PES Environmental, Inc.
Engineering & Environmental Services

September 29, 2022

1413.001.10

Washington State Department of Ecology
Northwest Region Toxics Cleanup Program
15700 Dayton Avenue North
Shoreline, Washington 98133
Attn: Ms. Tena Seeds

BY EMAIL ONLY

CONTINGENT ACTION ADDENDUM INJECTION APPROACH
AMERICAN LINEN SUPPLY CO DEXTER AVENUE SITE
AGREED ORDER NO. DE 14302

Dear Ms. Seeds:

On behalf of BMR-Dexter LLC ("BMRD"), PES Environmental, Inc. ("PES"), is submitting this plan for conducting injections at the American Linen Supply Co – Dexter Avenue Site. The purpose of the plan is to summarize the approach for injecting emulsified vegetable oil ("EVO") into the 63 injection wells that are located in the lowest parking level of the building at the 700 Dexter Avenue North property (the "Property") (Figure 1). The overall interim cleanup actions are described in the *Final Interim Action Work Plan, American Linen Supply Co – Dexter Avenue Site*[1] ("IAWP") dated August 2018. The upcoming injection event is described in more detail in the *Final Contingent Action Addendum to the Final Interim Action Work Plan*[2] ("CAA") dated February 14, 2019. As described in the CAA, the objective of the proposed CAA injections is to provide continued treatment of residual source area contamination beneath the building.

IAWP AND CAA REQUIREMENTS

Consistent with the CAA, the approach for the on-Property CAA injections will follow the general procedures used for the EVO injections on the Property in 2019 before redevelopment activities began. The on-Property CAA injections will be conducted consistent with the EVO injections into perimeter injection wells adjacent to the Property in late 2020 and early 2021.

Previous on-Property EVO injections were conducted in February and early March of 2019 and followed the approach outlined in Section 11.4.2 of the IAWP. Specifically, the on-Property injection program prior to redevelopment consisted of the following:

[1] PES. 2018. *Final Interim Action Work Plan, American Linen Supply Co-Dexter Avenue Site, 700 Dexter Avenue North, Seattle, Washington.* August.
[2] PES. 2019. *Final Contingent Action Addendum to the Final Interim Action Work Plan, American Linen Supply Co-Dexter Avenue Site, Agreed Order No. DE 14302.* February.

- **Target pore volume:** The target pore volume was 7 percent[3], which is equivalent to approximately 1,000 gallons of total injected fluids for the 15-foot screens;

- **EVO dosage:** The target volume of EVO injected was 165 gallons for the 15-foot screens[4]. EVO was injected at a concentration of approximately 10 percent;

- **Bioaugmentation amendment:** 1.5 liters of dehalococcoides (DHC) bioaugmentation culture per well; and

- **pH buffer dosage:** 1 pound per gallon of 60 percent EVO added.

CAA INJECTION APPROACH

The CAA injections into all 63 injection wells in the lowest parking level will be conducted using the same approach as used in the on-site injections in 2019 and in the perimeter injection wells in fall 2020 and winter 2021. Specifically, the primary EVO product will be SRS-SD® as in all previous injections, which will be augmented with additional reagents, including ferrous sulfide (FeS), a supplemental nutrient/additive blend (sold under the NutriMax label by Terra Systems, supplier of EVO and other injection products), and pH buffer. Iron sulfide rapidly abiotically dechlorinates CVOCs with reactions that do not generate lesser chlorinated ethenes (cis-1,2-DCE and vinyl chloride), similar to reactions of CVOCs with zero valent iron. The nutrient/additive blend contains nitrogen and phosphorus to support biotic dechlorination, and the sulfate will form metal sulfide minerals that perform abiotic reductive dechlorination generally consistent with previous on-Property injections. Specifically, the CAA injection program will consist of the following:

- **Target pore volume:** The target pore volume is 7 percent, which is equivalent to approximately 850 gallons of total injected fluids for the 15-foot screen. This effective pore volume target is consistent with previous on-Property and perimeter injections;

- **EVO dosage:** The EVO dosage dilution (6.75:1) is slightly more dilute than EVO dosages for the previous on-Property and perimeter injections (6:1). A slightly lower EVO dosage will be used with adequate chase water to minimize future biofouling of the well screen and sand pack for the first injection event in wells on-site that may require additional injections in the future;

- **FeS Dosage:** For each well, approximately 8 gallons of 10 percent FeS solution will be blended into the EVO solution prior to injection, resulting in approximately 8 pounds of FeS being injected into each well;

- **Supplemental Nutrients:** Approximately 16 pounds of NutriMax will be injected into each well. This is the manufacturer's recommended dosage for this type of application as a follow-up injection;

[3] The target percentage of the pore space within the radius of influence of the injection well that would be filled with injection fluids, including water, EVO, bioaugmentation solution, and buffer.
[4] Quantities of EVO are in the "as-shipped" concentration of 60 percent (i.e., 60 percent vegetable oil and 40 percent water, emulsifiers, preservatives, and nutrients).

- **Bioaugmentation amendment:** 1.5 liters of DHC bioaugmentation amendment will be added per well, which is consistent with previous on-Property and perimeter injections; and

- **pH buffer dosage:** 0.6 pounds of pH buffer (sodium bicarbonate) per gallon of 60 percent EVO added. This pH buffer dosage is a lower dosage from the 2019 injection and perimeter injections, based on 3 years of groundwater monitoring indicating long-term pH conditions favorable for reductive dechlorination.

The injection procedures will incorporate observations and lessons learned from on-property and perimeter injection activities. Specific injection procedural details include:

- Injection is anticipated to be performed in two to four injection wells simultaneously, and the active injection wells will be spread out to the extent practicable;

- Injection flow rates will be maintained between <1 and 2 gallons per minute;

- A maximum of 250 gallons of solution will injected into any screen at a time to minimize temporary mounding around each injection well;

- Injections will be accomplished at the lowest reasonable pressure. To meet this objective, the following steps will be taken:

    - The injections will be conducted in two phases (before Thanksgiving holiday and after Thanksgiving holiday). During the first phase, injections will be attempted at each of the 63 injection wells to make observations on flow rate and injection pressures; and

    - Where feasible, injections will be performed at pressures less than 40 pounds per square inch ("psi"), and if a flow rate of 1 to 2 gallons per minute occurs with injection pressure of 20 psi or less, higher flow rates will not be attempted. If, during the initial phase of injection, an adequate flow rate cannot be obtained with pressures up to 40 psi, injections will be stopped and attempted later during the second phase of injections.

The current schedule is for the injection subcontractor (ISOTEC) to mobilize to the site on or about November 7th, with injections starting approximately 2 days later, after all of the injection equipment has been set up, and EVO and amendments have been delivered and transported down the lower parking level. It is estimated that a total of 25 to 27 days of injections will be required, but the actual duration will be determined on the achievable injection rates.

If you have any questions regarding this letter, please do not hesitate to call either of us at (206) 529-3980.

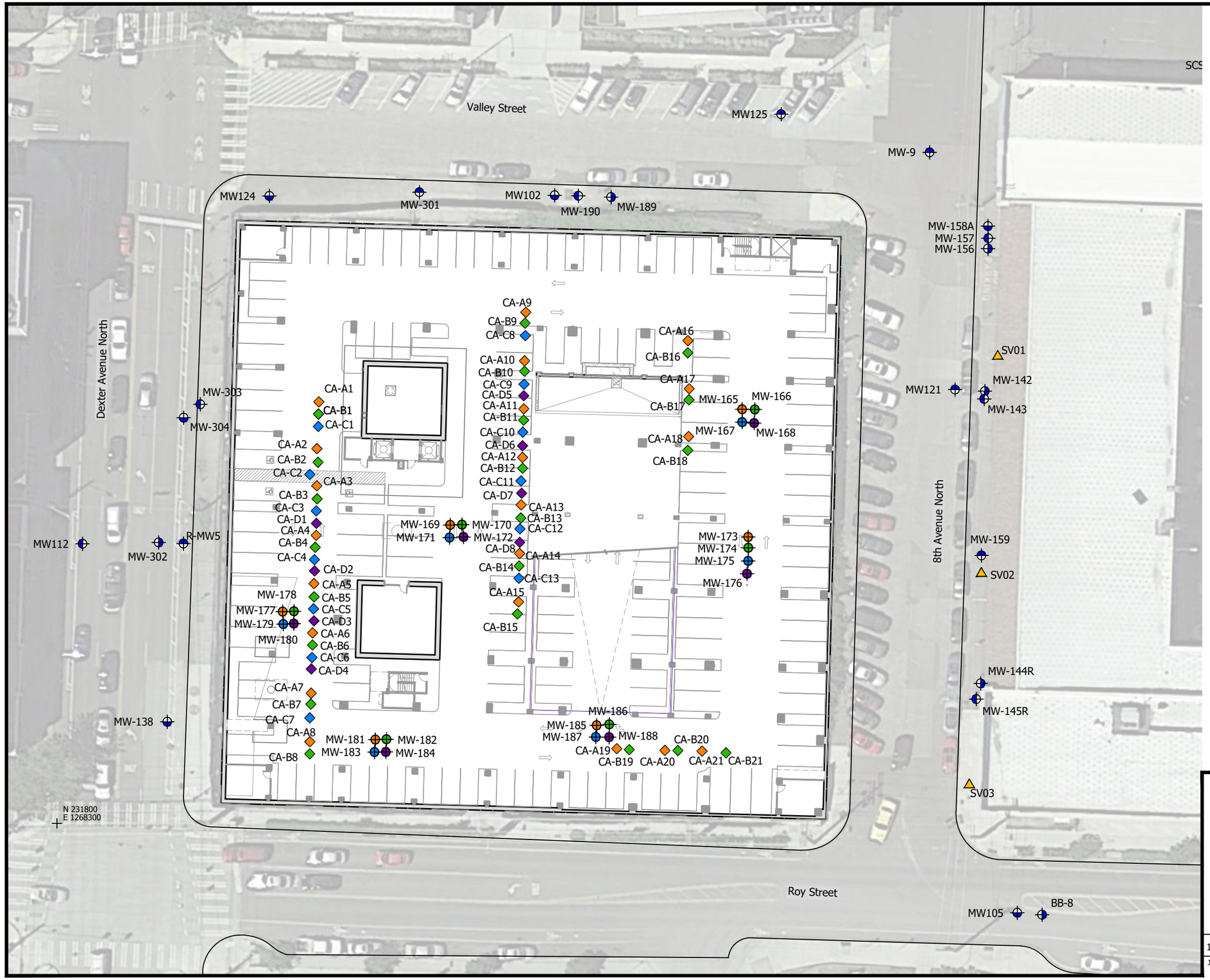
Sincerely,
PES ENVIRONMENTAL, INC.

Brian L. O'Neal, P.E.
Principal Engineer

Daniel A. Balbiani, P.E.
Principal Engineer

Attachments: Figure 1 – Contingent Action Injection Wells - Level P3

cc: John Moshy, BMRD
Elizabeth Dickey, BMRD



Explanation

- MW121 — Shallow Zone Monitoring Well
- MW116 — Intermediate A Zone Monitoring Well
- W-MW-02 — Intermediate B Zone Monitoring Well
- MW105 — Deep Zone Monitoring Well
- MW-165 — Treatment Zone A Monitoring Well
- MW-166 — Treatment Zone B Monitoring Well
- MW-167 — Treatment Zone C Monitoring Well
- MW-168 — Treatment Zone D Monitoring Well
- CA-A10 — Treatment Zone A CAA Injection Well
- CA-B10 — Treatment Zone B CAA Injection Well
- CA-C9 — Treatment Zone C CAA Injection Well
- CA-D5 — Treatment Zone D CAA Injection Well

N 231800
E 1268300 — Coordinate Reference Point
(NAD83, Washington State Plane North, US Feet)

Note: The original version of this figure includes color-designated features. A black and white copy of the figure may not accurately represent the information originally presented.

PES Environmental, Inc.
Engineering & Environmental Services

Contingent Action Injection Wells - Level P3
American Linen Supply Co. - Dexter Ave Site
700 Dexter Avenue North
Seattle, Washington

FIGURE
1

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JOB NUMBER	DRAWING NUMBER	REVIEWED BY	DATE