septic system of 100 feet; 2) to provide minimum risk of exposure to contamination from any known or suspected source; and 3) so that they do not infringe upon the ability of adjacent property owners to locate septic systems. No Drinking Water Well shall be physically connected with a public water supply line. A Drinking Water Well must be tested for coliform, nitrate-nitrogen, and volatile organic compounds and found to be within potable water limits as defined in 310 CMR 22.00 Drinking Water Regulations and must not exceed the Commonwealth of Massachusetts' Maximum Contaminant Levels. The Board of Health by this regulation reserves the right to require more extensive testing in areas of known or suspected contamination. A Drinking Water Well shall not be used until an as-build plan and the results of all required testing have been submitted and approved by the Board of Health.
B. Irrigation Wells – Irrigation Wells shall be located: 1) to maintain a minimum lateral distance from the well to the nearest septic system of 50 feet; 2) a minimum of 50 feet from a lot line in un-sewered areas; 3) to provide minimum risk of exposure to contamination from any known or suspected sources and; 4) for a lot served by Town sewer irrigation wells may be located 10 feet from a lot line, provided that only subsurface irrigation is used. No irrigation well shall be physically cross-connected with the plumbing of either a drinking water well or a public water supply line. All irrigation well spigots shall be placarded with a notice that reads "Irrigation well – not for drinking water purposes". Spigots for Irrigation Wells shall not be attached to a residence. An Irrigation Well shall not be used until: 1) an as-built plan and the results of all required testing have been submitted and approved by the Board of Health, and 2) a notice of the existence and location of the irrigation well shall be recorded with the Barnstable County Registry of Deeds. In areas of known or suspected contamination, such as exist in certain areas near the Massachusetts Military Reservation, initial testing of Irrigation Wells for contaminants shall be required prior to use. Irrigation Wells must not exceed the Maximum Contaminant Levels as set forth in 310 CMR 22.00 for contaminants referred to in section 1D.
C. Monitoring Wells – All Monitoring Wells shall have a locking cap or other device or structure to prevent unlawful use or entry. Caps shall be secure at all times when the well is not in use.
D. Compliance with water use restrictions. Private drinking water wells and irrigation wells shall be subject to water use restrictions to the same degree and extent that any such water use restrictions are placed upon the users of the Town's public water supply by the Commonwealth of Massachusetts.

Section 4. Conversion of Irrigation Wells:

Water from an Irrigation Well shall not be used as a drinking water well until it is demonstrated that: 1) the water meets all requirements of notability (Section 3A); 2) the well meets all the requirements of a Drinking Water Well relative to setbacks from septic systems and other potential sources of contamination; 3) the use of a well for such purpose shall not infringe upon the rights of adjacent property owners to construct or replace their septic systems, and; 4) the well is permitted as a Drinking Water Well.

Section 5. Abandonment of Wells

A. Drinking Water Wells – a Drinking Water Well may be abandoned by: 1) downgrading it to the classification of an Irrigation Well, or 2) permanently taking it out of service by disconnecting it from the residential drinking water system and sealing it with concrete followed by permitting and inspection by the Falmouth Board of Health. Downgrading a Drinking Water Well to an Irrigation Well requires that the well meet all the requirements for Irrigation Wells as denoted in Section 3 B.
B. Irrigation Well – An Irrigation Well may be abandoned by filling in the entire pipe volume with concrete, followed by a notice and inspection by the Falmouth Board of Health and recording said abandonment with the Registry of Deeds.
C. Monitoring Well – A Monitoring Well may be abandoned by filling the entire pipe volume with concrete, followed by a notice and inspection by the Falmouth Board of Health, or removal of the entire length of pipe from the ground.

Section 6. Variance

The Board of Health may vary the application of any provision of these water well regulations with respect to any particular case when, in its opinion, the enforcement thereof would do manifest injustice: provided, that the decision of the Board of Health shall not conflict with the spirit of these regulations. Requests for variances shall be submitted in writing to the Board of Health and shall enumerate the variance requested.

Section 7. Enforcement

This regulation will be enforced by the Board of Health or its designated agent(s) under the authority granted it under MGL Chapter 11, Section 30. Any citizen who desires to register a complaint pursuant to the regulation may do so by contacting the Board of Health of Falmouth or its designated agent(s) and the Board shall investigate.

Section 8. Severability

If any provision of these regulations is declared invalid or unenforceable, the other provisions shall not be affected thereby but shall continue in full force and effect.

These regulations are adopted on _____, 2017 and become effective on the date of publication.

_____
Jared Goldstone, Chairman

_____
George Heufelder

_____
Diana Molloy

_____
Stephen Rafferty

_____
John Waterbury

Appendix D

Mashpee BOH Regulations

PART XIX, SECTION 4.00 – **Amendment to Moratorium on Groundwater Wells**

TOWN OF MASHPEE
BOARD OF HEALTH

MORATORIUM ON GROUNDWATER WELLS

Under the authority of Massachusetts General Laws, Chapter 111, Section 31, the Board of Health of Mashpee adopts the following regulation in an effort to better protect the public health and welfare of the citizens and visitors in the Town.

REGULATION:

Existing and future residential wells located in documented or anticipated areas of groundwater contamination as defined by the Board of Health are herewith restricted from use for any purpose, including drinking, any agricultural use (lawn watering, gardening, livestock watering, irrigation of crop land, etc.) washing vehicles, pool filling, etc. This moratorium includes groundwater wells owned by the residents currently connected to a public water supply.

A Massachusetts Licensed Well Driller must decommission the affected wells and written evidence thereof must be submitted to the Board of Health.

PURPOSE:

This regulation seeks to prevent any inadvertent exposure to contaminated groundwater, which may present a potential health risk to the residents and visitors of Mashpee. Residential well waters in documented or potentially affected areas of groundwater pollution pose a possibility of exposure pathways to humans. Ingestion, inhalation and dermal exposure are potential pathways. This potential risk necessitates this regulation.

Adopted by the Board of Health on April 23, 1998. This regulation will become effective upon the date of publication in the press.

The original intent of the Board of Health was clarified on July 15, 1999, by inserting the words "Existing and Future" in the first paragraph of the regulation. The Board of Health approved this amendment to the regulation on July 29, 1999.

Per Order Of,
Mashpee Board of Health

Steven R. Ball, Chairman
John T. Doherty, Co-Chairman
Robert F. Cram, Clerk

Appendix E

MADPH Freshwater Fish Consumption Advisory List

Freshwater Fish Consumption Advisory List

Massachusetts Department of Public Health
Bureau of Climate and Environmental Health
(617) 624-5757
May 2024

WATERBODY	MUNICIPALITY	HAZARD(S)*	MEAL ADVICE** Sensitive populations***	MEAL ADVICE** General population
Aaron River Reservoir	Cohasset, Hingham, Scituate	Mercury	Do not eat any fish	Do not eat Chain Pickerel, Yellow Perch Limit other species to 2 meals/month
Alewife Brook and Little River	Arlington, Belmont, Cambridge, Somerville	PCBs	Do not eat Carp	Limit Carp to 2 meals/month
Ames Pond	Tewksbury	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Ashfield Pond	Ashfield	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Ashland Reservoir	Ashland	Mercury, PFAS	Do not eat any fish	Limit all fish to 1 meal/month
Ashley Lake	Washington	Mercury	Do not eat Yellow Perch	Limit Yellow Perch to 2 meals/month
Ashmere Lake	Hinsdale, Peru	Mercury	Do not eat Chain Pickerel, Largemouth Bass	Limit Chain Pickerel, Largemouth Bass to 2 meals/month
Ashumet Pond	Mashpee, Falmouth	Mercury, PFAS	Do not eat any fish	Do not eat any fish
Asnacomet Pond	Hubbardston	PFAS	Do not eat any fish****	Limit all fish to 1 meal/week
Atkins Reservoir	Amherst, Shutesbury	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Attitash, Lake	Amesbury, Merrimac	Mercury, PFAS	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month
Badluck Lake	Douglas	Mercury	Do not eat any fish	Do not eat any fish
Baker Pond	Brewster, Orleans	Mercury	Do not eat Yellow Perch	Limit Yellow Perch to 2 meals/month
Baldpate Pond	Boxford	Mercury	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month
Ballardvale Impoundment of Shawsheen River	Andover	Mercury	Do not eat Black Crappie, Largemouth Bass	Limit Black Crappie, Largemouth Bass to 2 meals/month
Bare Hill Pond	Harvard	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Bearse Pond	Barnstable	Mercury	Do not eat Largemouth Bass, Smallmouth Bass	Limit Largemouth Bass, Smallmouth Bass to 2 meals/month

Fish consumption advisories for contaminants other than PFAS apply to the consumption of all native game fish but do not apply to stocked trout at a waterbody (unless otherwise specified).

* See page 17 for hazard codes.

** Uncooked serving sizes should be 8 to 12 oz. of fish for adults and children over 12, with smaller amounts for younger children.

***Sensitive populations include children under 12; and people who are nursing, pregnant, or may become pregnant

****This waterbody has not been evaluated for mercury. Per DPH's statewide fish consumption advisory for mercury, sensitive populations should not eat fish from this waterbody until more information on mercury levels is available.

WATERBODY	MUNICIPALITY	HAZARD(S)*	MEAL ADVICE** Sensitive populations***	MEAL ADVICE** General population
Beaver Pond	Bellingham, Milford	Mercury	Do not eat Largemouth Bass, Chain Pickerel	Limit Largemouth Bass, Chain Pickerel to 2 meals/month
Big Pond	Otis	Mercury	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month
Blackstone River	Blackstone, Grafton, Millbury, Millville, Northbridge, Sutton, Uxbridge, Worcester	PFAS	Do not eat any fish****	Limit all fish to 2 meals/month
Boon, Lake	Hudson, Stow	Mercury, PFAS	Do not eat Black Crappie, Largemouth Bass Limit other species to 1 meal/6 months	Limit all fish to 1 meal/2 months
Box Pond	Bellingham, Mendon	DDT	Do not eat White Sucker	Do not eat White Sucker
Bracket Reservoir (Framingham Reservoir #2) – See Sudbury River				
Browning Pond	Oakham, Spencer	Mercury	Do not eat Largemouth Bass, Yellow Perch	Limit Largemouth Bass, Yellow Perch to 2 meals/month
Buck Pond	Westfield	PFAS	Do not eat any fish****	Limit all fish to 2 meals/month
Buckley Dunton Lake	Becket	Mercury	Do not eat any fish	Do not eat Largemouth Bass
Buffomville Lake	Charlton, Oxford	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Burr's Pond	Seekonk	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Cabot Pond – See Rumford River				
Canton River (between the Neponset River and Neponset Street dam)	Canton	PCBs, DDT	Do not eat any fish	Do not eat American Eel, White Sucker Limit other species to 2 meals/month
Cedar Swamp Pond	Milford	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Chadwicks Pond	Boxford, Haverhill	Mercury	Do not eat any fish	Do not eat any fish
Charles River (between the Medway Dam in Franklin and Medway and the South Natick Dam in Natick)	Dover, Franklin, Medfield, Medway, Millis, Natick, Norfolk, Sherborn	Mercury, Chlordane, DDT	Do not eat any fish	Limit all fish to 2 meals/month

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WATERBODY	MUNICIPALITY	HAZARD(S)*	MEAL ADVICE** Sensitive populations***	MEAL ADVICE** General population
Charles River (between the South Natick Dam in Natick and the Museum of Science Dam in Boston/Cambridge)	Boston, Cambridge, Dedham, Dover, Natick, Needham, Newton, Watertown, Wellesley, Weston, Waltham	PCBs, Pesticides, PFAS	Do not eat Carp, Largemouth Bass Limit other species to 1 meal/6 months	Do not eat Carp Limit other species to 1 meal/6 months
Chebacco Lake	Essex, Hamilton	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Chicopee Reservoir	Chicopee	PFAS	Do not eat any fish	Do not eat any fish
Chicopee River	Palmer, Ludlow, Wilbraham, Springfield, Chicopee	PFAS	Do not eat any fish****	Limit all fish to 2 meals/month
Clay Pit Pond	Belmont	Chlordane	Do not eat any fish	Do not eat any fish
Cleveland Pond	Abington	Mercury	Do not eat Black Crappie	Limit Black Crappie to 2 meals/month
Cochato River, Ice Pond and Sylvan Lake	Randolph, Holbrook, Braintree	Pesticides	Do not eat any fish	Do not eat American Eel, Brown Bullhead, Carp Limit other species to 2 meals/month
Cochichewick, Lake	North Andover	Mercury, PFAS	Do not eat Largemouth Bass, Smallmouth Bass Limit other species to 1 meal/month	Limit all fish to 2 meals/month
Cochituate, Lake (including Middle, North, South, and Carling Basins)	Framingham, Natick, Wayland	PCBs, PFAS	Do not eat any fish	Do not eat American Eel Limit other species to 1 meal/2 months
Concord River (from confluence with Sudbury and Assabet Rivers to the Faulkner Dam in Billerica)	Concord, Carlisle, Bedford, Billerica, Lowell	Mercury, PFAS	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month
Congomond Lake	Southwick	PFAS	Do not eat any fish****	Limit all fish to 1 meal/week
Connecticut River	Northfield, Gill, Erving, Montague, Greenfield, Deerfield, Sunderland, Whately, Hatfield, Hadley, Northampton, Easthampton, South	PCBs, PFAS	Do not eat any fish	Do not eat American Eel, Channel Catfish, White Catfish, Yellow Perch Limit other species to 2 meals/month

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****This waterbody has not been evaluated for mercury. Per DPH's statewide fish consumption advisory for mercury, sensitive populations should not eat fish from this waterbody until more information on mercury levels is available.

WATERBODY	MUNICIPALITY	HAZARD(S)*	MEAL ADVICE** Sensitive populations***	MEAL ADVICE** General population
	Hadley, Holyoke, Chicopee, West Springfield, Springfield, Agawam, Longmeadow			
Coonamessett Pond	Falmouth	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Copicut Reservoir	Dartmouth, Fall River	Mercury	Do not eat any fish	Do not eat any fish
Copicut River	Dartmouth, Fall River	PCBs, Mercury	Do not eat any fish	Do not eat American Eel Limit Largemouth Bass to 2 meals/month
Cornell Pond	Dartmouth	PCBs, Mercury	Do not eat any fish	Do not eat American Eel Limit Largemouth Bass to 2 meals/month
Crocker Pond	Westminster	PFAS	Do not eat any fish****	Limit all fish to 1 meal/2 months
Crystal Lake	Haverhill	Mercury	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month
Damon Pond	Chesterfield, Goshen	Mercury	Do not eat Chain Pickerel, Largemouth Bass	Limit Chain Pickerel, Largemouth Bass to 2 meals/month
Dennison, Lake	Winchendon	Mercury, PFAS	Do not eat Largemouth Bass Limit other species to 1 meal/month	Limit all fish to 2 meals/month
Dodgeville Pond – See Mechanics Pond				
Drinkwater River/ Indian Head River/North River (Between the Forge Pond Dam in Hanover and Route 3 in Norwell/Pembroke) and Factory Pond	Hanson, Hanover, Norwell, Pembroke	Mercury	Do not eat any fish	Do not eat any fish
Duck Pond	Wellfleet	Mercury	Do not eat any fish	Do not eat any fish
Dunn Pond	Gardner	PFAS	Do not eat any fish****	Limit all fish to 1 meal/month
Dyer Pond	Wellfleet	Mercury	Do not eat any fish	Do not eat any fish
East Brimfield Reservoir	Brimfield, Sturbridge	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
East Monponsett Pond	Halifax	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Echo Lake	Hopkinton, Milford	Mercury	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month
Ezekiel Pond	Plymouth	Mercury	Do not eat Chain Pickerel, Largemouth Bass	Limit Chain Pickerel, Largemouth Bass to 2 meals/month

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WATERBODY	MUNICIPALITY	HAZARD(S)*	MEAL ADVICE** Sensitive populations***	MEAL ADVICE** General population
Factory Pond – See Drinkwater River				
Fall Brook Reservoir	Leominster	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Falls Pond (All Basins)	North Attleboro	Mercury, PFAS	Do not eat Largemouth Bass Limit other species to 1 meal/6 months	Limit all fish to 1 meal/2 months
Farrar Pond	Lincoln	Mercury	Do not eat Black Crappie, Chain Pickerel, Largemouth Bass	Limit Black Crappie, Chain Pickerel, Largemouth Bass to 2 meals/month
Fearing Pond	Plymouth	PFAS	Do not eat any fish****	Limit all fish to 2 meals/week
Flax Pond	Lynn	DDT, Chlordane	Do not eat American Eel, White Perch	Do not eat American Eel
Flax Pond (Picture Lake)	Bourne	PFAS	Do not eat any fish****	Limit all fish to 1 meal/week
Flint Pond	Tyngsborough	Mercury, PFAS	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 1 meal/6 months
Forest Lake	Methuen	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Forge Pond	Littleton, Westford	Mercury, PFAS	Do not eat Largemouth Bass Limit other species to 1 meal/6 months	Limit all fish to 1 meal/2 months
Fort Meadow Reservoir	Hudson, Marlborough	Chlordane	Do not eat White Sucker	Limit White Sucker to 2 meals/month
Foster Pond	Swampscott	DDT	Do not eat American Eel	Do not eat American Eel
Fosters Pond	Andover, Wilmington	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Freeman Lake – See Newfield Pond				
French River (Between the Hodges Village Dam in Oxford and the North Webster Village Pond Dam in Webster)	Oxford, Webster	Mercury	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month
Fresh Pond	Plymouth	Mercury	Do not eat Chain Pickerel, Largemouth Bass	Limit Chain Pickerel, Largemouth Bass to 2 meals/month
Fulton Pond - See Rumford River				
Gales Pond	Warwick	Mercury	Do not eat Yellow Perch	Limit Yellow Perch to 2 meals/month
Garfield, Lake	Monterey	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Gibbs Pond	Nantucket	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Goodrich Pond	Pittsfield	PCBs	Do not eat any fish	Do not eat any fish
Great Herring Pond	Bourne, Plymouth	Mercury	Do not eat Smallmouth Bass	Limit Smallmouth Bass to 2 meals/month

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* See page 17 for hazard codes.

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***Sensitive populations include children under 12; and people who are nursing, pregnant, or may become pregnant

****This waterbody has not been evaluated for mercury. Per DPH's statewide fish consumption advisory for mercury, sensitive populations should not eat fish from this waterbody until more information on mercury levels is available.

WATERBODY	MUNICIPALITY	HAZARD(S)*	MEAL ADVICE** Sensitive populations***	MEAL ADVICE** General population
Great Pond	Truro	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Great Pond	Wellfleet	Mercury	Do not eat any fish	Do not eat any fish
Great South Pond	Plymouth	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Grews Pond	Falmouth	PFAS	Do not eat any fish****	Limit all fish to 2 meals/week
Grove Pond	Ft. Devens, Ayer	Mercury	Do not eat any fish	Do not eat any fish
Haggetts Pond	Andover	Mercury	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month
Halfway Pond	Plymouth	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Hamblin Pond	Barnstable	Mercury	Do not eat Smallmouth Bass	Limit Smallmouth Bass to 2 meals/month
Hardwick Pond	Hardwick	Mercury, PFAS	Do not eat Largemouth Bass Limit other species to 2 meals/month	Limit Largemouth Bass to 2 meals/month Limit other species to 2 meals/week
Heard Pond	Wayland	Mercury	Do not eat any fish	Do not eat any fish
Heart Pond	Chelmsford, Westford	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Hickory Hills Lake	Lunenburg	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Hocomonco Pond	Westborough	PAHs	Do not eat any fish	Do not eat any fish
Holland Pond	Brimfield, Holland, Sturbridge	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Hood (or Hoods) Pond	Topsfield, Ipswich	Mercury	Do not eat any fish	Do not eat Largemouth Bass, Yellow Perch Limit other species to 2 meals/month
Hoosic River (from the channelized section in North Adams to the MA/VT state line)	N. Adams, Williamstown	PCBs, PFAS	Do not eat any fish	Do not eat any fish
Hopedale Pond	Hopedale	PFAS	Do not eat any fish****	Limit all fish to 2 meals/month
Horn Pond	Woburn	DDT	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Horseleech Pond	Truro	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Houghton's Pond	Milton	PFAS	Do not eat any fish****	Limit all fish to 1 meal/week

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WATERBODY	MUNICIPALITY	HAZARD(S)*	MEAL ADVICE** Sensitive populations***	MEAL ADVICE** General population
Housatonic River (See footnote [1])	Dalton, Pittsfield, Lenox, Stockbridge, Lee, Great Barrington, Sheffield	PCBs	Do not eat any fish (also includes frogs and turtles)	Do not eat any fish (also includes frogs and turtles)
Hovey's Pond	Boxford	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Ice Pond – See Cochato River				
Indian Head River – See Drinkwater River				
Ipswich River (between the Bostik Findley Dam in Middleton and the Sylvania Dam in Ipswich)	Boxford, Danvers, Hamilton, Ipswich, Middleton, Peabody, Topsfield, Wenham	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Island Pond	Plymouth	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Jamaica Pond	Boston	PFAS	Do not eat any fish****	Limit all fish to 1 meal/month
Jenkins Pond	Falmouth	PFAS	Do not eat any fish****	Limit all fish to 1 meal/week
Johns Pond	Mashpee	Mercury, PFAS	Do not eat any fish	Do not eat Smallmouth Bass Limit other species to 1 meal/year
Johnsons Pond	Groveland, Boxford	Mercury	Do not eat LMB	Limit LMB to 2 meals/month
Kenoza Lake	Haverhill	Mercury	Do not eat any fish	Do not eat any fish
Kingman Pond – See Rumford River				
Knops Pond	Groton	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Konkapot River (From the Mill River Dam in New Marlborough to its confluence with the Housatonic River)	Sheffield, New Marlborough	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Lakes whose names begin with "Lake" are listed under the second word in their name (so that Lake Pentucket is listed under "Pentucket," etc.)				
Lashaway, Lake	North Brookfield, East Brookfield	Mercury	Do not eat Largemouth Bass, Smallmouth Bass	Limit Largemouth Bass, Smallmouth Bass to 2 meals/month
Laurel Lake	Erving, Warwick	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Lawrence Pond	Sandwich	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Leverett Pond	Boston, Brookline	DDT	Do not eat Carp	Do not eat Carp

[1] Fish taken from feeder streams to the Housatonic River should be trimmed of fatty tissue prior to cooking.

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***Sensitive populations include children under 12; and people who are nursing, pregnant, or may become pregnant

****This waterbody has not been evaluated for mercury. Per DPH's statewide fish consumption advisory for mercury, sensitive populations should not eat fish from this waterbody until more information on mercury levels is available.

WATERBODY	MUNICIPALITY	HAZARD(S)*	MEAL ADVICE** Sensitive populations***	MEAL ADVICE** General population
Lewin Brook Pond	Swansea	Mercury	Do not eat Black Crappie, Largemouth Bass	Limit Black Crappie, Largemouth Bass to 2 meals/month
Little Chauncy Pond	Northborough	Mercury	Do not eat Black Crappie, Largemouth Bass	Limit Black Crappie, Largemouth Bass to 2 meals/month
Little River – See Alewife Brook				
Locust Pond	Tyngsborough	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Long Pond	Brimfield, Sturbridge	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Long Pond	Dracut, Tyngsboro	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Long Pond	Lakeville, Freetown	PFAS	Do not eat any fish****	Limit all fish to 1 meal/2 months
Long Pond	Rutland	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Long Pond	Wellfleet	Mercury	Do not eat any fish	Do not eat any fish
Long Pond	Yarmouth	PFAS	Do not eat any fish****	Limit all fish to 2 meals/month
Long Pond (Rochester) – See Snipituit Pond				
Lost Lake	Groton	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Lowe Pond	Boxford	Mercury	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month
Lowell Canals (see footnote [2])	Lowell	Mercury, Lead, PCBs, DDT	Do not eat any fish	Do not eat American Eel Limit other species to 2 meals/month (see footnote [2])
Lower Mystic Lake	Arlington, Medford	PCBs, DDT	Do not eat White Sucker	Do not eat White Sucker
Malden River	Everett, Malden, Medford	PCBs, Chlordane, DDT	Do not eat any fish	Do not eat any fish
Manchaug Pond	Douglas, Sutton	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Martins Pond	North Reading	Mercury	Do not eat Black Crappie, Largemouth Bass, Yellow Perch	Limit Black Crappie, Largemouth Bass, Yellow Perch to 2 meals/month
Marys Pond	Rochester, Marion	Mercury	Do not eat any fish	Limit all fish to 2 meals/month

[2] For Lowell Canals, the public is advised to consume only the fillet of those species not specifically listed in the advisory.

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WATERBODY	MUNICIPALITY	HAZARD(S)*	MEAL ADVICE** Sensitive populations***	MEAL ADVICE** General population
Mascuppic Lake	Dracut, Tyngsborough	PFAS	Do not eat any fish****	Limit all fish to 1 meal/2 months
Mashpee Pond (Mashpee-Wakeby Pond)	Mashpee, Sandwich	Mercury, PFAS	Do not eat Largemouth Bass, Smallmouth Bass Limit other species to 1 meal/week	Limit Largemouth Bass, Smallmouth Bass to 2 meals/month Limit other species to 1 meal/week
Massapoag Lake	Sharon	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Massapoag Pond	Dunstable, Groton, Tyngsboro	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Mechanics Pond, Dodgeville Pond, and the section of the Ten Mile River that connects them	Attleboro	Chlordane	Do not eat White Perch	Limit White Perch to 2 meals/month
Merrimack River (from the MA/NH state line to Broadway Dam in Lawrence)	Tyngsborough, Chelmsford, Lowell, Dracut, Tewksbury, Andover, Methuen, Lawrence	Mercury, PFAS	Do not eat Largemouth Bass, White Sucker Limit other species to 1 meal/6 months	Limit all fish to 1 meal/2 months
Miacomet Pond	Nantucket	Mercury	Do not eat any fish	Do not eat White Perch Limit other species to 2 meals/month
Mill Pond	Burlington	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Mill Pond	Harwich, Brewster	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Mill Pond (SuAsCo Reservoir) above GH Nichols Dam	Westborough	Mercury	Do not eat any fish	Do not eat Largemouth Bass
Mill River	Hopedale	PCBs	Do not eat any fish	Limit all fish to 2 meals/month
Millers River and its tributaries (between the confluence with the Otter River in Winchendon and the Connecticut River in Erving/Montague)	Athol, Erving, Montague, Orange, Phillipston, Royalston, Wendell, Winchendon	PCBs, PFAS	Do not eat any fish	Do not eat American Eel, Brown Trout Limit other species to 2 meals/month

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WATERBODY	MUNICIPALITY	HAZARD(S)*	MEAL ADVICE** Sensitive populations***	MEAL ADVICE** General population
Millvale Reservoir	Haverhill	Mercury	Do not eat any fish	Do not eat Largemouth Bass
Mirimichi, Lake	Plainville, Foxboro	PFAS	Do not eat any fish	Limit all fish to 1 meal/year
Mirror Lake	Ft. Devens, Harvard	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Monomonac, Lake and the North branch of Millers River (Between the outlet of Lake Monomonac and the inlet of Whitney Pond)	Winchendon	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Moores Pond	Warwick	Mercury, PFAS	Do not eat American Eel, Chain Pickerel Limit other species to 2 meals/month	Limit American Eel, Chain Pickerel to 2 meals/month Limit other species to 1 meal/week
Morewood Lake	Pittsfield	PCBs	Do not eat any fish	Do not eat any fish
Mother Brook (between Charles River and Knight Street Dam)	Dedham, Boston	Mercury, DDT	Do not eat Carp, Largemouth Bass, White Sucker	Limit Carp, Largemouth Bass, White Sucker to 2 meals/month
Mother Brook (between the Knight Street Dam and the Neponset River)	Boston	PCBs, DDT	Do not eat any fish	Do not eat American Eel, White Sucker Limit other species to 2 meals/month
Muddy River	Boston, Brookline	PCBs	Do not eat any fish	Do not eat American Eel, Brown Bullhead, Carp Limit other species to 2 meals/month
Mystic River (between outlet of Lower Mystic Lake and Amelia Earhart Dam)	Arlington, Everett, Medford, Somerville	PCBs, Chlordane, DDT	Do not eat any fish	Do not eat any fish
Nabnasset Pond	Westford	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Nashua River	Clinton, Lancaster, Harvard, Shirley, Devens, Ayer, Groton, Pepperell, Dunstable	PFAS	Do not eat any fish****	Limit all fish to 1 meal/month

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WATERBODY	MUNICIPALITY	HAZARD(S)*	MEAL ADVICE** Sensitive populations***	MEAL ADVICE** General population
Neponset River (between the Hollingsworth & Vose Dam in Walpole and the Walter Baker Dam in Boston)	Boston, Canton, Dedham, Milton, Norwood, Sharon, Walpole, Westwood	PCBs, DDT	Do not eat any fish	Do not eat American Eel, White Sucker Limit other species to 2 meals/month
New Bedford Reservoir	Acushnet	Mercury, DDT	Do not eat American Eel, Largemouth Bass	Limit American Eel, Largemouth Bass to 2 meals/month
Newfield Pond (= Freeman Lake)	Chelmsford	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Nippenicket, Lake	Bridgewater, Raynham	Mercury	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month
Noquochoke Lake	Dartmouth	Mercury, PCBs	Do not eat any fish	Do not eat American Eel, Largemouth Bass Limit other species to 2 meals/month
North River – see Drinkwater River				
Norton Reservoir – See Rumford River				
Nutting Lake	Billerica	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Otis Reservoir	Otis, Tolland	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Otter River (between the Seaman Paper Dam in Templeton and the confluence with the Millers River in Winchendon)	Templeton, Winchendon	PCBs	Do not eat any fish	Do not eat Brown Bullhead, White Sucker Limit other species to 2 meals/month
Oxbow Pond	Easthampton, Northampton	PFAS	Do not eat any fish****	Limit all fish to 2 meals/month
Pearce Lake (Lower Pond)	Saugus	PFAS	Do not eat any fish****	Limit all fish to 2 meals/week
Pelham Lake	Rowe	Mercury, PFAS	Do not eat Largemouth Bass Limit other species to 2 meals/week	Limit Largemouth Bass to 2 meals/month Limit other species to 2 meals/week
Pentucket Pond	Georgetown	Mercury	Do not eat any fish	Do not eat Black Crappie, Largemouth Bass Limit other species to 2 meals/month
Pentucket, Lake	Haverhill	Mercury	Do not eat any fish	Do not eat any fish
Pepperell Pond	Pepperell, Groton	Mercury	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month

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WATERBODY	MUNICIPALITY	HAZARD(S)*	MEAL ADVICE** Sensitive populations***	MEAL ADVICE** General population
Pequot Pond (Hampton Ponds)	Westfield, Southampton	PFAS	Limit all fish to 1 meal/6 months	Limit all fish to 1 meal/2 months
Peters Pond	Sandwich	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Pettee Pond	Walpole, Westwood	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Plainfield Pond	Plainfield	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Pleasant Pond	Hamilton, Wenham	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Plowshop Pond	Ft. Devens, Ayer	Mercury	Do not eat any fish	Do not eat any fish
Plunkett Reservoir	Hinsdale	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Pomps Pond	Andover	Mercury	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month
Ponkapoag Pond	Canton, Randolph	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Pontoosuc Lake	Pittsfield, Lanesborough	Mercury, PFAS	Do not eat Largemouth Bass Limit other species to 2 meals/month	Limit Largemouth Bass to 2 meals/month Limit other species to 1 meal/week
Populatic Pond	Franklin, Medway, Norfolk	Mercury, Chlordane, DDT	Do not eat any fish	Limit all fish to 2 meals/month
Powder Mill Pond	Barre	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Puffer Pond	Ft. Devens Sudbury Training Annex, Maynard	Mercury	Do not eat any fish	Do not eat any fish
Quabbin & Wachusett Reservoirs (See footnote [3])	New Salem, Shutesbury, Petersham, Hardwick, Ware, Pelham, Belchertown, Boylston, West Boylston, Sterling, Clinton	Mercury	See footnote [3]	See footnote [3]
Quaboag Pond	E. Brookfield, Brookfield	Mercury	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month
Quannapowitt, Lake	Wakefield	DDT, PFAS	Do not eat Carp Limit other species to 1 meal/6 months	Limit all fish to 1 meal/month
Quinebaug River (from dam at Hamilton Reservoir through East	Brimfield, Holland, Sturbridge	Mercury	Do not eat any fish	Limit all fish to 2 meals/month

[3] Children younger than 12 years, pregnant women, and nursing women should not consume fish except for lake trout less than 24 inches long and salmon. All other people should not eat smallmouth bass, largemouth bass, or lake trout greater than 24 inches long; may eat unlimited amounts of salmon and lake trout less than 24 inches long; and should limit consumption of all other Quabbin and Wachusett Reservoir fish species to one five-ounce meal per week.

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WATERBODY	MUNICIPALITY	HAZARD(S)*	MEAL ADVICE** Sensitive populations***	MEAL ADVICE** General population
Brimfield Reservoir/Long Pond, including Holland Pond)				
Quinsigamond, Lake	Worcester, Shrewsbury	PFAS	Limit all fish to 1 meal/6 months	Limit all fish to 1 meal/2 months
Red Bridge Pond	Wilbraham	Mercury	Do not eat Black Crappie, Largemouth Bass	Limit Black Crappie, Largemouth Bass to 2 meals/month
Reservoir #6	Sutton	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Reservoir Pond	Canton	Mercury	Do not eat Largemouth Bass, White Perch	Limit Largemouth Bass, White Perch to 2 meals/month
Rice City Pond	Northbridge, Uxbridge	PCBs, DDT	Do not eat any fish	Do not eat Carp, White Sucker Limit other species to 2 meals/month
Ripple, Lake	Grafton	PFAS	Do not eat any fish****	Limit all fish to 1 meal/6 months
Riverdale Pond	Northbridge	PCBs	Do not eat any fish	Limit all fish to 2 meals/month
Robbins Pond	East Bridgewater, Halifax	PFAS	Do not eat any fish****	Limit all fish to 2 meals/month
Rock Pond	Georgetown	Mercury	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month
Rohunta, Lake (Middle, North, and South Basins)	Orange, Athol, New Salem	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Rolling Dam Impoundment	Blackstone	PCBs, DDT	Do not eat any fish	Do not eat Carp, White Sucker Limit other species to 2 meals/month
Round Pond East	Truro	Mercury	Do not eat any fish	Do not eat any fish
Round Pond West	Truro	Mercury	Do not eat Yellow Perch	Limit Yellow Perch to 2 meals/month
Rumford River (from Glue Factory Pond Dam; Fulton, Kingman, & Cabot ponds; Norton reservoir)	Foxborough, Mansfield, Norton	Dioxin, Pesticides	Do not eat any fish	Do not eat any fish
Ryder Pond	Truro	Mercury	Do not eat any fish	Do not eat any fish
Sabbatia, Lake	Taunton	PFAS	Do not eat any fish****	Limit all fish to 1 meal/2 months
Saltonstall, Lake	Haverhill	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Sampsons Pond	Carver	Mercury, DDT	Do not eat Brown Bullhead, White Perch	Limit Brown Bullhead, White Perch to 2 meals/month
Sandy Pond	Ayer	PFAS	Do not eat any fish****	Limit all fish to 2 meals/month
Sargent Pond	Leicester	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Sawdy Pond	Fall River, Westport	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month

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WATERBODY	MUNICIPALITY	HAZARD(S)*	MEAL ADVICE** Sensitive populations***	MEAL ADVICE** General population
Shawsheen River - See Ballardvale Impoundment				
Sheep Pond	Brewster	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Sherman Reservoir	Rowe, Monroe	Mercury	Do not eat any fish	Do not eat Yellow Perch Limit other species to 2 meals/month
Shirley Lake	Lunenburg	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Shubael Pond	Barnstable	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Silver Lake	Pittsfield	PCBs	Do not eat any fish	Do not eat any fish
Silver Lake	Wilmington	Mercury, DDT	Do not eat Largemouth Bass, Yellow Bullhead	Limit Largemouth Bass, Yellow Bullhead to 2 meals/month
Slough Pond	Truro	Mercury	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month
Snake Pond	Sandwich	Mercury, PFAS	Do not eat any fish	Do not eat Smallmouth Bass Limit other species to 2 meals/month
Snipituit Pond and Long Pond	Rochester	Mercury	Do not eat Black Crappie, Largemouth Bass	Limit Black Crappie, Largemouth Bass to 2 meals/month
Snow Pond	Truro	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
South Pond (= Quacumquasit Pond)	Sturbridge, Brookfield, E. Brookfield	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
South Watuppa Pond	Fall River, Westport	PFAS	Do not eat any fish****	Limit all fish to 1 meal/2 months
Spectacle Pond	Sandwich	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Spectacle Pond	Wellfleet	Mercury	Do not eat Yellow Perch	Limit Yellow Perch to 2 meals/month
Spicket River - See Stevens Pond & Spicket River				
Spy Pond	Arlington	DDT, Chlordane	Do not eat Carp	Do not eat Carp
Stern Reservoir (Framingham Reservoir #1) – See Sudbury River				
Stevens Pond	North Andover	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Stevens Pond & Spicket River (from Stevens Pond to Music Hall Dam in Methuen)	Lawrence, Methuen	Mercury, DDT	Do not eat Carp, Largemouth Bass, White Sucker	Limit Carp, Largemouth Bass, White Sucker to 2 meals/month
Stiles Pond	Boxford	DDT	Do not eat American Eel	Limit American Eel to 2 meals/month

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WATERBODY	MUNICIPALITY	HAZARD(S)*	MEAL ADVICE** Sensitive populations***	MEAL ADVICE** General population
Stockbridge Bowl	Stockbridge	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Studley Pond	Rockland	PFAS	Do not eat any fish	Limit all fish to 1 meal/year
Sudbury Reservoir	Marlborough, Southborough	Mercury	Do not eat any fish	Do not eat Bass
Sudbury River (from Ashland to its confluence with the Assabet and Concord Rivers), Stern Reservoir, and Bracket Reservoir	Ashland, Framingham, Wayland, Sudbury, Lincoln, Concord	Mercury	Do not eat any fish	Do not eat any fish
Sylvan Lake – See Cochato River				
Ten Mile River – see Mechanics Pond				
Texas Pond (= Thayer Pond)	Oxford	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Thayer Pond – see Texas Pond				
Tom Nevers Pond	Nantucket	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Turner Pond	Dartmouth, New Bedford	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Upper Naukeag Lake	Ashburnham	Mercury	Do not eat any fish	Do not eat Largemouth Bass, Smallmouth Bass Limit other species to 2 meals/month
Upper Reservoir	Westminster	Mercury	Do not eat any fish	Do not eat Largemouth Bass Limit other species to 2 meals/month
Upper Spectacle Pond	Otis, Sandisfield	PFAS	Do not eat any fish****	Limit all fish to 1 meal/week
Wachusett Lake	Princeton, Westminster	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Wachusett Reservoir – See Quabbin Reservoir				
Waite Pond	Leicester	Mercury	Do not eat any fish	Do not eat Chain Pickerel Limit other species to 2 meals/month
Wakeby Pond (Mashpee-Wakeby Pond)	Mashpee, Sandwich	Mercury, PFAS	Do not eat Largemouth Bass, Smallmouth Bass Limit other species to 1 meal/week	Limit Largemouth Bass, Smallmouth Bass to 2 meals/month Limit other species to 1 meal/week
Walden Pond	Concord	Mercury, PFAS	Do not eat Largemouth Bass, Smallmouth Bass Limit other species to 1 meal/month	Limit all fish to 2 meals/month
Walden Pond	Lynn, Lynnfield, Saugus	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Wallum Lake	Douglas	PFAS	Limit all fish to 1 meal/month	Limit all fish to 2 meals/month

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Wampanoag, Lake	Ashburnham, Gardner	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Ware River	Barre, Hardwick, Hubbardston, Princeton, Ware, Westminster, Warren, Palmer	PFAS	Do not eat any fish****	Limit all fish to 2 meals/month
Warner's Pond	Concord	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Watson Pond	Taunton	PFAS	Limit all fish to 2 meals/month	Limit all fish to 1 meal/week
Webster Lake (Chaubunagungamaug)	Webster	PFAS	Do not eat any fish****	Limit all fish to 2 meals/month
Wenham Lake	Beverly, Wenham	Mercury, DDT	Do not eat any fish	Do not eat American Eel, Largemouth Bass Limit other species to 2 meals/month
Wequaquet Lake	Barnstable	Mercury	Do not eat Largemouth Bass, Smallmouth Bass	Limit Largemouth Bass, Smallmouth Bass to 2 meals/month
West Lake	Sandisfield	PFAS	Do not eat any fish****	Limit all fish to 2 meals/week
West Monponsett Pond	Halifax, Hanson	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
White Pond	Dennis, Harwich	Mercury	Do not eat any fish	Limit all fish to 2 meals/month
Whitehall Reservoir	Hopkinton	Mercury	Do not eat any fish	Do not eat Yellow Bullhead Limit other species to 2 meals/month
Whitings Pond	North Attleborough, Plainville	Mercury	Do not eat Bluegill, Largemouth Bass	Limit Bluegill, Largemouth Bass to 2 meals/month
Whitmans Pond	Weymouth	DDT, PFAS	Do not eat any fish	Do not eat American Eel Limit other species to 1 meal/2 months
Whitney Pond	Winchendon	Mercury	Do not eat any fish	Do not eat Chain Pickerel Limit other species to 2 meals/month
Wickaboag, Lake	West Brookfield	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Willet Pond	Walpole, Norwood, Westwood	Mercury	Do not eat Largemouth Bass	Limit Largemouth Bass to 2 meals/month
Windsor Lake	Windsor	Mercury	Do not eat Largemouth Bass	Do not eat Largemouth Bass
Winthrop, Lake	Holliston	Dioxin, PFAS	Do not eat any fish	Do not eat any fish
Wrights Reservoir	Gardner, Westminster	Mercury	Do not eat any fish	Limit all fish to 2 meals/month

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Hazard Codes:
DDT=dichlorodiphenyltrichloroethane
PAHs=polycyclic aromatic hydrocarbons
PCB=polychlorinated biphenyls
PFAS=per- and polyfluoroalkyl substances

Fish consumption advisories for contaminants other than PFAS apply to the consumption of all native game fish but do not apply to stocked trout at a waterbody (unless otherwise specified).

* See page 17 for hazard codes.

** Uncooked serving sizes should be 8 to 12 oz. of fish for adults and children over 12, with smaller amounts for younger children.

***Sensitive populations include children under 12; and people who are nursing, pregnant, or may become pregnant

****This waterbody has not been evaluated for mercury. Per DPH's statewide fish consumption advisory for mercury, sensitive populations should not eat fish from this waterbody until more information on mercury levels is available.

Appendix F

Responsiveness Summary

Appendix G

MassDEP Concurrence Letter