

# Combined In Situ Treatment Methods and Technologies Reduce Mass at Large DNAPL Solvent Site

Mike Mazzarese (mmazzarese@astenv.com) (AST Environmental, Inc., Golden, CO, USA)
Gary Simpson (gsimpson@astenv.com) (AST Environmental Inc., Midway, KY, USA)

#### Site Background Information

Confidential Site in central Kentucky

 Historical Industrial Property that utilized chlorinated solvents for equipment maintenance from the 1950's to 1970's

•Materials are suspected to have been discharged to drainpipes which allowed for the contaminant migration

Site is still active with existing utilities and various structures

•The site geology consist of interbedded sands, silts and clays associated with river sedimentation

#### Project Timeline

Remedial Design Characterization (RDC) - 2013

•26 soil borings, 186 soil samples

•31 gw samples (nested implants)

•BOS 100 PRB -2014

Sodium Permanganate Soil Mixing - 2015

•CAT 100 Source Treatment - 2020

### RDC Findings

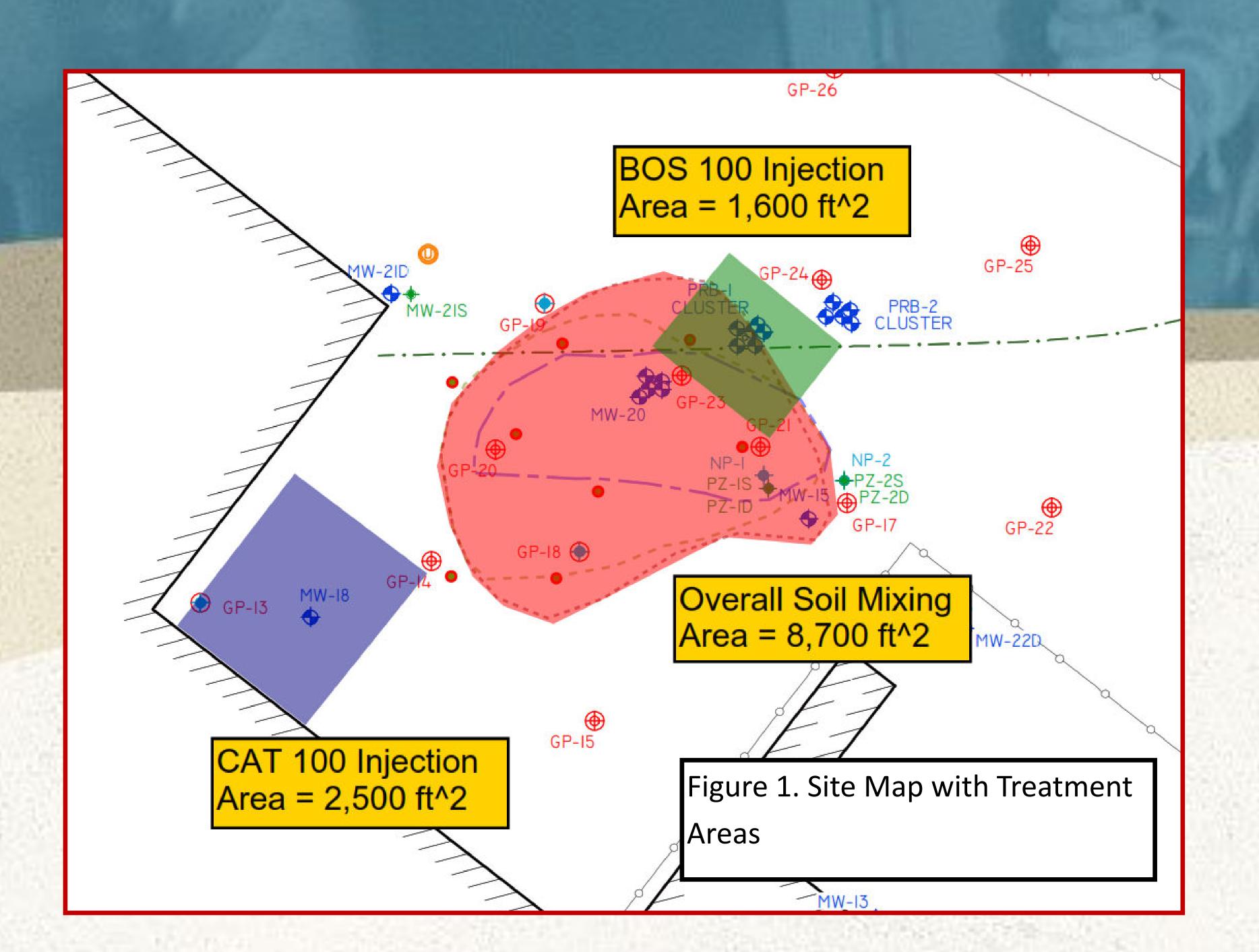
•DNAPL source area

Unsaturated and saturated impacts (8-46 ft bgs)

Groundwater table at approximately 15 ft bgs

•TCE (groundwater) maximum concentration = 730 mg/L

TCE (soil) maximum concentration = 5,350 mg/kg



# Technologies Selected

•Injected Permeable Reactive Barrier (PRB) => BOS 100<sup>®</sup> (RPI)

Activated carbon impregnated with metallic iron (6.5% w/w)

Treatment via abiotic β-elimination pathway

Treatment Interval = 26-46 ft bgs

•4,200 lbs BOS 100 applied in 28 DPT injection locations

•10 year design life

Soil Mixed Source Area => RemOx-L<sup>®</sup> (Carus)

Delivered as 40% w/w liquid

•54,000 lbs RemOx-L mixed into 2,830 cubic yards of soil

Injected Source Area => CAT 100 (RPI)

•BOS 100 + Electron Donor + Nutrients + Bacteria

•16,000 lbs CAT 100 applied in 69 injection locations





# Results

•PRB

PRB-1 had 5 vertical channels, average TCE concentration decrease over
 450+ days = 98.5%

•PRB-2 had 4 vertical channels, average TCE concentration decrease over 450+ days = 98.3%

•PRB-2 (downgradient well, Figure 1) maximum TCE concentration at 450+ days = 6 ppb

Soil Mixed Source Area

•95-99% reduction in TCE soil concentrations pre and post mixing

Baseline average = 1,100+ mg/kg TCE

Post soil mixing average = 12-56 mg/kg TCE

•99% reduction in TCE groundwater concentration

•Baseline = 730 mg/L TCE

Five years post mixing = 2.90 mg/L TCE

Injected Source Area

•Source Area well TCE concentration at baseline = 47,800 ug/L (>96% TCE on

molar basis), very little daughter product conversion, ethylene non-detect

•After one year: TCE < 5 ug/L, cis-1,2 DCE = 4,970 ug/L & VC = 2,600 ug/L

After two years: TCE < 5 ug/L, cis-1,2 DCE = 93 ug/L & VC = 244 ug/L</li>

After 1,000 days: TCE < 5 ug/L, cis-1,2 DCE = 21 ug/L & VC = 9 ug/L</li>

•Evidence of complete degradation provided by ethylene generation (Figure

7)



