

EXPLANATION OF SIGNIFICANT DIFFERENCES

ZONE 3: SITE 73 (ID073) FORMER PEASE AIR FORCE BASE PORTSMOUTH, NEW HAMPSHIRE

INTRODUCTION AND STATEMENT OF PURPOSE

This Explanation of Significant Differences (ESD) identifies the rationale behind implementation of supplemental remedial action to the existing remedy in place for Site 73, located in Zone 3, for contaminated groundwater at the former Pease Air Force Base (AFB) National Priorities List site in Portsmouth, New Hampshire.

The United States (U.S.) Air Force is the lead agency, with oversight from the U.S. Environmental Protection Agency (EPA) and the New Hampshire Department of Environmental Services (NHDES), for cleanup of sites at the former Pease AFB under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) as modified by the Superfund Amendments and Reauthorization Act. The regulatory program performed under the context of these combined laws and regulations is commonly referred to as "Superfund." The U.S. Air Force is issuing this ESD as part of the public participation requirements under Section 117(c) of CERCLA, Section 300.435(c)(2)(i) of the National Oil and Hazardous Substances Pollution Contingency Plan (NCP) and the U.S. Air Force Installation Restoration Program (IRP). In accordance with Section 300.825(a)(2) of the NCP, this ESD will become part of the administrative record for the facility. The administrative record also contains background information that was used to determine the original remedy, as documented in the 2003 Zone 3 Record of Decision (ROD) Amendment (MWH Americas, Inc. (MWH), 2003). The administrative record for the former

Pease AFB is available for review at the following location:

Shaw Environmental & Infrastructure, Inc.
20 Short Street
Portsmouth, New Hampshire
(603) 334-6430
Hours: 8:00 a.m. to 4:00 p.m.
Monday through Friday

And online at:

<https://afarpaar.lackland.af.mil/ar/docsearch.aspx>

In addition, a notice that briefly summarizes this ESD will be published in the *Fosters Daily Democrat* and the *Portsmouth Herald* and at Seacoastonline.com.

This ESD documents the rationale behind the implementation of anaerobic in situ enhanced bioremediation (ISEB) as a supplemental remedial action to the existing permeable reactive barrier (PRB) in place at Site 73.

SITE HISTORY, CONTAMINATION, AND SELECTED REMEDY

Site Description and History

The former Pease AFB is located in southeastern New Hampshire and is within the city of Portsmouth. The former Pease AFB is located on a peninsula bounded by the Great Bay to the west and southwest, by the Little Bay on the northwest, and by the Piscataqua River on the north and northeast (**Figure 1**). The former Pease AFB comprises 4,365 acres located in the center of the peninsula.

In 1951, the U.S. Air Force took possession of an airport located at the former Pease AFB location, and construction of the facility was completed in 1956. The former Pease AFB was historically used by the U.S. Air Force to maintain a combat-ready force capable of long-range bombardment operations. Various quantities of fuels, oils, lubricants, solvents, and protective coatings were used to support the missions; as a result, contaminants from those substances were released into the environment. At Site 73 (the former Building 234) in Zone 3, hazardous substances (trichloroethene [TCE], *cis*-1,2-dichloroethene [DCE], *trans*-1,2-DCE, vinyl chloride, tetrachloroethene [PCE], 1,1-DCE, and 1,1-dichloroethane [DCA]) entered the environment through the use of solvents and degreasers at the former Building 234 from 1956 until 1978.

Under the U.S. Department of Defense's IRP, the U.S. Air Force initiated activities to identify, evaluate, and remediate sites contaminated with hazardous substances. Because of the contamination discovered under the IRP, the former Pease AFB was placed on the National Priorities List in 1990, and the U.S. Air Force, the EPA, and the NHDES agreed to remediate it in accordance with the Federal Facility Agreement (FFA) signed in 1991 (FFA, 1991). Following the signing of the FFA, the former Pease AFB was placed on the Base Closure List by the U.S. Congress and was closed in March 1991.

Of the seven chlorinated volatile organic compounds (VOCs) detected at Site 73, TCE, *cis*-1,2-DCE, and vinyl chloride continue to be detected at concentrations exceeding restoration goals in shallow and deep overburden and shallow bedrock upgradient and immediately downgradient of the PRB.

Site-specific descriptions and histories for the areas of contamination relevant to this ESD are provided below.

Site 73—Regulatory History and Investigations

Site 73 is located in the central portion of the former Pease AFB and includes the former Building 234 and the surrounding driveways, grass areas, and the downgradient areas associated with the groundwater contaminant plume (**Figure 2**) (URS Group, Inc. [URS], 2010). The former Building 234 was originally used as a liquid oxygen plant and was later converted by the U.S. Air Force to a water demineralization production facility.

Site 73 was initially investigated under the underground storage tank program due to the presence of two 1,000-gallon fuel tanks. Under the underground storage tank program, both tanks were removed along with approximately 150 tons of contaminated soil from the surrounding area. When chlorinated VOCs were detected in groundwater, the site was transferred to the IRP.

Groundwater quality profiling was conducted in 1996 to determine the lateral and vertical extent of the plume originating from the former Building 234 source area and to investigate the potential for dense nonaqueous phase liquid (DNAPL) in the vicinity of the building. The initial plume emanating from Site 73 was found to be approximately 2,200 feet long, and no DNAPL was identified. As a result of the characterization activities, remedial alternatives were evaluated, and it was determined that the PRB and monitored natural attenuation (MNA) would be technically feasible to remediate the site (URS, 2010).

Site 73—Contaminated Groundwater

The 2003 Zone 3 ROD Amendment (MWH, 2003) selected contaminant source isolation using a zerovalent iron PRB, MNA of the downgradient plume, and implementation of a long-term monitoring (LTM) plan to address contamination in groundwater at Site 73. Implementation of the PRB and MNA of contaminants under the LTM plan were designed to attain the cleanup goals over the entire site in approximately 30 years.

The PRB, constructed in 1999, was placed approximately 125 feet downgradient from the

source area and is approximately 150 feet long and 2.5 feet wide (Figure 2). A 1-year performance monitoring program was conducted to evaluate the success of the PRB in reducing chlorinated solvent concentrations in site groundwater. The performance program determined that the PRB was capturing and treating 100 percent of the contaminated groundwater located within the overburden, but that a small portion (approximately 2 percent) of the plume was reaching the overburden/bedrock groundwater interface upgradient of the PRB (URS, 2010). As a result, the PRB and MNA processes downgradient of the PRB were determined to be performing as intended.

LTM has been ongoing since 2001. Monitoring data from 2010 indicate that chlorinated VOCs exceed the ROD restoration goals in shallow and deep overburden and shallow bedrock upgradient and immediately downgradient of the PRB. In 2010, the extent of the chlorinated VOC plume (at concentrations exceeding restoration goals) extended approximately 100 feet downgradient of the PRB (URS, 2010). This represents an approximate 95-percent reduction in plume size since the implementation of the PRB and MNA remedy.

Site 73—Supplemental Remedial Action

The implementation of anaerobic ISEB is designed to complement and enhance PRB performance and MNA. Case studies have shown that the remediation of chlorinated VOCs via zerovalent iron PRB technology can be enhanced with the addition of a carbon source such as emulsified vegetable oil (EVO) and bioaugmentation (Peale et al., 2007; Mueller et al., 2007). The ultimate goal in the additional implementation of anaerobic ISEB at Site 73 is to significantly decrease the amount of time required to reduce site groundwater contaminant concentrations down to the 2003 Zone 3 ROD Amendment cleanup goals. Application of the ISEB is anticipated to reduce the remediation time frame to approximately 2 years once implemented. As discussed above, the current PRB and MNA remedy will not likely attain groundwater cleanup goals for several more decades. Table 1 includes a timetable

comparison between the existing remedy and the supplemental remedial action.

Table 1

	Estimated Time until Remedial Action Objectives Are Met	
PRB/MNA	30 years from implementation	~2029
Anaerobic IESB	2 years from implementation	~2015

ISEB denotes in situ enhanced bioremediation.

MNA denotes monitored natural attenuation.

PRB denotes permeable reactive barrier.

Anaerobic ISEB entails the addition of electron donors (i.e., carbon source) and/or an anaerobic bioaugmentation culture within the subsurface to stimulate and enhance the biodegradation of TCE and its daughter products. During reductive dechlorination, carbon is used as an energy source by anaerobic microbes in the subsurface and the chlorinated VOCs are used as respiratory substrates, or electron acceptors. The Site 73 injection will distribute a carbon source and a bioaugmentation culture to blanket the overburden and fractured bedrock interface, producing an ISEB treatment zone by enhancing the geochemical conditions and providing a food and energy source for the microorganisms to more rapidly degrade TCE and its daughter products to the low toxicity hydrocarbons ethene and ethane. Figure 3 identifies the placement of the ISEB treatment zone and proposed injection points in relation to the existing PRB.

During the injection, EVO will be used to provide a long-lasting carbon source. Shaw’s dechlorinating consortium SDC-9 will be used as the bioaugmentation culture to increase the degradation rate of the chlorinated VOCs. The application of EVO and SDC-9 will require the direct injection of a dilute anaerobic aqueous solution into the aquifer. Groundwater treated with EVO will exhibit elevated total organic carbon concentrations. Therefore, total organic carbon measurements are a good indicator of the presence and distribution of the carbon source.

The annual 2012 sampling event will provide the baseline data for the ISEB application, and

postinjection sampling will occur in accordance with a revised LTM plan that will be designed to adequately assess ISEB remedy performance.

BASIS AND DESCRIPTION OF SIGNIFICANT DIFFERENCES

The 2003 Zone 3 ROD Amendment established three remedial action objectives to be achieved through in situ groundwater treatment by PRB, MNA, and LTM:

- Protect human receptors from ingestion of or direct contact with contaminated groundwater that may present an unacceptable risk.
- Comply with chemical-specific applicable or relevant and appropriate requirements (ARARs).
- Prevent discharge of contaminated groundwater to surface water bodies where such discharges may cause unacceptable risks to human health and the environment.

To date, the current LTM program for Site 73 has shown that only the second remedial action objective has yet to be achieved. While progress toward attainment of Site 73 groundwater cleanup goals (2003 Zone 3 ROD Amendment) for TCE, *cis*-1,2-DCE, *trans*-1,2-DCE, vinyl chloride, PCE, 1,1-DCE, and 1,1-DCA has occurred, the implementation of ISEB would speed remediation of remaining overburden and shallow bedrock groundwater contamination at the site.

ISEB degradation reactions that occur in an aquifer to break down the chlorinated VOCs can also lead to solubilization and mobilization of metals that occur naturally in the aquifer matrix. However, migration of metals out of an ISEB treatment zone is often substantially retarded by adsorption to the aquifer matrix and/or precipitation as insoluble metal sulfides. If elevated groundwater metals concentrations persist above established Pease background levels after the chlorinated VOCs have been reduced to concentrations below their respective cleanup goals, the introduction of oxygen via oxygen release compound or another

similar remedial technology will be implemented to help expedite the return of more oxidative conditions within the aquifer and precipitation of soluble metals, as needed. The 2003 Zone 3 ROD Amendment did not establish groundwater cleanup goals for metals at Site 73. As the ISEB remedy may result in the mobilization of metals at Site 73, cleanup goals for arsenic and manganese are required. The 2003 Zone 3 ROD Amendment established an arsenic groundwater cleanup goal of 23 micrograms per liter ($\mu\text{g/L}$) and a manganese groundwater cleanup goal of 942 $\mu\text{g/L}$ for Zone 3 groundwater. These concentrations represent Pease background groundwater concentrations for these metals. These groundwater cleanup concentrations will also apply to Site 73. If other metals become mobilized as a result of the implemented remedy, cleanup goals, where applicable, will be established for them as well.

As a result, this ESD for Site 73 proposes to add anaerobic ISEB as a supplemental remedial action to the current remedy at the site.

SUPPORT AGENCY COMMENTS

As part of the former Pease AFB realignment and closure cleanup team, EPA and NHDES representatives have had ongoing involvement in the decision-making process associated with the changes in the Site 73 remedies. The U.S. Air Force has obtained concurrence from the EPA and the NHDES on the modification to the remedial actions and confirms that it addresses the concerns of the community and protects human health and the environment.

STATUTORY DETERMINATIONS

The proposed change to the selected remedy will continue to satisfy the statutory requirements of CERCLA, Section 121; the modified remedy will remain protective of human health and the environment and will continue to comply with federal and state ARARs and be cost-effective.

PUBLIC PARTICIPATION

Public participation requirements as outlined in the NCP, Section 300.435(c)(2)(i), have been met.

FOR MORE INFORMATION

If you have questions or would like further information about this ESD for Site 73 at the former Pease AFB, please contact:

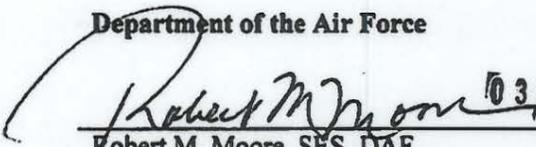
Peter Forbes, Remedial Project Manager
Air Force Civil Engineer Center
154 Development Drive
Limestone, Maine 04750
(207) 328-7109 ext 7

DECLARATION

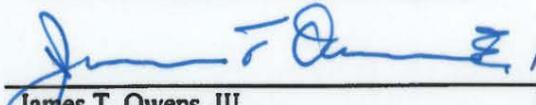
The issuance of the ESD for Site 73 at the former Pease AFB is concurred with.

Department of the Air Force

U.S. Environmental Protection Agency



Robert M. Moore, SES, DAF Date
Director, Installations Center of Excellence
Air Force Civil Engineer Center



James T. Owens, III Date
Director, Office of Site Remediation and
Restoration

U.S. EPA Region 1

REFERENCES

Federal Facility Agreement (FFA), 1991.

Federal Facility Agreement Under CERCLA Section 120, April.

Mueller, J., J. Molin, F. Lakhwala, J.

Valkenburg, J. Peale, and E. Bakkom, 2007. "In Situ Chemical Reduction (ISCR) PRB Technologies: Results from Two Field Applications," *EcoMondo*, Rimini, Italy, November.

MWH Americas, Inc. (MWH), 2003. *Zone 3 Record of Decision Amendment*, December.

Peale, J., E. Bakkom, F. Lakhwala, J. Mueller, J. Molin, E. Dmitrovic, and P. Dennis, 2007.

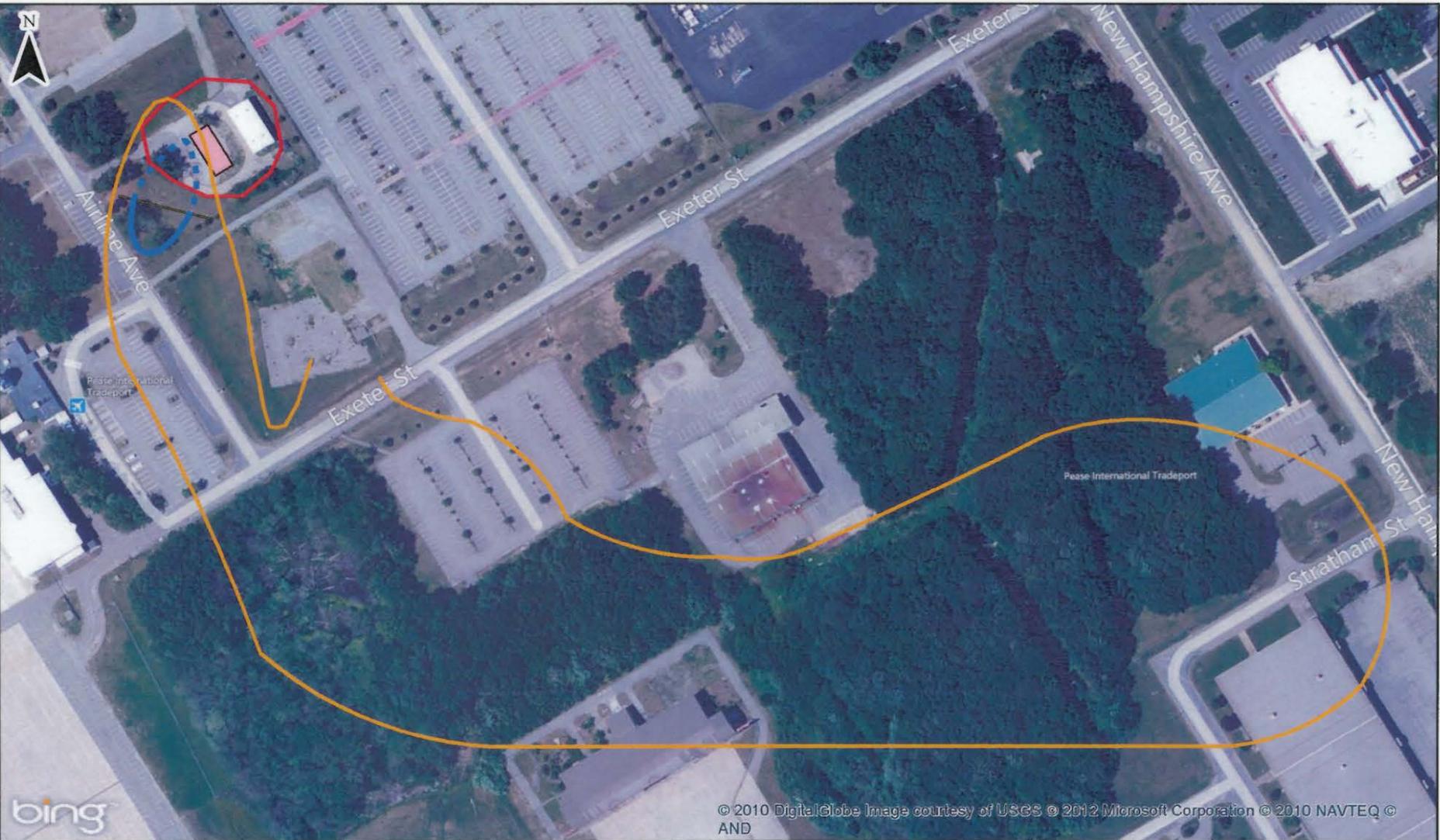
"Integrated Use of EHC™ and KB-1 for Source Area Treatment and PRB Applications at a TCE-Impacted Site," *Battelle's 9th International In Situ & On-Site Bioremediation Symposium*, Baltimore, Maryland, May 7–10.

URS Group, Inc. (URS), 2010. *Site 73*

Permeable Reactive Barrier 2010 Status Report, December.



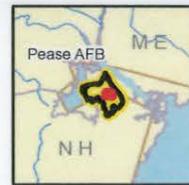
 Site 73 Boundary  Former AFB Boundary		 <p>U.S. AIR FORCE</p> <p>FIGURE NUMBER 1</p> <p>SITE LOCATION MAP, SITE 73 FORMER PEASE AIR FORCE BASE PORTSMOUTH, NEW HAMPSHIRE</p>
<p>0 1,500 3,000 Feet</p>		 a world of Solutions™
<p>Projection : NAD_1983_StatePlane_New_Hampshire_FIPS_2800_Feet</p>		



© 2010 DigitalGlobe Image courtesy of USGS © 2012 Microsoft Corporation © 2010 NAVTEQ © AND

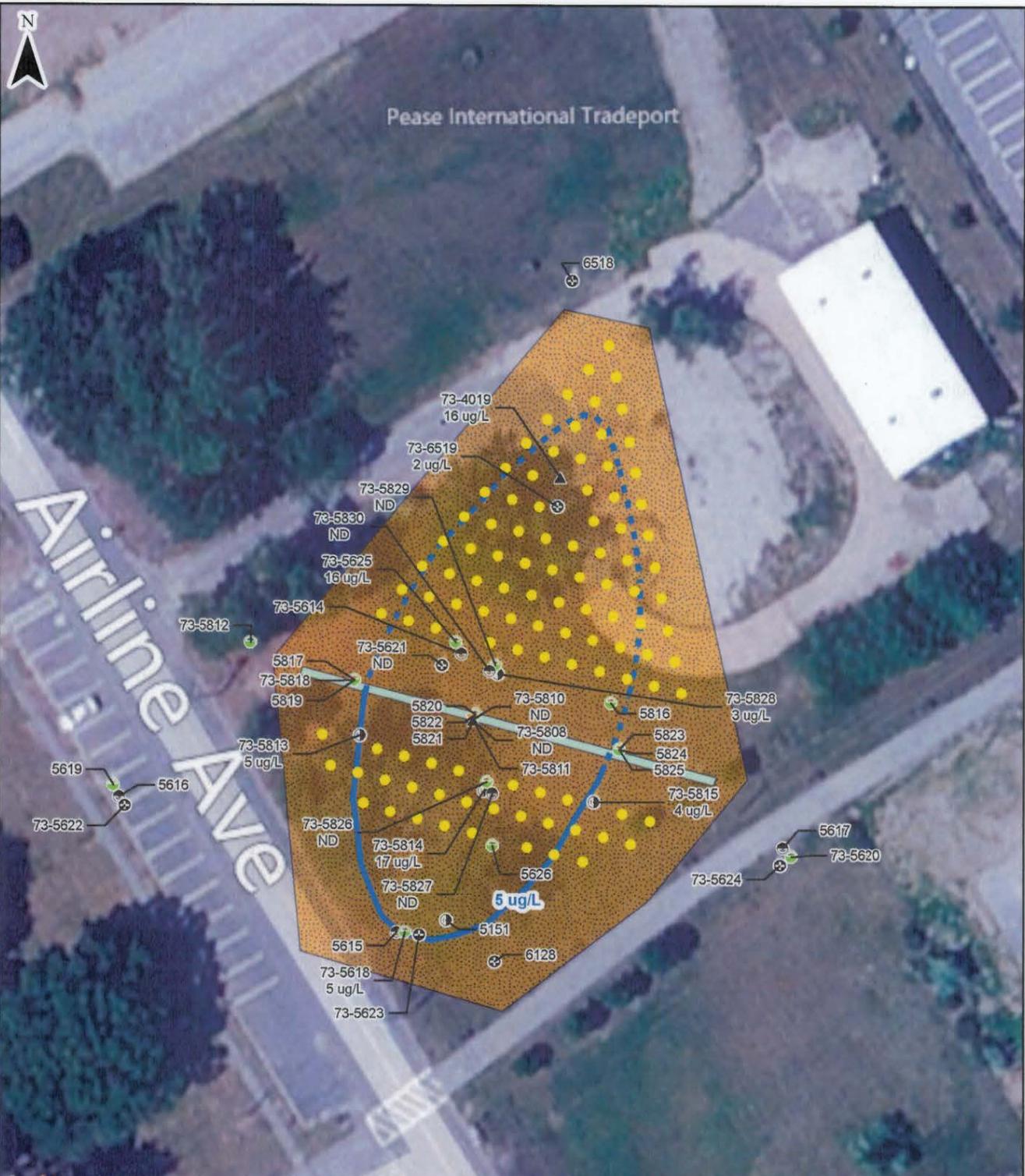
- Site 73 Boundary
- Former Building 234
- Permeable Reactive Barrier
- Historic TCE Plume Boundary
- 2011 TCE Isoconcentration (5 ug/L)
- 2011 TCE Isoconcentration (5 ug/L) (Inferred)

ug/L = Micrograms per Liter



Projection : NAD_1983_StatePlane_New_Hampshire_FIPS_2800_Feet

 U.S. AIR FORCE 	HISTORICAL AND 2011 TCE PLUME BOUNDARIES SITE 73 FORMER PEASE AIR FORCE BASE PORTSMOUTH, NEW HAMPSHIRE
FIGURE NUMBER 2	
 Shaw a world of Solutions™	



© 2010 DigitalGlobe © 2012 Microsoft Corporation © 2010 NAVTEQ © AND

	Anaerobic ISEB Treatment Zone		Shallow Overburden Piezometers
	Permeable Reactive Barrier		Deep Overburden Piezometers
	2011 TCE Isoconcentration (ug/L)		Shallow Bedrock Wells
	2011 TCE Isoconcentration (ug/L) (Inferred)		Shallow Bedrock Piezometers
	Proposed Injection Point		Deep Bedrock Wells
	Shallow Overburden Wells		Hybrid Wells
	Deep Overburden Wells		Fractured Bedrock Wells

ug/L = Micrograms per Liter Projection : NAD_1983_StatePlane_New_Hampshire_FIPS_2800_Feet

U.S. AIR FORCE

FIGURE NUMBER
3

ISEB INJECTION LAYOUT
SITE 73
FORMER PEASE AIR FORCE BASE
PORTSMOUTH, NEW HAMPSHIRE

Shaw a world of Solutions™