FIRST ENVIRONMENT

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March 14, 2018

Ms. Lynn Chambers
Division Chief – Groundwater Assessment & Remediation Division
Mississippi Department of Environmental Quality
515 E. Amite Street
Jackson, MS 39201

Re: ISCR Workplan and Corrective Action Workplan
Former Holley Automotive/Coltec Industries Facility, Water Valley, MS

Dear Ms. Chambers:

On behalf of EnPro Industries, Inc. (EnPro), First Environment, Inc. (First Environment) is submitting these responses to your February 21, 2018 email on behalf of the Mississippi Department of Environmental Quality (MDEQ) providing comments on the ISCR Workplan and Corrective Action Workplan (CAWP) regarding the Former Holley Automotive/Coltec Industries Facility (the "Plant") and known downgradient plume area (collectively referred to as the "Site").

MDEQ Comments regarding the ISCR Workplan (CAWP Addendum No. 1)

1. MDEQ does not believe that the currently proposed ISCR curtain construction length will completely intersect the migrating COC plume meeting the objectives as outlined in the CAP; expanding the curtain to the east would provide better coverage. Please respond.

There is an unoccupied field directly to the north of the Plant building, east of the currently proposed ISCR curtain. Counsel for EnPro is working to place institutional controls on the property. In addition to this, EnPro proposes to expand the ISCR curtain to the east at the tentative location, subject to field verification of utilities, as shown on Figure 1 attached, and described in more detail in response to Comments 4 and 5 below. Counsel and First Environment will work with BorgWarner on the logistics. The ISCR work may need to be done in phases to avoid disruption of the BorgWarner Plant operations.

2. The Workplan proposes the installation of two monitoring wells (PMW-1 and PMW-2) utilizing 25-foot screens in order to monitor the proposed reactive curtain's effectiveness. Being that these proposed monitoring wells are being installed as performance monitoring wells, MDEQ would typically require the use of clustered wells (one well screened across the water table and one well screened at the confining clay) at each location utilizing a 10-foot well screen, please respond.

New Jersey
California
Georgia
Illinois
Mississippi
New York
Puerto Rico
Canada

MDEQ representatives were present during the installation of monitoring wells PMW-1 and PMW-2, now designated MW-73 and MW-74. At the MDEQ's request in the field, MW-73 was installed with a 15 ft. screen to a depth of 40 ft. in the sandy layer zone where the presence of VOCs had been identified by the Membrane Interface Hydraulic Profiling Tool (MiHpt). MW-74 was installed with a 10 ft. screen to a depth of 50 ft. First Environment proposes to nest a second well with a 15 ft. screen at the location of MW-74 at a depth from 25 ft. to 40 ft. below ground surface (bgs). First Environment also proposes to install two (2) additional wells, one (1) in the location of MiHpt-1b and one (1) immediately downgradient of the curtain as depicted on Figure 1. These wells will be screened at 25 ft. to 40 ft. bgs in the zone believed to contain the highest VOC impact

.

With respect to the proposed expansion of the curtain to the east, First Environment proposes to install seven (7) monitoring wells as depicted on Figure 1. First Environment proposes to screen MW-77S, MW-78, MW-79, MW-80, and MW-81S at 25 ft. to 40 ft. bgs; and MW-77D and MW-81D at 40 to 50 ft. bgs.

3. MDEQ suggests additional wells need to be installed in the area of the ISCR curtain to aide in the evaluation of the curtain's performance.

There are currently two wells located immediately upgradient of the proposed ISCR curtain (MW-27 and MW-73) and two wells located immediately downgradient (MW-37 and MW-74). With the addition of a couplet well at the location of MW-74, and the installation of two (2) additional monitoring wells, these seven (7) monitoring wells in the northwest parking lot will enable First Environment to evaluate the initial performance of the northwest parking lot ISCR curtain.

4. Additional evaluation of the use of alkaline buffering agent is necessary as the most recent Groundwater Monitoring Report dated September 26, 2017 demonstrates the pH values in the immediate area to range from 4.12 to 5.49 standard units, and the literature suggests a buffer agent when pH <6 is encountered.

Three sampling events in the northwest parking lot area have measured the pH to be below six. During the October 2016 sampling activities, the pH values measured in the sampled monitoring wells ranged between 5.3 (MW-04) to 7.57 (MW-52). At this sampling event, the northwest parking lot wells, MW-27 and MW-37, had pH of 5.65 and 5.49, respectively. During the July 2017 sampling event, pH ranged between 4.07 (MW-12) and 6.01 (MW-25S). MW-27 had a pH of 5.23. At the February 2018 sampling event, pH was measured in the newly installed wells, MW-73 and MW-74, which measured 5.22 and 6.25, respectively. Based on this data, First Environment concurs that there is a slightly acidic environment in the groundwater at the Site.

EHC combines fibrous organic carbon and microscale ZVI providing an optimal balance of acidity-alkalinity as far as in-situ chemical reagents are considered. A pH buffer is not added to EHC injections where the pH of the aquifer is in the neutral range (6-8). However, for sites with pH less than the lower range of biological degradation (i.e., less than 6), buffers *are added along with the EHC injections to raise the pH to the optimal range. Choices of buffers include hydroxide or bicarbonate compound based reagents, such as magnesium hydroxide ($Mg(OH)_2$) or potassium bicarbonate ($KHCO_3$). The quantity of buffers is generally estimated by performing a simple titration test involving the collection of samples of native soils and groundwater from the site of concern. Application rates vary based on base buffering capacity but are in the general range of 0.03-0.2% by wt. of soil mass. The buffer solution can be simultaneously added along with EHC during the injection process.*

The vendor who will supply the EHC for this site has recommended that $Mg(OH)_2$ is a better buffer solution based on the injection method (i.e., direct push). Based on the calculated mass of impacted soils within the treatment zones for both the north and northwest parking lot areas, First Environment estimates the following:

Northwest Parking Lot Reactive Curtain

As detailed in the ISCR Workplan for the Northwest Parking Lot (CAWP Addendum No. 1), submitted to the MDEQ on December 22, 2017, the reactive curtain will be composed of three lines of injection with 15-ft. spacing, consisting of 20 injection points at each line (a total of 60 injection points). A total of 20,000 lbs of EHC will be injected at the first two lines of the curtain. A total of 10,000 lbs EHC+ will be injected at the third line of the curtain (most downgradient). Approximately 15 L of DHC bacteria will be injected for bioaugmentation in all three lines of the curtain. In order to sustain a buffered pH zone, First Environment estimates approximately 3,750 lbs of $Mg(OH)_2$ will be used. This estimated amount is based on a 0.05% rate by weight of impacted soil mass depicted in the attached revised calculation sheet for the northwest parking lot reactive curtain. The actual amount will be established by an analytical laboratory titration test.

North Parking Lot Reactive Curtain

As detailed in the attached calculation sheet for the north parking lot, the following quantities of the reagents will be injected along three distinct lines: 34,000 lbs of EHC in the first two lines of the curtain; 16,000 lbs of EHC+ in the third line; and 22 L of DHC bacteria in all three lines. Based on the impacted soil mass and a 0.05% rate by weight, First Environment estimates approximately 5,600 lbs of $Mg(OH)_2$ will be injected as a buffer, subject to analytical verification by a laboratory titration test.

5. Revisions to calculations for slurry injection are needed as (1) differing quantities exist in the CAP, (2) the calculations do not account for the total VOC contaminant mass in the treatment area, and (3) the calculations do not account for varying aquifer thickness in the area.

There is a typographical error in the CAWP Addendum No. 1. The statement "110 gallons" should read "220 gallons" per injection point as presented in Appendix A to CAWP Addendum No. 1.

Using the February 2018 MiHpt investigation results and soil boring information, First Environment confirmed that the treatment zone in the northwest parking lot is on average 15 ft. The calculation sheet provided in CAWP Addendum No. 1 showed a target groundwater concentration of 0.6 mg/L for treatment in this area. Based on the February 2018 groundwater sampling data, First Environment has revised this concentration to 1.2 mg/L. First Environment has also revised the depth to the treatment zone to 25 ft. However, the total amount of reagent requirements did not change. A revised copy of the calculations is attached. This information is subject to confirmation in the field.

Additionally, as discussed in response to Comments 1 and 2, First Environment has evaluated the eastward expansion of the ISCR curtain to the north parking lot of the Plant. Figure 1 depicts the proposed additional injection points. A January 2018 geophysical markout identified a sewer line running from west to east at the uppermost boundary of the north parking lot. The grass area between the northwest and north parking lots contains numerous utilities. Additionally, the entrance on the north side of the Plant is a major trucking route entrance. Based on these conditions, First Environment moved the proposed curtain closer to the Plant building. The depicted locations will need to be verified in the field by a subsequent geophysical survey, which will be conducted prior to the installation of the curtain.

In connection with the proposed expansion of the ISCR curtain, First Environment reviewed the February 2018 MiHpt investigation results (MiHpt 4b) as well as the existing monitoring well boring logs in the north parking lot. First Environment estimates the depth to treatment zone to be deeper than in the northwest parking lot (25 ft. bgs). The treatment zone thickness is also larger at 25 ft. bgs. Using the same spacing (15 ft. apart) and three lines of injection in the curtain, a total of 54 injection points are proposed as depicted in Figure 1. This will result in a 270 ft. long reactive curtain to capture contaminants migrating from the source areas. A separate calculation sheet for this expansion is provided herewith.

6. Additional information is needed for performance monitoring, specifically regarding the proposed dual phase remediation system installation and operation.

Performance monitoring will be included in the final design of the selected remedy and cannot be determined until a pilot test of the high vacuum dual-phase extraction (HVDPE) is conducted. As described in response to Comment 7 below, the pilot test will be submitted as an Addendum to the CAWP and include metrics for the effectiveness of the pilot test.

MDEQ Comments regarding the CAWP

7. Section 7.1 of this work plan selects high vacuum dual-phase extraction (HVDPE) as the chosen remedial option for the former TCE degreasers and TCE supply structures. The pilot test discussion and all supporting design documents should be included within this corrective actions plan.

As discussed in Section 5.1 of the CAWP, prior to implementation of the HVDPE pilot study, installation of additional monitoring wells and a baseline round of sampling were necessary to devise a detailed pilot study work plan. Those monitoring wells were installed and sampled in January and February 2018 and the results have been evaluated. As such, First Environment will prepare and submit to the MDEQ a detailed pilot test design for implementation as part of a CAWP addendum by March 30, 2018.

The CAWP dated January 12, 2018 provides a general overview of the pilot test in Section 7.2. The following supplements that section:

HVDPE is a process which volatilizes sorbed phase VOCs and removes those compounds from the unsaturated zone while removing liquid phase contaminants from the underlying aquifer.

During the pilot test, First Environment will utilize newly installed MW-70 as an extraction well. Figure 2 depicts the locations of the newly installed monitoring wells. First Environment selected this well based on the February 2018 sampling results, which revealed a TCE concentration of 21,200 µg/L. Furthermore, MW-70 is the closest well to the former AST area and is located directly adjacent to the Plant building. First Environment will utilize indoor wells MW-60, MW-62, and MW-63 and outdoor wells MW-65, MW-66, MW-67, MW-69, MW-71, MW-72, and MW-36 as observation wells.

As discussed in the CAWP, the HVDPE test will be conducted using a mobile treatment system trailer, consisting of a high-vacuum blower equipped with a flow regulator to control applied vacuum to the extraction well (MW-70). A drop tube ("stinger") will be placed in the well to extract groundwater and/or DNAPL, if present. A vapor-liquid separator tank will be utilized to separate contaminant vapors from the extracted liquid. The vapors will be treated on site using a serially connected two (2) 180-lb. granular activated carbon (GAC) units before being discharged to the atmosphere. The extracted groundwater will be temporarily containerized in a 25,000-gallon or larger capacity frac tank. One or more vacuum trucks will be employed to transfer extracted groundwater to the existing Treatment System No. 2 periodically. The extracted groundwater will be treated using the existing air stripper and will be discharged to the Otoucalofa Creek under the NPDES permit.

Before initiating the pilot test, First Environment will obtain static depth-to-water measurements from all wells in this region. Electronic pressure transducers will be placed in the wells, including the extraction well, to continuously measure drawdown values during the test. During the pilot test, the applied vacuum at the blower will be maintained at the maximum capacity (estimated up to 25" Hg). The sustainable air flow rate will also be maintained in the extraction well. The observation wells will be monitored for induced vacuum using portable magnehelic gauges during the performance of the test. Initially, the vacuum readings will be collected within 10-minute intervals and recorded; after equilibrium is established, the vacuum readings will be collected at 30-minute intervals for the first six (6) hours of the test. For the remainder of the test, intermittent vacuum readings will be collected, as appropriate.

The pilot test is intended to last between 24 and 48 hours. During the pilot test, three (3) sets of influent and effluent air samples will be collected for laboratory TO-15 analyses. The first round of sampling will be collected within the first hour of the test's initiation, the second round will be collected 24 hours later, and the third round will be collected within the last hour of the proposed duration of the test. At the conclusion of each work day, First Environment will also sample the extracted groundwater for VOC analysis.

The results of the pilot test will be analyzed to determine the efficacy and applicability of this technology. If the technology is deemed feasible, the results will be used as the basis for the design of a full-scale system. The full-scale system design will be provided to the MDEQ in a subsequent CAWP Addendum, which will detail all pilot test data and analysis, technical specifications of the proposed system, its appurtenances, and other regulatory requirements (i.e., permits, etc.).

7. Section 7.3.2 of the work plan selects pump and treat as the chosen remedial option with regard to the Frostland Drive portion of the down-gradient dissolved phase plume and Figure 24 illustrates the proposed locations. MDEQ approves the chosen remedial option. MDEQ suggests adding an addition monitoring well approximately 200 feet north of PRW-7 in order to evaluate pump influence to the north of Frostland drive (See Figure 1). Please respond.

EnPro's counsel will seek access for the installation of this suggested monitoring well approximately 200 ft. north of PRW-7. It is EnPro's understanding that with the MDEQ's approval of the Frostland Drive remedial option, the MDEQ is also approving no further implementation of the Initial Corrective Action for Champion Circle and the installation of three (3) monitoring wells in the vicinity of Champion Circle (CAWP Section 7.4) given that access – a necessary and mandatory requirement per the Agreed Order No. 6789-17, Section 3.B. – was effectively denied, rendering performance of this work legally impossible. Please refer to Butler Snow's January 12, 2018 letter to Gretchen Zmitrovich, Senior Attorney, MDEQ, for discussion of EnPro's evaluation and pursuit of other remedial and corrective actions in the Champion Circle area and south of Frostland Drive due to the denial of access.

9. MDEQ advises to begin preparations for expansion of the proposed extraction well for regional remediation and expanding the monitoring network with regard to compliance monitoring.

As detailed in CAWP Sections 7.2.3 and 10.2, First Environment plans to install a recovery well and monitoring well in the vicinity of MW-44 at Frostland Drive and perform a hydraulic evaluation. This hydraulic evaluation will inform whether other remedial alternatives should be considered and whether additional recovery wells should be installed. Counsel and First Environment have begun preparations for the installation of the proposed recovery well and monitoring well with implementation of these plans dependent upon whether the property owners grant access. As of this date, EnPro does not have a signed access agreement from the owner of property south of Frostland Drive where MW-44 is located.

10. Please proceed with communications with the City of Water Valley regarding the privately owned treatment works' (POTW) willingness to accept the discharge that is to be generated by the pump and treat system and the proposed HVDPE system at the Borg Warner Plant. The MDEQ EPD Branch Chief for this permit will be Becky Nester. Please contact Becky if you have specific questions.

First Environment has begun communications with the City of Water Valley regarding discharge to the POTW and is in the process of responding to technical questions. We will coordinate with Ms. Nester regarding any specific questions.

11. Section 10.1 of the work plan states, "…If air quality monitoring results demonstrate exceedances of the MDEQ action level of 26 ug/m^3, First Environment will evaluate the existing SSDS. MDEQ requests that EnPro continue to evaluate the SSDS until such time as it is proven that indoor air concentrations are below the sensitive population threshold of 8.8 ug/m^3. Additionally, EnPro should continue with the current air monitoring schedule until it can demonstrate indoor air concentrations remain below the EPA RSL of 3 ug/m^3.

First Environment is continuing to evaluate the SSDS and will continue with the MDEQ-approved air monitoring schedule.

Should you have any questions, please do not hesitate to contact me.

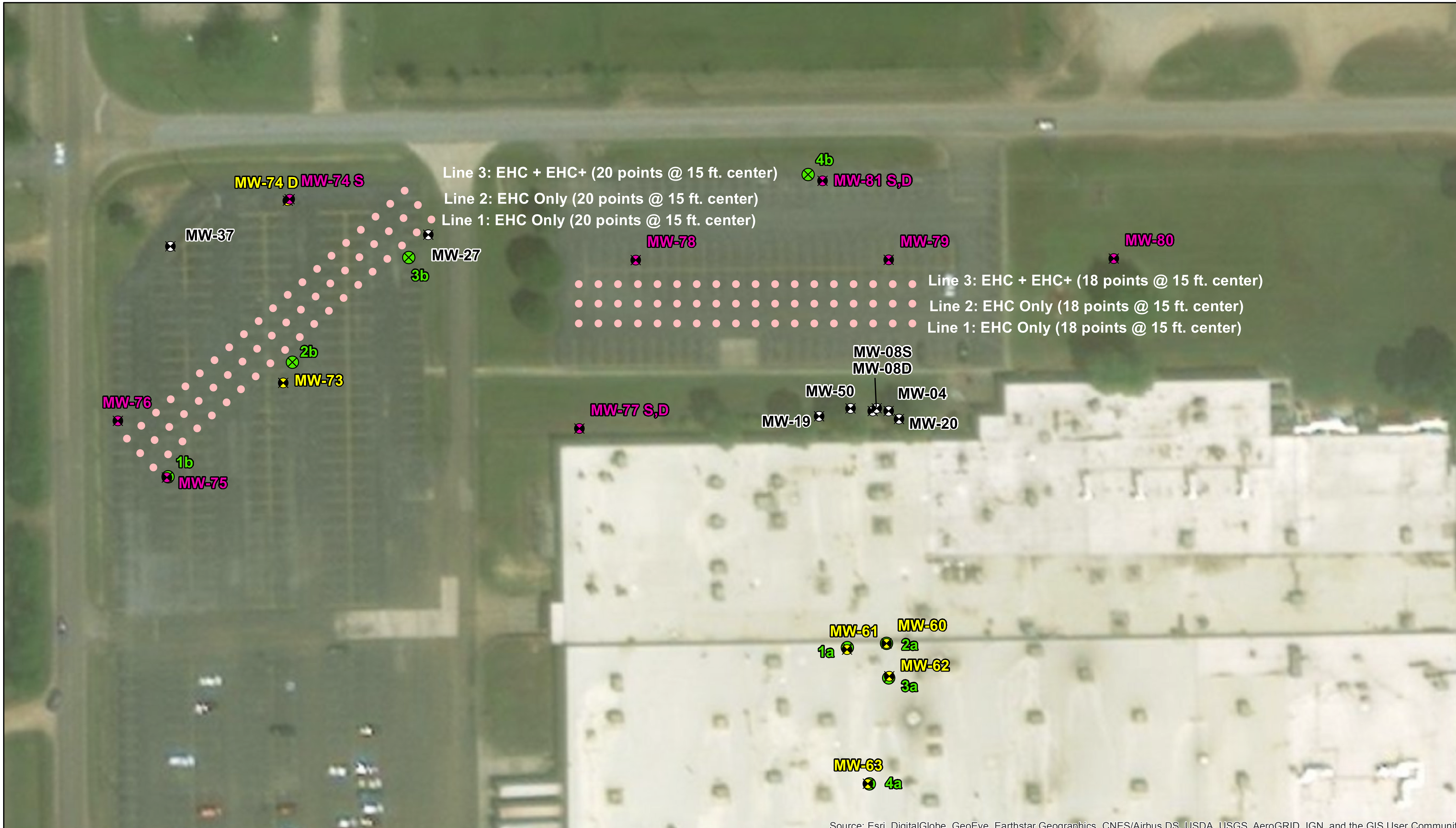
Very truly yours,

FIRST ENVIRONMENT, INC.

Bernard T. Delaney, Ph.D., P.E., BCEE
President

cc: Trudy Fisher, Esq.
Benne Hutson, Esq.
Amanda Tollison, Esq.

ATTACHMENTS



Legend

- Proposed Monitoring Well Locations
- February 2018 Monitoring Well Locations
- Existing Monitoring Well Locations
- January 2018 MiHpt Locations
- Proposed Reactive Curtain Injection Locations

The actual location of the reactive curtain is dependant on a geophysical markout and groundwater sampling results.

0 17.5 35 70 Feet

1 inch = 70 feet

N W E S

FIRST ENVIRONMENT

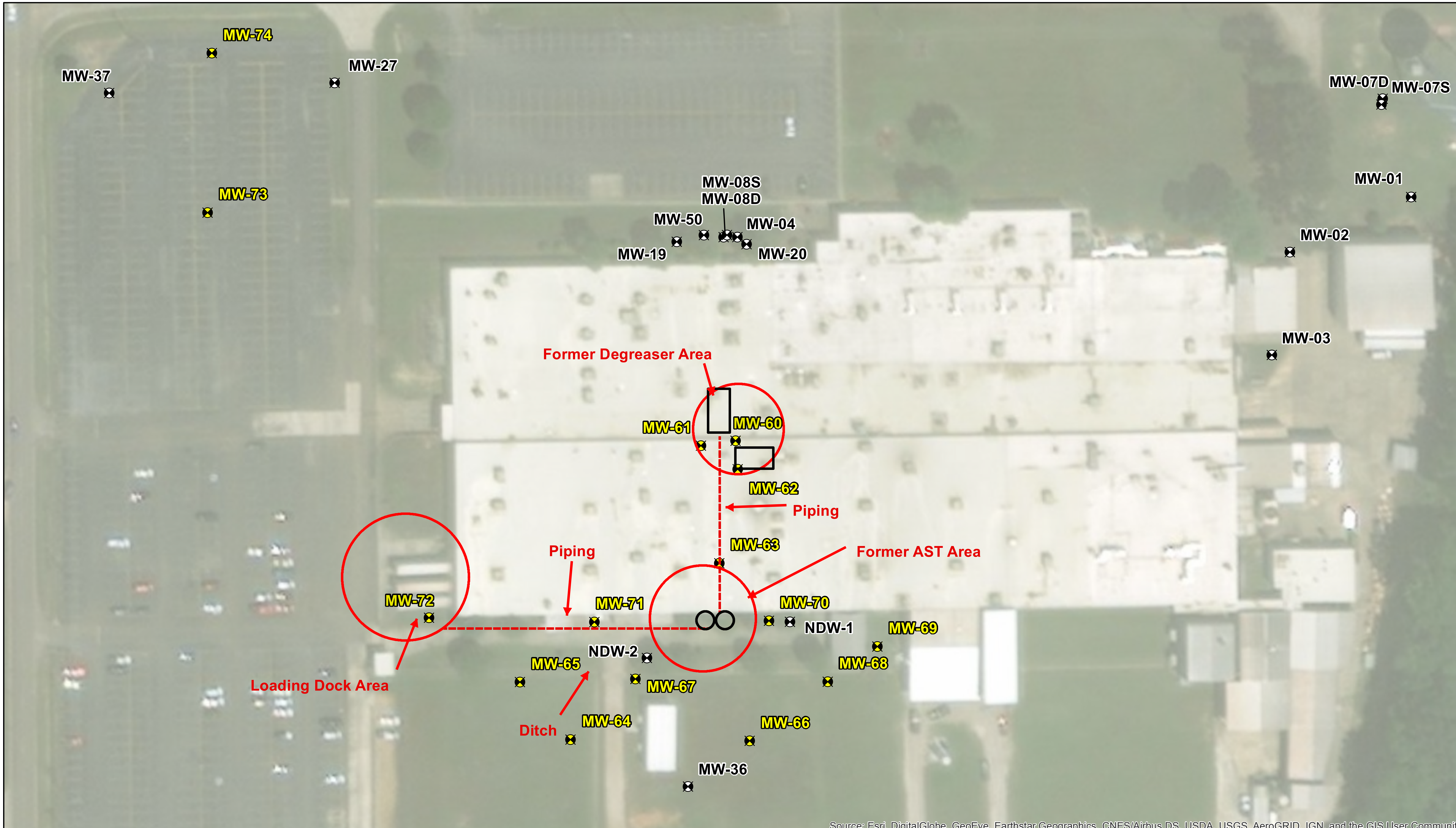
91 Fulton Street
Boonton, New Jersey 07005

FORMER HOLLEY AUTOMOTIVE/COLTEC INDUSTRIES FACILITY
600 Highway 32E, Water Valley, MS

FIGURE 1

PROPOSED MONITORING WELL LOCATIONS

Revised	Drawn	Checked	Approved	Date
	LS	SG	TCB	3/9/2018



Legend

- February 2018 Monitoring Well Locations
- Existing Monitoring Well Locations

0 20 40 80 Feet

1 in = 80 ft

N
W E
S

FIRST ENVIRONMENT

91 Fulton Street
Boonton, New Jersey 07005

FORMER HOLLEY AUTOMOTIVE/COLTEC INDUSTRIES FACILITY
600 Highway 32E, Water Valley, MS
FIGURE 2
MONITORING WELL LOCATIONS

Revised	Drawn	Checked	Approved	Date
	LS	IC	MS	02/27/2018

Northwest Parking Lot

IN-SITU CHEMICAL REDUCTION (ISCR) REAGENT (EHC®) MASS CALCULATIONS FOR PERMEABLE REACTIVE BARRIERS (PRBs)
by
Dr. Mete Talimcioglu
First Environment, Inc.

DESIGN PARAMETERS

Contaminant of Concern, *CoC* :	**TCE**	
PRB Design Life, *t* :	4	years
Length of PRB, *L* :	300	ft
Number of PRB Lines, n_p :	3	
Lateral Spacing of PRB Lines, l_p :	5	ft
Width of PRB, *w* :	15	ft
Lateral Spacing Between each Injection Location per PRB Line, l_i :	15	ft
Number of Injection Locations per PRB Line, n_i :	20	
Total Number of Injection Locations, n_t :	60	
Depth to Treatment Zone, d_t :	25	ft
Treatment Zone Thickness, *d* :	15	ft
Treatment Volume V_t :	67,500	ft^3
Total Groundwater Volume, V_{gw} :	20,250	ft^3
Calculated Soil Mass, *M* :	7,425,000	lbs
Advective Migration Distance over Treatment Life, L_t :	3,194	ft
Volume of Groundwater Passing Through Region over Treatment Life, V_{tgw} :	2,874,375	ft^3

HYDROGEOLOGIC PARAMETERS

Porosity of Soil, *n* :	0.3	--
Effective Porosity, n_e :	0.2	--
Bulk density of Soil, ρ_b :	110	lbs/ft^3
Hydraulic Conductivity of Soil, *K* :	87.5	ft/day
Hydraulic Gradient, *i* :	0.005	ft/ft
Specific Discharge, *v* :	0.4375	ft/day
Average Linear Velocity of Groundwater, *v** :	798	ft/yr

CONTAMINANT PARTITIONING

Organic Carbon Fraction, f_{oc} :	0.005	--
Normalized Partitioning Coefficient of CoC, K_{oc} :	107	L/Kg
Adsorption Coefficient, K_d:	0.535	L/Kg
Observed Dissolved Phase Concentration, C_L :	**1.2**	mg/L
Total Sorbed Phase Soil Contamination, C_s:	**0.642**	mg/Kg

CONTAMINANT MASS

CoC Mass in Soil, M_s :	4.8	lbs
CoC Mass in Groundwater in Treatment Zone, M_{gwt} :	1.5	lbs
Total CoC Mass in Groundwater Over Design Period, M_{gw} :	217.3	lbs
Total CoC Mass, M_t :	**222.0**	lbs

STOICHIOMETRY

Stoichiometric Hydrogen Demand Ratio for CoC, *SDR* :	0.3333	mol/mol
Molecular Weight of CoC, *MW* :	131.4	g
Molecular Weight of H_2, *MWH* :	2	g
Stoichiometric Hydrogen Demand Ratio for CoC, *SD* :	21.9	CoC Mass/H_2 Mass
Hydrogen Concentration from Dissolved CoCs in Groundwater, H_d :	0.05	mg/L
Hydrogen Concentration from Sorbed CoCs in Soil, H_s :	0.03	mg/Kg
Hydrogen Concentration from Competing Electron Acceptors, H_{cea} :	11.5	mg/L ---> from PeroxyChem
Total Hydrogen Concentration, H_t :	**11.6**	mg/L

HYDROGEN DEMAND CALCULATIONS

Hydrogen Demand from Soil within Targeted Area, H_{2s} :	0.2	lbs
Hydrrogen Demand from Groundwater within Targeted Area, H_{2gw} :	14.8	lbs
Hydrogen Demand from Groundwater Influx Over Design Period, H_{2inf} :	2097.4	lbs
Total Hydrogen Demand, H_{2t} :	2112.4	lbs

EHC MASS CALCULATIONS

Average H_2 Release Rate from EHC, R_{EHC} :	18.8	g H_2/Kg EHC/yr ---> from PeroxyChem
H_2 Release per Pound of EHC Over Design Period, R_t :	0.075	lbs
Total EHC Required, M_{EHC} :	28,090	lbs

EHC SLURRY CALCULATIONS FOR 25% SOLIDS

Mass of EHC per Bag, M_{bag} :	50	lbs
Number of Bags Required, n_b :	600	--
Percent Solids, *ps* :	25%	
Total Solids:	200	lbs
Total Water:	150	lbs
Average Water Density, ρ_w :	62.4	lbs/ft^3
Volume of Water Required per Bag of EHC, V_{bag} :	18	gals
Specific Gravity of EHC Slurry for 25% Solids , G_s :	1.09	---> from PeroxyChem
Volume of Slurry Generated per Bag of EHC, V_{bsl} :	22	gals

Total EHC Required, M_{design} :	**30,000**	lbs (rounded)
Safety Factor, *SF* :	**1.068**	
Total Volume of Water Required for EHC Slurry, V_w :	**10,800**	gals (rounded)
Total Volume of EHC Slurry to be Injected, V_{sl} :	**13,200**	gals (rounded)
Volume of EHC per Injection Point, V_i :	**220**	**gals**

North Parking Lot

IN-SITU CHEMICAL REDUCTION (ISCR) REAGENT (EHC®) MASS CALCULATIONS FOR PERMEABLE REACTIVE BARRIERS (PRBs)
by
Dr. Mete Talimcioglu
First Environment, Inc.

DESIGN PARAMETERS

Contaminant of Concern, *CoC* :		
PRB Design Life, *t* :	4	years
Length of PRB, *L* :	270	ft
Number of PRB Lines, n_p :	3	
Lateral Spacing of PRB Lines, l_p :	5	ft
Width of PRB, *w* :	15	ft
Lateral Spacing Between each Injection Location per PRB Line, l_i :	15	ft
Number of Injection Locations per PRB Line, n_i :	18	
Total Number of Injection Locations, n_t :	54	
Depth to Treatment Zone, d_t :	25	ft
Treatment Zone Thickness, *d* :	25	ft
Treatment Volume V_t :	101,250	ft^3
Total Groundwater Volume, V_{gw} :	30,375	ft^3
Calculated Soil Mass, *M* :	11,137,500	lbs
Advective Migration Distance over Treatment Life, L_t :	3,194	ft
Volume of Groundwater Passing Through Region over Treatment Life, V_{tgw} :	4,311,563	ft^3

HYDROGEOLOGIC PARAMETERS

Porosity of Soil, *n* :	0.3	--
Effective Porosity, n_e :	0.2	--
Bulk density of Soil, ρ_b :	110	lbs/ft^3
Hydraulic Conductivity of Soil, *K* :	87.5	ft/day
Hydraulic Gradient, *i* :	0.005	ft/ft
Specific Discharge, *v* :	0.4375	ft/day
Average Linear Velocity of Groundwater, *v** :	798	ft/yr

CONTAMINANT PARTITIONING

Organic Carbon Fraction, f_{oc} :	0.005	--
Normalized Partitioning Coefficient of CoC, K_{oc} :	107	L/Kg
Adsorption Coefficient, K_d:	0.535	L/Kg
Observed Dissolved Phase Concentration, C_L :	**11.7**	mg/L
Total Sorbed Phase Soil Contamination, C_s:	**6.2595**	mg/Kg

CONTAMINANT MASS

CoC Mass in Soil, M_s :	69.7	lbs
CoC Mass in Groundwater in Treatment Zone, M_{gwt} :	22.4	lbs
Total CoC Mass in Groundwater Over Design Period, M_{gw} :	3,177.5	lbs
Total CoC Mass, M_t :	**3,247.2**	lbs

STOICHIOMETRY

Stoichiometric Hydrogen Demand Ratio for CoC, *SDR* :	0.3333	mol/mol
Molecular Weight of CoC, *MW* :	131.4	g
Molecular Weight of H_2, *MWH* :	2	g
Stoichiometric Hydrogen Demand Ratio for CoC, *SD* :	21.9	CoC Mass/H_2 Mass
Hydrogen Concentration from Dissolved CoCs in Groundwater, H_d :	0.53	mg/L
Hydrogen Concentration from Sorbed CoCs in Soil, H_s :	0.29	mg/Kg
Hydrogen Concentration from Competing Electron Acceptors, H_{cea} :	11.5	mg/L ---> from PeroxyChem
Total Hydrogen Concentration, H_t :	**12.3**	mg/L

HYDROGEN DEMAND CALCULATIONS

Hydrogen Demand from Soil within Targeted Area, H_{2s} :	3.2	lbs
Hydrrogen Demand from Groundwater within Targeted Area, H_{2gw} :	23.6	lbs
Hydrogen Demand from Groundwater Influx Over Design Period, H_{2inf} :	3345.9	lbs
Total Hydrogen Demand, H_{2t} :	3372.7	lbs

EHC MASS CALCULATIONS

Average H_2 Release Rate from EHC, R_{EHC} :	18.8	g H_2/Kg EHC/yr ---> from PeroxyChem
H_2 Release per Pound of EHC Over Design Period, R_t :	0.075	lbs
Total EHC Required, M_{EHC} :	44,849	lbs

EHC SLURRY CALCULATIONS FOR 25% SOLIDS

Mass of EHC per Bag, M_{bag} :	50	lbs
Number of Bags Required, n_b :	1,000	--
Percent Solids, *ps* :	25%	
Total Solids:	200	lbs
Total Water:	150	lbs
Average Water Density, ρ_w :	62.4	lbs/ft^3
Volume of Water Required per Bag of EHC, V_{bag} :	18	gals
Specific Gravity of EHC Slurry for 25% Solids , G_s :	1.09	---> from PeroxyChem
Volume of Slurry Generated per Bag of EHC, V_{bsl} :	22	gals

Total EHC Required, M_{design} :	**50,000**	lbs (rounded)
Safety Factor, *SF* :	**1.115**	
Total Volume of Water Required for EHC Slurry, V_w :	**18,000**	gals (rounded)
Total Volume of EHC Slurry to be Injected, V_{sl} :	**22,000**	gals (rounded)
Volume of EHC per Injection Point, V_i :	**407**	**gals**