LAKEWOOD TOWNE CENTER 2023-2024 GROUNDWATER TREATMENT AND MONITORING

On August 4, 2021, Herrera Environmental Consultants, Inc. (Herrera) completed groundwater monitoring at six existing groundwater monitoring wells at the Lakewood Towne Center site (Site) in Lakewood, Washington and prepared a technical memorandum summarizing the results. Previous monitoring and analytical results from quarterly, semi-annual, and annual sampling events conducted from 2000 to 2012 indicated that a dry-cleaning solvent perchloroethylene (PCE), and several related halogenated volatile organic compounds (HVOCs) that are released as PCE biodegrades over time, have been detected in groundwater across the northwest portion of the Site. The source of the PCE was shallow groundwater near the former East Concourse Building where the dry cleaner had operated.

August 2021 and August 2022 groundwater monitoring showed a significant decreasing trend in contaminant concentrations at all six wells. These results indicate that biodegradation is ongoing, and concentrations of nearly all HVOC chemicals of concern (COCs) except vinyl chloride (VC) have dropped below the respective Model Toxics Control Act (MTCA) cleanup levels (CULs). The VC concentrations detected at MW-1S in 2021 and 2022 exceeded the MTCA Method A CUL. Continued groundwater monitoring without additional treatment is an option, but it could take years for concentrations of VC to naturally degrade below the MTCA Method A CUL.

In October 2022, Matt Barker with Kite Realty Group (KRG), requested that Herrera prepare a scope of work and budget to conduct groundwater treatment and monitoring at the Site in the vicinity of MW-1. This scope of work covers treatment, installation of two new monitoring wells, and groundwater monitoring to accelerate the degradation process by treating groundwater aerobically with stabilized hydrogen peroxide, a modulator, and nutrients. The groundwater treatment will release oxygen and provide nutrients to stimulate existing microorganisms that metabolize and break down VC and related contaminants.

This scope of work describes the activities, assumptions, and deliverables associated with the following four tasks:

1) Groundwater Treatment and Well Installation
2) Groundwater Monitoring and Reporting
3) Ecology Voluntary Cleanup Program Coordination
4) Project Management

TASK 1 – GROUNDWATER TREATMENT AND WELL INSTALLATION

Herrera has partnered with Tersus Environmental (Tersus) to prepare a proposal for groundwater treatment at the Site. Herrera will coordinate closely with Tersus regarding the types and quantities of chemicals (e.g., hydrogen peroxide) and nutrients (e.g., TersOx™ Nutrients) required to perform a one-time treatment of groundwater at wells MW-1S (shallow) and MW-1M (medium depth). Based on the historical data provided, Tersus determined that treatment at these two wells will be most effective at reducing residual concentrations of VC in the vicinity of MW-1S.

To provide the proposed treatment, Herrera staff and their drilling subcontractor Holocene Drilling (Holocene) of Puyallup, Washington, will mobilize to the Site. Holocene will mix and inject/infiltrate a stabilized hydrogen peroxide solution with nutrients into existing wells MW-1S and MW-1M. The treatment will boost the system with oxygen, remove some of the natural oxidant demand, and knock down concentrations of HVOCs by direct oxidation. TersOx™ Nutrients is a specialty blend of nitrogen, phosphorus, and microbial growth enhancers used to stimulate biological activity in soils and sludges. TersOx™ Nutrients provides a unique, balanced blend of limiting nutrients to enhance the rate and consistency of biological degradation of contaminants in aquifers, soils, sludges, and wastewater.

PCE is a dense non-aqueous phase liquid (DNAPL) that sinks in a groundwater plume. To better define the downgradient edge of the plume and confirm if concentrations of PCE and associated breakdown products are above or below MTCA CULs, Holocene will install two new deep monitoring wells (MW-7 and MW-8) downgradient of the treatment area (and downgradient of shallow wells MW-4 and MW-5). Information from the Phase II Environmental Site Assessment completed at the site indicates that wells MW-1D and 2D were installed just above the confining Vashon Till layer, at depths of approximately 48 and 58 feet below ground surface.

Assumptions

- Herrera will apply for an Underground Injection Control (UIC) permit from the Washington State Department of Ecology (Ecology) in advance of mobilizing to the Site.
- Approval of the UIC permit is anticipated to take approximately 2 months.
- After the UIC permit is approved by Ecology, Herrera staff will mobilize to the Site to oversee Holocene's work to inject a solution of water, stabilized hydrogen peroxide, and TersOx™ Nutrients into two existing wells, MW-1S and MW-1M.
- There is an onsite spigot where tap water can be easily obtained by Holocene to fill a portable tank used for mixing the treatment solution. This assumes that obtaining a fire hydrant permit or renting a water truck to provide water will not be necessary.
- Treatment mixture will be pumped at a rate of approximately 1- to 2-gallons per minute and approximately 4 days will be needed to complete the treatment.

- Scope of work and budget does not include the cost of potential follow-up treatment options or additional groundwater monitoring (beyond what is scoped in Task 2 below) should contamination persist, such as a second injection or an alternative. A potential follow-up treatment option could include installing gas-diffusion devices to sustain aerobic conditions and a co-substrate to allow aerobic co-metabolic destruction pathways of cis-1,2-dichloroethene (DCE) and VC.
- Holocene will require 2 days to install and develop the two new monitoring wells.
- Prior to well installation, Herrera will request a public one call 811 utility locate to mark underground utilities within the public right-of-way (ROW) and also a private utility locate from Applied Professional Services (APS) to locate utilities in the immediate vicinity where new wells MW-7 and MW-8 will be installed.
- A Herrera licensed geologist will oversee the well installation and development.

Deliverables

- See Task 2.

TASK 2 – GROUNDWATER MONITORING (UP TO SEVEN QUARTERS)

Herrera will complete up to seven quarterly groundwater monitoring events through the end of 2024 at onsite monitoring wells MW-1S, MW-1M, MW-1D, MW-2D, MW-4, MW-5, MW-7, and MW-8). MW-3 will not be sampled because it is located over 1,000 feet to the west and was installed to evaluate a different potential source at the former Villa Cleaners.

Assumptions

- Groundwater treatment is anticipated to be scheduled in February or March 2023.
- First quarterly groundwater monitoring event will occur at least 1 month after treatment (e.g., March or April 2023), and subsequent monitoring events will occur at roughly 3-month intervals after that through the end of 2024.
- Budget allows for up to a total of 7 quarterly monitoring events, but monitoring may be suspended sooner if concentrations of VC and other COCs drop and remain below CULs for a minimum of four consecutive quarters and if advised via consultation with Ecology.
- During each monitoring event, two Herrera staff will mobilize to the site for a 11-hour day to collect samples. Hours are included for travel, preparation, and coordination with the analytical laboratory.
- During each event, Herrera will:
  - Take static groundwater level measurements at all wells including MW-3 and create a groundwater contour map showing the direction of groundwater flow beneath the site.

  - Record field parameters with a field meter: dissolved oxygen (DO), oxygen reduction potential (ORP), conductivity, pH, and temperature.
  - Collect groundwater samples for geochemical parameters by laboratory analysis: HVOCs including vinyl chloride and other breakdown chemicals related to PCE, sulfate, dissolved iron and manganese, total nitrogen, and total phosphorous.
- Samples will be collected directly into bottles provided by the analytical laboratory, stored on ice, and delivered under chain-of-custody to OnSite Environmental, Inc. of Redmond, Washington.
- Wells will be purged and samples will be collected using a peristaltic pump, disposable polyethylene tubing, and the low-flow purge/sampling method.
- Herrera will coordinate with Lakewood Towne Center management for temporary storage of up to three 55-gallon Department of Transportation-approved drums in the storage room behind the former Old Country Buffet. The drums will be used to contain the investigation-derived waste (purged groundwater) generated during sampling activities.
- Upon completion of the project, Herrera will arrange for proper offsite disposal and treatment of the drum and contents by a licensed waste hauler.
- Herrera will provide the results of each monitoring event including field notes and laboratory reports from the laboratories to Tersus to evaluate how well the treatment is progressing.
- Tersus will prepare a baseline sampling evaluation after the 1st quarterly groundwater monitoring event, two progress reports after the 2nd and 3rd monitoring event, and a final report after the 4th monitoring event.
- Herrera will provide one technical memo following the final quarterly groundwater monitoring event that summarizes the groundwater treatment methods and all groundwater monitoring results, for submittal to KRG and Ecology.
- Herrera's memo will include a data quality assurance review of all analytical data, a table summarizing previous and recent groundwater data collected at the Site, one groundwater contour map for the final event, Site figures depicting the contaminants detected, conclusions, and recommendations.

Deliverables

- One baseline sampling evaluation email memo (after the 1st quarterly monitoring event) by Tersus, two progress analysis email memos by Tersus (after the 2nd and 3rd quarterly monitoring events), and a final progress analysis technical memo by Tersus after the 4th quarterly monitoring event (in Adobe PDF electronic file format).
- One technical memorandum by Herrera summarizing all field and laboratory analytical data for groundwater samples collected from the six wells (in Adobe PDF electronic file format).

TASK 3 – ECOLOGY VCP COORDINATION

Under this task Herrera will prepare an application to enter the Site into Ecology's Voluntary Cleanup Program (VCP). As each monitoring event is completed, Herrera will share the data with KRG and Tersus, and discuss when appropriate to request a No Further Action (NFA) Opinion Letter from the Ecology.

Assumptions

- Ecology does not charge an application fee to apply for the VCP.
- Contamination from dry cleaning, automotive repair, and spills are all typically eligible for the VCP.
- Herrera will discuss the groundwater monitoring data results with Tersus, KRG, and the Ecology project manager assigned to the site and determine when to request an NFA Opinion from Ecology (Ecology typically requires a minimum of four consecutive monitoring events with concentrations of all COCs below MTCA CULs to qualify for NFA).
- One Herrera staff will attend up to four 1-hour meetings with Ecology to discuss the groundwater monitoring results.
- Budget allows for up to 20 hours to upload all groundwater monitoring data collected since August 2021 to Ecology's Environmental Information Management (EIM) online database in advance of requesting an NFA Opinion.

Deliverables

- VCP application for submittal to Ecology.
- Meeting minutes and email summaries for all meetings or correspondence with Ecology.
- All groundwater data from 2021 through 2024 uploaded electronically to Ecology's EIM database.

TASK 4 – PROJECT MANAGEMENT / CONTRACT ADMINISTRATION

Herrera will be responsible for contract administration of this project, including preparing invoices and progress reports; as well as coordination of work efforts with the designated client point of contact, and subconsultants. Herrera's project manager George Iftner will have frequent phone and e-mail contact with KRG's project manager Sara Abdelrahman or a designee, subconsultants, and analytical laboratory on an as-needed basis.

Assumptions

- Herrera will attend up to four brief check-in meetings with KRG to discuss the project progress.

- Project management tasks will be conducted by phone or email.

Deliverables

- Monthly progress report submitted with monthly invoice.