Work Plan for Feasibility Pilot Study

Tiki Car Wash
Facility Site ID: 2352
Cleanup Site ID: 5096

Final

Prepared for:

Washington State Department of Ecology

Toxics Cleanup Program
Northwest Regional Office
Shoreline, Washington

March 14, 2024
Project No. M0592.06.001

Prepared by:

Maul Foster & Alongi, Inc.
2815 2nd Avenue, Suite 540, Seattle, WA 98121

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Work Plan for Feasibility Pilot Study

Tiki Car Wash
Facility Site ID: 2352
Cleanup Site ID: 5096

The material and data in this report were prepared under the supervision and direction of the undersigned.

Maul Foster & Alongi, Inc.

This digital seal certifies the signatory and document content.

Josh Elliott, PE 03-14-2024
Principal Engineer

Justin Hansen
Project Environmental Scientist

Akana

Charlie Swift
Senior Project Manager

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Abbreviations

AS	air sparging
bgs	below ground surface
DPE	dual-phase extraction
Ecology	Washington State Department of Ecology
FPS	feasibility pilot study
FS	feasibility study
GRW	groundwater recirculating well
IWAS	in-well air stripping
MFA	Maul Foster & Alongi, Inc.
MNA	monitored natural attenuation
OVM	organic vapor meter
PID	photoionization detector
the Property	11909 NE 8th Street, Bellevue, Washington 98005
QAPP	quality assurance project plan
RI	remedial investigation
SAP	sampling and analysis plan
the Site	Tiki Car Wash site (Facility Site ID: 2352, Cleanup Site ID: 5096)
SPC	specific conductance
SVE	soil vapor extraction
TPH	total petroleum hydrocarbon
WAC	Washington Administrative Code
work plan	work plan for feasibility pilot study

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1 Introduction

On behalf of the Washington State Department of Ecology (Ecology), Maul Foster & Alongi, Inc. (MFA), prepared this work plan for feasibility pilot study (FPS) (collectively the work plan) for the Tiki Car Wash site (the Site), located at 11909 NE 8th Street in Bellevue, Washington (the Property) (see Figure 1-1). The Site is listed in Ecology's cleanup database as Facility Site ID 2352 and Cleanup Site ID 5096.

1.1 Regulatory Framework

On March 29, 1993, Tiki Enterprises and Ecology entered Consent Decree No. 93-2-07710-6, which outlined the remedial action to be performed to address contamination at the Site. The scope of work in the consent decree described remedial action at the Site in three phases:

- Phase I: Remedial investigation (RI) and feasibility study (FS)
- Phase II: Cleanup action plan, and
- Phase III: Implementation of the cleanup action plan

In April 2023, Leidos completed the final RI report, documenting the nature and extent of total petroleum hydrocarbon (TPH) impacts to the Site (Leidos 2023). In January 2024, MFA prepared and submitted an RI amendment to address data gaps identified by Ecology following completion of the RI (MFA 2024). This work plan supports Phase I and future development of the FS, which will be completed under the direction of Ecology and submitted for agency and public review and comment.

1.2 Purpose and Objective

The purpose of the FPS is to generate data to evaluate the viability of one remedial approach to address groundwater contamination at the Site. The objective of the FPS is to collect data for use in the forthcoming feasibility study, where an evaluation of potential cleanup alternatives will be performed. These objectives will be supported by the following activities:

- Reconnaissance and field preparation, including communication with the Property owner, locating an external power supply and access point, coordinating traffic control and diversion measures, and marking the FPS work area.
- Coordination of public and public utility locates in the FPS work area.
- Direct-push drilling and installation of a groundwater recirculating well (GRW) and three piezometer wells in the FPS work area.
- Installation of piezometers to the west and southwest of the GRW to support data collection.
- Initial and future groundwater sample collection for laboratory analysis, as described in a sampling and analysis plan (SAP) (see Appendix A).

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- Data analysis and data validation, as described in a quality assurance project plan (QAPP) (see Appendix A).
- Report preparation.

1.3 Organization

This work plan defines the approach for conducting an FPS in alignment with the purpose and objectives defined in Section 1.2. Standard field operating procedures for sample collection, analyses, equipment decontamination, and managing investigation-derived waste are described in the SAP/QAPP (see Appendix A).

The work plan is organized into the following sections:

- **Section 2** outlines the background and physical setting.
- **Section 3** discusses key FS considerations.
- **Section 4** describes the scope of work to be performed.
- **Section 5** provides the anticipated schedule.
- **Section 6** states how results will be reported.

2 Background and Physical Setting

2.1 Property Overview

The approximately 0.59-acre Property is located at 11909 NE 8th Street in Bellevue, Washington 98005 (see Figure 2-1). Since 1971, the Property has been operated as a gas station and car wash with an on-Property convenience store. Four single-walled steel underground storage tanks have historically existed at the Property: three installed in 1971 and the fourth installed in 1979.

In 1995, an air sparging (AS) and soil vapor extraction (SVE) system was installed along the west and south edges of the Property. However, the system was prone to shutdown due to water accumulation and was ultimately abandoned sometime in 2000 (EA 2008).

2.2 Geology and Hydrogeology

According to previous reports, regional geology near the Property consists of Holocene fill and Pleistocene Vashon Drift (Enviros 1993, EA 2008). The fill is composed of silt, fine-to-medium grain sand, gravel, and occasional peat deposits. The Pleistocene Vashon Drift unit varies from weathered glacial till to a stratified alluvium and comprises recessional sand and gravel, Vashon till, advance outwash, and Lawton Clay. The glacial till, ranging in thickness from 20 to 150 feet, is an unsorted, unstratified, compact assortment of boulders, cobbles, pebbles, sand, silt, and clay.

The Property is underlain by 3 to 5 feet of fill material and at least 16 feet of weathered till (Enviros 1993). Generally, the fill unit comprises fine-to-medium-grained gravelly sand with intermittent stiff

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clay deposits. The gravelly silty sands become denser and resemble glacial till with increasing depth. Sand and gravel are occasionally encountered in the weathered till unit.

Regional hydrology records indicate that the Property and surrounding area are underlain by three aquifers: (1) a shallow aquifer approximately 5 feet below ground surface (bgs), associated with impermeable glacial till with thin beds of sand and gravel; (2) an intermediate aquifer beneath the glacial till with an average water depth around 38 feet bgs; and (3) a deep aquifer segregated from the intermediate aquifer by an impermeable clay unit, with an average water depth around 45 feet bgs.

2.3 Conceptual Site Model

2.3.1 Contaminants of Concern

In the RI, Leidos developed a conceptual site model for the Site (Leidos 2023). The conceptual site model identified gasoline-range TPH and benzene, toluene, ethylbenzene, and total xylenes as contaminants of concern in soil, groundwater, and soil vapor for the Site. MFA added diesel- and heavy-oil-range TPH as additional contaminants of concern in soil at the Site (MFA 2024).

2.3.2 Exposure Pathways

The RI identified potential exposure pathways for each impacted environmental media (i.e., soil, groundwater, and soil vapor) at the Site (Leidos 2023). The incidental ingestion/dermal contact pathway was considered limited because impacts in soil and groundwater are generally between 5 to 15 feet bgs. However, impacted soil and groundwater could be encountered during future investigation or construction activities at the Site. Further, the shallow aquifer is not used as a drinking water supply at or near the Site.

3 Feasibility Study Considerations

Leidos prepared a draft FS for the Site in May 2023 (Leidos 2023). This draft FS evaluated the following five remedial action alternatives:

- Alternative 1: AS/SVE and monitored natural attenuation (MNA)
- Alternative 2: Partial excavation, institutional controls, and MNA
- Alternative 3: Dual-phase extraction (DPE) and MNA
- Alternative 4: Enhanced aerobic biodegradation and MNA
- Alternative 5: Institutional controls and MNA

The draft FS selected DPE and MNA as the recommended alternative. MFA noted several potential issues with the alternative rankings.

Washington Administrative Code (WAC) 173-340-360 outlines the procedures for the evaluation of and selection of a cleanup action, including conducting a disproportionate cost analysis. Leidos

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ranked all alternatives the same for permanence given the assumption that petroleum hydrocarbons are expected to eventually biodegrade. MFA would disagree that Alternative 5 (institutional controls and MNA) provides a reasonable restoration time frame, especially since Ecology has made clear that a conditional point of compliance would not extend beyond the source property. Alternative 5 should then be eliminated from further evaluation.

Assuming the four remaining alternatives are similarly permanent, WAC 173-340-360(5)(c)(iii)(B) requires that less-cost effective, permanent cleanup action alternatives be eliminated from further consideration. This would lead to the selection of Alternative 4 (enhanced aerobic biodegradation and MNA) instead of the more costly Alternative 3 (DPE and MNA). Given the significant concerns with the draft FS conclusions, MFA and Akana propose that a reconsideration of the cleanup action alternatives and the prioritization of a pilot study prior to finalizing the FS. Based on the likely high groundwater volume that would need to be extracted, treated, and discharged using DPE technologies, an alternative of in-situ treatment was proposed to Ecology. MFA and Akana have proposed in-well air stripping (IWAS) as a technology potentially appropriate for the site conditions.

3.1 Space Considerations and Disruption to Site Operations

A primary consideration for the selection of the cleanup action alternative is that the cleanup action minimizes disruption of the gas station and car wash business operations at the Site. The cleanup action will need to effectively remediate contamination and provide for a short installation period and minimal treatment equipment footprint.

By definition, DPE requires the treatment of both liquid phase and vapor phase streams. Given the relatively shallow groundwater at the site, this would require significant groundwater extraction to avoid the same issues with water accumulation in the SVE system that plagued the previous AS/SVE system.

While DPE could be implemented, a groundwater treatment technology that liberates petroleum hydrocarbons to the vapor phase would significantly reduce costs, installation timeline, and the equipment footprint required. IWAS provides just such a system without the reliance on separate air sparging wells and concern for expansion of the plume. The IWAS process uses specially designed wells to allow air injection in the same well as the vapor extraction. As a result, the vacuum applied can be set at a lower suction but still ensure the capture of the vapors. This helps reduce the potential for groundwater removal by the SVE system as condensate.

In addition to contaminant mass removal by AS/SVE, IWAS would include elements of enhanced aerobic biodegradation. IAWS uses two screened intervals within the well and the density gradient induced by the air injection to drive a three-dimensional recirculation pattern in groundwater around the well (FRTR 2024). This recirculation current returns groundwater with low concentrations of dissolved fuels and high concentrations of dissolved oxygen to the aquifer, both enhancing biodegradation and physical removal of contaminant mass from source zones by dissolution to groundwater (for later air stripping within the well).

MFA and Akana proposed to Ecology the piloting of an IWAS system to inform future refinement of the FS. Ecology approved the development of this work plan for FPS to inform the scope of that effort. In addition to evaluation of the performance of the IAWS technology, the equipment would allow for the separate evaluation of SVE by itself. The proposed IAWS pilot system is described in detail in the following section.

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4 Scope of Work

4.1 Site Preparation

Field personnel from MFA and Akana will coordinate access with the owner before mobilizing to the Property. The initial reconnaissance will aim to achieve the following:

- Identify and mark the FPS work area in the northeast corner of the Property (see Figure 4-1).
- Mark the planned locations for the GRW and nearby piezometer wells.
- Locate a nearby power supply, which is currently assumed to be between the car wash on the Property and the adjacent Bartell Drugs property to the east. If there is sufficient capacity remaining on the electrical panel serving the car wash, a circuit for the FPS equipment could be added directly to this panel.
- Coordinate traffic control measures to divert automobile traffic exiting the car wash away from the FPS work area (see Figure 4-1).

4.2 Groundwater Recirculating Well and Piezometer Installation and Development

The GRW and three downgradient wells fitted with piezometers (PZ-10, PZ-15, and PZ-25) will be advanced using push-probe drilling to depths of 20 feet below ground surface (bgs) and 15 feet bgs, respectively. The GRW and piezometer well locations are shown on Figure 4-1. Drilling, well installation, and well development will be performed consistent with MFA standard operating procedures (see Appendix C). All wells will be constructed according to the Washington State well construction standards (WAC 173-160, Minimum Standards for Construction and Maintenance of Wells). Details are provided below.

- The GRW will be constructed with 4-inch-diameter polyvinyl chloride or stainless-steel riser pipes and screened sections consisting of 0.101-inch machine slots. The GRW may be constructed with prepacked well screen with 10 x 20 washed silica sand or by placing materials downhole, following WAC 173-160. The GRW will be screened between 3 and 25 feet bgs.
- The three piezometer wells will be constructed with 2-inch diameter polyvinyl chloride or stainless-steel riser pipes and screened sections consisting of 0.101-inch machine slots. All wells may be constructed with prepacked well screen with 10 x 20 washed silica sand or by placing materials downhole, following WAC 173-160. The piezometer wells will be screened between 3 and 15 feet bgs.
- Additional filter pack may be placed around the prepacked screen, if used. The additional filter pack will consist of graded 10 x 20 washed silica sand and will extend a maximum of 1 foot below the bottom of the screen and 3 feet above the top of the screen. A weighted line may be used to monitor the level of the filter pack during installation. The filter pack may be surged during installation.

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- Bentonite grout or chips hydrated with potable water (e.g., 0.75-inch minus) will be used to seal the annulus above the filter pack. A weighted line may be used to measure the top of the bentonite chips as they are poured into place.[1]
- At least 24 hours after well installation, each well will be developed by surging, bailing, or pumping to remove sediment that may have accumulated during installation and to improve the hydraulic connection with the water-bearing zone.
- Water quality field parameters such as specific conductance (SPC), pH, temperature, and turbidity will be measured during well development, as deemed appropriate. The wells will be developed until the turbidity measurements are 10 nephelometric turbidity units or less, or until there is a noticeable decrease in turbidity. To the extent practical, water quality field parameters will be considered stable when the SPC is within 10 percent of the previous reading, pH is within 0.1 standard unit of the previous reading, and temperature is within 0.1 degree Celsius of the previous reading.
- Development methods, purge volumes, and water quality parameters will be recorded on well development field forms.

4.3 Groundwater Parameter Monitoring

To reduce the impact on the operation of the gas station and car wash, the testing equipment is located on the northeast portion of the site (see Figure 4-1). The chemical response to the additional energy and oxygen may take many days to be observed outside of the GRW. To collect consistent and reliable data, certain groundwater parameters will be continuously monitored (see Appendix A).

4.4 *In-Situ* Air Sparging and Soil Vapor Extraction

Once developed, the GRW will be outfitted for AS/SVE as follows:

- An insert will be placed in the GRW to allow for groundwater aeriation (i.e., air injection). An air injection line will be placed, with centralizers, at approximately 18 to 20 feet bgs, leaving 5 feet of screen at the bottom of the well and a minimum of 2 feet of blank casing for air injection.
- The air injection system will be installed in the GRW. The air injection line will be attached to an air compressor/blower unit located within the work area. A vacuum line will be manifolded to remove soil vapor from the outer annulus of the GRW to the well head and connected to a vacuum pump system.

Operation of the GRW outfitted for AS/SVE is shown in a process flow diagram (see Figure 4-2). The SVE system will be started and removed soil vapors will be monitored at the exhaust point with a photoionization detector (PID) or organic vapor meter (OVM) continuously for the first four hours of operation. Once the vacuum rate is set and the operator confirms that well condensate is not being drawn into the system, the AS equipment will be started, and the exhaust will be monitored with the PID or OVM. The maximum air pressure applied will be the break-pressure needed to overcome the submerged depth based on the depth to water. The air injection rate will not exceed five cubic feet per minute and the pressure will be set to allow air flow but not produce excessive condensate in the extracted air stream.

[1] The top of the GRW casing will be fitted to allow for SVE prior to seal placement.

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4.5 SVE System Exhaust Sampling

The extracted air at the exhaust point of the SVE system will be sampled according to the procedures described in the SAP/QAPP (see Appendix A). The final day of testing will be the final air sample to be collected.

4.6 Groundwater Sampling

Initial and follow-up groundwater sampling will be performed according to the procedures described in the SAP/QAPP (see Appendix A).

4.7 Equipment Decommissioning and Removal

Upon FPS test completion, all AS/SVE equipment will be removed. Down well data loggers will be left in the piezometer wells for 30 days additional days following FPS test completion. At that point, the piezometer wells will be decommissioned.

4.8 Investigation-Derived Waste

Purge water from GRW development will be containerized in Department of Transportation-approved 55-gallon drums for characterization prior to off-Property disposal by an approved subcontractor.

5 Schedule

The project schedule will be determined based on communication with the Property owner and Ecology. MFA anticipates that the GRW and supporting equipment will be installed in March/April 2024 and that sampling will be complete by June 2024. Samples will be submitted to the analytical laboratory on a standard turnaround time. It is expected that analytical data validation and a draft report will be submitted to Ecology in July 2024 and that the final report will be submitted to Ecology in August 2024.

Upon completion of the test, the equipment will be dismantled and removed from the Site. Groundwater will be allowed to equilibrate for approximately one week before samples will be collected and sent to the laboratory for analysis. The final testing duration may be modified based on Site conditions or access constraints as identified and agreed upon by MFA and Ecology.

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6 Reporting

MFA will prepare and submit to Ecology a report describing the work completed, water quality parameter data, field sampling data, laboratory analytical data, and a summary of our findings and recommendations.

MFA will provide documentation of the fieldwork, data validation and quality assurance/quality control, and evaluation of the analytical results of the FPS, including a summary of baseline and GRW process results for comparative purposes. The results of the FPS will be used to inform the remedial options considered in the future feasibility study. The report will evaluate the radius of influence for the GRW, which may be used to inform future full-scale remedial design, as well as the potential for enhanced microbial activity as a means for achieving further soil and groundwater remediation.

Groundwater analytical data will be screened against Model Toxics Control Act Method A (Tables 740-1 and 720-1 of WAC 173-340-900, respectively), consistent with data screening performed in the RI (Leidos 2023) and RI Addendum (MFA 2024).

Per Ecology Toxics Cleanup Program Policy 840 (Data Submittal Requirements), all data collected from the Property by MFA will be uploaded to Ecology's Environmental Information Management system database. Consistent with WAC 173-340-840(5) and Policy 840, data generated will be submitted in both written and electronic format.

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MFA. 2024. *Remedial Investigation Amendment, Tiki Car Wash, Facility Site ID: 2352, Cleanup Site ID: 5096.* Prepared for the Washington State Department of Ecology, Toxics Cleanup Program, Northwest Regional Office, Shoreline, Washington. Maul Foster & Alongi, Inc.: Seattle, WA. January 26.

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Limitations

The services undertaken in completing this plan were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This plan is solely for the use and information of our client unless otherwise noted. Any reliance on this plan by a third party is at such party's sole risk.

Opinions and recommendations contained in this plan apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this plan.

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Figures

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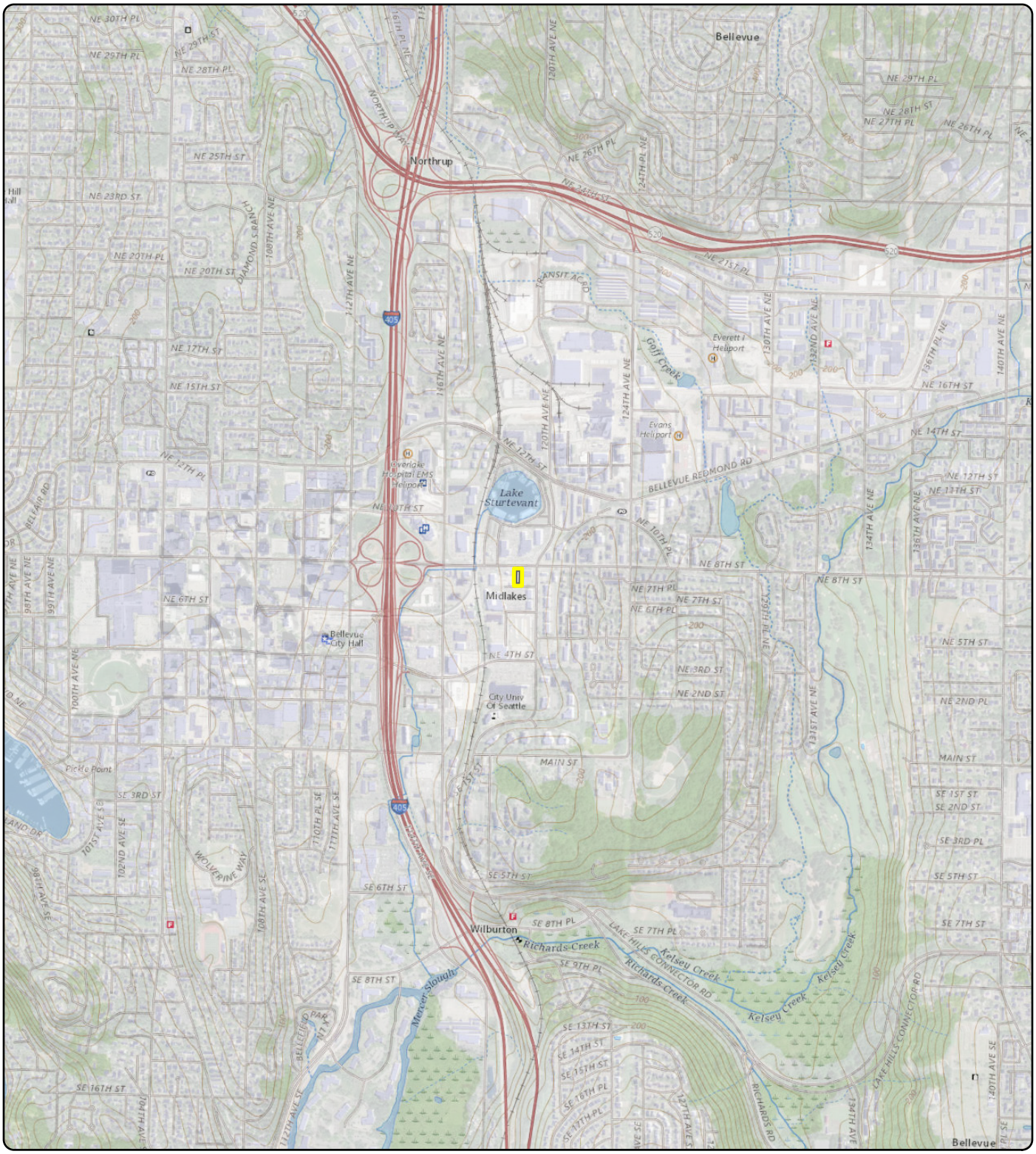
Path: X:\O_MFA_Projects\M0592\06.001\Pro\M0592_06_001_001.aprx\Fig 1-1 Vicinity Map
Print Date: 12/12/2023
Reviewed By: jhansen
Produced By: jroberts
Project: M0592.06.001



Notes
U.S. Geological Survey 7.5-minute topographic quadrangle (2020): Mercer Island.
Township 25 north, range 5 east, section 33.

Data Source
Boundary for parcel 3325059180 obtained from King County.

Legend

Property Boundary

Figure 1-1
Vicinity Map

Tiki Car Wash
11909 NE 8th Street
Bellevue, WA

0 1,000 2,000
Feet

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Figure 2-1
Property Features

Tiki Car Wash
11909 NE 8th Street
Bellevue, WA

Legend

- UST (Approximate)
- Property Boundary
- Parcel

Note
UST = underground storage tank.

0 30
Feet

Data Sources
Aerial photograph obtained from Microsoft Bing; parcel data obtained from King County; approximate UST locations obtained from *Report of May 1996 Groundwater Sampling and Analysis* (Enviros 1996).

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Path: X:\O_MFA_Projects\M0592.06\001\Pro\M0592_06_001_001.aprx\Fig 2-1 Property Features
Print Date: 2/5/2024
Reviewed By: jhansen
Produced By: jelstrott
Project: M0592.06.001

Figure 4-1
Proposed Groundwater Recirculating Well Location

Tiki Car Wash
11909 NE 8th Street
Bellevue, WA

Legend

- Monitoring Well
- Proposed Recirculating Well
- Piezometer
- Work Area
- Property Boundary
- Parcel

0 10
Feet

Data Sources
Aerial photograph obtained from Microsoft Bing; parcel data obtained from King County.

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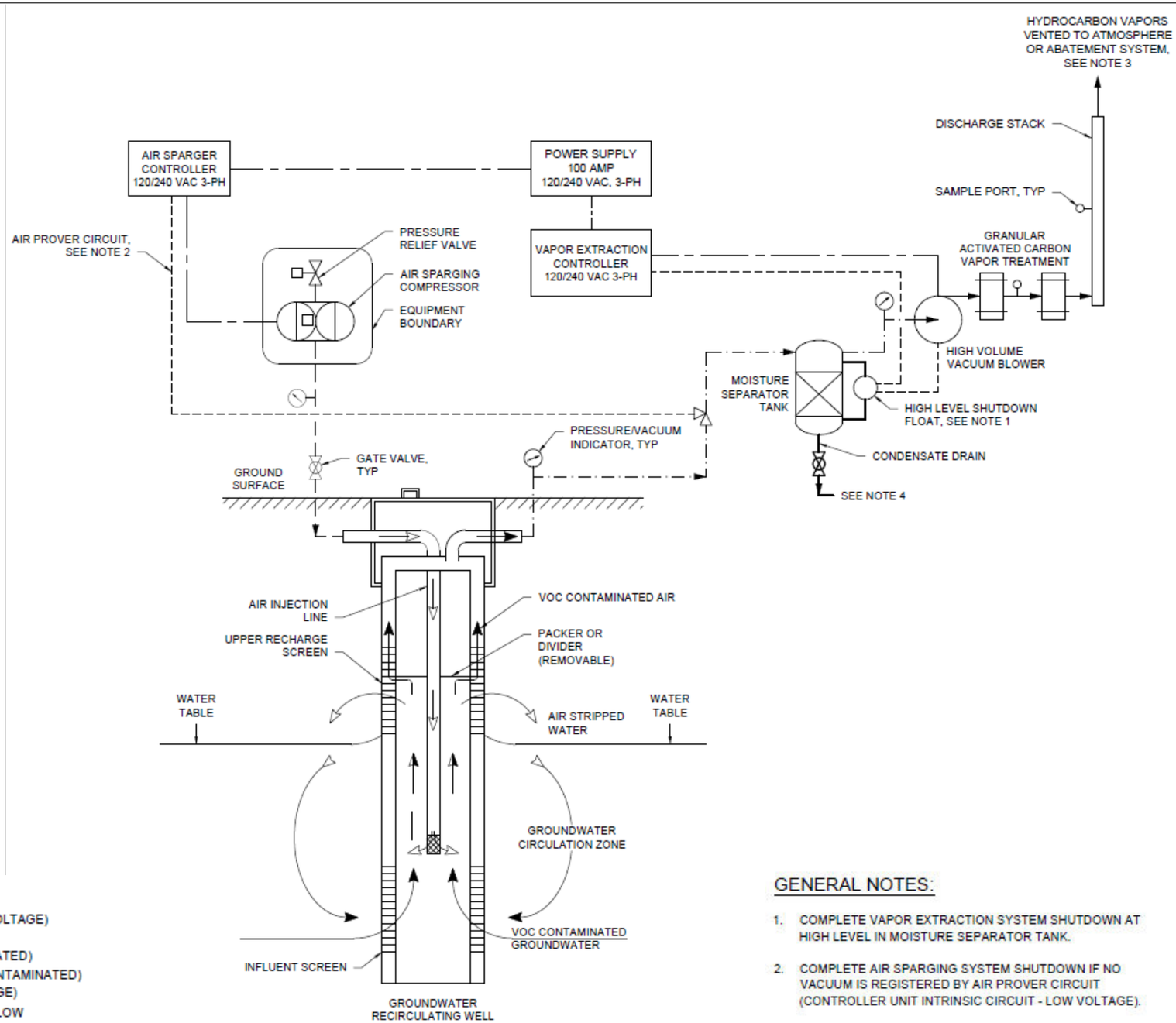
Path: X:\O_MFA_Projects\M0592\06\001\Pro\M0592_06_001_001.aprx\Fig 4-1 Prop Groundwater Recirculating Well Location
Print Date: 2/5/2024
Reviewed By: jhansen
Produced By: jelstott
Project: M0592.06.001

Path: X:\O_MFA_Projects\M0592\06.001\Pro\M0592_06_001_001.aprx\Fig 4-2 Groundwater Recirculating Well Process Flow Diagram
Print Date: 3/12/2024
Reviewed By: jhansen
Produced By: jroberts
Project: M0592.06.001



LEGEND

- CONTROL SIGNAL (LOW VOLTAGE)
- INJECTED AIRFLOW
- WATER FLOW (CONTAMINATED)
- DISCHARGE AIRFLOW (CONTAMINATED)
- ELECTRICAL (HIGH VOLTAGE)
- VAPOR EXTRACTION AIRFLOW
- VOLATILE ORGANIC COMPOUND (VOC) CONTAMINATED
- TRANSITION
- UNCONTAMINATED
- FLOW ARROW

PROCESS FLOW DIAGRAM

SCALE: NOT TO SCALE

GENERAL NOTES:

1. COMPLETE VAPOR EXTRACTION SYSTEM SHUTDOWN AT HIGH LEVEL IN MOISTURE SEPARATOR TANK.
2. COMPLETE AIR SPARGING SYSTEM SHUTDOWN IF NO VACUUM IS REGISTERED BY AIR PROVER CIRCUIT (CONTROLLER UNIT INTRINSIC CIRCUIT - LOW VOLTAGE).
3. TREATED AIR EFFLUENT MONITORED AND SAMPLED AS REQUIRED BY SITE SPECIFIC AIR DISCHARGE PERMIT.
4. CONDENSATE MAY REQUIRE TESTING AND/OR TREATMENT, FOR PROPER DISPOSAL.

Figure 4-2
Groundwater Recirculating Well Process Flow Diagram

Tiki Car Wash
11909 NE 8th Street
Bellevue, WA

Image Source:
Process flow diagram developed by Akana.

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