

# Amendment Delivery Methodology for Permeable Reactive Barrier (PRB) Installation in Challenging Lithology at Shaw AFB

ENVIRONMENTAL, INC.

# Project Goals and Objectives

- Actively intercept the off-base portion of the TCE/PCE plume within the UBC Aquifer
- Demonstrate the ability of an activated-carbon based amendment (ACBA) to address distal PCE/TCE plume in a permeable reactive barrier (PRB) application
- Demonstrate the methodology to effectively install the ACBA in a relatively deep aquifer (90 to 167' bgs)



## Activated Carbon Based Amendment

- BOS 100<sup>®</sup> selection criteria:
- Proven ability to remediate PCE/TCE sources/plumes at hundreds of sites
- Longevity in PRB applications (>13 years)
- Abiotic treatment mechanism not incumbered by low pH (4 to 5) as exists in the UBC aquifer
- BOS 100<sup>®</sup> Specially manufactured activated carbon impregnated with metallic iron (6.5% by weight metallic iron) – treats chloroethenes, ethanes and methanes
- Activated carbon is the trap mechanism to adsorb contaminant
- Metallic iron impregnated within the carbon pore structure provides the abiotic iron reduction treatment mechanism
- Primary abiotic degradation products chloride and unregulated dissolved gases such as ethene

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#### BOS 100<sup>®</sup> Tech Demo Phases of Work

Three primary phases:

- Site preparation and maintenance (April 2018 to April 2019)
- Tree clearing and grading
- >3,000 ft of haul road to access remote location
- 350 ft of fence with gates to isolate injection area from farm operations
- Water line and 10,000-gallon water holding system installation
- Sediment and erosion control measures silt fence, water bars, grading
- Drilling fluids and solids management area
- Materials management area 300 drums of BOS 100<sup>®</sup>,
   >7,000 buckets of pellets and 4,000 bags of bentonite grout
- Plume Refinement (RDC) & CSM Update to finalize the vertical and horizontal limits of BOS 100<sup>®</sup> PRB – Field work April 2018 to October 2018
- Installation of the 650' long BOS 100<sup>®</sup> PRB, 90' to 167' bgs; field work December 2018 to March 2019; 60,000 lbs of BOS 100<sup>®</sup> injected into UBC Aquifer



# Installation Technique - Pre-Drill (GeoTap<sup>SM</sup>)

Applicable to sites where DPT (alone) cannot be used due to early refusal
 Pre-drill technique consists of the use of augers, air rotary or roto sonic techniques to total depth, backfill with bentonite, followed by direct push through bentonite using DPT to inject the BOS 100<sup>®</sup> slurry into the formation

 130 Injection points were pre drilled to depths varying from 125' to 167' bgs (15' between points and 10' between rows)

Bottom 70' of injection points backfilled with bentonite
60,000 lbs of BOS 100<sup>®</sup> injected using AST's High-Capacity Mixing/ Injection System



Top-down injections DPT rig w/2.25" rods in bottom 30' of UBC
Depth of injections determined from lithology, logging as part of pre-drill (southern section 92' to 122', northern section 135' to 167')
Backfill injection point with bentonite pellets to 3' bgs, then topsoil to ground surface

### Post Injection Results

- Previously determined seepage velocity approximately 20 feet/year to be updated based on new wells
- No groundwater samples collected since November 2019; initially planned for May 2020, postponed until Summer 2022

