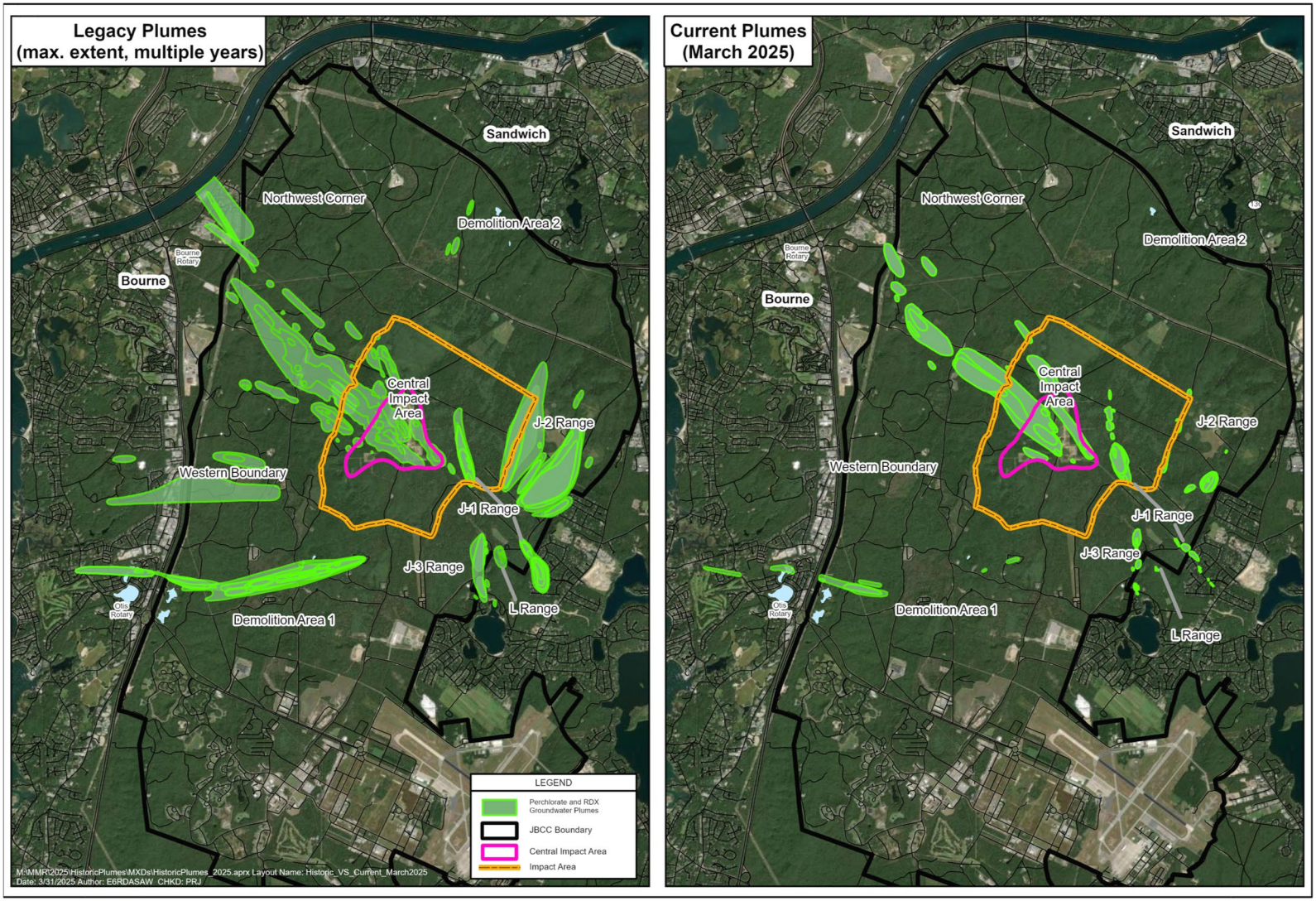
Impact Area Groundwater Study Program Update

JBCC CT August 27, 2025

Mr. Shawn Cody
Federal Program Manager

Groundwater Plumes Over Time



Program Overview

Background

- Since 1911 – Military activities including artillery, small arms, pyrotechnics and demolition training; testing and disposals occurred on contractor leased ranges.
- 1997 – Administrative Orders 1 and 2 (SDWA) required:
  - Investigate nature and extent of contamination.
  - Cease artillery, mortar and small arms firing.
- 2000 – Administrative Order 3 (SDWA) required:
  - Rapid response actions, feasibility studies and remedial actions to address contamination, unexploded ordnance (UXO) and munitions.
- 2001 – Administrative Order 4 (RCRA) required:
  - Munitions found be properly stored and disposed of in a Contained Detonation Chamber, or by other means which prevent the release of explosives, metal and other contaminants into the environment.

Current Status

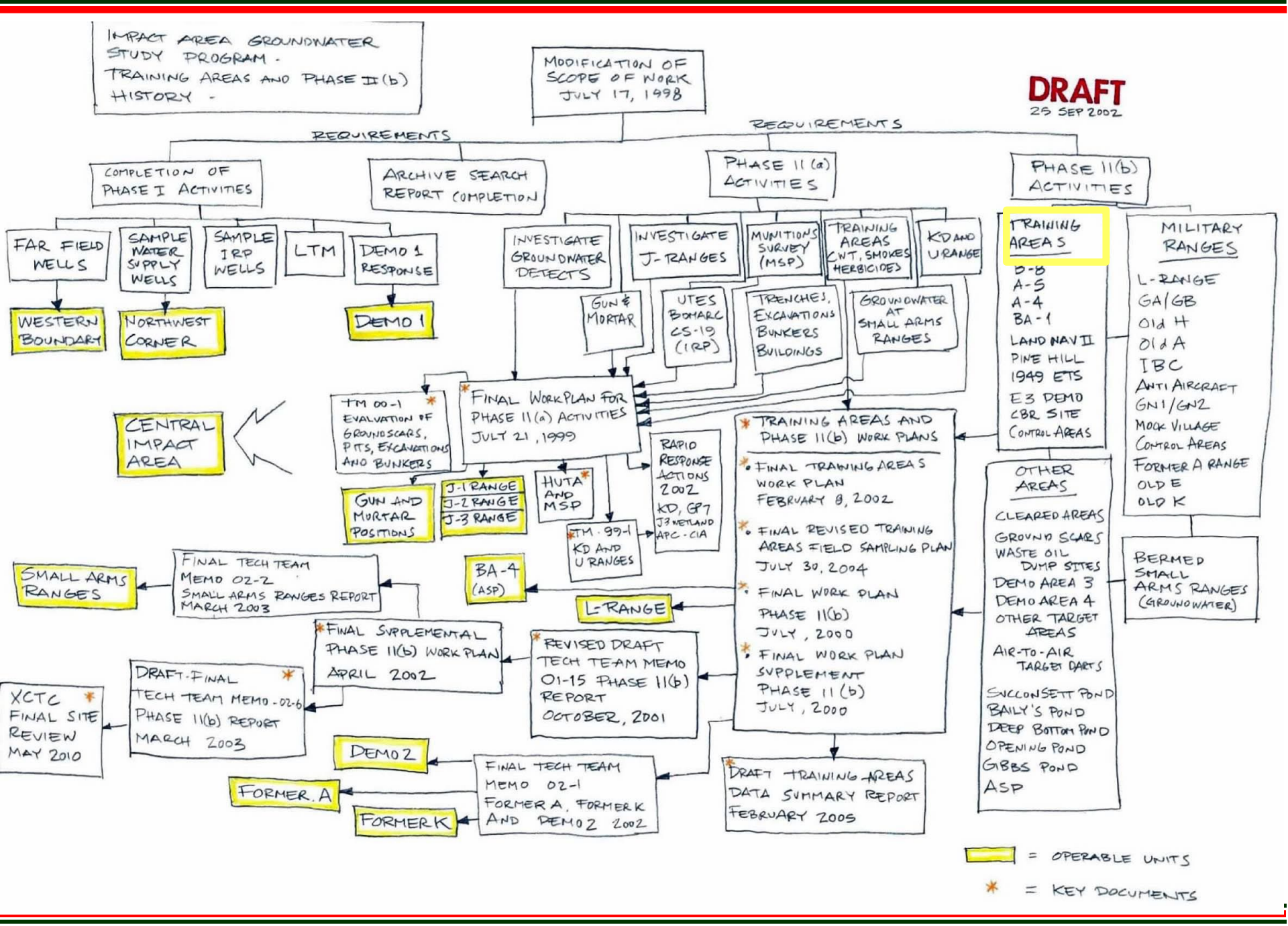
- 14 Operable Units (OUs)
  - Decision Documents completed and remedies in place for all OUs.
- Currently 7 Groundwater plumes
  - 15 extraction, treatment, reinjection (ETR) systems treating more than 2.8 million gallons of groundwater per day.
  - Over 21 billion gallons of groundwater treated to date.
- Known source areas removed and treated.
  - More than 125,000 tons of soil has been excavated and treated.
  - Four tons of explosives safely removed.
  - 700 tons of munitions-related scrap recycled.

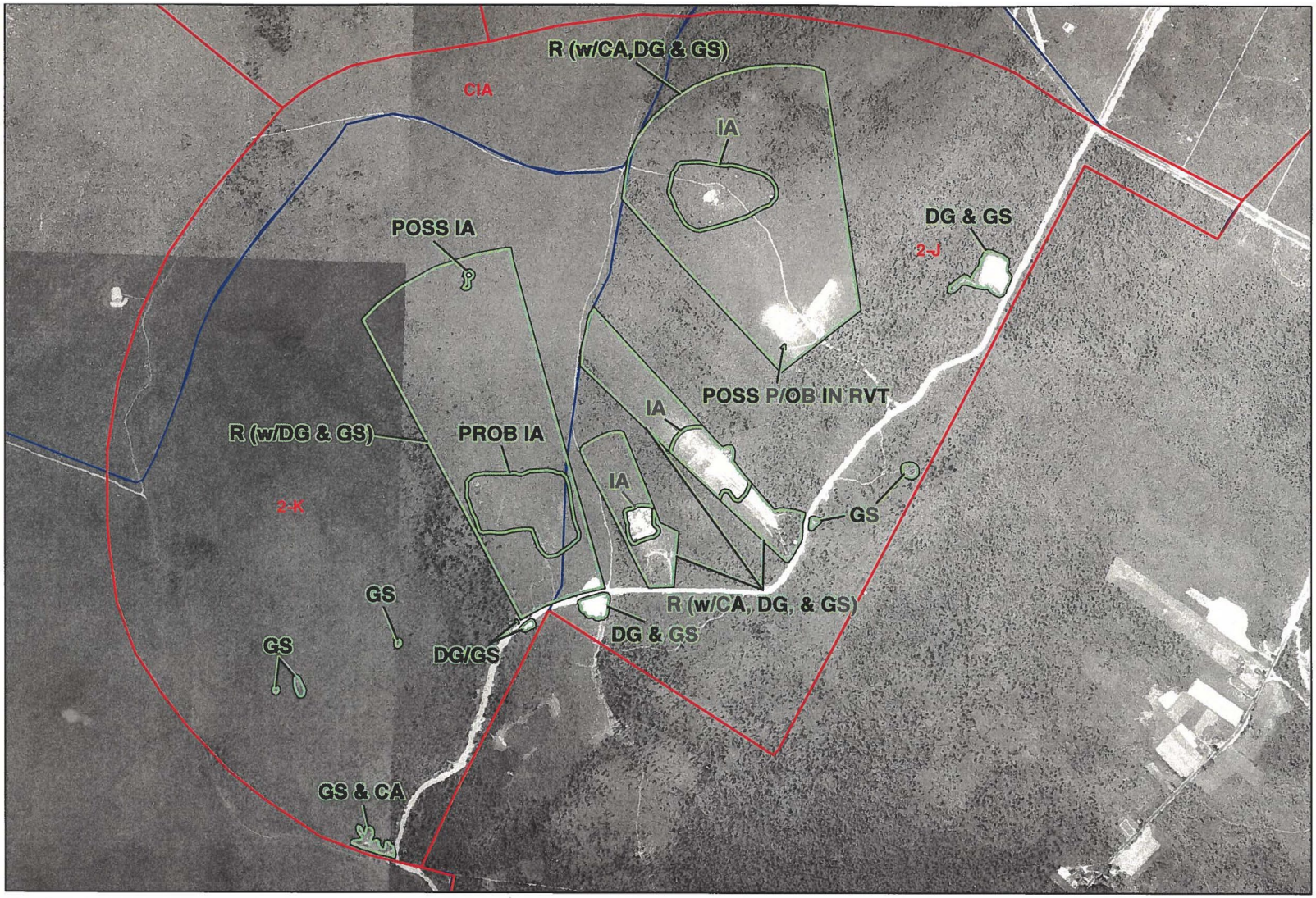
Investigations/Findings

- 1996 – present
  - 1,400+ monitoring well screens in over 700 locations.
  - 100,000+ groundwater and soil samples.
  - Over 12,000 Geophysical anomalies investigated.
- Contaminants of concern:
  - Groundwater: RDX 0.6* µg/L (10^{-6} Cancer Risk); Massachusetts Contingency Plan (MCP) GW-1 standard=1 ug/L; Perchlorate 2 µg/L.
  - Soil: Explosives, propellants, perchlorate & metals.

Unique Features

- Regulatory Framework.
  - Most cleanups performed under CERCLA
- Source of funding, authorities, exemptions.
- Natural resources/habitat.
- Unexploded Ordnance.
- Unclear path to close out Administrative Orders.


IMPACT AREA GROUNDWATER STUDY PROGRAM - TRAINING AREAS AND PHASE II(b) HISTORY -
MODIFICATION OF SCOPE OF WORK JULY 17, 1998
DRAFT
25 SEP 2002
REQUIREMENTS
REQUIREMENTS
COMPLETION OF PHASE I ACTIVITIES
ARCHIVE SEARCH REPORT COMPLETION
PHASE II (a) ACTIVITIES
PHASE II(b) ACTIVITIES
FAR FIELD WELLS
SAMPLE WATER SUPPLY WELLS
SAMPLE IRP WELLS
LTM
DEMO 1 RESPONSE
WESTERN BOUNDARY
NORTHWEST CORNER
DEMO 1
INVESTIGATE GROUNDWATER DETECTS
INVESTIGATE J-RANGES
MUNITIONS SURVEY (MSP)
TRAINING AREAS CWT, SMOKES HERBICIDES
KD AND U RANGE
GUN & MORTAR
UTES BOMARC CS-19 (IRP)
TRENCHES, EXCAVATIONS BUNKERS BUILDINGS
GROUNDWATER AT SMALL ARMS RANGES
TRAINING AREAS
B-8
A-5
A-4
BA-1
LAND NAV II
PINE HILL
1949 ETS
E3 DEMO
CBR SITE
CONTROL AREAS
MILITARY RANGES
L-RANGE
GA/GB
Old H
Old A
IBC
ANTI AIRCRAFT
GN1/GN2
MOCK VILLAGE
CONTROL AREAS
FORMER A RANGE
OLD E
OLD K
CENTRAL IMPACT AREA
TM 00-1 EVALUATION OF GROUNDSCARS, PITS, EXCAVATIONS AND BUNKERS
FINAL WORKPLAN FOR PHASE II(a) ACTIVITIES JULY 21, 1999
RAPID RESPONSE ACTIONS 2002 KD, GP7 J3 WETLAND APC - CIA
TRAINING AREAS AND PHASE II(b) WORK PLANS
FINAL TRAINING AREAS WORK PLAN FEBRUARY 8, 2002
FINAL REVISED TRAINING AREAS FIELD SAMPLING PLAN JULY 30, 2004
FINAL WORK PLAN PHASE II(b) JULY, 2000
FINAL WORK PLAN SUPPLEMENT PHASE II (b) JULY, 2000
OTHER AREAS
CLEARED AREAS
GROUND SCARS
WASTE OIL DUMP SITES
DEMO AREA 3
DEMO AREA 4
OTHER TARGET AREAS
AIR-TO-AIR TARGET DARTS
SUCCONSETT POND
BAILY'S POND
DEEP BOTTOM POND
OPENING POND
GIBBS POND
ASP
BERMED SMALL ARMS RANGES (GROUNDWATER)
GUN AND MORTAR POSITIONS
J-1 RANGE
J-2 RANGE
J-3 RANGE
HUTA AND MSP
TM-99-1 KD AND U RANGES
SMALL ARMS RANGES
FINAL TECH TEAM MEMO 02-2 SMALL ARMS RANGES REPORT MARCH 2003
BA-4 (ASP)
L-RANGE
FINAL SUPPLEMENTAL PHASE II(b) WORK PLAN APRIL 2002
REVISED DRAFT TECH TEAM MEMO 01-15 PHASE II(b) REPORT OCTOBER, 2001
DRAFT-FINAL TECH TEAM MEMO-02-6 PHASE II(b) REPORT MARCH 2003
XCTC FINAL SITE REVIEW MAY 2010
DEMO 2
FORMER A
FORMER K
FINAL TECH TEAM MEMO 02-1 FORMER A, FORMER K AND DEMO 2 2002
DRAFT TRAINING AREAS DATA SUMMARY REPORT FEBRUARY 2005
= OPERABLE UNITS
= KEY DOCUMENTS



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LEGEND

B.....BUILDING
BK.....BUNKER
CA.....CLEARED AREA
CP.....CONCRETE PAD
CY.....CYLINDRICAL
DE.....DEPRESSION
DG.....DISTURBED GROUND
EQ.....EQUIPMENT
EX.....EXCAVATION
GA.....GRADED AREA
GS.....GROUND SCAR
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R.....RANGE
RVT....REVETMENT
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TR.....TRENCH
TW.....TOWER
VT.....VERTICAL TANK
----- ACCESS ROAD

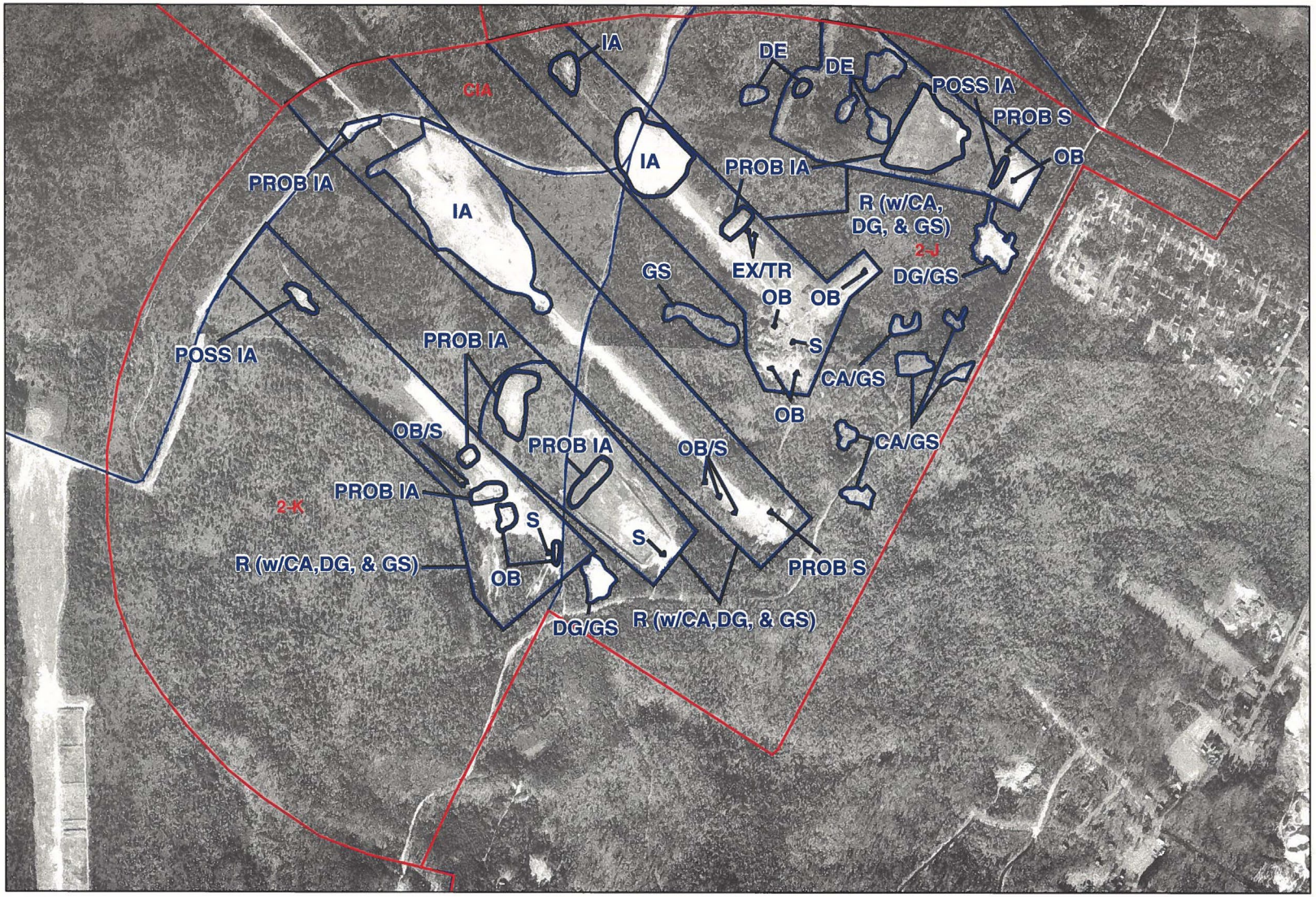
GROUNDWATER STUDY REGION 4
CAMP EDWARDS, MMR

DRAFT

June 24, 1943

1:9,000

1 inch equals 750 feet



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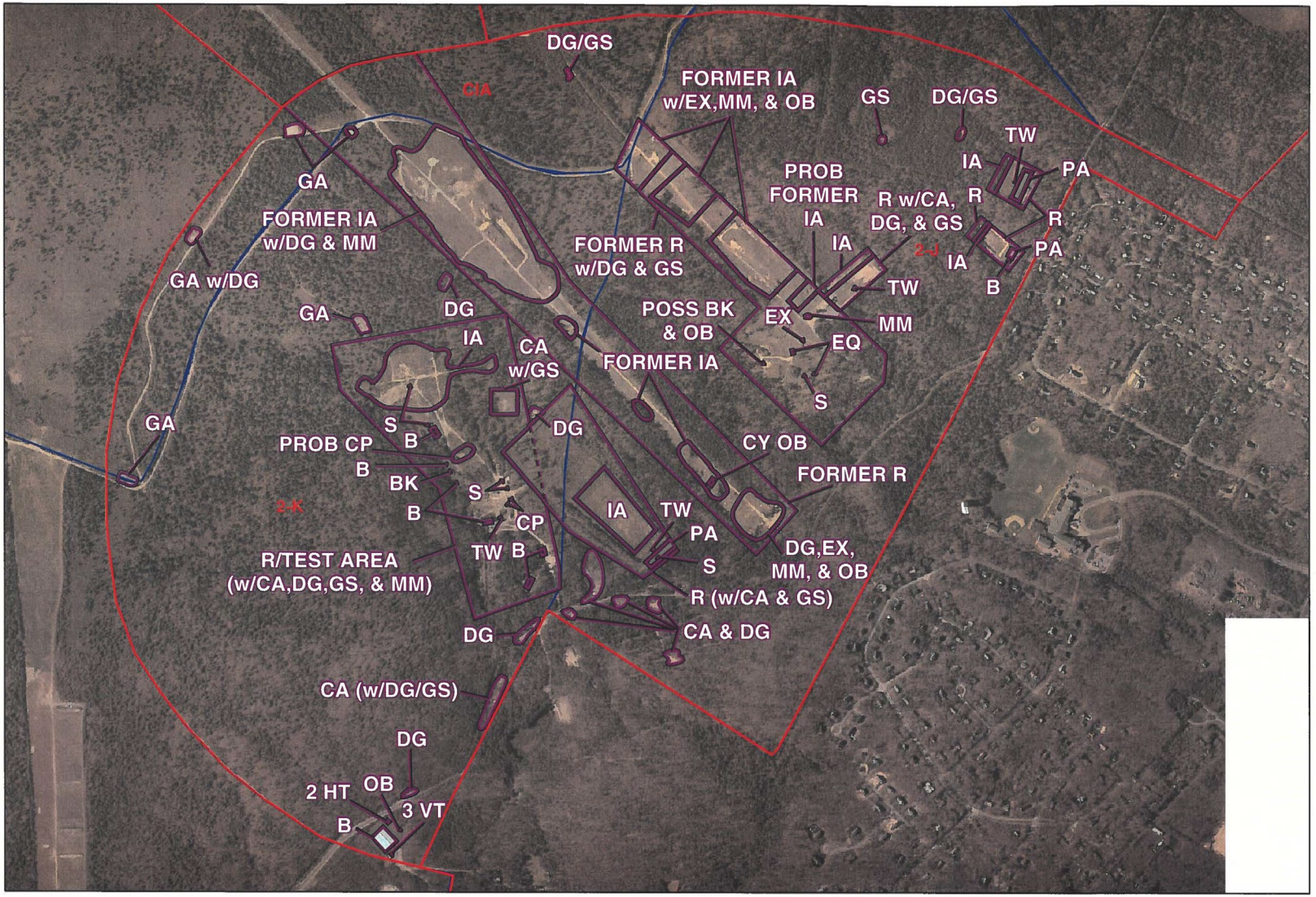
GROUNDWATER STUDY REGION 4
CAMP EDWARDS, MMR

DRAFT
April 10, 1977

1:9,000
1 inch equals 750 feet



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GROUNDWATER STUDY REGION 4
CAMP EDWARDS, MMR

DRAFT
April 24, 2002

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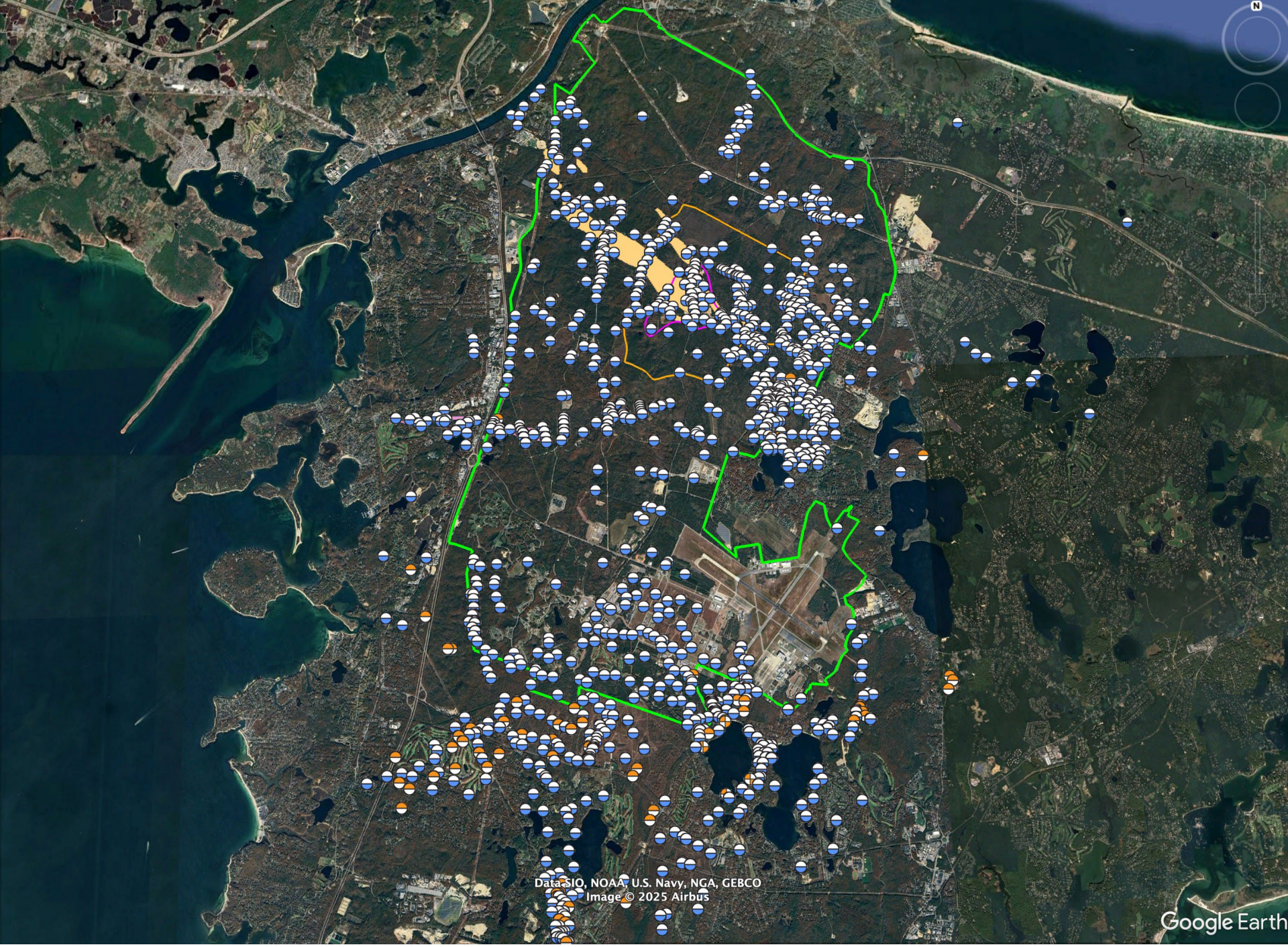

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image © 2025 Airbus
Google Earth

Operable Units

OUs with Groundwater treatment:

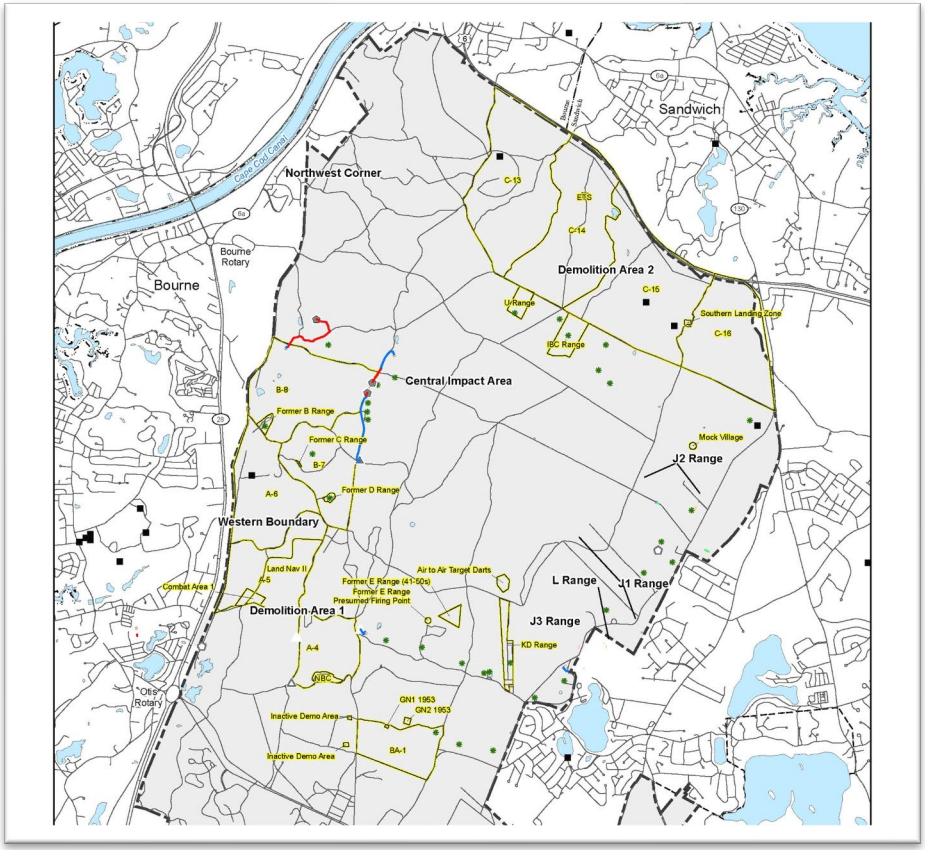
Central Impact Area (2054)
Demolition Area 1 (2034)
J-1 Range South (2036)
J-1 Range North (2051)
J-2 Range North (2034)
J-2 Range East (2031)
J-3 Range (2028)

OUs in Closure Process:

Northwest Corner
Demolition Area 2
L Range
Small Arms Ranges
Training Areas

OUs with No Further Action/Closed:

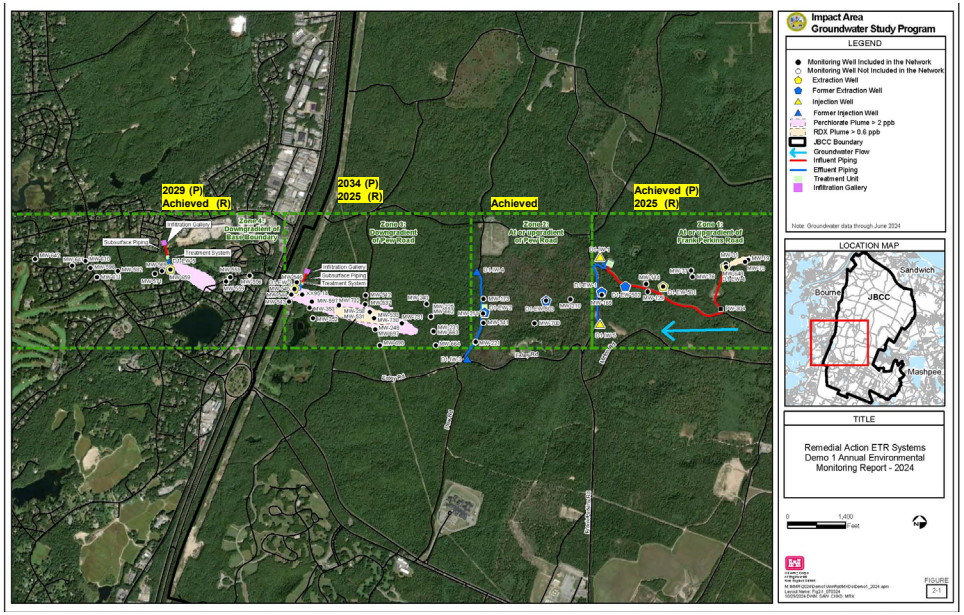
Gun and Mortar Positions (NFA, 2012)
Former K Range (NFA, 2012)
Former A Range (2019)
Western Boundary (2019)
    BA-4 Disposal Area (2009)



Demolition Area 1

Background

- Used from the mid-1970s to 1997 for demolition training and disposal of munitions, fireworks & explosives.
- Source area removed in 2004; 28,000 tons of soil excavated, treated and returned to site.
- Historic maximum groundwater concentrations: RDX 370 µg/L, perchlorate 500 µg/L. Current maximum concentrations: RDX 4.3 µg/L, perchlorate 12 µg/L.
- Frank Perkins Road, Base Boundary and Leading-Edge treatment systems operate at a combined 290 gpm.
  - Over four billion gallons of groundwater treated to date.



Current Status

- 2024 EMR recommended shut down of EW-501.
  - Currently running while EW-4 is down for repairs.
- Shut down and removal of off-base boundary treatment system scheduled for fall 2025.

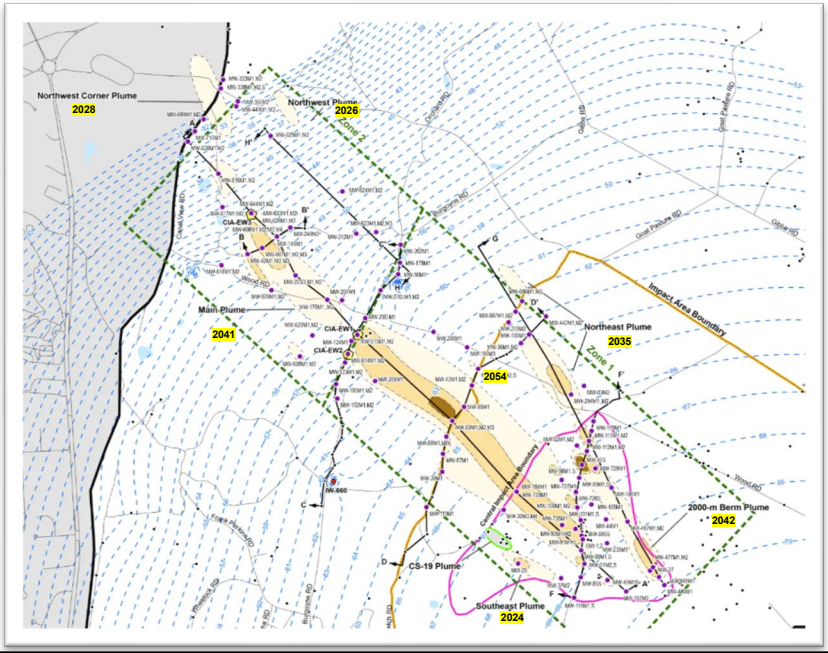
Next Steps

- Continue operation of ETR systems.
- Continue annual monitoring and reporting.
- Identify unused monitoring wells for removal/abandonment.
- Determine plan to repurpose components of Pew Road facility and off-base system.

Central Impact Area

Background

- 330-acres used from the1930s through 1997 as the primary target for artillery and mortar firing from gun and mortar positions.
- More than 150 acres have been cleared of munitions
  - ~3,000 UXO items recovered
  - ~8,500 pounds of explosives removed
- ~15,000 tons of soil were excavated and treated on-site or disposed of off-site.
- Three extraction wells each with their own mobile treatment units operate at a combined 750 gpm.
  - Over four billion gallons of groundwater treated to date.
- Historic maximum RDX groundwater concentration:45 µg/L perchlorate 11.1 µg/L, Current maximums: RDX 9.1 µg/L, perchlorate 2.2 µg/L.



Current Status

- Currently reducing the sampling frequency of 48 well screens and removing nine wells from the monitoring program.
- UXO clearance activities ongoing.

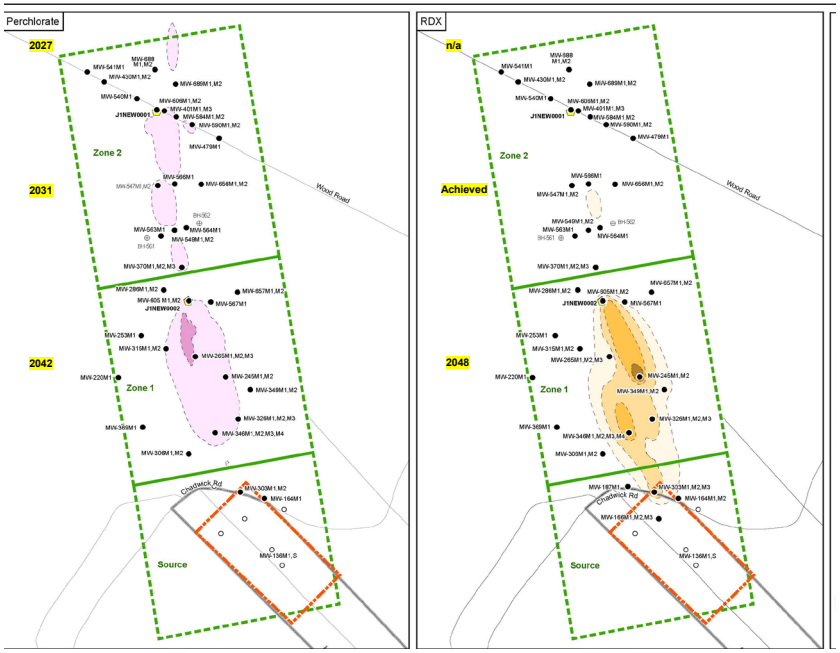
Next Steps

- Continue operation of ETR systems.
- Continue annual monitoring and reporting.
- Continue source removal activities.
  - 180 out of 330 acres cleared
  - Continue to dispose of items using consolidated shot structure.
- Identify unused monitoring wells for removal/abandonment

J-1 Northern Plume

Background

- From 1957 to the late 1980s, the range was used by defense contractors. Excess explosives, propellants and munitions were burned and buried on the range.
  - 5,700 tons of soil were removed/treated
  - 3,500 munitions items were removed.
- The primary sources of the J-1 Range Northern plume are in the “Inter-berm” area of the range, near a regional groundwater divide designated as the “Top of Mound”.
- Two well ETR system has treated 1.5 billion gallons since its startup in 2013.
- Historic maximum concentrations: RDX 87.2 µg/L, perchlorate 78 µg/L, current maximum concentrations: RDX 22 µg/L, perchlorate 12 µg/L.



Current Status

- Extraction well optimization focusing on upgradient extraction well was recently implemented.
  - Most of the perchlorate and RDX plume mass currently remains in Zone 1.
  - Decreased flow at the leading edge well J1NEW0001 from 125 gpm to 85 gpm, and increased flow at the upgradient well J1NEW0002 from 125 gpm to 165 gpm, maintaining a total system extraction rate of 250 gpm.

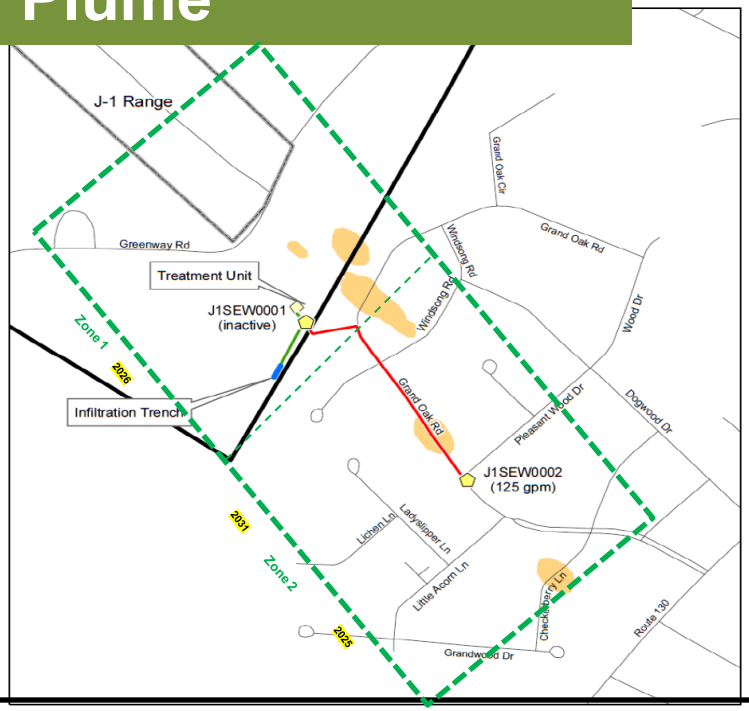
Next Steps

- Continue operation of ETR systems.
- Continue annual monitoring and reporting.
- Identify unused monitoring wells for removal/abandonment.
  - Recently removed nine wells from the sampling network.

J-1 Southern Plume

Background

- The major source for the J-1 Southern plume was the disposal and/or burning of munitions that would have led to soil contamination.
  - Areas located between the firing points and the 1,000-meter berm contained contaminants consistent with what was found in downgradient groundwater.
- Southern plume ETR system consists of one off-base extraction well operating at 125 gpm.
  - 868 million gallons of water treated to date.
- Historic maximum RDX groundwater concentration: 130 µg/L, current maximum 2 µg/L.



Current Status

- Review the groundwater transport model and measured chemistry trends in the monitoring well network to determine if optimization of the ETR wellfield can be implemented.
  - Majority of the most recent samples were either non-detect or only trace values. The current maximum is a single detection of 2.0 µg/L and only one other well screen had a concentration greater than 0.97 µg/L.

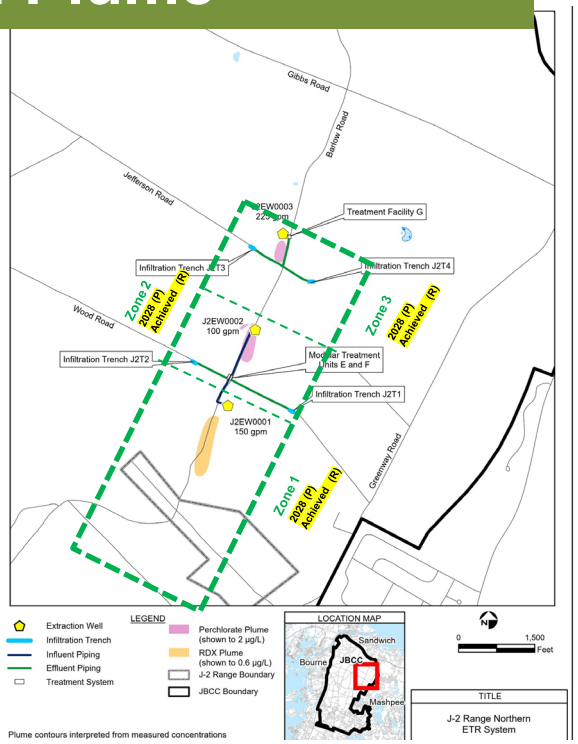
Next Steps

- Continue operation of ETR system.
- Continue annual monitoring and reporting.
- Identify unused monitoring wells for removal/abandonment.
  - Prioritize off-base wells.
- Potentially optimize the ETR system by deactivating the off-base extraction well and allowing monitored natural attenuation and land use controls to achieve the remaining attenuation of RDX until groundwater has been restored to concentrations below 0.97 µg/L sitewide.

J-2 Range Northern Plume

Background

- Used for military training in the 1940s and by defense contractors for munitions testing from 1953 to the late 1980s. Excess explosives, propellants and munitions were burned and buried on the range.
- Geophysical investigations were conducted from 1997 through 2009 utilizing several approaches to identify and remove munitions and disposal pits
  - 21,600 munitions containing HE were removed and ~ 11,100 munitions containing small quantities of explosives were removed along with 114,000 pounds of range debris.
- Historic maximum concentrations: RDX 16 µg/L, perchlorate 140 µg/L ,current maximum concentrations: RDX 0.90 µg/L, perchlorate 6.5 µg/L .
- ETR systems operate at 475 gpm and have treated over 2.4 billion gallons of water to date.



Current Status

- Perchlorate concentrations are generally diminishing throughout the plume and the perchlorate concentrations at the extraction wells have been declining during the past several years of pumping.
  - RDX plume no longer has detections above the new 0.97µg/L remedial goal.

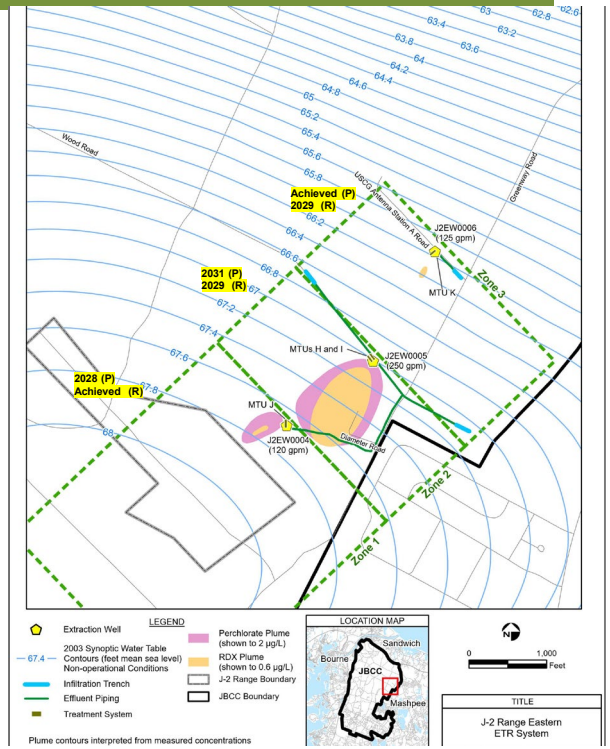
Next Steps

- Continue operation of ETR system.
  - Recently optimized system G to no longer sample for explosives.
- Continue annual monitoring and reporting.
- Identify unused monitoring wells for removal/abandonment
  - Reduced sampling frequency at 14 well screens and removed 37 well screens from the perchlorate monitoring network and reduced sampling frequency at three well screens and removed 19 well screens from the explosives monitoring network.

J-2 Range Eastern Plume

Background

- The sources for J-2 Eastern plume located near the center and up-range portion of the range, primarily related to the disposal and testing of munitions.
  - More than 10,000 tons of soil were excavated and treated by either thermal desorption of alkaline hydrolysis.
- Three well ETR system operating at a combined rate of 495 gpm has treated over 3.9 billion gallons since startup in 2008.
- Historic maximum concentrations: RDX 16 µg/L, perchlorate 71 µg/L, current maximum concentrations: RDX 4.7 µg/L, perchlorate 25 µg/L.



Current Status

- Installed a packer in J2EW0005 to restrict extraction of groundwater to the deep screen of the well to target deep portions of perchlorate and RDX plumes
- Redevelopment of J2EW0004 occurred in 2024
  - New pump installed.

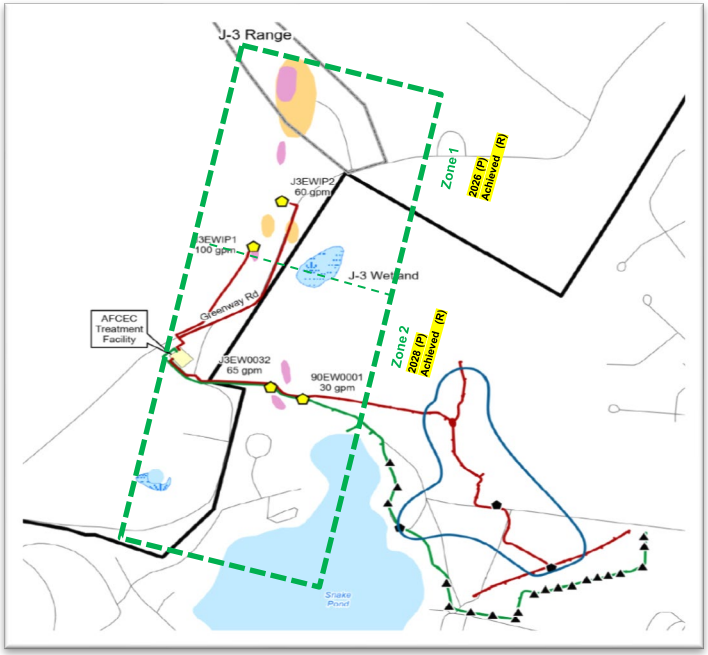
Next Steps

- Continue operation of ETR system.
  - Recently optimized system to reduce the flow rate at J2EW004 to 90 gpm and shut down J2EW0006/MTU K
- Continue annual monitoring and reporting.
- Identify unused monitoring wells for removal/abandonment
  - Reduced sampling frequency at six well screens in the perchlorate and explosives monitoring network.

J-3 Range

Background

- Area used in the 1940s as a mortar and rocket impact area. From 1968 to the late 1990s, constructed as a defense contractor range for weapons testing and as a development range.
- In 2004, 3,500 tons of soil were removed and treated by thermal desorption.
- ETR system housed in AFCEC's Fuel Spill-12 treatment facility has treated 1.9 billion gallons of groundwater to date.
  - Four extraction wells currently operating at 255 gpm.
- Historic maximum concentrations: RDX 38 µg/L, perchlorate 770 µg/L, current maximum concentrations: RDX 1.3 µg/L, perchlorate 4.2 µg/L.



Current Status

- The DD predicted that perchlorate would be below 2.0 µg/L by 2022 and RDX would be below 0.6 µg/L by 2021. Based on the updated 2024 results, perchlorate is expected to be below 2.0 µg/L off-base by 2026 and below 2.0 µg/L on base by 2037 due to the fluctuation and persistent contamination at MW-163S.
- RDX is currently at or near the goal of 0.97 µg/L.

Next Steps

- Continue operation of ETR system.
- Continue annual monitoring and reporting.
- Identify unused monitoring wells for removal/abandonment.

L Range

Background

- Primarily used since the 1940s as a 40mm grenade-launcher familiarization range.
- Source area was removed during a series of actions in 2008-09. Remote-controlled robotic equipment was used to clear the range.
  - 165 munitions and 24,000 pounds of munitions debris were removed.
  - 4,100 tons of soil was treated by alkaline hydrolysis.
- Decision Document called for monitored natural attenuation and land use controls as the remedy.
- Historic maximum concentrations: RDX 9 µg/L , perchlorate 3 µg/L, current maximum concentrations: RDX 0.4 µg/L. Perchlorate sampling was discontinued in 2014 as the DD cleanup <2 µg/L MMCL was achieved.

Current Status

- There are currently no RDX samples above the risk-based concentration (RBC) of 0.6 µg/L, the EPA RSL of 0.97 µg/L or the MassDEP GW-1 of 1 µg/L.
- Current Environmental Monitoring Report recommends discontinuing sampling at the site.
- Range is used by Mass Army National Guard (MAARNG) for training.

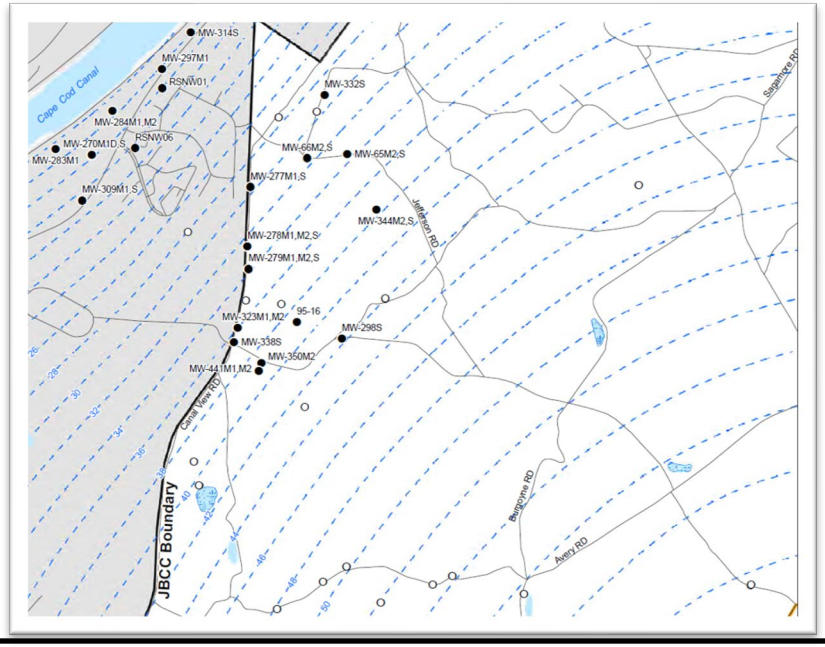
Next Steps

- Discontinue sampling for explosives at all wells, as remedial goals have been achieved.
  - No evidence of continual upgradient RDX source migrating off-base. MW-242M1 trace to 0.22 µg/L since 2020.
- Begin site-closeout documentation as site has met remedial goal of 0.97 µg/L.
  - Demonstration of Compliance report to be submitted later this year.
- Identify unused monitoring wells for removal/abandonment

Northwest Corner

Background

- Site located near the Cape Cod Canal and includes areas where pyrotechnics and artillery were used. Fireworks displays were conducted in the area from 1996 until 2003.
- Soil investigations found significant levels of perchlorate in the soil immediately after fireworks display. Subsequent sampling indicated perchlorate levels were depleted; therefore, no soil remediation was necessary.
- 2010 Decision Document called for monitored natural attenuation and land use controls.
- Historic maximum groundwater concentrations: RDX 15 µg/L, perchlorate 8.5 µg/L, current maximum concentration: perchlorate 0.54* µg/L .



Current Status

- Perchlorate sampling has been discontinued since May 2022.
  - The perchlorate plume is thought to have attenuated below 2 µg/L through natural processes and groundwater discharge to the Cape Cod Canal, resulting in no detected concentrations of perchlorate in the plume above 2 µg/L since 2013.
  - RDX plume at the Northwest Corner originates in the CIA, and therefore, the RDX plume is being addressed as part of the CIA OU.

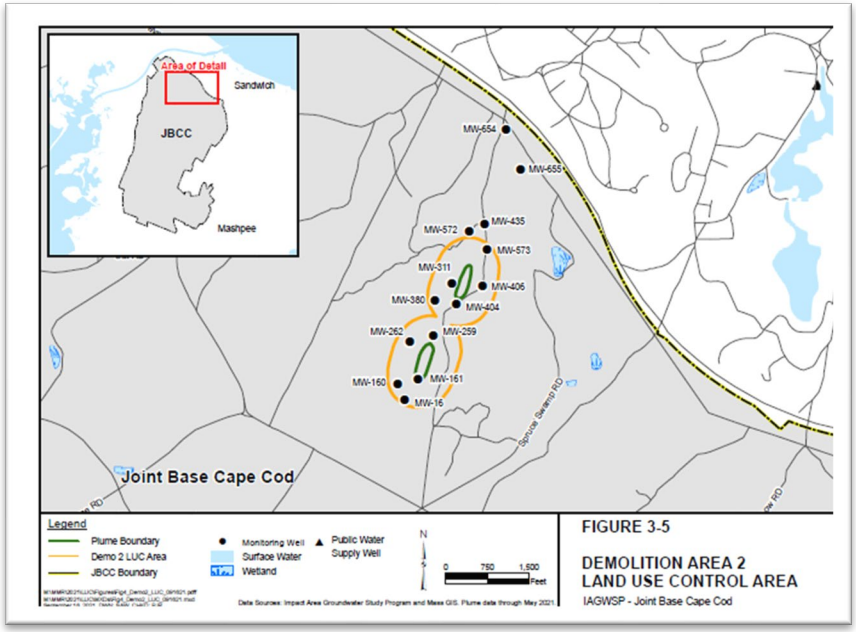
Next Steps

- Finalize Demonstration of Compliance Report.
  - Site closeout is underway.
- Identify unused monitoring wells for removal/abandonment

Demolition Area 2

Background

- Site was used from the late 1970s to the late 1980s for demolition training involving small explosive charges.
- Soil investigations found RDX and propellants in soil in a man-made berm and adjacent soil piles. In 2004 a source area response action excavated 1,200 tons of soil from the berm, the soil piles and the center of the site.
- Groundwater sampling identified an RDX plume migrating to the north. Recent monitoring showed that all levels were below 1 µg/L.
- The plume is entirely on-base and no private or public water supplies are impacted by it.



Current Status

- Decision Document signed in 2010 called for monitored natural attenuation and land-use controls.

Next Steps

- Begin drafting Demonstration of Compliance report to initiate site close out process.
- Identify unused monitoring wells for removal/abandonment.

Small Arms Ranges

Background

- A berm maintenance program removed 60 tons of lead and treated 36,000 tons of soil at 16 ranges.
- More than 7,000 tons of lead impacted soil was removed from three former ranges in 2009.
- 3,500 tons of tungsten-impacted soil was removed from multiple ranges.
- Tango, Juliet and Kilo Ranges were investigated and cleared by EPA for use with lead ammunition.
- Sierra and India Ranges were investigated and cleared by EPA for use with copper ammunition.
- Decision Document has no timeframe for remedy completion; metals have been below cleanup levels or non-detect since 2010.

Current Status

- Sampling of metals as part of the long-term monitoring program at the Small Arms Ranges (operational-inactive ranges) indicate metals are not an issue in groundwater at SAR.
- Since 2006, antimony, copper, lead, and tungsten have remained one to two orders of magnitude below the EPA MCL, EPA HA, and the MassDEP Interim Drinking Water Guideline (tungsten) at the B, C, G, GA/GB, J and K ranges.

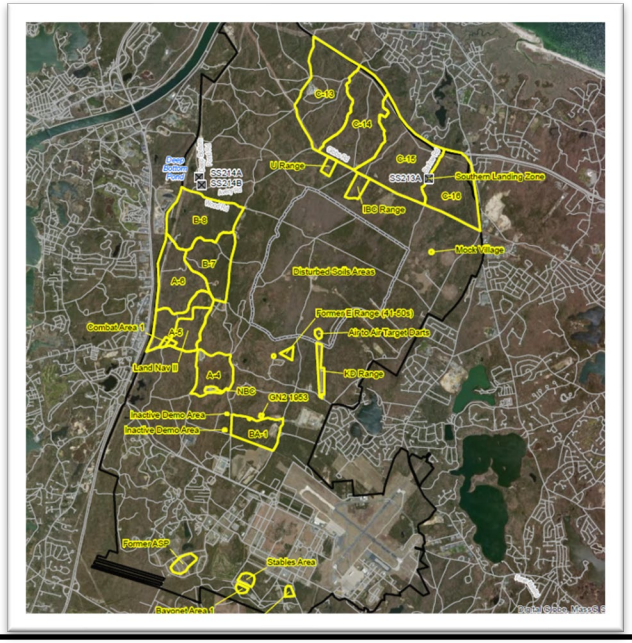
Next Steps

- Recently recommended that metals monitoring be discontinued at SAR.
  - IAGWSP does not plan to abandon the monitoring wells, so they would be available if the ranges were to again become operational-active.
- Drafting project note to document that Post-DD sampling has been completed and site can be closed out.

Training Areas

Background

- The Training Areas Operable Unit is composed of 36 sites or locations located throughout JBCC where various types of military-training related activities have occurred.
- Investigations included historical reviews, site surveys and over 500 soil samples.
- Based upon the absence of any groundwater contamination beneath any of the Training Areas and previous response actions, the DD required no further remedial actions for most of the Training Areas
  - Six areas required data review and/or confirmatory sampling and geophysical screening.



Current Status

- All post-DD fieldwork has been completed, and no further actions are required.

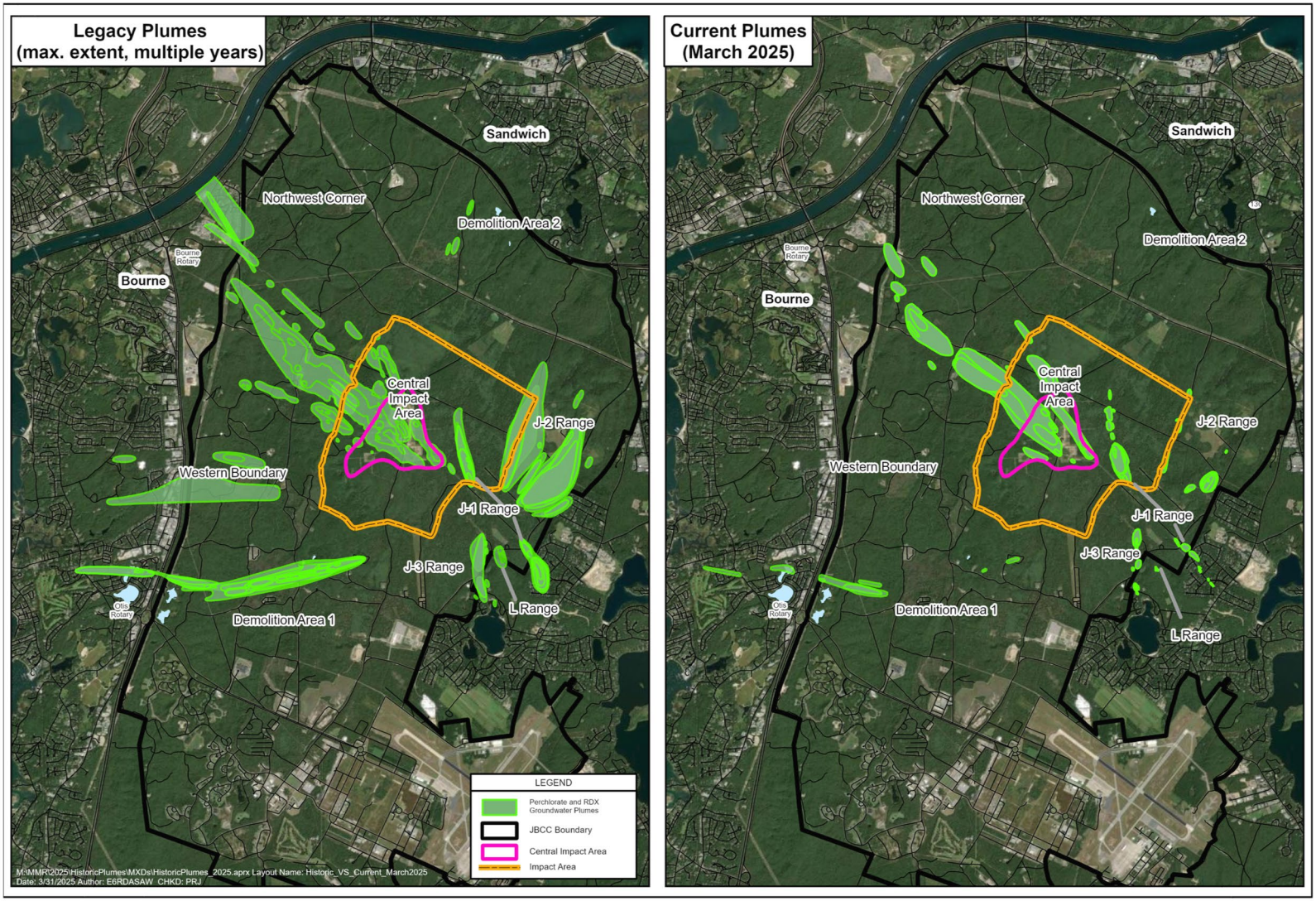
Next Steps

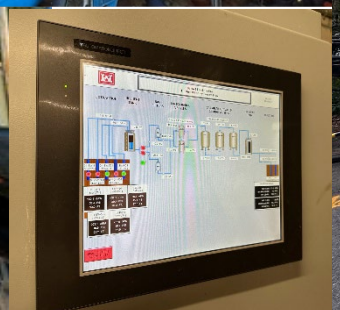
- Drafting project note to document that Post-DD sampling has been completed and site can be closed out.
- Identify unused monitoring wells for removal/abandonment.

Miscellaneous

- **Finalize Comprehensive PFAS Report**
- **Close out Training Areas and Small Arms Ranges Operable Units**
  - Document that the follow-on actions required by the DDs was completed and no further actions are warranted at either OU.
    - Goal is to receive a Certificate of Completion from EPA.
- **Site-wide Decision Document Addendum**
  - Change RDX cleanup goal from 0.6 to 0.97 µg/L.
- **Monitoring Well Decommissioning**
  - Effort underway to identify wells for decommissioning/abandonment, beginning with wells off-site.
- **Land Use Controls:**
  - Administrative and legal controls that minimize the potential for human exposure to contamination by limiting land or resource use. Includes site access and security measures, coordination with local Boards of Health, review of Dig Safe notices, and private well verifications.
    - Private well verifications has been completed for sites that historically had off-base areas of groundwater contamination.
  - Land Use Controls are needed until contamination at the sites no longer poses an unacceptable risk.
- **Coordination with Camp Edwards Natural Resources and Joint Base Cape Cod Fire Department**
  - Provide access to treated water for fire suppression.
  - Coordinate work areas to assist with making and maintaining fire breaks.

Groundwater Plumes Over Time





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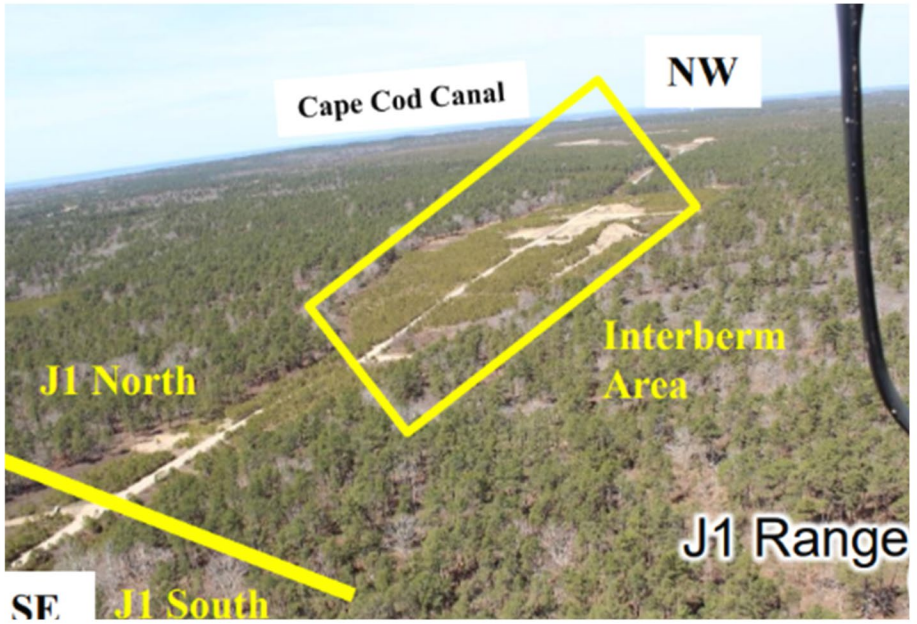
Cape Cod Canal
NW
J1 North
Interberm
Area
J1 Range
SE
J1 South


J – 2 North
Groundwater
Treatment
System