FINAL POST REMEDIATION GROUNDWATER INVESTIGATION & VAPOR INTRUSION ASSESSMENT REPORT

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RGI PROJECT NO. 2017-015K
ECOLOGY AGREED ORDER NO. 16537

ROYSTONE REDEVELOPMENT
TEXACO 211577 MONTEREY SITE
631 QUEEN ANNE AVENUE NORTH
SEATTLE, WASHINGTON 98109

MARCH 16, 2023

TABLE OF CONTENTS

LIST OF APPENDICES

1.0 Introduction

The Riley Group, Inc. (RGI) is pleased to present this Post Remediation Groundwater Investigation and Vapor Intrusion Assessment Report (GWI/VIA Report) documenting work performed after the completion of the Interim Action (IA) in 2020 to evaluate groundwater conditions and the vapor intrusion risk at the Roystone Redevelopment property located at 631 Queen Anne Avenue North in Seattle, Washington (herein referred to as the Property). The general location of the Property is displayed on Figure 1.

The Property is owned by Roystone on Queen Anne LLC (Roystone) and is identified by the King County Assessor as tax parcel 38789900425 (Parcel 0425). Petroleum releases associated with one or more of the former gasoline service stations and related underground improvements located on the Property have been confirmed and documented in previous investigations and were thoroughly remediated during the IA in 2020.

The Property is part of a larger Site identified by the Washington Department of Ecology (Ecology) as the Texaco 211577 Monterey Site (CSID 6663). Ecology determined that Roystone and Chevron Environmental Management Company (CEMC) were Potentially Liable Parties (PLPs) for the Site in 2019. On August 19, 2020, Roystone, CEMC, and Ecology entered into Agreed Order (AO) No. 16537. A copy of the executed AO is included in Appendix A.

Under AO 16537, Roystone and CEMC have designated lead roles for work associated with the cleanup of the Site. Roystone is responsible for the cleanup of the portion of the Site situated within the Property boundaries and the cleanup of the remainder of the Site, outside the Property boundaries, is the responsibility of CEMC. The location of the Property and the Site is displayed on Figure 2.

In 2020, RGI collaborated with Ecology to complete the IA, which consisted of removing all soil containing concentrations of contaminants of concern (COCs) from the Property. A total of approximately 16,745 tons of petroleum contaminated soil (PCS) and 61 tons of soil classified as F002 listed hazardous waste were removed from the Property during the IA. The dewatering system operated on the Property from July 20, 2020 through September 5, 2020 and approximately 610,900 gallons of water was pumped, treated, and discharged to the sanitary sewer under a permit obtained by Roystone.

The purpose of the GWI/VIA Report is to document the installation of groundwater monitoring wells and associated groundwater sampling, evaluate the effectiveness of the IA at reducing concentrations of COCs in groundwater, and to evaluate the vapor intrusion risk for the Property building associated with volatile contaminants that remain present in soil outside the Property boundaries.

During the IA, a chemical vapor barrier was installed beneath the building and along all parking garage walls to create an envelope around the building. A passive subslab depressurization (SSD) system was also installed beneath the western half of the building. The purpose of installing the SSD system and chemical vapor barrier was to prevent the occurrence of any vapor intrusion to the Property building. After the IA was completed, Ecology requested that Roystone demonstrate that there is no vapor intrusion risk for the building, which inherently required evaluating the effectiveness of the chemical vapor barrier.

RGI submitted a Draft GWI/VIA Report to Ecology in September of 2022, which utilized modeling in to demonstrate that there was no vapor intrusion risk for the building. Ecology indicated that, due to the use of commercial soil vapor screening levels (Commercial SVSLs) in that evaluation, an

Environmental Covenant would be necessary for the Property. Ecology further indicated that an EC would not be required if Roystone demonstrated there was no vapor intrusion risk to the Property building using soil vapor data and Ecology's most stringent SVSLs intended for residential uses. Section 6 of this report presents the VIA, which was completed in two phases.

Roystone has fulfilled their obligation to remediate all COCs previously present in soil and groundwater within the Property boundaries under the AO. This GWI/VIA Report is being submitted to Ecology in support of a request for a letter from Ecology stating that IA has successfully remediated COCs present in soil and groundwater on the Property and that the work was completed to the satisfaction of Ecology's under AO 16537. No further investigation work or remediation work is required at the Property.

2.0 Previous Investigations

The following documents have previously been prepared, which document the history of the Property and previous investigations and cleanup work completed for the Property:

- *Draft Groundwater Investigation & Vapor Intrusion Assessment Rep*ort (First Draft GWI/VIA Report) dated September 15, 2022 by RGI;
- *Final Interim Action Report* (IA Report) dated March 21, 2022 by RGI;
- *Interim Action Work Plan* (Work Plan) dated August 20, 2019 by RGI;
- *Groundwater Monitoring – 4th Quarter 2018 dated January 15, 2019* by RGI*;*
- *Supplemental Subsurface Investigation Report* (SSI Report) dated December 26, 2017 by RGI;
- *Second Semi-annual Groundwater Monitoring Report* dated March 26, 2014 by Liedos;
- *Limited Subsurface Investigation Report* (LSI) dated July 10, 2012 by Sound Earth Strategies (SES);
- *Final Remedial Investigation and Site Summary Report* (RI) dated August 20, 2007 by Science Applications International Corporation (SAIC), and
- *Conceptual Site Model, Risk Assessment, and Supplemental Investigation Proposal* dated August 21, 2002 by Delta Environmental Consultants (Delta).

In addition, numerous other documents have been prepared for the Site since 1989, which document the history of the Property and previous investigations. See Appendix B of the IA Report for a full list of previous reports. Summaries of previous investigations as they pertain to the Property were provided in the IA Report. For additional details regarding previous investigations, the reader should refer to the original documents in their entirety.

3.0 Scope of Services

The scope of services performed for the GWI/VIA consisted of the following:

- Coordinated with Ecology regarding all work completed;
- Advanced six borings on the Property using standard hollow stem auger drilling techniques. Borings were completed as groundwater monitoring wells MWA through MWF and are located in the parking garage of the Property building. Groundwater monitoring wells were developed and surveyed after installation;

- Retained the services of a licensed land surveyor to obtain top of casing elevations from the north side of casing of wells MWA through MWF;
- Purged, sampled and collected groundwater samples from each of the six wells under low flow conditions in July and October of 2021 and February and May of 2022. MWD was also sampled again in August of 2022 at the request of Ecology. Groundwater samples were analyzed for COCs identified by RGI in previous subsurface investigations and the IA;
- Evaluated groundwater conditions on the Property using MTCA regulations and available scientific information pertaining to petroleum degradation;
- Conducted Phase 1 of the VIA, which utilized modeling to evaluate Post IA soil and groundwater concentrations of COCs to determine the effectiveness the chemical vapor barrier and if a there is a vapor intrusion risk for the Property building.
- Conducted Phase 2 of the VIA, which consisted of collecting two soil vapor samples from locations adjacent to the Roystone Property boundaries. Soil vapor samples were analyzed for COCs determined during the IA and soil vapor concentrations were compared to Ecology's most stringent SVSLs considered protective of indoor air.
- Prepared this Second Draft GWI/VIA Report presenting our observations, findings, conclusions, and recommendations.

4.0 Regulatory Analysis of Property Conditions Under MTCA

4.1 MTCA CLEANUP REGULATION

In Washington State, the Model Toxics Control Act (MTCA, 70A.305 RCW), mandates that site cleanups protect human health and the environment. The MTCA Cleanup Regulation (173-340 WAC) defines the approach for establishing cleanup requirements for individual sites, including the establishment of cleanup standards and selection of cleanup actions.

The following section presents the cleanup levels and screening levels utilized to evaluate COCs in soil and groundwater. Indoor air and soil vapor screening levels utilized to conduct the VIA and vapor intrusion regulations are presented in Section 6.1.

4.2 SOIL CLEANUP LEVELS

Soil was fully remediated at the Property during the IA. Therefore, no soil samples were collected during the GWI/VIA. However, it was necessary to evaluation concentrations of COCs in soil left in place at the Property boundaries after remediation was completed.

The selected soil cleanup levels for the Property were the MTCA Method A Soil Cleanup Levels for Unrestricted Land Uses. RGI's evaluation of soil analytical data obtained during the IA and previous investigations indicate that these soil cleanup levels were sufficient to evaluate concentrations of COCs in soil for compliance with MTCA regulations throughout the Property.

In previous investigations, compounds were detected in soil that are factored into the MTCA Method A TPH soil cleanup level calculations. These compounds (for example, 1,2,4-trimethylbenzene, 1,3,5-trimethylbenzene, and isopropylbenzene) were not assessed individually, as the MTCA Method A soil cleanup levels are sufficient to assess risks associated with these compounds.

Carcinogenic polycyclic aromatic hydrocarbons (cPAHs) were analyzed in soil and product samples during the IA. CPAHs included benzo(a)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene and ideno(1,2,3-cd)pyrene.

When evaluating cPAHs, the mixture of the cPAH compounds is considered a single hazardous substance. The toxicity equivalency factor (TEF) methodology was developed by the EPA to evaluate the toxicity and assess the risks of a mixture of structurally related chemicals with a common mechanism of action. A TEF is an estimate of the relative toxicity of a chemical mixture compared to a reference chemical. For mixtures of cPAHs, the reference chemical is benzo(a)pyrene. Therefore, when evaluating these compounds in soil for MTCA compliance, the calculated total cPAHs (TEF modified) is compared to the MTCA Method A soil cleanup for benzo(a)pyrene of 0.1 milligrams/kilogram (mg/kg) as per WAC 173-340-708(8).

When no MTCA Method A soil cleanup level had been established for a given compound, the MTCA Method B soil cleanup level obtained from the Ecology Cleanup Level and Risk Calculation (CLARC) database was referenced.

Analytical data associated with soil that remained in place at the Property boundaries after completion of the IA and MTCA Method A and B soil cleanup Levels, collectively referred to as soil cleanup levels herein, are summarized in Table 1.

4.3 GROUNDWATER CLEANUP LEVELS

Post remediation groundwater data was obtained from July of 2021 through August of 2022 for the purpose of evaluating the effectiveness of the IA at remediating contaminated groundwater.

The selected groundwater cleanup levels for the Property were the MTCA Method A Cleanup Levels for Groundwater. RGI's evaluation of groundwater analytical data obtained during the IA and previous investigations indicate that these groundwater cleanup levels were sufficient to evaluate concentrations of COCs in groundwater for compliance with MTCA regulations throughout the Property.

Under MTCA regulations, groundwater cleanup levels must be set at concentrations at least as stringent as applicable state and federal laws (Applicable or Relevant and Appropriate Requirements [ARARs], WAC 173-340-700[5][a]). Therefore, when no Method A groundwater cleanup level was available for a given compound, the ARAR was referenced.

Analytical data associated with all groundwater samples obtained from the Property prior to and after completion of the IA and the MTCA Method A groundwater cleanup levels and ARARs, collectively referred to as groundwater cleanup levels herein, are summarized in Table 2. Groundwater cleanup levels and ARARs were obtained from the Ecology Cleanup Levels and Risk Calculation (CLARC) database in August of 2022.

5.0 Groundwater Investigation

Between September of 2020 and August of 2022, RGI conducted groundwater investigation activities intended to assess groundwater concentrations of COCs after soil and groundwater remediation was completed during the IA in 2020. These activities are discussed in the following sections.

The surface grade at the Property ranges from approximate elevations 147' to 148' and the grade of the parking garage floor, where groundwater monitoring wells were installed, is situated at elevation 136' (or 11' below ground surface [bgs]). For the purpose of discussion, depths are referenced using elevation data.

Prior to installation of groundwater monitoring wells, all soils containing concentrations of COCs above applicable MTCA soil cleanup levels were removed from the Property via remedial excavation. The depth of soil contamination generally corresponded with the depth of the dense silt/clay layer (Lawton clay) that underlies the Property, which was encountered between elevations 117.5’ and 121.5’. The maximum depth of remedial excavation on the eastern portion of the Property was elevation 123’ and on the western portion of the Property, the maximum depth of remedial excavation was approximately elevation 114’.

After completion of remedial excavation, the Property was backfilled with clean Type 17 fill to elevations ranging from elevations 131.5’ to 132.5’.

5.1 GROUNDWATER MONITORING WELL CONSTRUCTION

Installation of groundwater monitoring wells was completed in two phases, which are discussed in the sections below. The locations of groundwater monitoring wells are presented on Figures 2 through 11 and logs displaying wells construction details are presented in Appendix B.

Prior to wells installations, RGI strategically coordinated with the construction team in order to ensure wells were placed in locations that did not significantly disrupt construction (i.e., the location of footings and the garage access ramp) and also to coordinate sealing the chemical vapor barrier to the well casings in locations beneath the slab (see Section 6 for details regarding the chemical vapor barrier). RGI also coordinated with Ecology to ensure that wells were positioned in locations that Ecology agreed were appropriate for post remediation compliance monitoring.

Phase 1 of groundwater monitoring well installation was completed in September of 2020 and consisted of advancing six soil borings that were partially completed and protected during the pouring of the concrete slab for the parking garage, which consisted of a 3’ mat slab on the eastern portion of the Property and a 5” slab on the western portion of the Property (in locations where footings were not present).

Phase 2 of groundwater monitoring well installations was completed in July of 2021 after the slab of the parking garage floor was poured. This phase of work consisted of completing the wells flush with the garage floor and required modifications to well casings.

5.1.1 Phase 1 of Groundwater Monitoring Well Installations

Phase 1 of groundwater monitoring well installations was conducted on September 17 and 18, 2020. RGI retained the services of Cascade Drilling, Inc. (Cascade) to advance six borings (MWA through MWF) using standard hollow stem auger (HSA) drilling techniques in the locations displayed on Figures 2 through 11. At that time, the grade of the Property ranged from approximately 131.5’ to 132.5’. Confirmation soil sample data obtained during the IA indicated that all soil containing concentrations of COCs above applicable MTCA soil cleanup levels had been removed from the Property. In addition, the majority of soil situated in drilling locations consisted of clean Type 17 backfill.

All borings were advanced to a depth of approximately 3’ below the clay layer, which ranged from elevations 114.5’ (MWA) to 118.5’ (MWC). Since it was known that the Property had been backfilled with clean Type 17 backfill after remedial excavation was completed, only soil from cuttings during drilling was field screened and soil samples were not collected. Soil cuttings were periodically field screened for contamination using a photoionization detector (PID) along with visual and olfactory observations. No evidence of soil contamination was encountered in any of the well locations. This was consistent with the confirmation soil sample data obtained during the IA, which demonstrated that all soil containing concentrations of COCs above MTCA soil cleanup levels had been removed from within the Property boundaries. Therefore, no soil samples were submitted to the laboratory for analyses of COCs. Confirmation soil sample data is displayed graphically on Figure 3 and summarized in Table 1.

The soil conditions encountered during drilling were described using the Unified Soil Classification System (USCS) and subsurface conditions consisted of Type 17 fill used as backfill after remedial excavation, which extended to the surface of the clay layer, which ranged between elevations 117.5' and 121.5' in groundwater monitoring well locations.

In each location, 2-inch diameter PVC well casing with screen sections, ranging in length from 12' to 15' long, were placed at the bottom of the borehole, which ranged from elevations 114.5' to 118.5'. The well screen extended up above the surface at that time to approximately elevation 134'. The annular space surrounding the screen was filled with #60 sand to approximately one foot above the well screen.

Six inch PVC was placed over the 2 inch well casing in each location and extended to approximately elevation 135.5'. The purpose of encasing the 2-inch PVC well screen within the 6-inch PVC casing was to protect the wells during pouring of the concrete slab for the parking garage. The concrete slab consisted of a 3' thick mat slab on the eastern portion of the Property in the locations of wells MWA, MWC, MWE, and MWF and a 5" thick slab on the western portion of the Property in the locations of wells MWB and MWD. Approximately 3' of dry bentonite chips and 10" of silica sand were placed above the sand in the 6-inch PVC casing. The top of each 6-inch PVC casing was sealed with a 2-inch thick concrete cap to protect the 2" well casing prior to completing the second phase of well installations discussed in Section 5.1.2.

Four feet of groundwater was observed in wells MWA and MWB and one foot of groundwater was observed in well MWE at the time of drilling. No groundwater was encountered in wells MWC, MWD, or MWF at the time drilling. However, groundwater was later present in all well locations, which is discussed further in Section 5.2.1.

5.1.2 Phase 2 of Groundwater Monitoring Well Installations

Activities associated with Phase 2 of groundwater monitoring well installations were conducted in December of 2020 and July of 2021.

In December of 2020, the GC placed approximately 15" x 15" wood frames around all six wells situated on the Property. The purpose of the wood frames was to further protect the wells during the 3' mat slab pour on the east side of the Property (MWA, MWC, MWE, and MWF) and the pour of the 5" thick slab on the west side of the Property (MWB and MWD).

On July 9 and 10, 2021, RGI retained Cascade to complete the wells flush with the garage floor. This consisted of extending the two inch well casings, installing monuments at each location, and developing the wells. Prior to extending well casings, the protective 2" concrete cap on top of the 6" PVC was removed and sand above the dry bentonite chips was also removed via vacuum excavation. Cascade then proceeded to extend the 2" well casings using couplers by lengths ranging from 8" to 18", which raised the top of casing elevation to between 135.59' to 135.73', which was just below the final parking garage floor elevation at elevation 136'. Approximately 3' of bentonite chips surrounding the 2" casing were hydrated and concrete was placed on top of the bentonite. After well casings were extended, each 2-inch well casing was sealed with a j-plug.

The final well construction consisted of sand surrounding the well screen extending from the bottom of the well screen to approximately one foot above the well screen, above which hydrated bentonite was present. Cascade completed the wells flush mount traffic rated monuments set in

1.5’ of concrete and flush with the grade of the parking garage floor. It was necessary to modify the monuments due to the presence of rebar in well locations between 7.5” and 9” below the grade of the garage floor.

5.2 GROUNDWATER MONITORING WELL DEVELOPMENT & SURVEYING

In July of 2021, RGI developed and surveyed groundwater monitoring wells MWA through MWF. These activities are discussed in this section.

5.2.1 Groundwater Monitoring Well Development

On July 9 and July 13, 2021, Cascade developed wells MWA through MWF using a 1.5” bailer and standard purging and surging techniques. All purge water was stored in a 250-gallon tote situated in the parking garage.

Prior to development, RGI obtained water levels from each well location using an electronic water level meter and the depth to groundwater ranged between 6.99’ (MWF) and 127.51’ (MWD) below the TOC (or between elevations 128.71’ and 128.6’) at that time.

All groundwater monitoring wells were developed by Cascade on July 13, 2021 except for well MWB, which started development on July 9th and was completed on July 13th.

On July 9, 20 gallons of water were purged from MWB after which, water was still significantly turbid. On July 13, an additional 5 gallons were purged from MWB after which, turbidity was significantly reduced. At MWA, approximately 20-gallons of water were purged and no significant turbidity was observed during purging. At wells MWC and MWD, no significant turbidity was observed and both wells purged dry after approximately 6 gallons of water were purged from each well. At MWE, water was slightly turbid at the start of purging and cleared up after approximately 3 gallons were purged. MWE purged dry after 20 gallons. At MWF, no significant turbidity was observed and the well purged dry after a total of 12 gallons were purged.

Investigation derived waste (IDW) consisted of purge water generated during well development. All purge water was placed in one 250-gallon water tote, labeled non-hazardous waste, and temporarily stored in the parking garage.

5.2.2 Groundwater Monitoring Well Surveying

On July 21, 2021 wells MWA through MWF were surveyed by Bush, Roed, & Hitchings, Inc. (BRH), a licensed land surveyor. The survey consisted of obtaining the vertical elevation at the top of the north side of the top of casing (TOC) for each well, the surface of the well cover, and the ground surface adjacent to each well.

The vertical elevations utilized the National Geodetic Vertical Datum of 1988 (NAVD88) for vertical elevation control. Vertical elevation data was used to generate groundwater elevation contours and determine groundwater flow direction and hydraulic gradient across the Property.

The horizontal location of each well was also surveyed using Washington State Plane North Zone horizontal datum (NAD 83). A copy of the survey provided by BRH is included in Appendix C.

5.3 POST REMEDIATION GROUNDWATER SAMPLING EVENTS

After the IA was completed, RGI conducted five quarters of groundwater sampling in July and October of 2021 and February, May, and August of 2022. RGI collaborated with Ms. Jing Song of Ecology regarding the scheduling of groundwater sampling events and the selection of analyses for groundwater samples. Activities associated with groundwater sampling are described below.

5.3.1 Groundwater Sampling Methodology

The methodology described in this section was used to complete all groundwater sampling events and is therefore, not repeated in subsequent sections.

Prior to sampling groundwater monitoring wells, the depth to groundwater was measured at each well from the northernmost point of the top of each well casing using an electronic water level meter. This data was used to determine the groundwater flow direction and hydraulic gradient across the Property.

After collection of groundwater elevation data, wells were purged using a peristaltic pump and dedicated tubing. Measurements of water quality parameters [temperature, pH, dissolved oxygen, salinity, oxygen reduction potential (ORP), total dissolved solids (TDS), and conductivity] were collected using a YSI Quatro meter. Purging continued until water quality parameters had stabilized for at least three consecutive readings.

Prior to commencing with groundwater sampling, the flow rate of the peristaltic pump was reduced to less than 100 milliliters per minute (mL/min) in accordance with standard EPA low flow sampling techniques. Groundwater was pumped directly through dedicated tubing into laboratory-supplied containers appropriate for the intended analyses.

All groundwater samples obtained during this project were collected in accordance with RGI's standard operating and decontamination procedures. Samples were placed in preconditioned, sterilized containers provided by an Ecology accredited analytical laboratory. All reusable equipment was decontaminated between sample locations. Samples collected for dissolved lead were field-filtered using disposable 0.45 micron filters. All samples were appropriately labeled and stored in an iced cooler and transported to the analytical laboratory using standard chain-of-custody protocols.

IDW consisted of purge water generated during the five groundwater sampling events. All purge water was placed in one 250-gallon water tote, labeled non-hazardous waste, and temporarily stored in the parking garage.

5.3.2 Laboratory Analyses & Data Validation

A total of 25 groundwater samples were submitted Friedman & Bruya, Inc. (FBI) for analyses during this project. Groundwater samples were obtained from all six on-Property wells during four separate groundwater sampling events. In addition, well MWD was sampled a fifth time at the request of Ecology.

The first post remediation groundwater sampling event was completed in July of 2021 and consisted of analyzing select groundwater samples for additional contaminants based on soil analytical data obtained during the IA. Fewer contaminants were analyzed in subsequent groundwater sampling events since many of the additional contaminants analyzed during the first sampling event were not present in groundwater.

During the 2021-Q3 groundwater sampling event, groundwater samples were submitted to the laboratory for one or more of the following analyses:

- ➢ Diesel and oil-range TPH using Northwest test method NWTPH-Dx;
- ➢ Gasoline-range TPH using Northwest test method NWTPH-Gx;
- ➢ VOCs using EPA Method 8260D;
- ➢ Benzene, toluene, ethylbenzene, and xylenes (BTEX) using EPA Method 8021B;

- Carcinogenic polycyclic aromatic hydrocarbons (cPAHs) using EPA Method 8270E, and
- Total and dissolved lead (Pb) using EPA Method 6020B.

During the 2021-Q4, 2022-Q1, 2022-Q2, and 2022-Q3 groundwater sampling events, all groundwater samples were submitted to the laboratory for the following analyses:

- Diesel and oil-range TPH using Northwest test method NWTPH-Dx. Samples analyzed during the 2021-Q4 groundwater sampling event were analyzed with and without silica gel cleanup;
- Gasoline-range TPH using Northwest test method NWTPH-Gx, and
- Benzene, toluene, ethylbenzene, and xylenes (BTEX) using EPA Method 8021B.

All analytical data obtained during this project was submitted to Pyron Environmental, Inc. (Pyron) for data validation services in accordance with the requirement of the AO.

Pyron conducted a Stage 2A data review using the procedures specified in the United States Environmental Protection Agency (USEPA) Contract Laboratory Program (CLP) National Functional Guidelines (NFG) for review of analytical data.

Pyron evaluated hold times, method blank, surrogate spikes, matrix spike/matrix duplicate, and laboratory control sample for all analyses performed during this project described above.

Pyron determined that all analytical data were at known quality at the level of quality evaluation (EPA Stage 2A) and were acceptable for use.

Post remediation groundwater analytical data are displayed graphically on Figure 4 and summarized in Table 2. Copies of final analytical laboratory reports for all groundwater samples analyzed during this project are included in Appendix D. Copies of the five associated *Data Validation Reports* obtained from Pyron are included in Appendix E.

5.3.3 2021-Q3 Groundwater Sampling Event

On July 14, 2021, RGI sampled all six on-Property groundwater monitoring wells (MWA through MWF). Groundwater analytical data obtained during this sampling event is displayed on Figure 4 and groundwater elevation contours are presented on Figure 5.

Depth to groundwater measurements for wells ranged from 7.13’ to 8.34’ below the TOC at each well location. The corresponding groundwater elevations ranged from 128.57’ to 127.41’. Groundwater flow direction was determined to be to the west with an approximate hydraulic gradient of 0.011 ft/ft (MWF to MWB).

All groundwater samples obtained during this groundwater sampling event were analyzed for gasoline-, diesel-, and oil-range TPH and BTEX (or included BTEX in the VOC analysis). Samples obtained from wells MWC, MWD, MWE, and MWF were also analyzed for VOCs and samples from MWC, MWD, and MWE were additionally analyzed for cPAHs and total and dissolved Pb.

Diesel-range TPH was detected in wells MWA through MWF at concentrations ranging from 98 μg/L (MWA) to 250 μg/L (MWB). None of these concentrations exceeded the MTCA groundwater cleanup level for diesel-range TPH of 500 μg/L. All diesel-range TPH concentrations were flagged by the laboratory indicating that the sample chromatographic pattern did not resemble the fuel standard used for quantitation.

No other COCs were detected in any of the wells at concentrations above the compound-specific laboratory detection limits during this sampling event.

5.3.4 2021-Q4 Groundwater Sampling Event

On October 15, 2021, RGI sampled all six on-Property groundwater monitoring wells (MWA through MWF). Groundwater analytical data obtained during this sampling event is displayed on Figure 4 and groundwater elevation contours are presented on Figure 6.

Depth to groundwater measurements for wells ranged from 8.06’ to 9.78’ below the TOC at each well location. The corresponding groundwater elevations ranged from 127.64’ to 125.97’. Groundwater flow direction was determined to be to the west with an approximate hydraulic gradient of approximately 0.02 ft/ft (MWF to MWB).

All groundwater samples obtained during this groundwater sampling event were analyzed for gasoline-, diesel-, and oil-range TPH and BTEX.

Diesel-range TPH was detected in wells MWB through MWF at concentrations ranging from 110 μg/L (MWC and MWF) to 510 μg/L (MWD) and was not detected at a concentration above the laboratory detection limit in well MWA. All diesel-range TPH concentrations were flagged by the laboratory indicating that the sample chromatographic pattern did not resemble the fuel standard used for quantitation. Gasoline-range TPH, toluene, and xylenes were also detected in well MWD, but at concentrations below applicable MTCA groundwater cleanup levels.

Since the diesel-range TPH concentration in MWD of 510 μg/L exceeded the MTCA groundwater cleanup level of 510 μg/L, RGI requested that the FBI chemist further evaluate the chromatograph pertaining to the sample obtained from MWD to obtain more information regarding the reason for the flagged data.

FBI evaluated the chromatograph for MWD and concluded that the pattern observed indicated the possible presence of naturally occurring organics. Based on this analysis, RGI analyzed all samples obtained during this sampling event with silica gel cleanup. No diesel-range TPH was detected at a concentration above the MTCA groundwater cleanup level after analysis using silica gel cleanup. FBI concluded that the material quantified without silica gel cleanup was polar. Therefore, the material present likely consisted of polar metabolites resulting from the biodegradation of petroleum. Studies have shown that polar metabolites of this nature are significantly less toxic than petroleum that has not undergone biodegradation, which the MTCA groundwater cleanup level for diesel-range TPH is based on. RGI does not consider the data obtained from MWD during this sampling event to be a concern for the Property and this is discussed further in the context of all post remediation groundwater data in section 5.4.

No other COCs were detected in any of the wells at concentrations above the compound-specific laboratory detection limits during this sampling event.

5.3.5 2022-Q1 Groundwater Sampling Event

RGI scheduled the 2022-Q1 groundwater sampling event in January of 2022. However, when RGI arrived at the Property four of the wells were inaccessible due to the presence of construction materials and it was necessary to reschedule the sampling event twice for this reason. RGI communicated with Ms. Jing Song regarding the schedule throughout this process and the work was ultimately completed on February 23, 2022. The reason for the delay was primarily due to supply chain issues and the contractor having to buy materials in advance and not having enough space to store the material at the Property. The reason for the delay was explained in detail in an email to Ms. Jing Song on March 28, 2022.

On February 23, 2022, RGI sampled all six on-Property groundwater monitoring wells (MWA through MWF). Groundwater analytical data obtained during this sampling event is displayed on Figure 4 and groundwater elevation contours are presented on Figure 7.

Depth to groundwater measurements for wells ranged from 5.99’ to 7.45’ below the TOC at each well location. The corresponding groundwater elevations ranged from 129.71’ to 128.30’. Groundwater flow direction was determined to be to the west-northwest with an approximate hydraulic gradient of approximately 0.015 ft/ft (MWF to MWB).

All groundwater samples obtained during this groundwater sampling event were analyzed for gasoline-, diesel-, and oil-range TPH and BTEX.

Diesel-range TPH was detected in wells MWB through MWF at concentrations ranging from 97 µg/L (MWA) to 380 µg/L (MWE). None of these concentrations exceeded the MTCA groundwater cleanup level for diesel-range TPH of 500 µg/L. All diesel-range TPH concentrations were flagged by the laboratory indicating that the sample chromatographic pattern did not resemble the fuel standard used for quantitation.

No other COCs were detected in any of the wells at concentrations above the compound-specific laboratory detection limits during this sampling event.

5.3.6 2022-Q2 Groundwater Sampling Event

On May 23, 2022, RGI sampled all six on-Property groundwater monitoring wells (MWA through MWF). Groundwater analytical data obtained during this sampling event is displayed on Figure 4 and groundwater elevation contours are presented on Figure 8.

All groundwater samples obtained during this groundwater sampling event were analyzed for gasoline-, diesel-, and oil-range TPH and BTEX.

Depth to groundwater measurements for wells ranged from 5.99’ to 7.45’ below the TOC at each well location. The corresponding groundwater elevations ranged from 129.71’ to 128.30’. Groundwater flow direction was determined to be to the west with an approximate hydraulic gradient of approximately 0.013 ft/ft (MWF to MWB).

All groundwater samples obtained during this groundwater sampling event were analyzed for gasoline-, diesel-, and oil-range TPH and BTEX.

Diesel-range TPH was detected in wells MWB through MWF at concentrations ranging from 90 µg/L (MWC) to 300 µg/L (MWB). None of these concentrations exceeded the MTCA groundwater cleanup level for diesel-range TPH of 500 µg/L. All diesel-range TPH concentrations were flagged by the laboratory indicating that the sample chromatographic pattern did not resemble the fuel standard used for quantitation.

No other COCs were detected in any of the wells at concentrations above the compound-specific laboratory detection limits during this sampling event.

5.3.7 2022-Q3 Groundwater Sampling Event

On August 11, 2022, RGI, Roystone, and Ecology discussed the results of post remediation groundwater data after four consecutive quarters of sampling. RGI recommended no further groundwater sampling at the Property for the reasons discussed in Section 5.4. Ecology indicated that one more sample needed to be collected and analyzed from MWD to verify that concentrations of COCs remained below applicable MTCA groundwater cleanup levels and if concentrations of COCs were below MTCA groundwater cleanup levels no further groundwater sampling would be required. However, Ecology did indicate that Chevron may need to access the Property in the future for groundwater sampling or other purposes associated with the remediation of the Site they are working on. Roystone agreed to continue to cooperate with Ecology and Chevron for this purpose.

On August 18, 2022, RGI sampled well MWD and obtained groundwater elevation data from all six on-Property groundwater monitoring wells (MWA through MWF) at the request of Ecology. Groundwater analytical data obtained during this sampling event is displayed on Figure 4 and groundwater elevation contours are presented on Figure 9.

The groundwater sample obtained from MWD during this groundwater sampling event was analyzed for gasoline-, diesel-, and oil-range TPH and BTEX.

Depth to groundwater measurements for wells ranged from 6.88' to 8.21' below the TOC at each well location. The corresponding groundwater elevations ranged from 128.82' to 127.54'. Groundwater flow direction was determined to be to the west-northwest with an approximate hydraulic gradient of approximately 0.016 ft/ft (MWF to MWB).

Diesel-range TPH was detected in well MWD at concentration of 220 μg/L, which is below the MTCA groundwater cleanup level for diesel-range TPH of 500 μg/L. The diesel-range TPH concentration was flagged by the laboratory indicating that the sample chromatographic pattern did not resemble the fuel standard used for quantitation.

No other COCs were detected in MWD at concentrations above the compound-specific laboratory detection limits during this sampling event.

5.4 POST REMEDIATION GROUNDWATER DATA EVALUATION

RGI evaluated all post remediation groundwater data obtained from July of 2021 through August of 2022. The evaluation of this data demonstrates that the remediation work completed during the IA in 2020 was highly successful at bringing concentrations of contaminants that were previously present in soil and groundwater at the Property into compliance with MTCA regulations. During the IA, approximately 16,747 tons of contaminated soil and approximately 610,000 gallons of impacted groundwater were removed from the Property. Further discussion pertaining to this evaluation is presented in the following sections.

During the baseline groundwater sampling event completed 2018, prior to commencing with the IA, diesel-range TPH was the primary COC present in groundwater on the Property. The highest diesel-range TPH concentration was detected in former well DPE7 at a concentration of 4,100 μg/L. Well MWB is located in close proximity to the former location of well DPE7 and the average diesel-range TPH concentration over four quarters of post remediation groundwater sampling in MWB was 325 μg/L. This concentration is below the MTCA groundwater cleanup level of 500 μg/L for diesel-range TPH and represents over an order of magnitude reduction in diesel-range TPH concentrations since remediation was completed.

Post remediation groundwater data consisted of analyzing 25 samples for COCs discussed with Ecology from July 14, 2021 through August 18, 2022. Of these 25 samples, the only concentration to exceed the MTCA groundwater cleanup level of 500 μg/L was a diesel-range TPH concentration of 510 μg/L, which was obtained from well MWD in October of 2021. RGI does not consider this data a concern for the Property and does not recommend additional groundwater sampling at the Property. The lines of evidence that lead RGI to this conclusion are presented in the following section.

5.4.1 Evaluation of 2021-Q4 Groundwater Data for MWD

This section presents the evaluation of groundwater data obtained from MWD in October of 2021, which was the only time the MTCA groundwater cleanup level was exceeded during post remediation groundwater sampling. A copy of the FBI laboratory report pertaining to MWD dated November 11, 2021 is included in Appendix D.

5.4.1.1 Evaluation of Polar Metabolites Present in Well MWD

Diesel-range TPH was detected in groundwater 24 out of the 25 times that diesel-range TPH was analyzed during post remediation groundwater sampling. All of these diesel-range TPH concentrations were flagged by the analytical laboratory (FBI). The flag indicated that the sample chromatographic pattern did not resemble the fuel standard used for quantitation. RGI requested that FBI further evaluate the chromatograph and quality control data for the sample obtained from MWD on October 15, 2021.

FBI evaluated the chromatograph for MWD and concluded that the pattern observed indicated the possible presence of organics. Based on this analysis, RGI analyzed all samples obtained during this sampling event with silica gel cleanup and no diesel-range TPH was detected at a concentration above the MTCA groundwater cleanup level. FBI concluded that the material quantified without silica gel cleanup was polar. It is also reasonable to conclude that all detected diesel-range TPH concentrations were similar in nature although FBI did not conduct the evaluation on all groundwater samples.

The diesel-range TPH concentration observed in well MWD in October of 2021 is likely due to the presence of polar metabolites resulting from the biodegradation of petroleum compounds. Numerous studies have been completed, which evaluate the toxicity of polar metabolites resulting from petroleum biodegradation at petroleum release sites where diesel-range TPH is present. The results of these studies consistently demonstrate that these polar metabolites have a much lower toxicity profile than compounds present in petroleum that have not undergone biodegradation. The studies also indicate that due to this lower toxicity profile, polar metabolites are unlikely to result in a significant risk to human health. One example of such a study is Nature and Estimated Human Toxicity of Polar Metabolite Mixtures in Groundwater Quantified as TPHd/DRO at Biodegrading Fuel Release Sites (Toxicity of Polar Metabolites Study) by Dawn A Zemo, Kirk T. O'Reilly, Rachel E. Mohler, Asheesh K. Tiwary, Renae I. Magaw, and Karen A. Synowiec. A copy of this study is included in Appendix F for reference.

The significant difference in toxicity between polar metabolites resulting from biodegradation of petroleum and compounds present in petroleum that have not undergone biodegradation is not factored into the MTCA groundwater cleanup level calculation, which determined the groundwater cleanup level of 500 μg/L for diesel-range TPH. Therefore, it is reasonable to postulate that if this toxicity difference was factored into the MTCA groundwater cleanup level calculations, the groundwater cleanup level calculated for these polar metabolites would be higher than 500 μg/L. Since the diesel-range TPH concentration in MWD is only 10 μg/L above the MTCA groundwater cleanup level, it is also reasonable to postulate that the detected concentration of 510 μg/L would be below a cleanup level determined for polar metabolites with a low toxicity profile.

Based on the presence of polar metabolites with a low toxicity profile present in the sample obtained from MWD and the evaluation presented below in Section 5.4.1.2, RGI does not consider this slight exceedance of the MTCA groundwater cleanup level a concern for the Property.

5.4.1.2 Percent Error Analysis & Evaluation of Quality Control Data

RGI further evaluated the data obtained from MWD using the accepted percent error for NWTPH-Dx analysis of +/- 20% and quality assurance data (specifically the laboratory control sample and the surrogate recovery percent for MWD).

The detected diesel-range TPH concentrations during the five quarters of post remediation groundwater sampling in MWD were as follows:

- 2021-Q3 – 220x µg/L
- 2021-Q4 – 510x µg/L
- 2022-Q1 – 210x µg/L
- 2022-Q2 – 220x µg/L
- 2022-Q3 – 270x µg/L

The average concentration obtained from these five quarters of data is 286 µg/L. Taking into account the accepted percent error for diesel-range TPH of +/- 20% the acceptable range for the actual diesel-range TPH concentration present in MWD from the reported concentration of 510 µg/L would be between 402 µg/L and 612 µg/L.

Data obtained from the four quarters outside of the 2021-Q4 data was relatively consistent and only varied by a maximum of 60 µg/L. The detected concentration of 510 µg/L in MWD was 224 µg/L above the average concentration in MWD. This data suggests is likely that the actual diesel-range TPH concentration is in the lower end of the accepted range and closer to the average.

Additional data supporting this conclusion was obtained from the quality assurance data for MWD. The surrogate spike recovery was 116% for MWD, which is biased high. In addition, the laboratory control sample for the batch containing MWD showed recoveries 112% and 108%, which is also biased high. The fact that the quality assurance samples were biased high correlates directly to the likelihood that the diesel-range TPH data reported for MWD was also biased high and if the reported concentration was biased high by 2% or more it would indicate that the actual concentration was below the MTCA groundwater cleanup level.

Based on the above evaluation it appears likely that the diesel-range TPH concentration reported for MWD during the 2021-Q4 groundwater sampling event was biased high and if that is the case, it is very likely that the actual concentration is below the MTCA groundwater cleanup level and closer to the average diesel-range TPH concentration in well MWD during the post remediation groundwater sampling period.

5.4.1.3 Evaluation Conclusions

This evaluation presented the following key information regarding the reported diesel-range TPH concentration obtained from MWD in October of 2021:

- The reported concentration was likely higher than the actual concentration diesel-range TPH concentration present in the sample. Therefore, it is highly likely the actual concentration was below the MTCA groundwater cleanup level;
- The material present in the sample likely consisted of polar metabolites resulting from the biodegradation of petroleum hydrocarbons. These polar metabolites have been demonstrated to be significantly less toxic than the toxicity values used to calculate the MTCA groundwater cleanup level for diesel-range TPH of 500 µg/L. Therefore, it is highly likely that if a cleanup level was established using the toxicity values associated with these

polar metabolites, that cleanup level would be significantly higher than the detected diesel-range TPH concentration of 510x µg/L.

All of the above-mentioned factors support RGI's conclusion that this one exceedance of the MTCA groundwater cleanup level in MWD does not represent an environmental concern for the Property. No further groundwater sampling is warranted.

6.0 Vapor Intrusion Evaluation

RGI completed a Vapor Intrusion Assessment (VIA) consisting of two phases, which are described in the sections below.

6.1 BACKGROUND

Prior to conducting the IA in 2020, RGI anticipated that volatile COCs in soil or groundwater may be left in place after the IA was completed. Based on this evaluation, RGI coordinated with the Client, Roystone construction team, Advanced Radon Technologies, Inc. (ART) and EPRO to develop a plan for protecting the future building from potential vapor intrusion issues due to soil and/or groundwater contamination that remained in place after the IA was completed. The plan developed assumed a worst case scenario, which at that time, consisted of leaving high concentrations of volatile COCs in soil beneath the building, at the Property boundaries, and having volatile COCs present in groundwater beneath the building after the IA was completed. The vapor intrusion mitigation approach selected consisted of installing a chemical vapor barrier beneath the building and along the sides of all parking garage walls to create an envelope around the building and installing a passive subslab depressurization (SSD) system beneath the western half of the building. These vapor intrusion mitigation strategies were presented to Ecology in the *Interim Action Work* Plan dated August 20, 2019 by RGI.

After the IA was completed, Ecology indicated that a VIA was necessary to demonstrate that there would not be a vapor intrusion risk to the Property building. In order to complete the VIA, it was necessary to demonstrate the effectiveness the chemical vapor barrier would have at protecting the building from vapor intrusion as a result of volatile COCs in soil left in place outside the Property boundaries.

Details pertaining to the vapor intrusion mitigation methods implemented at the Property and the VIA are presented the following sections.

6.2 VAPOR INTRUSION REGULATIONS

In order to conduct the VIA, RGI utilized the following sources:

- *Guidance for Evaluating Vapor Intrusion in Washington State* dated March 2022 by Ecology (Final Ecology VI Guidance) – This document contains substantial revisions to the Ecology 2009 Draft VI Guidance and is the primary resource for evaluating vapor intrusion in Washington State. The document also directs readers to guidance's from other states;
- *Ecology Cleanup Level and Risk Calculation (CLARC) Database* (CLARC) – The CLARC database was last revised in January of 2023 and provides a wide range of Ecology accepted technical information associated with vapor intrusion assessments. CLARC also provides current indoor air screening levels (IASLs) for commercial properties, MTCA Method B IACULs, and associated SVSLs for residential and commercial scenarios, and
- *Model Toxics Control Act.*

6.2.1 Indoor Air Screening Levels

In order to complete the evaluation presented in Phase 1 of the VIA presented in 6.4, it was necessary to calculate conservative predicted indoor air concentrations of COCs that would be expected to result from volatile COCs that remain in place in soil outside the Property boundaries. These predicted indoor air concentrations of COCs were compared to Commercial IASLs in the first draft of this report. This second draft compare predicted indoor air concentration to MTCA Method B IAUCLs and Commercial IASLs as applicable.

RGI confirmed with the construction team that the first floor of the future Roystone Apartment building would be used exclusively for commercial purposes. The first phase of the VIA evaluated concentrations of COCs that would be anticipated to be present in the parking garage prior to migrating to the commercial space above. Since the parking garage certainly has significantly less occupancy time than the commercial space above and a high air exchange rate (AER) of 4.11, RGI considered it appropriate and conservative to evaluate predicted indoor air concentrations of COCs that would apply to the parking garage using the Commercial IASLs and MTCA Method B IACULs obtained from the Ecology CLARC database in February of 2023.

6.2.2 Soil Vapor Screening Levels

In order to complete the evaluation presented in Phase 2 of the VIA presented in Section 6.5, it was necessary to evaluate soil vapor data using SVSLs that Ecology considers protective of MTCA Method B IACULs. These SVSLs are also considered appropriate for evaluating residential use scenarios and the use of these SVSLs does not trigger the requirement for an EC on the Property.

Soil vapor analytical data, MTCA Method B IACULs, and SVSLs are summarized in Table 3.

6.3 VAPOR INTRUSION MITIGATION

Vapor intrusion mitigation consisted of installation of a passive SSD system on the western portion of the Property and installation of a chemical vapor barrier beneath the building and along all the parking garage walls. Details pertaining to these vapor intrusion mitigation methods are discussed in this section.

6.3.1 PreTak Chemical Vapor Barrier

Compounds that have the potential to pose a vapor intrusion threat for the Property were historically present in soil and groundwater on the Property. Therefore, Roystone retained EPRO to install a PreTak chemical vapor barrier/waterproofing system beneath the concrete slab of the building and along all outside walls of the parking garage. The PreTak system is formulated to resist VOCs and petroleum-related compounds in soil and groundwater and to prevent these compounds from entering indoor air in the building through vapor intrusion. The installation of the PreTak system was managed by Roystone and their GC.

The PreTak system has an estimated 100 year lifespan and was installed in the following locations:

- E Drain 6000 was installed along all the underground parking garage walls (approximately 6,389 square feet) and is used to spread out irregular surface areas. PreTak sheet was then placed on top of the E Drain 6000 along all parking garage walls.
- PreTak sheet was installed beneath the entire underground parking garage floor slab (approximately 10,511 square feet).

- In all locations where it was necessary to penetrate the slab, such as groundwater monitoring wells MWA through MWF and the passive SSD system vent pipe, well casings and pipes were sealed to the vapor barrier using PreTak, PreTak Tape, BentoTak, and Estop GU.

The vapor barrier was designed to create an envelope around the entire building. The locations where the PreTak chemical vapor barrier was installed are depicted on Figure 11. Figures displaying how these products were utilized, specifications sheets pertaining to products used in the PreTak system, installation details, and photos obtained during the installation of the vapor barrier are included in Appendix G.

6.3.2 Passive SSD System

Prior to commencing with the IA, the western portion of the Property was considered to be at the highest risk with regards to leaving contaminated soil in place on the Property beneath the building. Therefore, in order to prepare for the worst case scenario, the GC was retained to install a passive SSD system on the western half of the building. The system consisted of a network of perforated horizontal pipes that connects to a vent that will run up above the roof after building construction is complete. This passive SSD system was installed to mitigate potential vapor intrusion impacts to the future building.

It was not necessary to leave any contaminated soil on Property beneath the building after the IA was completed. The SSD system in conjunction with the chemical vapor barrier provide strong protection against vapor intrusion in the Property building. The location of the passive SSD system is displayed on Figure 11.

6.4 VAPOR INTRUSION ASSESSMENT PHASE I

After completion of the IA in 2020 and installation of the chemical vapor barrier and passive SSD system had been completed, Ecology requested that a VIA be conducted to demonstrate that there would not be a vapor intrusion risk to the Property building. RGI first evaluated the option of collecting soil vapor and indoor air samples on the Property and determined that this was not a good option due to the following reasons:

- The Property was currently undergoing construction and there was a high likelihood that petroleum related chemicals would be present in air because of construction related activities (i.e., operation of heavy equipment and construction materials used for construction that contain petroleum compounds). The presence of these chemicals would convolute indoor air data thereby preventing adequate assessment of the vapor intrusion risk.
- Collecting soil vapor samples from beneath the building would require penetrating the chemical vapor barrier/waterproofing system that underlies the Property. RGI discussed this issue with EPRO, the manufacturer of the PreTak chemical vapor barrier/waterproofing system. EPRO indicated that collecting soil vapor samples is not recommended primarily due to the fact that it would compromise the integrity of the waterproofing system that underlies the building. In addition, a three-foot-thick mat slab is present beneath the parking garage on the eastern portion of the Property, which would make it logistically difficult to collect soil vapor samples.

Due to the above-mentioned factors, soil vapor and indoor air samples were not obtained on the Property.

RGI consulted with Dr. Blayne Hartman, who is a vapor intrusion expert and provides vapor intrusion training to regulators across the country, to develop an effective strategy for determining the vapor intrusion risk to the Property building without the use of soil vapor and indoor air data. RGI also obtained information required to complete the VIA from EPRO and the Roystone construction team. The strategy developed consisted of the following:

1) Evaluate concentrations of volatile COCs that remain in place in soil and/or groundwater beneath the building to determine if COCs were present that could cause a vapor intrusion concern for the Property building;
2) Utilize modeling to generate high predicted indoor air concentrations of COCs in the parking garage as a result of remaining concentrations of volatile COCs in soil and/or groundwater,
3) Compare predicted indoor air concentrations of COCs to IASLs that comply with current vapor intrusion regulations.

The strategy for conducting the VIA is presented in detail in the following sections.

6.4.1 Evaluation of COCs in Soil and Groundwater

The first step in the evaluation consisted of evaluating concentrations of COCs that remain in soil and/or groundwater to determine if they pose a vapor intrusion concern for the Property building.

6.4.1.1 Volatile Groundwater COCs

As discussed in Section 5, the IA was effective at reducing concentrations of COCs in groundwater to levels that comply with MTCA regulations. Twenty-five groundwater samples were collected and analyzed during five quarters of post-remediation groundwater sampling. The primary COC detected in groundwater was diesel-range TPH, which was only detected on one occasion (October of 2021) at a concentration slightly above the MTCA groundwater cleanup level of 500 μg/L. This one exceedance of the MTCA groundwater cleanup level was determined not to be a concern for the Property for the reasons discussed in Section 5.4.1.

Groundwater concentrations of diesel-range TPH and other volatile COCs currently do not exceed applicable MTCA groundwater cleanup levels. Therefore, no further assessment of the vapor intrusion risk with regards to groundwater is warranted.

6.4.1.2 Volatile COCs in Soil

After the IA was completed in 2020, the only locations where soil containing concentrations of COCs above applicable MTCA soil cleanup levels was left in place was outside the Property boundaries. Soil analytical data pertaining to these soil samples are displayed graphically on Figure 3.

MTCA regulations state that the vapor intrusion pathway must be evaluated when a soil concentration of gasoline-range TPH or other petroleum related COC is significantly higher than a cleanup level derived for the protection of groundwater. The Final Ecology VI Guidance further states that Ecology considers the term “significantly higher” for gasoline-range TPH and benzene to be at least three times a MTCA soil cleanup level derived for the protection of groundwater. MTCA regulations further state that the vapor intrusion pathway must evaluated when a diesel-range TPH soil concentration exceeds 10,000 mg/kg and the Final Ecology VI guidance states that the vapor intrusion pathway should be evaluated for soil containing concentrations of diesel-range TPH below 10,000 mg/kg.

RGI evaluated all soil analytical data pertaining to soil that remains in place outside the Property boundaries and determined that total petroleum hydrocarbons (TPH) as gasoline- and diesel-range TPH, benzene, toluene, ethylbenzene, and xylenes were the only COCs present in soil that had the potential to pose a vapor intrusion risk for the Property building. Soil concentrations of all these COCs meet the criteria described above and were at least three times the applicable MTCA soil cleanup level in some confirmation soil sample locations.

6.4.1.3 COCs Selected for Further Evaluation

Based on RGI's evaluation of all post remediation soil and groundwater data for the Property, RGI determined that the COCs, for the purpose of assessing the vapor intrusion pathway, were gasoline- and diesel-range TPH (evaluated under current vapor intrusion regulations as total petroleum hydrocarbons), benzene, ethylbenzene, toluene, and xylenes in soil. Therefore, soil analytical data obtained from the following confirmation samples, which had the highest concentrations of these COCs, was used to further evaluate the vapor intrusion risk for the Property building:

1) Confirmation sample NPL-12S-10 at 10' bgs was located at the northern Property boundary and was selected to represent the worst case TPH concentration of 15,700 mg/kg. This concentration is the sum of the gasoline-and diesel-range TPH analytical data.
2) Confirmation sample EPL-8S-11 at 11' bgs was located at the eastern Property boundary and was selected to represent the worst case toluene, ethylbenzene, and xylenes concentrations of 52 mg/kg, 41 mg/kg, and 110 mg/kg, respectively.
3) Confirmation sample WPL-17S-22 at 22' bgs was located at the western Property boundary and was selected to represent the worst case benzene concentration of 2 mg/kg.

The locations of these confirmation soil samples are displayed on Figure 3 with red databoxes.

6.4.2 Use of Modeling to Predict Indoor Air Concentrations of COCs

The following sections describe the steps that were taken to estimate indoor air concentrations of COCs the parking garage of the Property building.

6.4.2.1 Justification for Use of the EPA Excel Spreadsheet SL-SCREEN Model

RGI consulted with Dr. Blayne Hartman and determined that the most effective method of evaluating the vapor intrusion risk posed by volatile COCs that remain in soil outside the Property boundaries was to utilize the EPA Excel Spreadsheet SL-SCREEN model, which is a model historically used by the EPA. The model uses the Fugacity Equation to calculate indoor air concentrations of COCs based on soil concentrations of COCs. This model has been shown to over predict indoor air concentration by 100 to 1,000 times in studies and was therefore considered conservative and appropriate for conducting the evaluation.

Prior to using the model, RGI obtained the diffusion rate for the chemical vapor barrier from EPRO and obtained the established air changes per hour (ACH) for the parking garage from the Roystone construction team. This data along with characteristics of the building, chemical characteristics, chemical concentrations of COCs, and default conservative values used by the EPA were used to calculate high predicted indoor air concentrations of COCS in the parking garage. A copy of the letter provided by EPRO describing the diffusion rate of the chemical vapor barrier is provided in Appendix H.

It is extremely important to emphasis that the SL-SCREEN model was intentionally used in such a manner as to overestimate predicted indoor air concentration of COCs in the parking garage. This was done to ensure that a vapor intrusion risk was not left unidentified due to data entered into the model. RGI is confident that the model calculated indoor air concentrations in the garage that are conservative, (i.e., overestimated) due to the following factors:

1) The model assumes equilibrium partitioning between the soil contamination and soil vapor at the soil interface. Studies have demonstrated that soil gas concentrations calculated by the model overestimate measured actual soil gas concentrations by factors between 100 and 1,000 times. In addition, the model does not account for the rapid rate of bio-attenuation of petroleum related chemicals that occurs. The model also assumes that there are cracks present in the slab, which would increase the rate of vapor intrusion. The newly constructed garage floor slab does not have any cracks.

2) No soil contamination is present beneath the building and remaining soil contamination is situated outside the Property boundaries along the sides of the parking garage walls, which are protected by a chemical vapor barrier designed to prevent vapor intrusion. The model assumes contaminated vapors are migrating up through the slab from beneath the building. Under actual conditions, soil vapor along the sides of the parking garage walls would migrate in the path of least resistance rather than attempt to migrate laterally through a relatively impermeable barrier. Soil vapor would instead migrate in other directions where less resistance is present. The model does not take this into account.

3) The diffusion rate of the chemical vapor barrier provided by EPRO as a result of testing performed with PCE was 1.1 x 10^{-14} m^2/sec (or 1.1 x 10^{-10} cm^2/sec). This value is considered conservative as petroleum-related chemicals are known to attenuate more rapidly than PCE in the subsurface.

4) For all data modeled, the EPRO diffusion rate of 1.1 x 10^{-10} cm^2/sec was applied to a distance of 1 cm, which is the minimum distance the model allows. Actual conditions consist of a 30 mil chemical vapor barrier followed by a 10" (or 25.5 cm) thick concrete wall on the east Property boundary in the location of confirmation sample EPL-8S-11 and the northern Property boundary in the location of sample NPL-12S-10. On the west property boundary, in the location of sample WPL-12S-22, there is approximately 24" of controlled density fill (CDF) followed by the 30 mil chemical vapor barrier and the 10" concrete garage wall, which covers a total distance of approximately 86.5 cm. In addition, at the western Property boundary, the model does not take into account that the contaminated soil is situated approximately 11' below the floor of the parking garage (approximately 22' bgs).

5) Hexane was used to represent the worst case total TPH concentration of 15,700 mg/kg, which consisted of 1,700 mg/kg gasoline-range TPH and 14,000 mg/kg diesel-range TPH. Hexane was specifically selected to exaggerate the predicted indoor air concentration as the vapor pressure for hexane of 151.29 mmHg is significantly higher than the average vapor pressures for gasoline- and diesel-range TPH of 85 mmHg and 0.85 mmHg, respectively listed in the BioVapor model. In addition, the TPH indoor air screening level obtained from CLARC was used to evaluate the data instead of the higher hexane screening level.

6) The model was used to predict indoor air concentrations of COCs in the parking garage. The first location that a vapor intrusion concern would apply to is the future commercial level situated above the parking garage. Additional attenuation of COCs would occur as

contaminated vapors migrated from the parking garage to the commercial level. This is not factored into the evaluation.

7) As discussed in Section 6.2.2, a passive SSD system is present beneath the western half of the building which would allow any vapors beneath the building to migrate up through the vent pipe and discharge above the roof. The predicted indoor air concentrations presented in the following section do not take the SSD system into account.

6.4.2.2 Model Data Entry & Output

RGI consulted with Dr. Blayne Hartman regarding the appropriate use of the SL-SCREEN model. Copies of the Data Entry and Model Output sheets are included in Appendix H and Property-specific data entered into the model and model outputs are highlighted in yellow. All other values utilized in the model were conservative default values used by the EPA.

Note that the first draft of this report only presented Commercial IASLs and has been revised to present MTCA Method B IACULs and Commercial IASLs where appropriate.

RGI utilized the following Property-specific values for all of the SL-SCREEN modeling:

1) **Air Changes/Hour (ACH) value of 4.11** – The ACH value of 4.11 was based on information provided by the Roystone construction team.

2) **Building ventilation rate of 278,384 cm^3/sec**. This value was obtained by taking the EPA default area of the space in the model of 1,000,000 cm^2 x 243.84 cm (representing a default 8' building height) x 4.11 (actual ACH for the parking garage) = 1,002,182,000 cm^3/hr. This value of 1,002,182,000 cm^3/hr was then divided by 3600 (number of seconds in an hour) to provide the value entered into the model of 278,384 cm^3/sec.

3) **Diffusion rate of 1.1 x 10^{-14} – m^2/sec** - This diffusion rate was obtained from EPRO based on testing associated with PCE on the PreTak chemical vapor barrier system. Since petroleum-related contaminants degrade more rapidly in the subsurface than PCE due to aerobic attenuation, this diffusion rate was considered conservative and appropriate. The diffusion rate was converted to 1.1 x 10^{-10} cm^2/sec prior to entering into the model.

4) **Diffusion Path Length of 1 cm –** This value is the minimum value the model allows and was considered appropriate as the model does not take into account the 10" concrete wall, 24" of CDF, and/or actual distance of soil contamination from the building.

The above listed values were entered into the SL-SCREEN model along with the maximum soil concentrations of COCs to provide worst-case predicted indoor air concentrations of COCs in the parking garage listed below:

1) **Total TPH concentration of 15,700 mg/kg** - Confirmation sample NPL-12S-10 at 10' bgs was located at the northern Property boundary and was selected to represent the worst case TPH concentration of 15,700 mg/kg. This TPH concentration consisted of a gasoline-range TPH concentration of 1,700 mg/kg and a diesel-range TPH concentration of 14,000 mg/kg. Hexane was used to represent the total TPH concentration as it guaranteed that the model would over predict the indoor air concentration since hexane is a more volatile chemical and has a vapor pressure of 151.29 mmHg. The average vapor pressures for gasoline- and diesel-range TPH obtained from the BioVapor model were 85 mmHg and 0.85 mmHg, respectively.

The total TPH concentration of 15,700 mg/kg was entered into the model as a 15,700,000 μg/kg hexane and resulted in a predicted indoor air concentration of 68 μg/m^3 in the parking garage. This concentration is below the Commercial IASL for TPH of 390 μg/m^3.

It is important to note that the predicted indoor air concentration for total TPH was the only COC that required use of a Commercial IASL to demonstrate compliance. In addition, the MTCA Method B IACUL for hexane 320 μg/m^3 and if this value was referenced, no Commercial IASLs would have been necessary in the evaluation.

2) **Benzene concentration of 2 mg/kg** - Confirmation sample WPL-17S-22 at 22' bgs was located at the western Property boundary and was selected to represent the worst case benzene concentration of 2 mg/kg. Note that this benzene contaminated soil is situated approximately 11' below the bottom of the building (or 22' bgs) and the significant attenuation that would occur at this depth is not factored into the model.

   A benzene concentration of 2,000 μg/kg was entered into the model and resulted in predicted indoor air benzene concentration of 0.0004 μg/m^3 in the parking garage. This concentration is well below the MTCA Method B IACUL for benzene of 0.32 μg/m^3, which is appropriate for evaluating residential use scenarios.

3) **Toluene soil concentration of 52 mg/kg** - Confirmation sample EPL-8S-11 at 11' bgs was located at the eastern Property boundary and was selected to represent the worst case toluene soil concentration of 52 mg/kg.

   A toluene soil concentration of 52,000 μg/kg was entered into the model and resulted in predicted indoor air toluene concentration of 0.0075 μg/m^3 in the parking garage. This concentration is well below the MTCA Method B IACUL for toluene of 2,300 μg/m^3, which is appropriate for evaluating residential use scenarios.

4) **Ethylbenzene soil concentration of 41 mg/kg** - Confirmation sample EPL-8S-11 at 11' bgs was located at the eastern Property boundary and was selected to represent the worst case ethylbenzene concentration of 41 mg/kg.

   A ethylbenzene soil concentration of 41,000 μg/kg was entered into the model and resulted in predicted indoor air ethylbenzene concentration of 0.0042 μg/m^3 in the parking garage. This concentration is well below the MTCA Method B IACUL for ethylbenzene of 460 μg/m^3, which is appropriate for evaluating residential use scenarios.

5) **Xylenes soil concentration of 110 mg/kg** - Confirmation sample EPL-8S-11 at 11' bgs was located at the eastern Property boundary and was selected to represent the worst case xylenes concentration of 110 mg/kg.

   A xylenes soil concentration of 110,000 μg/kg was entered into the model and resulted in predicted indoor air xylenes concentration of 0.0074 μg/m^3 in the parking garage. This concentration is well below the MTCA Method B IACUL for xlyenes of 389 μg/m^3, which is appropriate for evaluating residential use scenarios.

None of the high predicted indoor air concentrations of COCs exceeded the applicable MTCA Method B IACULs or Commercial IASLs.

TPH was the only COC where the predicted indoor air concentration required the use of a Commercial IASL to demonstrate compliance. RGI is not of the opinion that the TPH concentration predicted by the model represented an actual vapor intrusion threat to the building under a residential scenario. This is due to the fact that the use of hexane to represent TPH grossly exaggerated the vapor intrusion risk and this was in addition to all the other factors described in Section 6.4.2.1. In addition, the lower TPH indoor air screening level was used in the evaluation instead of the hexane screening level.

This evaluation demonstrates that the PreTak chemical vapor barrier provides sufficient protection against vapor intrusion in the Property building.

6.5 VAPOR INTRUSION ASSESSMENT PHASE 2

In September of 2022, the draft version of this report was submitted to Ecology with the vapor intrusion evaluation presented above in Section 6.4. After reviewing the report, Ecology indicated that the use of Commercial IASLs presented in that evaluation would trigger the requirement for an Environmental Covenant (EC) on the Property. Since significant effort and expense went into avoiding an EC during the IA (i.e., excavating contaminated soil behind shoring walls and beneath the redevelopment subgrade), Roystone proceeded with taking the necessary steps to avoid having an EC placed on the Property.

Based on discussions with Ecology, Ecology and Roystone agreed to collect and analyze two soil vapor samples from locations where the highest concentrations of volatile COCs were present in soil outside the Property boundaries. Soil vapor data obtained during Phase 2 of the VIA superseded the high predicted indoor air concentrations of COCs generated by the SL SCREEN model presented in Phase 1 of the VIA.

The scope of work associated with Phase 2 of the VIA was outlined in the *Supplemental Vapor Intrusion Evaluation Scope of Work* dated December 2, 2022, which was reviewed and approved by Ecology.

6.5.1 Utility Locating

Prior to installation of temporary soil vapor probes, RGI located public and privately owned underground utilities. In addition, RGI reviewed construction plans and sewer cards to verify the locations of sanitary sewers. RGI also met with the Roystone construction team and subcontractors to coordinate access to the work areas prior to completing the work.

Prior to drilling, RGI contacted One-Call to locate publicly-owned underground utilities (electric, natural gas, telecommunications, etc.) and marked temporary soil vapor probe locations with white paint prior to contacting the public locator.

On December 1, 2022, RGI retained the services of Applied Professional Services, Inc. (APS) to locate privately owned utilities such as water, electric, and other privately-owned utilities in locations SV-1 and SV-2. No utilities were found to be present in the proposed soil vapor probe locations.

6.5.2 Soil Vapor Probe Installation

On December 7, 2022, RGI retained the services of Standard Probe, Inc. (Standard) to advance two test probes (SV-1 and SV-2) to a depth of 5’ bgs in the locations displayed on Figure 10. Soil vapor probe construction details are displayed in Appendix I.

Temporary soil vapor probe SV-1 was situated adjacent to northern Property boundary where IA confirmation soil sample NPL-12S-10 was located. This soil sample contained gasoline and diesel-range TPH, ethylbenzene, and xylenes at concentrations of 1,700 milligrams/kilogram (mg/kg) 14,000 mg/kg, 9.6 mg/kg, and 13 mg/kg, respectively.

Temporary soil vapor probe SV-2 was situated adjacent to the eastern Property boundary where IA confirmation soil sample EPL-8S-11 was located. This soil sample contained a gasoline-range TPH concentration of 6,400 mg/kg. The detection limit for benzene was also elevated at 0.4 mg/kg in this location. However, it is unknown if benzene was actually present. Based on discussions with the laboratory, the high gasoline-range TPH concentration of 6,400 mg/kg likely skewed the benzene detection limit high.

Each soil vapor probe location was advanced to approximately 5' bgs after which, the drill rod was removed, which exposed the approximately 2 ¼- inch diameter probe. Approximately 24 inches of 10/20 silica sand was placed at the bottom of the probe and was used to fill the approximately 3' bgs to 5' bgs interval. A soil vapor probe filter was placed a few inches up from the bottom of the sand layer and was surrounded by sand. 1/8" Nylaflow tubing (1/8") was attached to each vapor probe filter and extended up through the center of the probe above the soil surface and was later connected to the sample train/Summa canister. Twelve inches of dry granular bentonite was placed above the sand layer between 2' bgs and 3' bgs and hydrated bentonite was placed from 2' bgs up to the surface to complete the surface seal.

After installation was completed, soil vapor probes were given a minimum of 2 hours to equilibrate prior to sampling.

6.5.3 Soil Vapor Sampling

On December 7, 2022, RGI collected soil vapor samples from soil vapor probes SV-1 and SV-2. The Nylaflow tubing present at the surface of each vapor probe was attached to a sample train supplied by Friedman & Bruya, Inc. (FBI). Three-way valves were used throughout the system to direct vapor flow.

A shut-in test was completed at each soil vapor probe location to verify that there were no leaks in the sample train. The shut-in test was conducted by attaching a low-flow peristaltic pump to the sample train and Summa canister and purging the line of the sample train to create a vacuum of approximately 13" Hg in SV-1 and 14" Hg in SV-2. In each location, the vacuum did not change over a 2 minute period indicating that the shut-in test was passed.

Once the shut-in test was passed, a helium leak detection test was performed in each location in conjunction with purging the well. The purpose of the leak detection test was to verify the integrity of the surface seal at each temporary soil vapor probe location. During leak detection testing, approximately 700 mL of soil vapor were purged from each probe at a flow rate less than 200 mL/min. A shroud was then placed over each probe and filled with helium at a concentration of 90% helium in the shroud. Soil vapor was purged through the helium filled shroud and collected in the tedlar bags. The helium meter was then used to measure the helium concentration in the tedlar bags to determine if any leaks are present. No helium was detected in the tedlar bags at locations SV-1 and SV-2 indicating that no leaks were present in the surface seal.

Soil vapor samples were then collected by setting valves on the sample train to direct soil vapor flow through the tubing leading to the pressurized laboratory supplied individually certified 1-Liter Summa canisters. The starting mercury level in both locations was 29.5" Hg and sampling commenced by opening the Summa canister valve. Sampling continued for approximately 6 minutes after which the regulator valve was closed.

Both soil vapor samples were transported to Friedman & Bruya, Inc. (FBI) in Seattle, Washington in accordance with standard chain of custody protocols.

6.5.4 Soil Vapor Analytical Data

Two soil vapor samples (SV-1 and SV-2) were submitted to FBI laboratory for the following analyses:

- Petroleum fractions EC5-8 (aliphatics), EC9-12 (aliphatics), and EC9-10 (aromatics) using Volatile Compounds by Method Massachusetts Air Phase Hydrocarbons (MA-APH);
- Benzene, Toluene, Ethylbenzene, m,p-Xylene, o-Xylene, and Naphthalene using EPA Method TO-15 Select Ion Monitoring (SIM), and
- Carbon Dioxide, Carbon Monoxide, Methane, Nitrogen, Oxygen, and Hydrogen using EPA Method 3C.

Copies of final analytical laboratory reports are included in Appendix J. Soil vapor analytical data and applicable SVSLs are summarized in Table 3 and soil vapor analytical data is displayed on Figure 10.

Petroleum hydrocarbon fraction EC9-12 was detected at a concentration of 150 µg/m^3 in soil vapor probe SV-2. This was the only detection of a petroleum hydrocarbon fraction in SV-1 and SV-2.

Under current vapor intrusion regulations, total TPH is evaluated as the sum of the petroleum fractions EC5-8 (aliphatics), EC9-12 (aliphatics), and EC9-10 (aromatics). For the purpose of representing the worst case scenario, RGI calculated total TPH as the sum of detected petroleum hydrocarbon fractions and the laboratory detection limits for petroleum hydrocarbon fractions that were not detected.

Using this methodology, the total TPH concentrations for SV-1 and SV-2 were 640 µg/m^3 and 720 µg/m^3. Both of these concentrations were below the Ecology SVSL for total TPH of 1,500 µg/m^3, which is appropriate for evaluating residential use scenarios.

Petroleum contaminated soil that remains in place outside the Property boundaries does not represent a vapor intrusion concern for the Property building.

Carbon dioxide, carbon monoxide, methane, nitrogen, oxygen, and hydrogen were also analyzed in samples obtained from SV-1 and SV-2 and the analytical results are summarized in Table 3. These gases were analyzed to assess attenuation in the event high concentrations of COCs were detected in soil vapor. Since all soil vapor concentrations of COCs were below the most stringent Ecology SVSLs, this evaluation was not necessary.

6.6 VAPOR INTRUSION EVALUATION DISCUSSION

The results of Phase 1 and 2 of the VIA further demonstrate that IA conducted in 2020 was successful at remediating soil and groundwater containing concentrations of COCs that were present on the Property prior to the IA.

There are no COCs present in groundwater that would pose a vapor intrusion concern for the Property building.

Volatile COCs are present in soil outside the Property boundaries. However, the modeling presented in Phase 1 of the VIA (Section 6.4) demonstrated that this petroleum contaminated soil does not pose a vapor intrusion concern for the Property building due to the vapor intrusion mitigations measures implemented at the Property (i.e., PreTak chemical vapor barrier and passive SSD system). This evaluation also indicated that any concentrations of COCs present in soil vapor would attenuate by several orders of magnitude prior to entering the Property building due to the protection provided by the chemical vapor barrier.

The findings of Phase 1 of the VIA were confirmed by soil vapor data obtained during Phase 2 of the VIA. Soil vapor data obtained from soil vapor probes SV-1 and SV-2 did not contain concentrations of COCs above the most stringent SVSLs established by Ecology, which are considered protective of the MTCA Method B IACULs. These SVSLs are also appropriate for evaluating residential use scenarios and use of these SVSLs does not trigger the requirement for an EC on the Property.

Soil vapor data in conjunction with the added protection provided to the Property building by the chemical vapor barrier and passive SSD system, clearly demonstrate that there is no vapor intrusion risk for the Property building and no further vapor intrusion investigation is warranted at the Property.

7.0 Conclusions & Recommendations

The findings of the GWI/VIA support the following conclusions:

- The IA conducted in 2020 was successful at remediating soil and groundwater containing concentrations of COCs to levels below applicable MTCA soil and groundwater cleanup levels at all locations within the Property boundaries.
- Post remediation groundwater sampling consisted of collecting and analyzing 25 groundwater samples for COCs from July 14, 2021 through August 18, 2022. The groundwater flow direction was generally to the west during all five groundwater sampling events. Out of the 25 groundwater samples analyzed, the MTCA groundwater cleanup level was only exceeded on one occasion where a diesel-range TPH concentration of 510 µg/L was detected in well MWD in October of 2021. Due to the likelihood that the reported diesel-range TPH concentration was biased high and low toxicity of the polar metabolites present in the sample, RGI does not consider this groundwater data a concern for the Property. There also are no volatile COCs present in groundwater on the Property that would pose a vapor intrusion concern for the Property building. No further groundwater investigation or sampling is warranted.
- The result of Phase 1 and 2 of the VIA demonstrate that there is no vapor intrusion risk for the Property building. Volatile contaminants are present in soil outside the Property boundaries. However, the modeling presented in Phase 1 of the VIA (Section 6.4) demonstrated that this petroleum contaminated soil does not pose a vapor intrusion risk for the Property building due to the vapor intrusion mitigations measures implemented at the Property (i.e., PreTak chemical vapor barrier and passive SSD system). The evaluation also indicated that any concentrations of COCs present in soil vapor would attenuate by several orders of magnitude prior to entering indoor air in the building and further attenuation would occur after that as air in the parking garage migrated to the occupied commercial space above.

  Soil vapor data obtained from soil vapor probes SV-1 and SV-2 during Phase 2 of the VIA (Section 6.5) confirmed the findings presented in Phase I of the VIA. No COCs were detected in soil vapor at concentrations above the most stringent SVSLs established by Ecology, which are considered protective of the MTCA Method B IACULs, which are appropriate for evaluating residential use scenarios. This data in conjunction with the added protection provided to the Property building by the chemical vapor and SSD system, clearly demonstrates that there is no vapor intrusion risk for the Property building. In addition, the soil vapor data obtained during Phase 2 of the VIA supersedes the predicted indoor air concentrations determined by modeling presented in Phase 1, which were known to be higher than actual values based on the data entered into the model. Soil vapor concentrations of COCs were also evaluated using Ecology's most stringent SVSLs intended for evaluating vapor intrusion in a residential use scenario. Therefore, an Environmental Covenant is not required in connection with regulatory closure of the Property. No further vapor intrusion investigation is warranted at the Property.

- All electronic information management (EIM) soil, groundwater and soil vapor data has been submitted to Ecology in accordance with Ecology's submittal requirements.
- Roystone has fulfilled their obligation under the Agreed Order No 16537 to cleanup soil and groundwater containing contaminants at concentration above applicable MTCA soil and groundwater cleanup level at all locations within the Property boundaries and there is not a vapor intrusion risk for the Property building. No further environmental remediation or investigation is warranted for the Property. However, it may be necessary to cooperate with Chevron and Ecology as they work to cleanup the portions of the Site situated outside the Property boundaries.

In addition, RGI makes the following recommendation:

- Submit this report to Ecology and request that Ecology prepare a letter stating that Roystone has fulfilled their obligation to remediate soil and groundwater on the Roystone Redevelopment property under AO 16537 and state that Ecology considers the work completed during and subsequent to the IA is sufficient. Therefore, no further investigation or remediation work is required by Roystone under the AO.

8.0 Limitations

This report is the property of RGI, Roystone on Queen Anne, LLC and their authorized representatives and was prepared in a manner consistent with the level of skill and care ordinarily exercised by members of the profession currently practicing in the same locality and under similar conditions. This report is intended for specific application to the Property located at 631 Queen Anne Avenue North in Seattle, Washington. No other warranty, expressed or implied, is made.

The analyses and recommendations presented in this report are based upon data obtained from our review of available information at the time of preparing this report, our soil excavation on the Property, or other noted data sources. Conditional changes may occur through time by natural or human-made process on this or adjacent properties. Additional changes may occur in legislative standards, which may or may not be applicable to this report. These changes, beyond RGI's control, may render this report invalid, partially or wholly. If variations appear evident, RGI should be requested to reevaluate the recommendations in this report.

If you have any questions, or need additional information, please contact us at (425) 415-0551.

Sincerely,

THE RILEY GROUP, INC.

State of Washington Licensed Geologist
1264
Paul D. Riley

Jerry Sawetz
Senior Environmental Scientist

Paul D. Riley, LG, LHG
Principal Geologist

Report Distribution	Mr. Pui Leung, Roystone on Queen Anne, LLC (pdf) Ms. Jing Song, Washington Department of Ecology (pdf)

USGS, 2020, Seattle North, Washington
USGS, 2020, Seattle South, Washington
7.5-Minute Quadrangle

Approximate Scale: 1"=1000'
0 500 1000 2000
N

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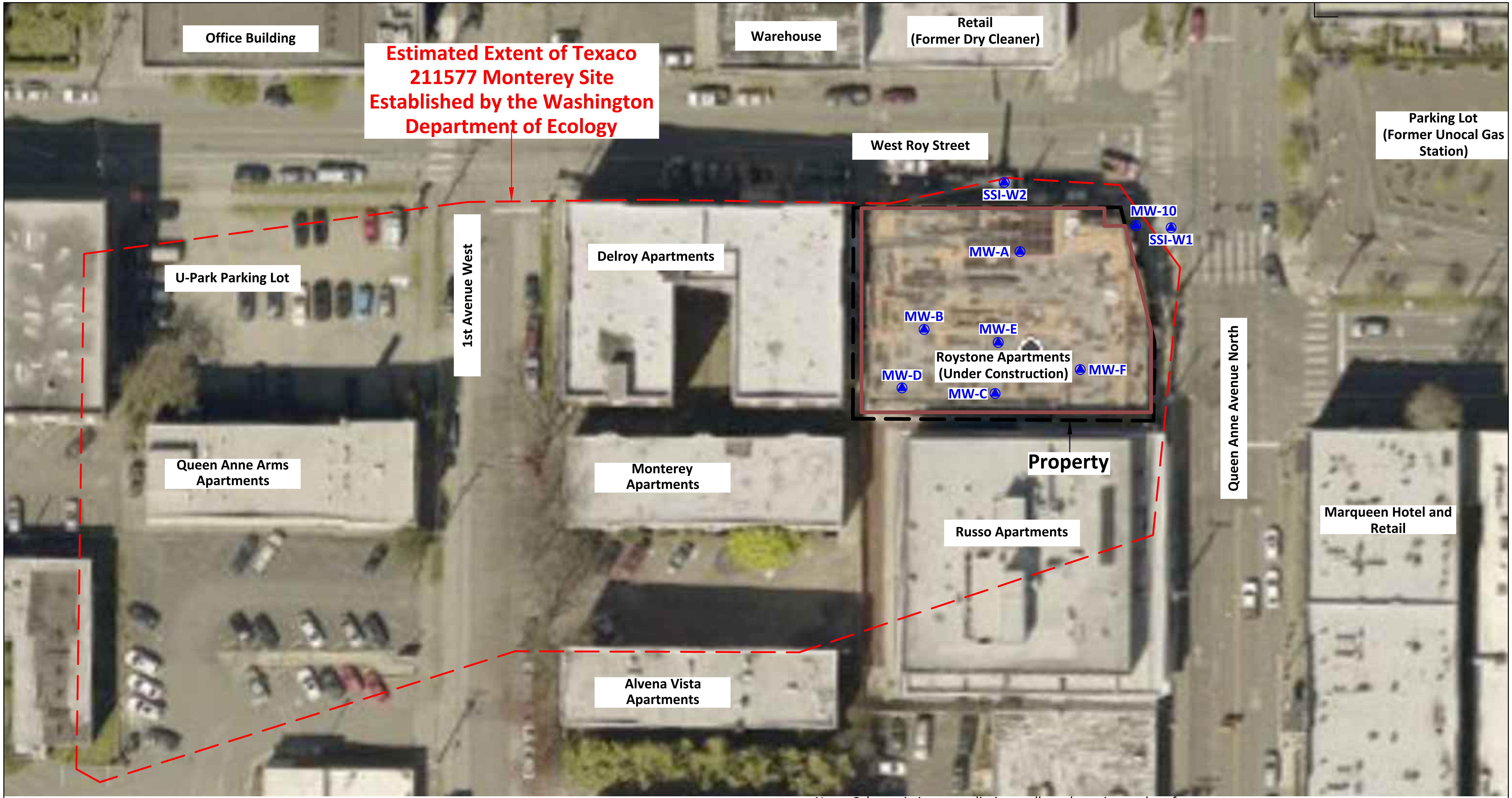
Roystone Redevelopment		Figure 1
RGI Project Number 2017-015K	Property Vicinity Map with Site Location	Date Drawn: 03/2023
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		



● = Existing groundwater monitoring well. Wells MWA through MWF are situated on-Property in the parking garage of Roystone Apartments and wells MW10, SSI-W1 and SSI-W2 are situated off-Property at the grade of the sidewalk.

━ = Boundary of Roystone Apartments parking garage, which consists of 10' thick poured concrete walls. On the southern portion of the east Property boundary, the southern Property boundary, and the western Property boundary, contaminated soil was removed from the location between the parking garage wall and the Property boundary and backfilled with controlled density fill (CDF) during the Interim Action in 2020.

- - - = (in red) Site boundary

▬ ▬ = Property boundary

Note: Other existing remediation wells and previous subsurface investigation locations on- and off-Property are not shown here. Off-Property contamination associated with the Site is being managed by Others.

Approximate Scale: 1"=40'
0 20 40 80
N

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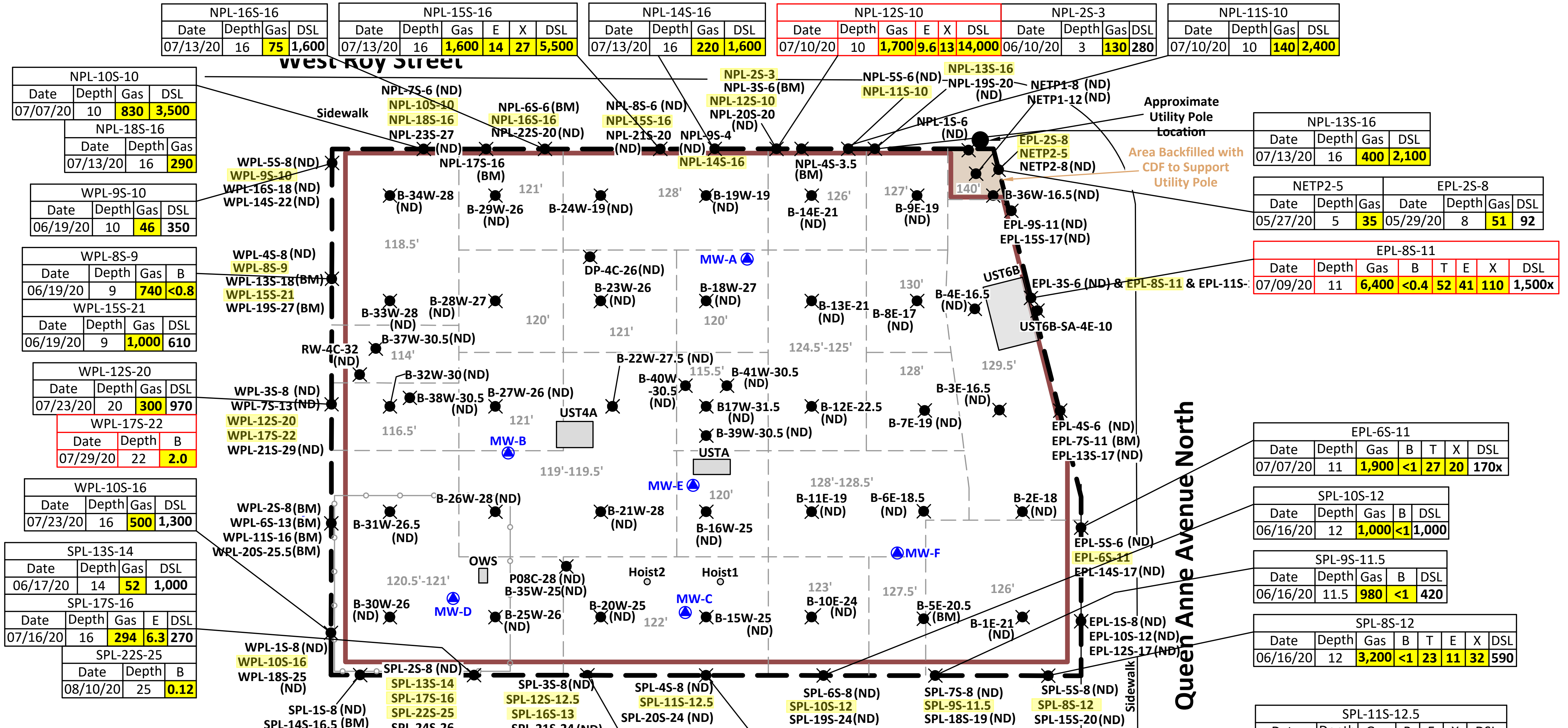
Roystone Redevelopment		Figure 2
RGI Project Number 2017-015K	Property Representation with Site Location	Date Drawn: 03/2023
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		



NPL-16S-16			
Date	Depth	Gas	DSL
07/13/20	16	**75**	**1,600**

NPL-15S-16					
Date	Depth	Gas	E	X	DSL
07/13/20	16	**1,600**	**14**	**27**	**5,500**

NPL-14S-16			
Date	Depth	Gas	DSL
07/13/20	16	**220**	**1,600**

NPL-12S-10					
Date	Depth	Gas	E	X	DSL
07/10/20	10	**1,700**	**9.6**	**13**	**14,000**

NPL-2S-3			
Date	Depth	Gas	DSL
06/10/20	3	**130**	**280**

NPL-11S-10			
Date	Depth	Gas	DSL
07/10/20	10	**140**	**2,400**

NPL-10S-10			
Date	Depth	Gas	DSL
07/07/20	10	**830**	**3,500**

NPL-18S-16		
Date	Depth	Gas
07/13/20	16	**290**

WPL-9S-10			
Date	Depth	Gas	DSL
06/19/20	10	**46**	**350**

WPL-8S-9			
Date	Depth	Gas	B
06/19/20	9	**740**	**<0.8**

WPL-15S-21			
Date	Depth	Gas	DSL
06/19/20	9	**1,000**	**610**

WPL-12S-20			
Date	Depth	Gas	DSL
07/23/20	20	**300**	**970**

WPL-17S-22		
Date	Depth	B
07/29/20	22	**2.0**

WPL-10S-16			
Date	Depth	Gas	DSL
07/23/20	16	**500**	**1,300**

SPL-13S-14			
Date	Depth	Gas	DSL
06/17/20	14	**52**	**1,000**

SPL-17S-16				
Date	Depth	Gas	E	DSL
07/16/20	16	**294**	**6.3**	**270**

SPL-22S-25		
Date	Depth	B
08/10/20	25	**0.12**

NPL-13S-16			
Date	Depth	Gas	DSL
07/13/20	16	**400**	**2,100**

NETP2-5		
Date	Depth	Gas
05/27/20	5	**35**

EPL-2S-8			
Date	Depth	Gas	DSL
05/29/20	8	**51**	**92**

EPL-8S-11							
Date	Depth	Gas	B	T	E	X	DSL
07/09/20	11	**6,400**	**<0.4**	**52**	**41**	**110**	**1,500x**

EPL-6S-11						
Date	Depth	Gas	B	T	X	DSL
07/07/20	11	**1,900**	**<1**	**27**	**20**	**170x**

SPL-10S-12				
Date	Depth	Gas	B	DSL
06/16/20	12	**1,000**	**<1**	**1,000**

SPL-9S-11.5				
Date	Depth	Gas	B	DSL
06/16/20	11.5	**980**	**<1**	**420**

SPL-8S-12							
Date	Depth	Gas	B	T	E	X	DSL
06/16/20	12	**3,200**	**<1**	**23**	**11**	**32**	**590**

SPL-11S-12.5						
Date	Depth	Gas	B	E	X	DSL
06/16/20	12.5	**1,000**	**<1**	**6.6**	**14**	**1,400**

SPL-12S-12.5			
Date	Depth	Gas	DSL
06/16/20	12.5	**820**	**1,500**

SPL-16S-13		
Date	Depth	Gas
07/09/20	13	**1,000**

▦ = Soil Analytical Data in mg/kg;

Depth = Feet below ground surface
Gas/DSL/Oil = Gasoline/diesel/oil total petroleum hydrocarbons (TPH)
BTEX = Benzene, toluene, ethylbenzene, xylenes
ND = Not detected, BM = Below MTCA Cleanup levels, D = Detected
Bold concentration indicates concentration above laboratory detection limit, but below applicable MTCA soil cleanup levels
Yellow highlighted concentration indicates petroleum related contaminants present in soil at concentrations exceeding MTCA soil cleanup levels
(in red) Databox with red boundary indicates soil data was used to conduct first phase of vapor intrusion assessment. See Section 6.4 of the Draft GWI/VIA Report for discussion.

▲ = Existing completed groundwater monitoring well located on the ground floor of the parking garage.

120.5'-121' = (in gray) Approximate bottom elevation of remedial excavation at indicated location

✕ = Final confirmation soil sample location indicating location where soil remains in place. Highlighted sample ID indicates a location where soil containing concentrations of contaminants above applicable MTCA soil cleanup levels remains in place at the property boundary.

— = Boundary of Roystone Apartments parking garage, which consists of 10' thick poured concrete walls. On the southern portion of the east Property boundary, the southern Property boundary, and the western Property boundary, contaminated soil was removed from the location between the parking garage wall and the Property boundary and backfilled with controlled density fill (CDF) during the Interim Action in 2020.

– – = Property boundary

Note: Prior to 2020 IA, approximate surface elevation ranged from 146.5' on the west side of the Property to 148.5' on the east side.

USTA: 317-Gallon Suspected Waste Oil UST (Decommissioned & Removed)
UST4A: 1,066-Gallon Diesel #2 UST (No Release/ Decommissioned & Removed)
UST6B: 3,455-Gallon Suspected Gasoline UST Filled with CDF (Decommissioned & Removed)
Hoist 1 & 2: No Release/Decommissioned & Removed
OWS: Oil-Water Separator (No Release/Decommisioned & Removed)

Approximate Scale: 1"=20'
0 10 20 40
N

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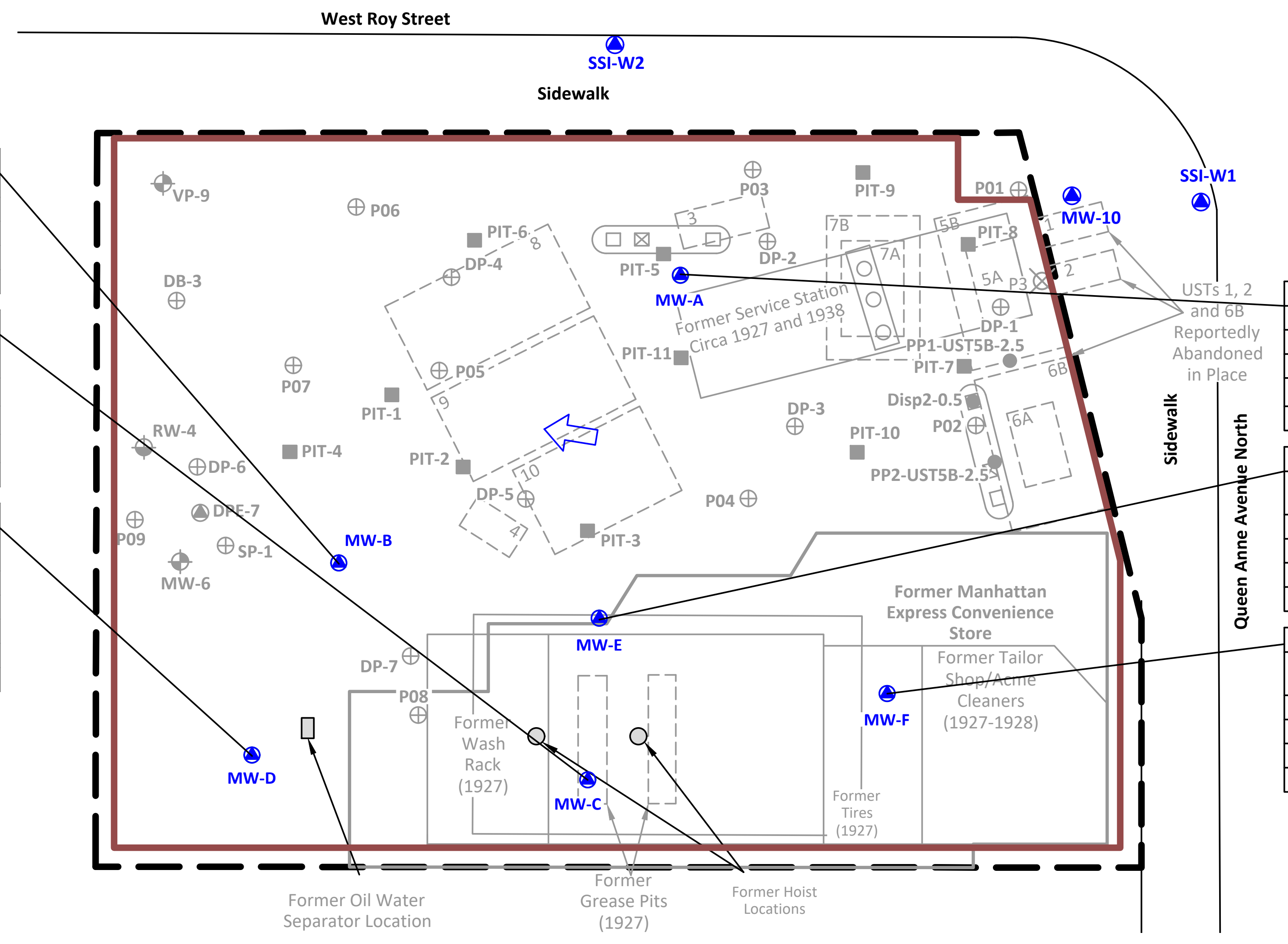
Roystone Redevelopment		Figure 3
RGI Project Number 2017-015K	Historical Soil Analytical Data Used for Phase 1 of VIA	Date Drawn: 03/2023
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		

\\RGI4\DATA\PROJECTS\2017\2017-015K\2017-015K INTERIM ACTION TASKS 1 - 13\TASK 6 GWI VIA\FIGURES\POST IA GWI-VIA REPORT (SECOND ROUND FEB 2023)\2017-015K - TASK 6 (FIGURE 3).DWG <Fig 3 - CON Soil> Plotted: 3/1/2023 3:24 PM



MW-B									
Date	Gas	B	T	E	X	DSL	Oil	DSL*	OIL*
05/23/22	ND	ND	ND	ND	ND	**300x**	ND	----	----
02/23/22	ND	ND	ND	ND	ND	**310x**	ND	----	----
10/15/21	**110**	ND	**1.2**	ND	ND	**440x**	ND	ND	ND
07/14/21	ND	ND	ND	ND	ND	**250x**	ND	----	----

MW-C											
Date	Gas	BTEX	DSL	Oil	DSL*	OIL*	Naph.	cPAHs	VOCs	Total Lead	Pb
05/23/22	ND	ND	**90x**	ND	----	----	----	----	----	----	----
02/23/22	ND	ND	**130x**	ND	----	----	----	----	----	----	----
10/15/21	ND	ND	**110x**	ND	ND	ND	----	----	----	----	----
07/14/21	ND	ND	**220x**	ND	----	----	ND	ND	ND	ND	ND

MW-D														
Date	Gas	B	T	E	X	DSL	Oil	DSL*	OIL*	Naph.	cPAHs	VOCs	Total Lead	Pb
08/18/22	ND	ND	ND	ND	ND	**270x**	ND	----	----	----	----	----	----	----
05/23/22	ND	ND	ND	ND	ND	**220x**	ND	----	----	----	----	----	----	----
02/23/22	ND	ND	ND	ND	ND	**210x**	ND	----	----	----	----	----	----	----
10/15/21	290	ND	**8.1**	ND	**22**	**510x**	ND	ND	ND	----	----	----	----	----
07/14/21	ND	ND	ND	ND	ND	**220x**	ND	----	----	ND	ND	ND	ND	ND

MW-A				
Date	Gas	BTEX	DSL	Oil
05/23/22	ND	ND	**98x**	ND
02/23/22	ND	ND	**97x**	ND
10/15/21	ND	ND	ND	ND
07/14/21	ND	ND	**98x**	ND

MW-E											
Date	Gas	BTEX	DSL	Oil	DSL*	OIL*	Naph.	cPAHs	VOCs	Total Lead	Pb
05/23/22	ND	ND	**290x**	ND	----	----	----	----	----	----	----
02/23/22	ND	ND	**380x**	ND	----	----	----	----	----	----	----
10/15/21	ND	ND	**190x**	ND	ND	ND	----	----	----	----	----
07/14/21	ND	ND	**150x**	ND	----	----	ND	ND	ND	ND	ND

MW-F								
Date	Gas	BTEX	DSL	Oil	DSL*	OIL*	Naph.	VOCs
05/23/22	ND	ND	**130x**	ND	----	----	----	----
02/23/22	ND	ND	**160x**	ND	----	----	----	----
10/15/21	ND	ND	**110x**	ND	ND	ND	----	----
07/14/21	ND	ND	**140x**	ND	----	----	ND	ND

⊠ P4 = RGI test probe location, P1 - P7 drilled May 2017 and SSI-P1 - SSI-P5 drilled December 2017
⊕ W-14 = Former Monitoring well by others
● DPE-5 = Former Extraction well by others
⊕ RW-4 = Former Recovery well by others
⊕ DB,SP,DP,P09 = Soil boring by others
■ Pit-1 = 1993 UST excavation sample

▲ = Existing groundwater monitoring well. Wells MWA through MWF are situated on-Property in the parking garage of Roystone Apartments and wells MW10, SSI-W1 and SSI-W2 are situated off-Property at the grade of the sidewalk.
⇦ = Groundwater flow direction
8 = UST identification number reported in previous reports.
— = Boundary of Roystone Apartments parking garage, which consists of 10' thick poured concrete walls. On the southern portion of the east Property boundary, the southern Property boundary, and the western Property boundary, contaminated soil was removed from the location between the parking garage wall and the Property boundary and backfilled with controlled density fill (CDF) during the Interim Action in 2020.
– – = Property boundary

▦ = Groundwater Analytical Data in micrograms per liter (ug/L);
Gas/DSL/Oil = Gasoline/diesel/oil total petroleum hydrocarbons. An asterisk (*) indicates the sample was analyzed using silica gel cleanup.
BTEX = Benzene, toluene, ethylbenzene, xylenes
Naph. = Napthalenes
cPAHs = Carcinogenic polycyclic aromatic hydrocarbons
VOCs = Volatile organic compounds
Pb = Dissolved lead
x = The sample chromatographic pattern does not resemble the fuel standard used for quantitation.
ND = Not detected
---- = Not sampled or not applicable
Bold concentration indicates concentration above laboratory detection limit, but below applicable MTCA groundwater cleanup level
Bold and yellow highlight (if any) indicates concentrations above MTCA Groundwater cleanup levels.

Note: This figure includes the most recent groundwater results, not all historical data is shown here. See Table 2 for a summary of all pre-Interim Action groundwater data pertaining to the Property.

Approximate Scale: 1"=20'
0 10 20 40
N

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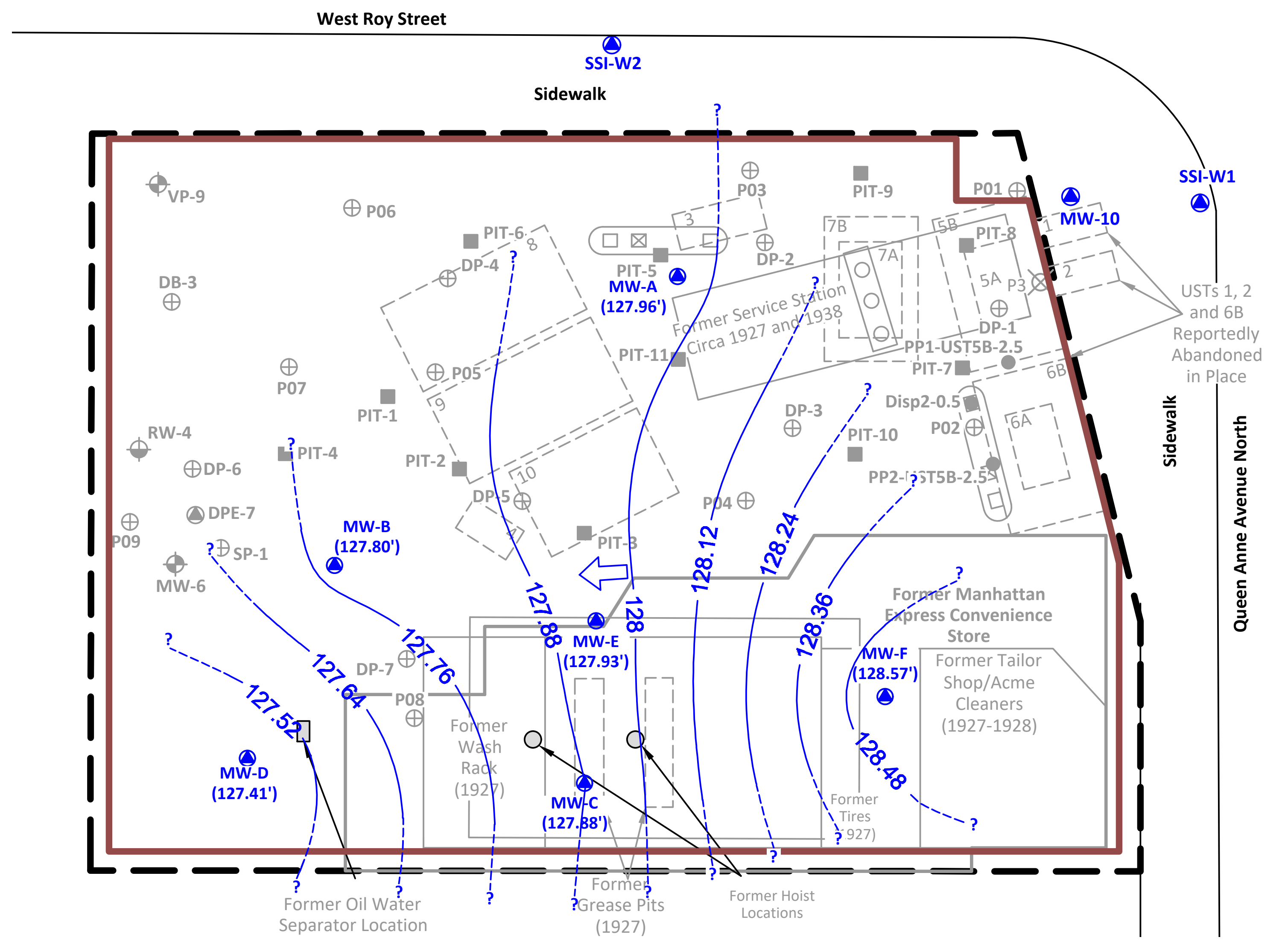
Roystone Redevelopment
Figure 4
RGI Project Number
2017-015K
Post Remediation Groundwater Analytical Data
Date Drawn:
03/2023
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109



—128.48— = Groundwater contours generated using Surfer Software (based on Kriging method). Contours based on July 14, 2021 water level measurements.

(127.93') = Groundwater elevation (in feet)

▲ = Existing groundwater monitoring well. Wells MWA through MWF are situated on-Property in the parking garage of Roystone Apartments and wells MW10, SSI-W1 and SSI-W2 are situated off-Property at the grade of the sidewalk.

⇦ = Groundwater flow direction

8 = UST identification number reported in previous reports.

— = Boundary of Roystone Apartments parking garage, which consists of 10' thick poured concrete walls. On the southern portion of the east Property boundary, the southern Property boundary, and the western Property boundary, contaminated soil was removed from the location between the parking garage wall and the Property boundary and backfilled with controlled density fill (CDF) during the Interim Action in 2020.

- - - = Property boundary

Note: This figure includes the most recent groundwater results, not all historical data is shown here. See Table 2 for a summary of all pre-Interim Action groundwater data pertaining to the Property.

⊠ P4	= RGI test probe location, P1 - P7 drilled May 2017 and SSI-P1 - SSI-P5 drilled December 2017
⊕ MW-14	= Former Monitoring well by others
● DPE-5	= Former Extraction well by others
⊕ RW-4	= Former Recovery well by others
⊕ DB,SP,DP,P09	= Soil boring by others
■ Pit-1	= 1993 UST excavation sample

Approximate Scale: 1"=20'
0 10 20 40
N

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Bothell, Washington 98011
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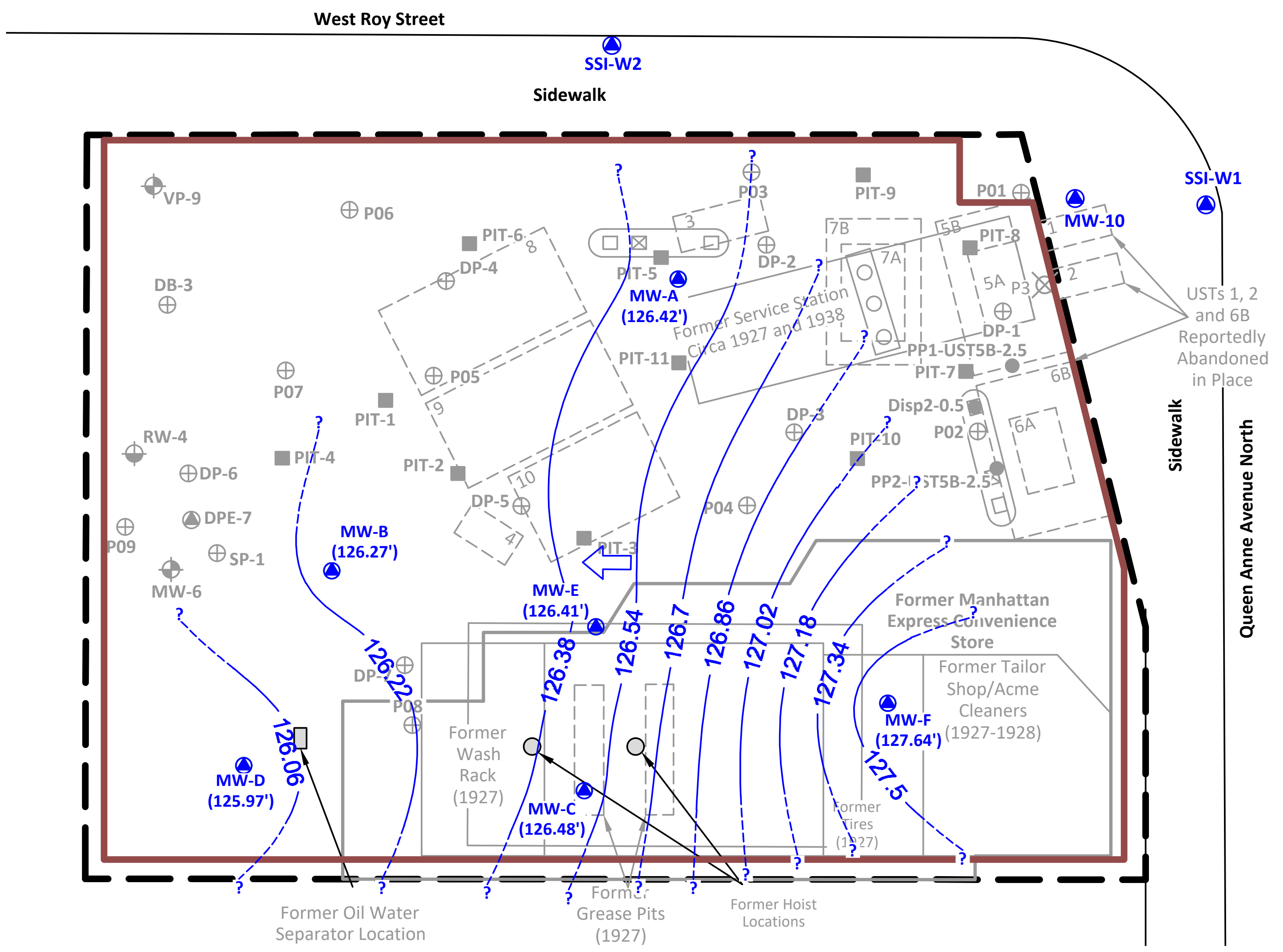
Fax: 425.415.0311

Roystone Redevelopment		Figure 5
RGI Project Number 2017-015K	2021 Q3 Groundwater Elevation Contours	Date Drawn: 03/2023

Address: 631 Queen Anne Avenue North, Seattle, Washington 98109



—— 126.38 —— = Groundwater contours generated using Surfer Software (based on Kriging method). Contours based on October 15, 2021 water level measurements.

(126.48') = Groundwater elevation (in feet)

● = Existing groundwater monitoring well. Wells MWA through MWF are situated on-Property in the parking garage of Roystone Apartments and wells MW10, SSI-W1 and SSI-W2 are situated off-Property at the grade of the sidewalk.

⇦ = Groundwater flow direction

[8] = UST identification number reported in previous reports.

—— = Boundary of Roystone Apartments parking garage, which consists of 10' thick poured concrete walls. On the southern portion of the east Property boundary, the southern Property boundary, and the western Property boundary, contaminated soil was removed from the location between the parking garage wall and the Property boundary and backfilled with controlled density fill (CDF) during the Interim Action in 2020.

— — — = Property boundary

☒ P4 = RGI test probe location, P1 - P7 drilled May 2017 and SSI-P1 - SSI-P5 drilled December 2017

⊕ MW-14 = Former Monitoring well by others

● DPE-5 = Former Extraction well by others

⊕ RW-4 = Former Recovery well by others

⊕ DB,SP,DP,P09 = Soil boring by others

■ Pit-1 = 1993 UST excavation sample

Note: This figure includes the most recent groundwater results, not all historical data is shown here. See Table 2 for a summary of all pre-Interim Action groundwater data pertaining to the Property.

Approximate Scale: 1"=20'

0 10 20 40

N

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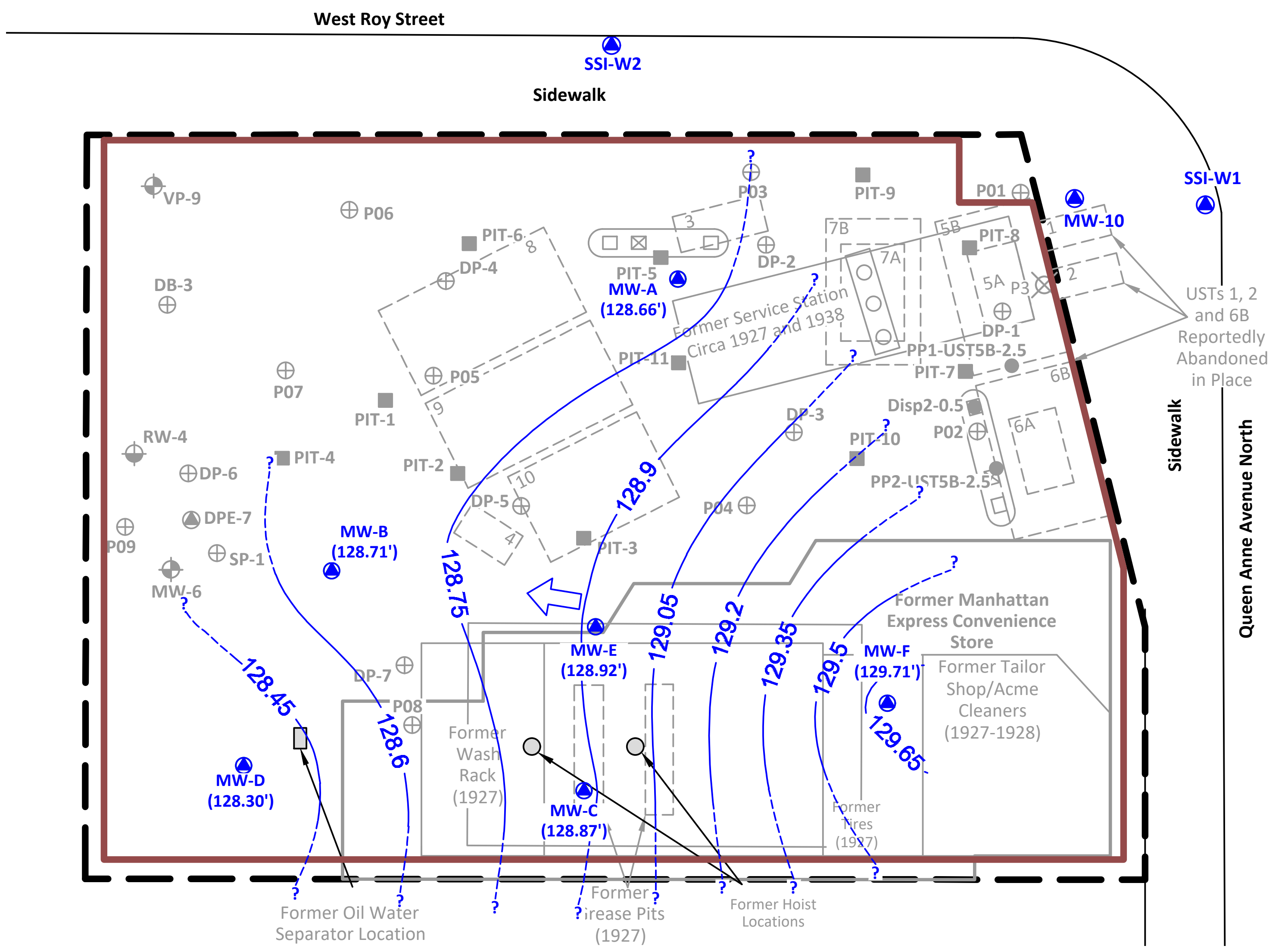
Roystone Redevelopment		Figure 6
RGI Project Number 2017-015K	2021 Q4 Groundwater Elevation Contours	Date Drawn: 03/2023
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		



—129.65— = Groundwater contours generated using Surfer Software (based on Kriging method). Contours based on February 23, 2022 water level measurements.

(128.87') = Groundwater elevation (in feet)

▲ = Existing groundwater monitoring well. Wells MWA through MWF are situated on-Property in the parking garage of Roystone Apartments and wells MW10, SSI-W1 and SSI-W2 are situated off-Property at the grade of the sidewalk.

⇦ = Groundwater flow direction

8 = UST identification number reported in previous reports.

▬ = Boundary of Roystone Apartments parking garage, which consists of 10' thick poured concrete walls. On the southern portion of the east Property boundary, the southern Property boundary, and the western Property boundary, contaminated soil was removed from the location between the parking garage wall and the Property boundary and backfilled with controlled density fill (CDF) during the Interim Action in 2020.

— — = Property boundary

⊠ P4	= RGI test probe location, P1 - P7 drilled May 2017 and SSI-P1 - SSI-P5 drilled December 2017
⊕ MW-14	= Former Monitoring well by others
▲ DPE-5	= Former Extraction well by others
⊕ RW-4	= Former Recovery well by others
⊕ DB,SP,DP,P09	= Soil boring by others
■ Pit-1	= 1993 UST excavation sample

Note: This figure includes the most recent groundwater results, not all historical data is shown here. See Table 2 for a summary of all pre-Interim Action groundwater data pertaining to the Property.

Approximate Scale: 1"=20'
0 10 20 40
N

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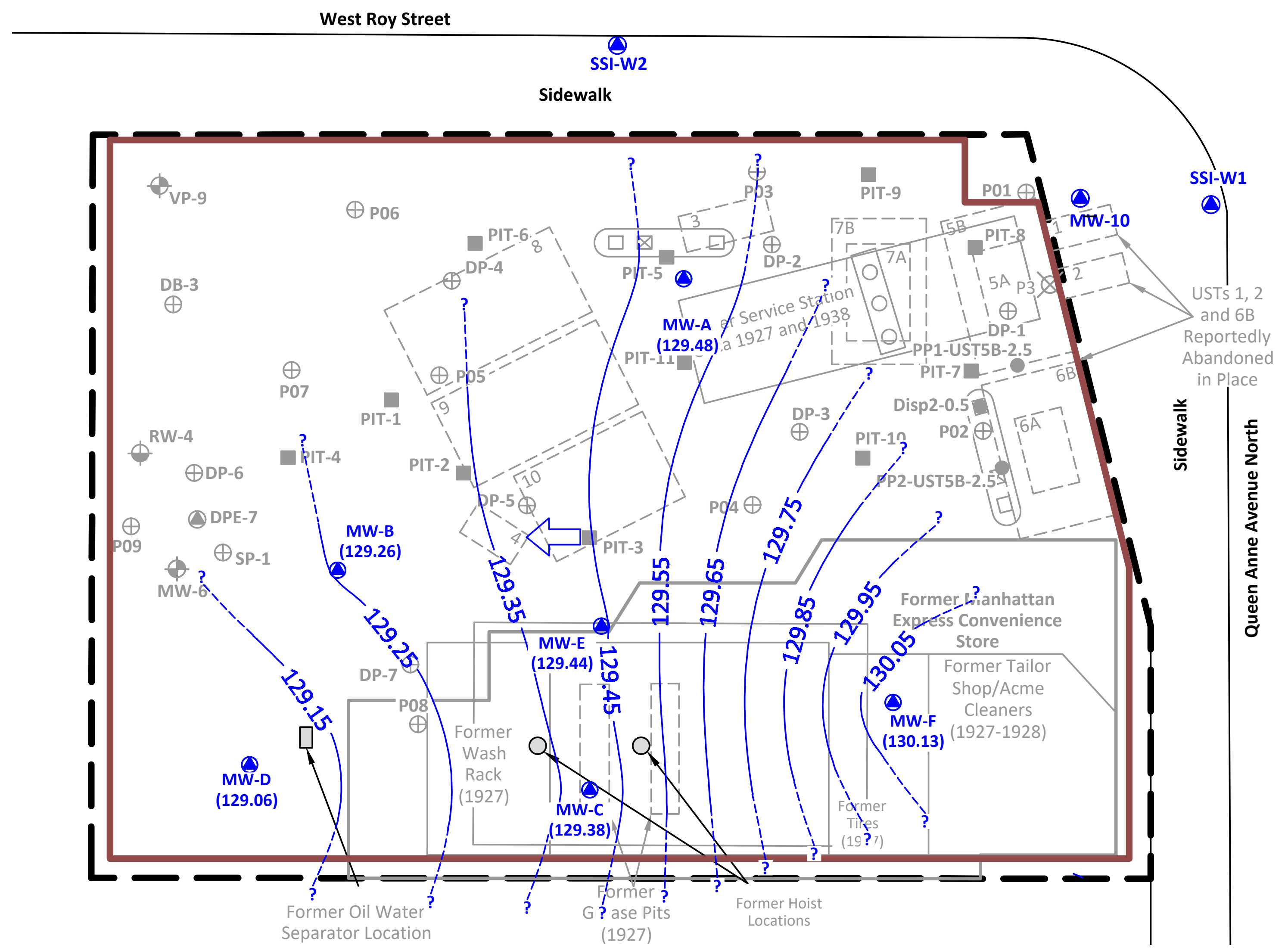
Roystone Redevelopment		Figure 7
RGI Project Number 2017-015K	2022 Q1 Groundwater Elevation Contours	Date Drawn: 03/2023
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		



—129.85— = Groundwater contours generated using Surfer Software (based on Kriging method). Contours based on May 23, 2022 water level measurements.

(129.38') = Groundwater elevation (in feet)

▲ = Existing groundwater monitoring well. Wells MWA through MWF are situated on-Property in the parking garage of Roystone Apartments and wells MW10, SSI-W1 and SSI-W2 are situated off-Property at the grade of the sidewalk.

⇦ = Groundwater flow direction

8 = UST identification number reported in previous reports.

— = Boundary of Roystone Apartments parking garage, which consists of 10' thick poured concrete walls. On the southern portion of the east Property boundary, the southern Property boundary, and the western Property boundary, contaminated soil was removed from the location between the parking garage wall and the Property boundary and backfilled with controlled density fill (CDF) during the Interim Action in 2020.

– – – = Property boundary

Note: This figure includes the most recent groundwater results, not all historical data is shown here. See Table 2 for a summary of all pre-Interim Action groundwater data pertaining to the Property.

P4 = RGI test probe location, P1 - P7 drilled May 2017 and SSI-P1 - SSI-P5 drilled December 2017
MW-14 = Former Monitoring well by others
DPE-5 = Former Extraction well by others
RW-4 = Former Recovery well by others
DB,SP,DP,P09 = Soil boring by others
Pit-1 = 1993 UST excavation sample

Approximate Scale: 1"=20'
0 10 20 40
N

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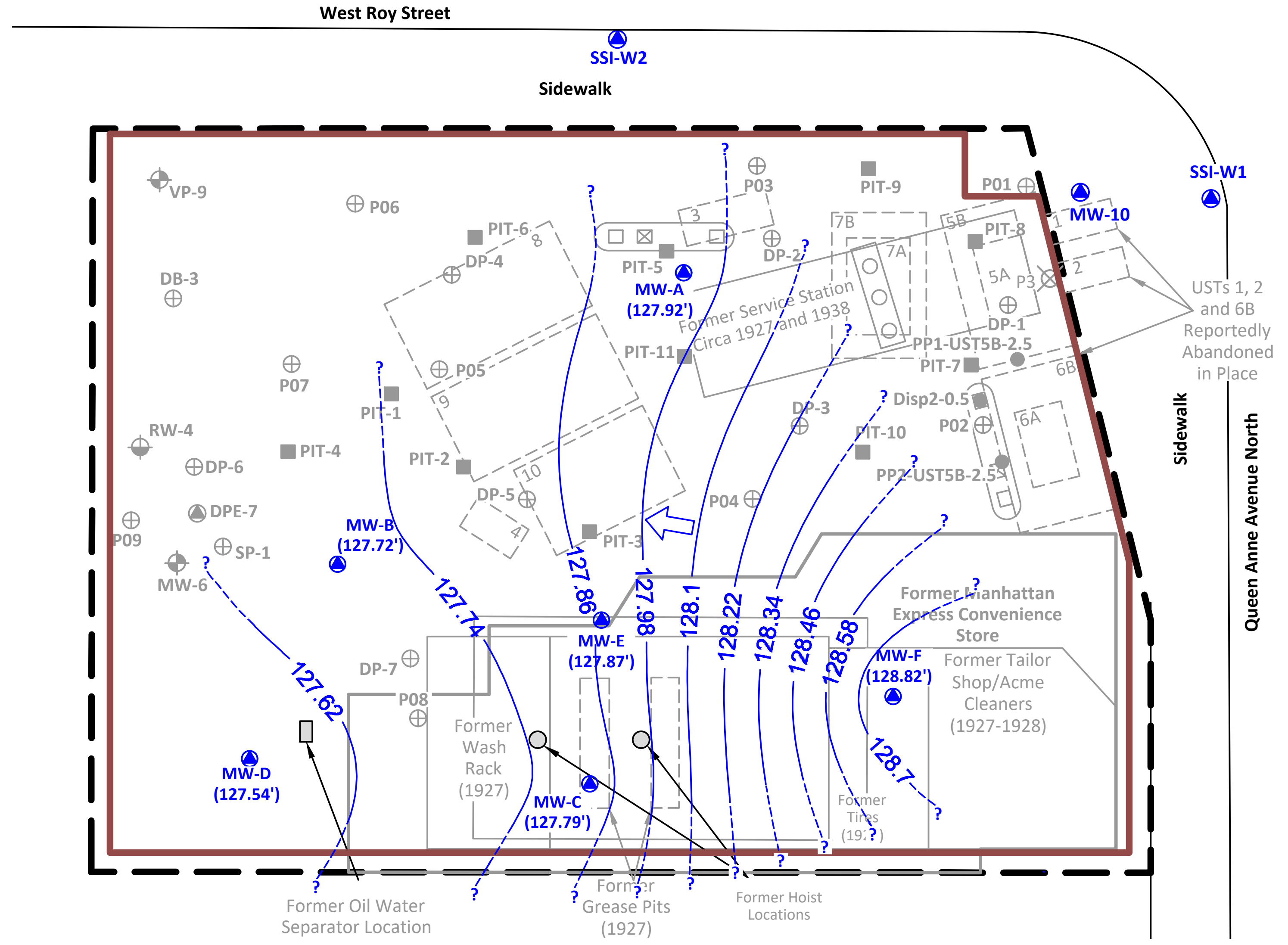
Roystone Redevelopment		Figure 8
RGI Project Number 2017-015K	2022 Q2 Groundwater Elevation Contours	Date Drawn: 03/2023
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		



— 128.58 — = Groundwater contours generated using Surfer Software (based on Kriging method). Contours based on August 18, 2022 water level measurements.

(127.72') = Groundwater elevation (in feet)

● = Existing groundwater monitoring well. Wells MWA through MWF are situated on-Property in the parking garage of Roystone Apartments and wells MW10, SSI-W1 and SSI-W2 are situated off-Property at the grade of the sidewalk.

⇦ = Groundwater flow direction

8 = UST identification number reported in previous reports.

━━ = Boundary of Roystone Apartments parking garage, which consists of 10' thick poured concrete walls. On the southern portion of the east Property boundary, the southern Property boundary, and the western Property boundary, contaminated soil was removed from the location between the parking garage wall and the Property boundary and backfilled with controlled density fill (CDF) during the Interim Action in 2020.

━ ━ ━ = Property boundary

⊠ P4	= RGI test probe location, P1 - P7 drilled May 2017 and SSI-P1 - SSI-P5 drilled December 2017
⊕ MW-14	= Former Monitoring well by others
● DPE-5	= Former Extraction well by others
⊕ RW-4	= Former Recovery well by others
⊕ DB,SP,DP,P09	= Soil boring by others
■ Pit-1	= 1993 UST excavation sample

Note: This figure includes the most recent groundwater results, not all historical data is shown here. See Table 2 for a summary of all pre-Interim Action groundwater data pertaining to the Property.

Approximate Scale: 1"=20'

0 10 20 40

N

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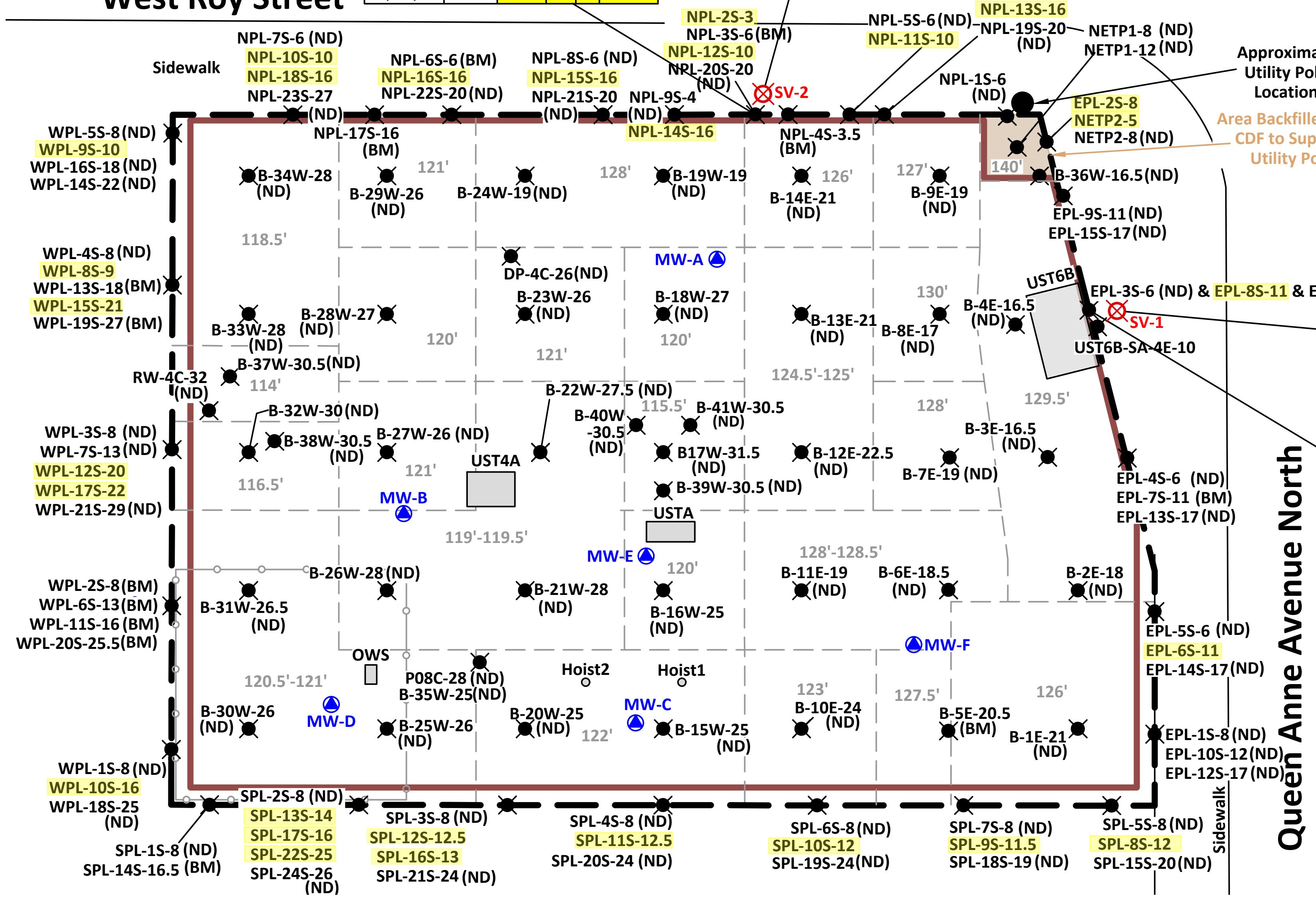
Roystone Redevelopment		Figure 9
RGI Project Number 2017-015K	2022 Q3 Groundwater Elevation Contours	Date Drawn: 03/2023
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		

NPL-12S-10 (soil)					
Date	Depth	Gas	E	X	DSL
07/10/20	10	**1,700**	**9.6**	**13**	**14,000**

SV-2 (Soil Vapor)										
Date	Depth	Total TPH[1]	C_5 - C_8 [2]	C_9 - C_{12} [2]	C_9 - C_{10} [3]	B	T	E	X	Naph.
12/7/22	5	**720**	ND<430	**150**	ND<140	ND<1.8	ND<110	ND<2.5	ND<7.5	ND<1.5



SV-1 (Soil Vapor)										
Date	Depth	Total TPH[1]	C_5 - C_8 [2]	C_9 - C_{12} [2]	C_9 - C_{10} [3]	B	T	E	X	Naph.
12/7/22	5	**640**	ND<380	ND<130	ND<130	**3**	**ND<9.6**	ND<2.2	ND<6.6	ND<1.3

EPL-8S-11 (soil)							
Date	Depth	Gas	B	T	E	X	DSL
07/09/20	11	**6,400**	**<0.4**	**52**	**41**	**110**	**1,500x**

Note: Prior to IA, approximate surface elevation ranged from 146.5' on the west side of the Property to 148.5' on the east side.

1. The total TPH concentration includes the sum of detected petroleum hydrocarbon fractions and the laboratory detection limit when petroleum fractions were not detected. Therefore, the displayed total TPH concentration is higher than the actual concentration.
2. C5 - C8 and C9 - C12 aliphatic petroleum hydrocarbon fractions
3. C9 - C10 aromatic petroleum hydrocarbon fraction

USTA: 317-Gallon Suspected Waste Oil UST (Decommissioned & Removed)
UST4A: 1,066-Gallon Diesel #2 UST (No Release/ Decommissioned & Removed)
UST6B: 3,455-Gallon Suspected Gasoline UST Filled with CDF (Decommissioned & Removed)
Hoist 1 & 2: No Release/Decommissioned & Removed
OWS: Oil-Water Separator (No Release/Decommissioned & Removed)

SV-1 ☒ = Soil vapor sample location pertaining to Phase 2 of the Vapor Intrusion Assessment (VIA). Soil vapor samples were collected at approximately 5' bgs.

▲ = Existing groundwater monitoring well located on the ground floor of the parking garage. Off-property wells are not displayed.

120.5'-121' = (in gray) Approximate bottom elevation of remedial excavation at indicated location

✱ = Final confirmation soil sample location indicating location where soil remains in place. Highlighted sample ID indicates a location where soil containing concentrations of contaminants above applicable MTCA soil cleanup levels remains in place at the property boundary.

━━ = Boundary of Roystone Apartments parking garage, which consists of 10' thick poured concrete walls. On the southern portion of the east Property boundary, the southern Property boundary, and the western Property boundary, contaminated soil was removed from the location between the parking garage wall and the Property boundary and backfilled with controlled density fill (CDF) during the Interim Action in 2020.

━ ━ = Property boundary

▦ = (in red) Soil Vapor Analytical Data in micrograms/cubic meter (µg /m³)

▦ = (in black) Soil Analytical Data in milligrams/kilogram (mg/kg)

Depth = Feet below ground surface
Gas/DSL/Oil = Gasoline/diesel/oil total petroleum hydrocarbons (TPH)
BTEX = Benzene, toluene, ethylbenzene, xylenes
NAPH= Napthalenes
ND = Not detected, BM = Below MTCA Cleanup levels, D = Detected
Bold concentration indicates concentration above laboratory detection limit, but below applicable MTCA soil cleanup levels
Yellow highlighted concentration indicates petroleum related contaminants present in soil at concentrations exceeding MTCA soil cleanup levels
Black databox indicates soil analytical data
Red databox indicates soil vapor analytical data

Approximate Scale: 1"=20'
0 10 20 40
N

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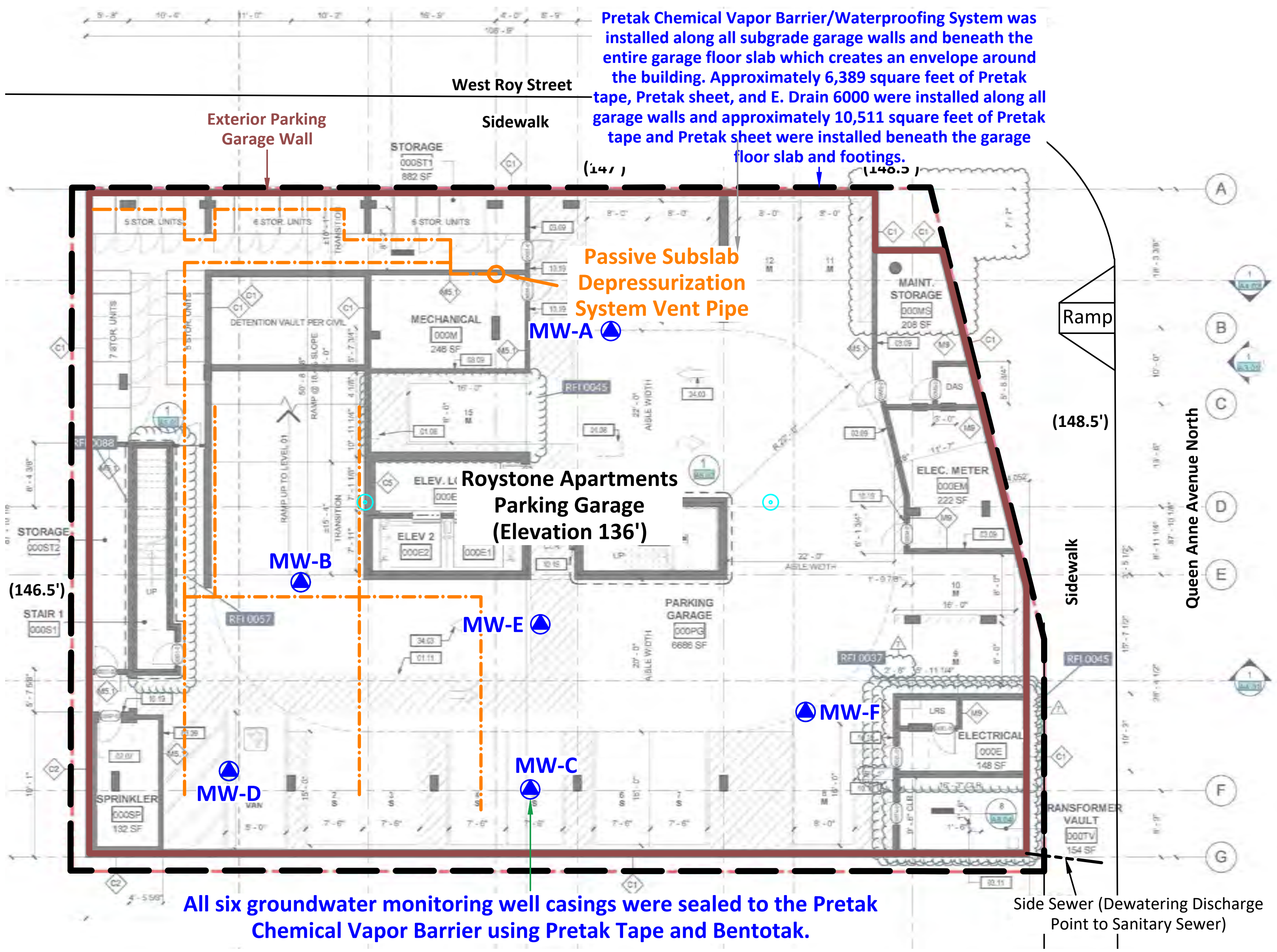
Roystone Redevelopment		Figure 10
RGI Project Number 2017-015K	Soil Vapor Sample Locations with Soil Vapor Analytical Data	Date Drawn: 03/2023
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		

\\RGI4\DATA\PROJECTS\2017\2017-015K INTERIM ACTION TASKS 1 - 13\TASK 6 GWI VIA\FIGURES\POST IA GWI-VIA REPORT (SECOND ROUND FEB 2023)\2017-015K - TASK 6 (FIGURE 3).DWG <Fig 10 - CON Soil> Plotted: 3/1/2023 3:02 PM



Pretak Chemical Vapor Barrier/Waterproofing System was installed along all subgrade garage walls and beneath the entire garage floor slab which creates an envelope around the building. Approximately 6,389 square feet of Pretak tape, Pretak sheet, and E. Drain 6000 were installed along all garage walls and approximately 10,511 square feet of Pretak tape and Pretak sheet were installed beneath the garage floor slab and footings.

All six groundwater monitoring well casings were sealed to the Pretak Chemical Vapor Barrier using Pretak Tape and Bentotak.

*Base map obtained from Vibrant Cities: Roystone Apartments plan set (Sheet A2.00) dated 04/06/20 by Jackson Main Architecture.

Note: The PreTak Chemical Vapor Barrier/Waterproofing System consists of Pretak sheet, E. Drain 6000, Pretak Tape, BentoTak, and Estop GU. See Appendix G for specification sheets and installation details.

▲ = Existing groundwater monitoring well located on the ground floor of the one level parking garage.

-·-·-·- = (in orange) Subslab depressurization pipe layout beneath concrete slab

▬▬ = Boundary of Roystone Apartments parking garage, which consists of 10' thick poured concrete walls. On the southern portion of the east Property boundary, the southern Property boundary, and the western Property boundary, contaminated soil was removed from the location between the parking garage wall and the Property boundary and backfilled with controlled density fill (CDF) during the Interim Action in 2020

▬ ▬ ▬ = Property boundary

Approximate Scale: 1"=20'
0 10 20 40

N

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Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

Roystone Redevelopment

Figure 11

RGI Project Number
2017-015K

Subslab Depressurization System Pipe Layout with Chemical Vapor Barrier Location

Date Drawn:
03/2023

Address: 631 Queen Anne Avenue North, Seattle, Washington 98109

F:\RILEY GROUP INC\2017-015K TASK 6A\2017-015K - TASK 6 (FIRGURE 11).DWG <Figure 11> Plotted: 2/16/2023 12:16 PM

Table 1, Page 1 of 5. Summary of 2020 Interim Action Confirmation Soil Samples
Roystone Redevelopment (Texaco 211577 Monterey Site/Agreed Order No. 16537)
631 Queen Anne Avenue North, Seattle, Washington 98109
The Riley Group, Inc. Project No. 2017-015K

Sample Number	Sample Depth	Sample Date	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	HCID			PCE	TCE	Hexane	MTBE	EDC	EDB	Other HVOCs	Naph.	Total Pb
				B	T	E	X			Gasoline	Diesel	Heavy Oil									
Soil Analytical Data Pertaining to UST Site Assessments, Fuel System Decommissioning, Soil Characterization, and Confirmation Samples																					
B-39W-30.5	30.5	08/19/20	----	ND<0.02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
B-40W-30.5	30.5	08/19/20	----	ND<0.02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
B-41W-30.5	30.5	08/19/20	----	ND<0.02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
NPL-23S-27	27	08/14/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-19S-27	27	08/14/20	ND<10	**0.026**	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-20S-25.5	25.5	08/14/20	ND<10	**0.028**	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-17W-31.5	31.5	08/14/20	----	ND<0.02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
B-37W-30.5	30.5	08/14/20	----	ND<0.02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
WPL-21S-29	29	08/14/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-38W-30.5	30.5	08/14/20	----	ND<0.02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
NPL-21S-20	20	08/14/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-22S-20	20	08/14/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-33W-28	28	08/13/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-34W-28	28	08/13/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-28W-27	27	08/13/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-23W-26	26	08/13/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
DP-4C-26	26	08/13/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-18W-27	27	08/13/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-36W-16.5	16.5	08/13/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-19S-20	20	08/13/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-20S-20	20	08/13/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-22W-27.5	27.5	08/13/20	----	ND<0.02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
B-32W-30	30	08/13/20	----	ND<0.02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
SPL-24S-26	26	08/13/20	----	ND<0.02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
B-14E-21	21	08/12/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-19W-19	19	08/12/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-24W-19	19	08/12/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-26W-28	28	08/12/20	----	ND<0.02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
B-21W-28	28	08/12/20	----	ND<0.02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
B-27W-26	26	08/12/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-29W-26	26	08/12/20	----	ND<0.02	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
WPL-18S-25	25	08/12/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
RW-4C-32	32	08/11/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-16W-25	25	08/11/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-20S-24	24	08/10/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-21S-24	24	08/10/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-22S-25	25	08/10/20	ND<10	**0.12**	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-15W-25	25	08/07/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-20W-25	25	08/07/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
MTCA Method A Soil Cleanup Levels for Unrestricted Land Uses			**100/30^1**	**0.03**	**7**	**6**	**9**	**2,000**		**100/30^1**	**2,000**		**0.05**	**0.03**	**----**	**0.1**	**0.05^3**	**0.05^3**	**Analyte Specific**	**5**	**250**
MTCA Method B Soil Cleanup Levels for Unrestricted Land Uses^2			**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**----**	**----**	**400**	**----**	**----**	**----**	**----**	**---**	**---**

Table 1, Page 2 of 5. Summary of 2020 Interim Action Confirmation Soil Samples
Roystone Redevelopment (Texaco 211577 Monterey Site/Agreed Order No. 16537)
631 Queen Anne Avenue North, Seattle, Washington 98109
The Riley Group, Inc. Project No. 2017-015K

Sample Number	Sample Depth	Sample Date	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	HCID			PCE	TCE	Hexane	MTBE	EDC	EDB	Other HVOCs	Naph.	Total Pb
				B	T	E	X			Gasoline	Diesel	Heavy Oil									
SPL-15S-20	20	08/07/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-10E-24	24	08/07/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-30W-26	26	08/07/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-35W-25	25	08/07/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
P08C-28	28	08/07/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-25W-26	26	08/07/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-31W-26.5	26.5	08/07/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-19S-24	24	08/07/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-18S-19	19	08/07/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
BIE-21	21	08/06/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
EPL-15S-17	17	08/06/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-17S-22	22	07/29/20	ND<5	**2.0**	**0.029**	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-15S-21	21	07/29/20	**1,000**	ND<0.02j	ND<0.1	**0.13**	ND<0.3	**610 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-14S-22	22	07/29/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-16S-18	18	07/30/30	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
EPL-11S-17	17	07/22/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
EPL-12S-17	17	07/22/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
EPL-13S-17	17	07/22/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
EPL-14S-17	17	07/22/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-10S-16	16	07/23/20	**500**	ND<0.02j	ND<0.1	ND<0.1	ND<0.3	**1,300**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-11S-16	16	07/23/20	**25**	ND<0.02	**0.052**	**0.099**	**0.20**	**160 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-12S-20	20	07/23/20	**300**	ND<0.02j	**0.36**	**0.76**	ND<0.3	**970**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-13S-18	18	07/23/20	ND<5	ND<0.02	**0.024**	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-2E-18	18	07/16/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-3E-16.5	16.5	07/16/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-4E-16.5	16.5	07/16/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-5E-20.5	20.5	07/16/20	**11**	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-17S-16	16	07/16/20	**294 E**	ND<0.02	ND<0.10	**6.3**	ND<0.15	**270**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-8E-17	17	07/16/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-6E-18.5	18.5	07/16/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B7E-19	19	07/16/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-11E-19	19	07/16/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-12E-22.5	22.5	07/16/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-9E-19	19	07/16/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
B-13E-21	21	07/16/20	ND<10	ND<0.02	ND<0.10	ND<0.05	ND<0.15	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-13S-16	16	07/13/20	**400**	ND<0.02 j	ND<0.1	**0.84**	**0.90**	**2,100**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-14S-16	16	07/13/20	**220**	ND<0.02 j	**0.25**	**0.80**	**1.5**	**1,600**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-15S-16	16	07/13/20	**1,600**	ND<0.02 j	**5.2**	**14**	**27**	**5,500**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-16S-16	16	07/13/20	**75**	ND<0.02	ND<0.02	**0.044**	ND<0.06	**1,600**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-17S-16	16	07/13/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	**440**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-18S-16	16	07/13/20	**290**	ND<0.02 j	**0.20**	**1.1**	**2.1**	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-11S-10	10	07/10/20	**140**	ND<0.02	ND<0.02	ND<0.02	ND<0.06	**2,400**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
MTCA Method A Soil Cleanup Levels for Unrestricted Land Uses			**100/30[1]**	**0.03**	**7**	**6**	**9**	**2,000**		**100/30[1]**	**2,000**		**0.05**	**0.03**	**----**	**0.1**	**0.05[3]**	**0.05[3]**	**Analyte Specific**	**5**	**250**
MTCA Method B Soil Cleanup Levels for Unrestricted Land Uses[2]			**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**----**	**----**	**400**	**----**	**----**	**----**	**----**	**---**	**---**

Table 1, Page 3 of 5. Summary of 2020 Interim Action Confirmation Soil Samples
Roystone Redevelopment (Texaco 211577 Monterey Site/Agreed Order No. 16537)
631 Queen Anne Avenue North, Seattle, Washington 98109
The Riley Group, Inc. Project No. 2017-015K

Sample Number	Sample Depth	Sample Date	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	HCID			PCE	TCE	Hexane	MTBE	EDC	EDB	Other HVOCs	Naph.	Total Pb
				B	T	E	X			Gasoline	Diesel	Heavy Oil									
NPL-12S-10	10	07/10/20	1,700	ND<0.2	1.5	9.6	13	14,000	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
EPL-9S-11	11	07/09/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
EPL-10S-12	12	07/09/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
EPL-8S-11	11	07/09/20	6,400	ND<0.4	52	41	110	1,500 x	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-16S-13	13	07/09/20	1,000	ND<0.02	0.091	ND<0.02	5.4	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
EPL-7S-11	11	07/09/20	ND<5	ND<0.02	0.025	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-10S-10	10	07/07/20	830	ND<0.02 j	0.34	3.8	2.4	3,500	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
EPL-6S-11	11	07/07/20	1,900	ND<1	27	4.0	20	170 x	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-8S-6	6	06/22/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-9S-4	4	06/22/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-8S-9	9	06/19/20	740	ND<0.8	ND<0.8	5.3	4.5	270 x	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-3S-6	6	06/19/20	6.1	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-4S-3.5	3.5	06/19/20	9.5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-5S-6	6	06/19/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
EPL-3S-6	6	06/19/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
EPL-4S-6	6	06/19/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
EPL-5S-6	6	06/19/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-9S-10	10	06/19/20	46	ND<0.02	ND<0.02	0.82	0.63	350 x	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-6S-6	6	06/19/20	6.5	ND<0.02	ND<0.02	0.15	0.084	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-7S-6	6	06/19/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-6S-13	13	06/18/20	14	ND<0.02	ND<0.02	ND<0.02	ND<0.06	81	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-7S-13	13	06/18/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-13S-14	14	06/17/20	52	ND<0.02	0.098	0.12	0.15	1,000	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-14S-16.5	16.5	06/17/20	10	ND<0.02	0.037	ND<0.02	0.080	290	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-8S-12*	12	06/16/20	3,200	ND<1	23	11	32	590 x	ND<250	----	----	----	----	----	ND<0.25	ND<0.05	ND<0.05	ND<0.05	----	ND<0.05	6.15
SPL-9S-11.5	11.5	06/16/20	980	ND<1	3.8	3.9	5.4	420	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-10S-12	12	06/16/20	1,000	ND<1	7.0	3.9	4.5	1,000	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-11S-12.5	12.5	06/16/20	1,000	ND<1	5.7	6.6	14	1,400	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-12S-12.5	12.5	06/16/20	820	ND<0.02	1.1	3.3	6.0	1,500	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-7S-8	8	06/10/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-2S-3	3	06/10/20	130	ND<0.02j	0.29	0.30	ND<0.3	280	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-6S-8	8	06/08/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
EPL-2S-8	8	05/29/20	51	ND<0.02	0.092	0.10	0.20	92	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NPL-1S-6	6	05/29/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
EPL-1S-8	8	05/28/20	ND<5	ND<0.03	ND<0.05	ND<0.05	ND<0.15	ND<50	ND<250	ND<20	ND<50	ND<250	ND<0.025	ND<0.02	----	----	ND<0.05	----	ND	----	----
SPL-5S-8	8	05/28/20	ND<5	ND<0.03	ND<0.05	ND<0.05	ND<0.15	ND<50	ND<250	ND<20	ND<50	ND<250	ND<0.025	ND<0.02	----	----	ND<0.05	----	ND	----	----
NETP1-8	8	05/27/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NETP1-12	12	05/27/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NETP2-5	5	05/27/20	35	ND<0.02	0.046	0.046	0.11	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
NETP2-8	8	05/27/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
MTCA Method A Soil Cleanup Levels for Unrestricted Land Uses			100/30[1]	0.03	7	6	9	2,000		100/30[1]	2,000		0.05	0.03	----	0.1	0.05[3]	0.05[3]	Analyte Specific	5	250
MTCA Method B Soil Cleanup Levels for Unrestricted Land Uses[2]			---	---	---	---	---	---	---	---	---	---	----	----	400	----	----	----	----	---	---

Table 1, Page 4 of 5. Summary of 2020 Interim Action Confirmation Soil Samples
Roystone Redevelopment (Texaco 211577 Monterey Site/Agreed Order No. 16537)
631 Queen Anne Avenue North, Seattle, Washington 98109
The Riley Group, Inc. Project No. 2017-015K

Sample Number	Sample Depth	Sample Date	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	HCID			PCE	TCE	Hexane	MTBE	EDC	EDB	Other HVOCs	Naph.	Total Pb
				B	T	E	X			Gasoline	Diesel	Heavy Oil									
WPL-4S-8	8	05/12/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-5S-8	8	05/12/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-1S-8	8	05/05/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
WPL-2S-8	8	05/06/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	**750**	----	----	----	----	----	----	----	----	----	----	----	----
WPL-3S-8	8	05/06/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-1S-8	8	04/30/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-2S-8	8	04/30/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-3S-8	8	04/30/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
SPL-4S-8	8	04/30/20	ND<5	ND<0.02	ND<0.02	ND<0.02	ND<0.06	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----
MTCA Method A Soil Cleanup Levels for Unrestricted Land Uses			**100/30[1]**	**0.03**	**7**	**6**	**9**	**2,000**		**100/30[1]**	**2,000**		**0.05**	**0.03**	**----**	**0.1**	**0.05[3]**	**0.05[3]**	**Analyte Specific**	**5**	**250**
MTCA Method B Soil Cleanup Levels for Unrestricted Land Uses[2]			**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**---**	**----**	**----**	**400**	**----**	**----**	**----**	**----**	**---**	**---**

Notes:
Confirmation soil sample = Soil sample collected from the limits of the remedial excavation and/or the Property boundary. Data obtained from these samples are representative of soil that remains in place.
All results and detection limits are given in milligrams per kilogram (mg/kg); equivalent to parts per million (ppm).
Sample Depth = Soil sample depth interval in feet below ground surface (bgs) prior to the start of construction.
Gasoline TPH (total petroleum hydrocarbons) determined using Northwest Test Method NWTPH-Gx.
BTEX (benzene, toluene, ethylbenzene, and xylenes) determined using EPA Test Method 8021B and 8260D.
Notes continued:
Diesel and Oil TPH (total petroleum hydrocarbons) determined using Northwest Test Method NWTPH-Dx.
Gasoline, Diesel, and Oil HCID (hydrocarbon identification) determined using Northwest Test Method NWTPH-HCID.
PCE (tetrachloroethene), TCE (trichloroethene), Hexane, MTBE (methyl t-butyl ether), EDC (1,2-dichloroethane), EDB (1,2-dibromoethane), and other HVOCs (halogenated volatile organic compounds) determined using EPA Test Method 8260D.
Naph. (naphthalene) determined using EPA Test Method 8260D.
Total Pb (lead) determined using EPA Method 6020B.
x = The sample chromatographic pattern does not resemble the fuel standard used for quantitation.
* = Soil sample SPL-8S-12 was initially mislabeled as SPL-15S-12. The sample ID was later revised to SPL-8S-12 after the laboratory report was issued.
j = The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.
ND = Not detected at a concentration above the analytical detection limit.
---- = Not analyzed or not applicable.
Washington State Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Method A Soil Cleanup Levels for Unrestricted Land Uses (WAC 173-340-900, Table 740-1). MTCA Method B Soil Cleanup Levels from Ecology's Cleanup Level and Risk Calculation (CLARC) database.

Table 1, Page 5 of 5 Summary of Confirmation Soil Sample Analytical Data

Roystone Redevelopment (Texaco 211577 Monterey Site/Agreed Order No. 16537)

631 Queen Anne Avenue North, Seattle, Washington 98109

The Riley Group, Inc. Project No. 2017-015K

[1] The higher cleanup level is allowed if no benzene is present in the gasoline mixture and the total concentration of toluene, ethylbenzene and xylenes is less than 1% of the gasoline mixture.

[2] No MTCA Method A Cleanup Level has been established. Therefore, the applicable MTCA Method B Standard Formula Value obtained from CLARC is referenced.

[3] The cleanup level is less than the method detection limit. Therefore, the detection limit is referenced.

Bold results indicate concentrations (if any) above laboratory detection limits.

Bold and yellow highlighted results indicate concentrations (if any) that exceed MTCA Method A or B Soil Cleanup Levels.

Table 2, Page 1 of 6. Summary of Groundwater Analytical Laboratory Results for the Property
Roystone Redevelopment
631 Queen Anne Avenue North, Sea. le, Washington 98109
The Riley Group, Inc. Project No. 2017-015K

Sample Number	Sample Date	TOC Elevation (ft)	Depth to Water Below Well TOC (ft)	LNAPL Thickness (ft)	Groundwater Elevation (ft)	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	Diesel TPH	Oil TPH	Naph.	cPAHs	MTBE	EDB	EDC	PCE	TCE	cis-1,2-DCE	Other VOCs[7]	Total Pb	Dissolved Pb	Dissolved As	Other Metals
							B	T	E	X	without silica gel		with silica gel														
Groundwater Monitoring Wells																											
MW-A	**Screened Interval 5.5-21.5 feet bgs, 2-Inch Diameter Casing**																										
MWA	08/18/22	135.66	7.74	0.00	127.92	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWA	05/23/22	135.66	6.18	0.00	129.48	ND<100	ND<1	ND<1	ND<1	ND<3	**98 x**	ND<300	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWA	02/23/22	135.66	7.00	0.00	128.66	ND<100	ND<1	ND<1	ND<1	ND<3	**97 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWA	10/15/21	135.66	9.24	0.00	126.42	ND<100	ND<1	ND<1	ND<1	ND<3	ND<60	ND<300	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWA	07/14/21	135.66	7.70	0.00	127.96	ND<100	ND<1	ND<1	ND<1	ND<3	**98 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-B	**Screened Interval 6.5-20.5 feet bgs, 2-Inch Diameter Casing**																										
MWB	08/18/22	135.59	7.87	0.00	127.72	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWB	05/23/22	135.59	6.33	0.00	129.26	ND<100	ND<1	ND<1	ND<1	ND<3	**300 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWB	02/23/22	135.59	6.88	0.00	128.71	ND<100	ND<1	ND<1	ND<1	ND<3	**310 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWB	10/15/21	135.59	9.32	0.00	126.27	**110**	ND<1	**1.2**	ND<1	ND<3	**440 x**	ND<300	ND<60	ND<300	----	----	----	----	----	----	----	----	----	----	----	----	----
MWB	07/14/21	135.59	7.79	0.00	127.80	ND<100	ND<1	ND<1	ND<1	ND<3	**250 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW-C	**Screened Interval 5.5-17.5 feet bgs, 2-Inch Diameter Casing**																										
MWC	08/18/22	135.69	7.9	0.00	127.79	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWC	05/23/22	135.69	6.31	0.00	129.38	ND<100	ND<1	ND<1	ND<1	ND<3	**90 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWC	02/23/22	135.69	6.82	0.00	128.87	ND<100	ND<1	ND<1	ND<1	ND<3	**130 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWC	10/15/21	135.69	9.21	0.00	126.48	ND<100	ND<1	ND<1	ND<1	ND<3	**110 x**	ND<250	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----
MWC	07/14/21	135.69	7.81	0.00	127.88	ND<100	ND<0.35	ND<1	ND<1	ND<3	**220 x**	ND<300	----	----	ND<1	ND<0.04	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND	ND<1	ND<1	----	----
MW-D	**Screened Interval 6.5-19 feet bgs, 2-Inch Diameter Casing**																										
MWD	08/18/22	135.75	8.21	0.00	127.54	ND<100	ND<1	ND<1	ND<1	ND<3	**270 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWD	05/23/22	135.75	6.69	0.00	129.06	ND<100	ND<1	ND<1	ND<1	ND<3	**220 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWD	02/23/22	135.75	7.45	0.00	128.30	ND<100	ND<1	ND<1	ND<1	ND<3	**210 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWD	10/15/21	135.75	9.78	0.00	125.97	**290**	ND<1	**8.1**	ND<1	**22**	**510 x**	ND<250	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----
MWD	07/14/21	135.75	8.34	0.00	127.41	ND<100	ND<0.35	ND<1	ND<1	ND<3	**220 x**	ND<250	----	----	ND<1	ND<0.04	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND	ND<1	ND<1	----	----
MW-E	**Screened Interval 5.5-17.5 feet bgs, 2-Inch Diameter Casing**																										
MWE	08/18/22	135.73	7.86	0.00	127.87	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWE	05/23/22	135.73	6.29	0.00	129.44	ND<100	ND<1	ND<1	ND<1	ND<3	**290 x**	ND<300	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWE	02/23/22	135.73	6.81	0.00	128.92	ND<100	ND<1	ND<1	ND<1	ND<3	**380 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWE	10/15/21	135.73	9.32	0.00	126.41	ND<100	ND<1	ND<1	ND<1	ND<3	**190 x**	ND<300	ND<60	ND<300	----	----	----	----	----	----	----	----	----	----	----	----	----
MWE	07/14/21	135.73	7.80	0.00	127.93	ND<100	ND<0.35	ND<1	ND<1	ND<3	**150 x**	ND<250	----	----	ND<1	ND<0.04	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND	ND<1	ND<1	----	----
MW-F	**Screened Interval 5.5-18.5 feet bgs, 2-Inch Diameter Casing**																										
MWF	08/18/22	135.70	6.88	0.00	128.82	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWF	05/23/22	135.70	5.57	0.00	130.13	ND<100	ND<1	ND<1	ND<1	ND<3	**130 x**	ND<300	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWF	02/23/22	135.70	5.99	0.00	129.71	ND<100	ND<1	ND<1	ND<1	ND<3	**160 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MWF	10/15/21	135.70	8.06	0.00	127.64	ND<100	ND<1	ND<1	ND<1	ND<3	**110 x**	ND<300	ND<60	ND<300	----	----	----	----	----	----	----	----	----	----	----	----	----
MWF	07/14/21	135.70	7.13	0.00	128.57	ND<100	ND<0.35	ND<1	ND<1	ND<3	**140 x**	ND<250	----	----	ND<1	----	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND	----	----	----	----
MW6	**Screened Interval 15-29 feet bgs, 2-Inch Diameter Casing**																										
MW6	11/13/18	146.05	20.70	0.00	125.35	**110**	**0.89**	ND<1	ND<1	ND<3	**1,000 x**	ND<250	**570 x**	ND<250	ND<0.8	ND	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND	----	----	----	----
	11/11-13/13[3]	146.05	19.87	0.00	126.18	**97**	**3**	ND<0.5	**0.6**	**0.5**	**340**	ND<70	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/20-22/13[3]	146.05	18.47	0.00	127.58	**280**	**5**	ND<0.5	**0.5**	**0.6**	**600**	ND<71	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/12-14/12[3]	146.05	19.74	0.00	126.31	**370**	**9**	**1**	**2**	**3**	**1,600**	**190**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/07-08/12[3]	146.05	18.50	0.00	127.55	**250**	**1**	ND<0.5	ND<0.5	ND<0.5	**540**	ND<70	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/10-12/11[3]	146.05	18.32	0.00	127.73	**600**	**12**	**0.7**	**1**	**0.9**	**12,000**	**1,500**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	01/17-20/11[3]	146.05	18.24	0.00	127.81	**130**	**4**	ND<0.5	ND<0.5	ND<0.5	**12,000**	**4,600**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/19-22/10[3]	146.05	18.83	0.00	127.22	**650**	**24**	**0.9**	**0.6**	**1**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10/12-15/09[3]	146.05	20.28	0.00	125.77	**1,200**	**16**	**1**	**0.5**	**2**	**5,100**	ND<660	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/13-16/09[3]	146.05	20.18	0.00	125.87	**1,100**	**31**	**0.8**	**2**	**3**	**26,000**	**3,000**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/10/08[3]	146.05	20.93	0.00	125.12	ND<50.0	**0.6**	ND<0.5	ND<0.5	ND<0.5	**3,200**	ND<660	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/28-05/01/08	146.05	22.28	0.00	123.77	**360**	**3**	**0.7**	**5**	**3**	**8,600**	**1,200**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	08/09/06	113.32[6]	25.85	0.00	87.47	**15,000**	**1,900**	**1,000**	**590**	**1,700**	**14,000**	ND<2,300	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/18-21/05	113.32[6]	20.31	0.00	93.01	**3,600**	**1,000**	**120**	**110**	**360**	**7,700**	ND<1,000	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	01/24-31/05	113.32[6]	20.38	0.00	92.94	**5,600**	**220**	**60**	**110**	**310**	**11,000**	ND<480	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10/28-11/01/04	113.32[6]	20.93	0.00	92.39	**24,000**	**8,600**	**2,800**	**690**	**3,100**	**9,200**	ND<96	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	7/15-16/04	113.32[6]	20.48	0.00	92.84	**46,600**	**9,610**	**3,190**	**758**	**3,060**	**3,800**	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	**1.69**	----	----
	4/29-30/04	113.32[6]	20.22	**0.02**	93.12	Not sampled due to the presence of LNAPL																					
	10/01-02/03	113.32[6]	23.07	**0.03**	90.27	Not sampled due to the presence of LNAPL																					
MTCA Method A Cleanup Levels for Ground Water						**800/1,000[1]**	**5**	**1,000**	**700**	**1,000**	**500**	**500**	**500**	**500**	**160**	**0.1**	**20**	**0.01**	**5**	**5**	**5**	**NVE**	**Analyte Specific**	**15**	**15**	**5**	**Analyte Specific**
Applicable or Relevant and Appropriate Requirements (ARARs)[2]						**----**	**5**	**1,000**	**700**	**10,000**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**0.05**	**5**	**5**	**5**	**70**	**Analyte Specific**	**15**	**15**	**10**	**Analyte Specific**

Table 2, Page 2 of 6. Summary of Groundwater Analytical Laboratory Results for the Property
Roystone Redevelopment
631 Queen Anne Avenue North, Seattle, Washington 98109
The Riley Group, Inc. Project No. 2017-015K

Sample Number	Sample Date	TOC Elevation (ft)	Depth to Water Below Well TOC (ft)	LNAPL Thickness (ft)	Groundwater Elevation (ft)	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	Diesel TPH	Oil TPH	Naph.	cPAHs	MTBE	EDB	EDC	PCE	TCE	cis-1,2-DCE	Other VOCs[7]	Total Pb	Dissolved Pb	Dissolved As	Other Metals
							B	T	E	X	without silica gel		with silica gel														
MW6	06/30-07/01/03	113.32[6]	21.41	**0.03**	91.93	Not sampled due to the presence of LNAPL																					
	4/23-24/03	113.32[6]	20.91	**0.03**	92.43	Not sampled due to the presence of LNAPL																					
	01/21/03	113.32[6]	21.74	**0.03**	91.60	Not sampled due to the presence of LNAPL																					
	10/17-18/02	113.32[6]	20.69	**0.05**	92.67	Not sampled due to the presence of LNAPL																					
	07/24/02	113.32[6]	19.76	0.00	93.56	**31,000**	**8,900**	**1,600**	**820**	**4,200**	**29,000**	ND<10,000	----	----	----	----	----	----	----	----	----	----	----	----	**5.1**	----	----
	01/1997	113.38[6]	----	----	----	**54,000**	**7,290**	**12,400**	**2,340**	**19,800**	----	----	----	----	----	----	----	----	----	ND<1,000	ND<1,000	ND<1,000	----	----	**61.9**	----	----
	10/1995	113.38[6]	----	----	----	**62,000**	**12,000**	**13,800**	**920**	**5,690**	----	----	----	----	----	----	----	----	----	**1.6**	**2.3**	**2.9**	----	----	**33.3**	----	----
	07/07/93	113.38[6]	22.30	**1.60**	92.36	Not sampled due to the presence of LNAPL																					
	03/26-28/91	113.38[6]	21.22	**0.67**	92.70	----	**25,000**	**29,000**	**2,500**	**19,000**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	09/1990	113.38[6]	21.95	**0.81**	92.08	Not sampled due to the presence of LNAPL																					
	11/03/86	113.71[6]	24.29	**2.26**	91.23	Not sampled due to the presence of LNAPL																					
MW9	**Screened Interval 14-29 feet bgs, 2-Inch Diameter Casing**																										
MW9	11/13/18	147.18	21.17	0.00	126.01	ND<100	ND<1	ND<1	ND<1	ND<3	**440 x**	ND<250	**140**	ND<250	ND<0.4	ND	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND	----	----	----	----
	08/15/17	147.18	19.63	0.00	127.55	----	----	----	----	----	**1,500 x**	**490 x**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/06/17	147.18	17.93	0.00	129.25	**480**	ND<1	**2.2**	**1.8**	**3.4**	----	----	----	----	----	----	----	----	----	ND<1	ND<1	ND<1	ND	----	----	----	----
	11/11-13/13	147.18	20.21	0.00	126.97	**180**	ND<0.5	ND<0.5	ND<0.5	ND<0.5	**400**	ND<71	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/20-22/13	147.18	18.19	0.00	128.99	**240**	ND<0.5	ND<0.5	ND<0.5	ND<0.5	**1,400**	ND<68	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/12-14/12	147.18	20.09	0.00	127.09	**190**	ND<0.5	ND<0.5	ND<0.5	ND<0.5	**2,700**	**150**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/07-08/12	147.18	18.88	0.00	128.30	**230**	ND<0.5	ND<0.5	ND<0.5	ND<0.5	**1,500**	ND<67	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/10-12/11	147.18	18.68	0.00	128.50	**160**	ND<0.5	ND<0.5	ND<0.5	ND<0.5	**2,200**	**260**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	01/17-20/11	147.18	18.65	0.00	128.53	**280**	ND<0.5	ND<0.5	ND<0.5	ND<0.5	**6,400**	**1,400**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/19-22/10	147.18	19.04	0.00	128.14	**130**	**1**	ND<0.5	ND<0.5	ND<0.5	**1,200**	**190**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10/12-15/09	147.18	20.67	0.00	126.51	**83**	ND<0.5	ND<0.5	ND<0.5	ND<0.5	**960**	ND<66	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/13-16/09	147.18	24.60	0.00	122.58	**160**	**0.7**	ND<0.5	ND<0.5	ND<0.5	**1,100**	**69**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/10/08	147.18	21.29	0.00	125.89	**130**	**0.5**	ND<0.5	ND<0.5	ND<0.5	**2,000**	**97**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	12/04-05/07	147.18	23.15	0.00	124.03	ND<50.0	ND<0.5	ND<0.5	ND<0.5	ND<1.5	**2,200**	**280**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	08/09/06	147.18	22.80	0.00	124.38	**450**	**66**	**1.9**	**0.8**	**47**	**2,700**	ND<540	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/18-21/05	147.18	20.59	0.00	126.59	**480**	**1.4**	ND<1.0	**5.7**	**3.1**	**14,000**	ND<630	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	01/24-31/05	147.18	20.66	0.00	126.52	**730**	**1.7**	ND<1.0	**2.7**	ND<6.0	**140,000**	ND<5,300	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10/28-11/01/04	147.18	21.22	0.00	125.96	**300**	**1.4**	**0.5**	**1.9**	ND<3.0	**3,900**	**420**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	7/15-16/04	147.18	20.71	0.00	126.47	**9,540**	**3.84**	**10.4**	**25.9**	**31.6**	**2,540**	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	**2.54**	----	----
	4/29-30/04	147.18	20.38	0.00	126.80	**1,200**	**2**	**1.2**	**10**	**7.8**	**92,000**	ND<5,000	----	----	----	----	----	----	----	----	----	----	----	----	**4.8**	----	----
	1/21-23/04	147.18	20.36	0.00	126.82	**2,300**	**7.2**	**2.4**	**45**	**19**	**100,000**	ND<5,100	----	----	----	----	----	----	----	----	----	----	----	----	**5.5**	----	----
	10/1-02/03	147.18	21.26	0.00	125.92	**3,500**	**110**	**30**	**100**	ND<100	**33,000**	ND<5,000	----	----	----	----	----	----	----	----	----	----	----	----	**3.9**	----	----
	4/23-24/03	147.18	20.04	0.00	127.14	**6,760**	**388**	**15.9**	**277**	**105**	**3,680**	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	**1.31**	----	----
	10/17-18/02	147.18	20.88	0.00	126.30	**6,380**	**493**	**13.0**	**230**	**107**	**43,600**	**671[4]**	----	----	----	----	----	----	----	----	----	----	----	----	**2.66**	----	----
	06/14/00	147.18	----	----	----	**4,740**	**786**	**26.0**	**274**	**156**	**6,070**	ND<500	----	----	----	----	----	----	----	----	----	----	----	**7.86**	**1.59**	----	----
	12/15/99	147.18	----	----	----	**4,460**	**831**	**22.4**	**274**	**138**	**8,510**	ND<500	----	----	----	----	----	----	----	----	----	----	----	**15**	**1.03**	----	----
	11/1997	147.18	----	----	----	**5,000**	**2,010**	**80**	**334**	**400**	----	----	----	----	----	----	----	----	----	ND<1	ND<1	ND<1	----	**3.3**	----	----	----
	07/1997	147.18	----	----	----	**2,200 J**	**2,680**	**127**	**460**	**620 J**	----	----	----	----	----	----	----	----	----	ND<200	ND<200	ND<200	----	**8.6 j**	----	----	----
	04/1997	147.18	----	----	----	**9,100**	**2,980**	**173**	**413**	**674**	----	----	----	----	----	----	----	----	----	ND<1	ND<1	ND<1	----	**6.8**	----	----	----
	01/01/97	147.18	----	----	----	**4,400**	**2,600**	**53**	**310**	**285**	----	----	----	----	----	----	----	----	----	----	----	----	----	**4.6 P**	----	----	----
	10/01/95	147.18	----	----	----	**3,400**	**3,520**	**70 J**	ND<200	**312 J**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	03/26-28/91	114.65[6]	20.44	**0.17**	94.18	----	**1,600**	**2,900**	**250**	**3,100**	----	----	----	----	----	----	----	----	----	ND<250	ND<250	----	----	----	**1.03**	----	----
MW13	**Screened Interval 10-20 feet bgs, 2-Inch Diameter Casing**																										
MW13	11/13/18	147.88	----	----	Dry well																						
	08/15/17	147.88	18.04	----	129.84	----	----	----	----	----	**60 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/06/17	147.88	16.26	----	131.62	ND<100	ND<1	ND<1	ND<1	ND<3	----	----	----	----	----	----	----	----	----	ND<1	ND<1	ND<1	ND	----	----	----	----
	2002-2013	147.88	----	0.00	Not Sampled																						
RW4	**Screened Interval 17-32 feet bgs, 8-Inch Diameter Casing**																										
RW4 (Product Recovery Well)	10/18/06	110.82[6]	23.64	0.00	87.18	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	07/15-16/04	110.82[6]	18.20	**0.22**	92.84	Not sampled due to the presence of LNAPL																					
MTCA Method A Cleanup Levels for Ground Water						**800/1,000[1]**	**5**	**1,000**	**700**	**1,000**	**500**	**500**	**500**	**500**	**160**	**0.1**	**20**	**0.01**	**5**	**5**	**5**	**NVE**	**Analyte Specific**	**15**	**15**	**5**	**Analyte Specific**
Applicable or Relevant and Appropriate Requirements (ARARs)[2]						----	**5**	**1,000**	**700**	**10,000**	----	----	----	----	----	----	----	**0.05**	**5**	**5**	**5**	**70**	**Analyte Specific**	**15**	**15**	**10**	**Analyte Specific**

Table 2, Page 3 of 6. Summary of Groundwater Analytical Laboratory Results for the Property
Roystone Redevelopment
631 Queen Anne Avenue North, Seattle, Washington 98109
The Riley Group, Inc. Project No. 2017-015K

Sample Number	Sample Date	TOC Elevation (ft)	Depth to Water Below Well TOC (ft)	LNAPL Thickness (ft)	Groundwater Elevation (ft)	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	Diesel TPH	Oil TPH	Naph.	cPAHs	MTBE	EDB	EDC	PCE	TCE	cis-1,2-DCE	Other VOCs[7]	Total Pb	Dissolved Pb	Dissolved As	Other Metals
							B	T	E	X	without silica gel		with silica gel														
RW4 (Product Recovery Well)	01/21/03	110.82[6]	17.88	0.00	92.94	**689**	**0.991**	ND<0.500	**2.37**	**7.03**	**2,830**	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.00	----	----
	10/17-18/02	110.82[6]	19.29	0.00	91.53	**3,160**	**59.8**	**2.50**	**40.4**	**15.6**	**8,930**	**939**	----	----	----	----	----	----	----	----	----	----	----	----	**1.23**	----	----
	07/24/02	110.82[6]	18.30	0.00	92.52	**990**	**62**	**1.3**	**32**	**7.0**	**15,000**	ND<2,000	----	----	**5.0**	----	ND<2	----	ND<2	ND<1	ND<1	ND<1	----	----	**3.3**	**6.1**	----
	07/07/93	110.82[6]	21.65	0.00	89.17	**14,000**	**6,500**	**2,800**	**370**	**2,000**	----	----	----	----	----	----	----	----	----	----	----	----	----	**45**	----	----	----
DPE5	**Screened Interval 14-24 feet bgs, 4-Inch Diameter Casing**																										
DPE 5 (Dual Phase Extraction Well)	11/21/18	113.81[6]	17.28	0.00	96.53	ND<100	**1.6**	ND<1	ND<1	ND<3	**1,300 x**	**420 x**	**99**	ND<250	ND<1	----	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND	----	**1.37**	----	----
	04/06/17	113.81[6]	13.37	0.00	100.44	----	----	----	----	----	----	----	----	----	----	----	----	----	----	ND<1	ND<1	ND<1	ND	----	----	----	----
	11/11-13/13	113.81[6]	16.68	0.00	97.14	**5,400**	**44**	**20**	**690**	**290**	**150**	ND<72	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/20-22/13	113.81[6]	16.65	0.00	97.17	**5,700**	**41**	**22**	**620**	**550**	**120**	ND<67	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/12-14/12	113.81[6]	15.35	0.00	98.47	**580**	**5**	**2**	**56**	**46**	**260**	ND<72	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/07-08/12	113.81[6]	14.08	0.00	99.74	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<29	ND<67	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/10-12/11	113.81[6]	16.16	0.00	97.66	**520**	**18**	**4**	**30**	**63**	**1,900**	**270**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	01/17-20/11	113.81[6]	13.99	0.00	99.83	ND<50	ND<0.5	ND<0.5	**2**	**1**	**540**	**230**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/19-22/10	113.81[6]	15.92	0.00	97.90	**78**	**2**	ND<0.5	ND<0.5	**0.5**	**530**	**95**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10/12-15/09	113.81[6]	18.60	0.00	95.22	**490**	**22**	**2**	**19**	**10**	**25,000**	ND<1,400	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/13-16/09	113.81[6]	14.63	0.00	99.19	**110**	**2**	ND<0.5	**1**	**3**	**690**	**83**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/03/08	113.82[6]	22.45	0.00	91.37	**460**	**77**	**7**	**4**	**17**	**12,000**	ND<3,500	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/29-29/08[3]	113.82[6]	18.93	0.00	94.89	ND<250	**32**	**4**	**3**	**22**	**11,000**	ND<2,500	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	12/04-06/07	113.81[6]	23.72	0.00	90.09	**180**	**0.6**	**0.5**	**0.6**	**4.3**	**4,000**	ND<470	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/17-19/07	113.81[6]	23.78	0.00	90.03	**200**	**17**	**2.6**	**1.6**	**11**	**4,600**	ND<470	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/17/06	113.81[6]	----	----	----	**19,000**	**1,100**	**1,400**	**160**	**2,900**	**4,800**	ND<190	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	01/23/06	113.81[6]	16.75	**0.05**	96.61	Not sampled due to the presence of LNAPL																					
	11/28/05	----	----	----	----	**36,000**					**5,300**	ND<1,000	----	----	----	----	ND<0.5	----	ND<0.5	ND<0.8	ND<1	ND<0.8	----	----	----	----	----
DPE6	**Screened Interval 15.5-30.5 feet bgs, 4-Inch Diameter Casing**																										
DPE 6 (Dual Phase Extraction Well)	11/13/18	113.32[6]	20.93	0.00	92.39	ND<100	ND<1	**1.1**	ND<1	ND<3	**3,300 x**	**610 x**	**180**	ND<250	ND<1	----	ND<1	ND<1	ND<1	ND<1	ND<1	ND<1	ND	----	ND<2	----	----
	04/06/17	113.32[6]	17.75	0.00	95.57	----	----	----	----	----	----	----	----	----	----	----	----	----	----	ND<1	ND<1	ND<1	ND	----	----	----	----
	11/11-13/13	114.14[6]	20.04	0.00	94.10	**140**	**7**	ND<0.5	ND<0.5	ND<0.5	**1,100**	ND<70	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/20-22/13	114.14[6]	18.62	0.00	95.52	**570**	**3**	**2**	**2**	**8**	**170**	ND<71	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/12-14/12	114.14[6]	19.90	0.00	94.24	**220**	**4**	ND<0.5	ND<0.5	**1**	**94**	ND<71	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/07-08/12	114.14[6]	18.80	0.00	95.43	**360**	**9**	**1**	**1**	**4**	**1,000**	ND<66	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/10-12/11	114.14[6]	18.44	0.00	95.70	**510**	**16**	**2**	**5**	**14**	**8,300**	**1,300**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	01/17-20/11	114.14[6]	18.61	0.00	95.53	**520**	**42**	**2**	**4**	**6**	**16,000**	**27,000**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/19-22/10	114.14[6]	19.02	0.00	95.12	**680**	**44**	**3**	**13**	**13**	**10,000**	**2,000**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10/12-15/09	114.14[6]	20.51	0.00	93.63	**490**	**18**	**3**	**8**	**9**	**3,600**	ND<680	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/13-16/09	114.14[6]	20.60	0.00	93.54	**900**	**100**	**6**	**16**	**24**	**16,000**	**880**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/04/08	114.14[6]	21.30	0.00	92.84	**870**	**16**	**12**	**7**	**63**	**11,000**	ND<1,300	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/28-29/08[3]	114.14[6]	22.81	0.00	91.33	**460**	**1**	**6**	**2**	**32**	**8,500**	ND<480	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	12/04-05/07	113.32[6]	28.51	0.00	84.81	**160**	ND<2.0	**0.6**	ND<2.0	**3.8**	**1,100**	ND<190	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/17/07	113.32[6]	29.83	0.00	83.49	**5,400**	**27**	**39**	**35**	**350**	**110,000**	ND<9,300	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/17/06	113.32[6]	----	0.00	----	**38,000**	**3,000**	**5,400**	**690**	**4,900**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/28/05	----	----	----	----	**280**	----	----	----	----	**170**	ND<100	----	----	----	----	ND<0.5	----	ND<0.5	ND<0.8	ND<1	**8**	----	----	----	----	----
DPE7	**Screened Interval 11-29 feet bgs, 4-Inch Diameter Casing**																										
DPE 7 (Dual Phase Extraction Well)	11/13/18	113.15[6]	20.52	0.00	92.63	**700**	**3.3**	**8.1**	**2.3**	**30**	**4,100 x**	**850 x**	**430 x**	ND<250	**1.3**	ND	----	----	----	----	----	----	----	----	ND<2	----	----
	04/06/17	113.15[6]	17.28	0.00	95.87	----	----	----	----	----	----	----	----	----	----	----	----	----	----	ND<1	ND<1	ND<1	ND	----	----	----	----
	11/03/08	113.15[6]	20.96	**0.01**	92.18	Not sampled due to the presence of LNAPL																					
	04/28-29/08	113.15[6]	22.26	0.00	90.87	ND<250	**7**	**2**	**2**	**6**	**6,300**	ND<980	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MTCA Method A Cleanup Levels for Ground Water						**800/1,000[1]**	**5**	**1,000**	**700**	**1,000**	**500**	**500**	**500**	**500**	**160**	**0.1**	**20**	**0.01**	**5**	**5**	**5**	**NVE**	**Analyte Specific**	**15**	**15**	**5**	**Analyte Specific**
Applicable or Relevant and Appropriate Requirements (ARARs)[2]						----	**5**	**1,000**	**700**	**10,000**	----	----	----	----	----	----	----	**0.05**	**5**	**5**	**5**	**70**	**Analyte Specific**	**15**	**15**	**10**	**Analyte Specific**

Table 2, Page 4 of 6. Summary of Groundwater Analytical Laboratory Results for the Property
Roystone Redevelopment
631 Queen Anne Avenue North, Seattle, Washington 98109
The Riley Group, Inc. Project No. 2017-015K

Sample Number	Sample Date	TOC Elevation (ft)	Depth to Water Below Well TOC (ft)	LNAPL Thickness (ft)	Groundwater Elevation (ft)	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	Diesel TPH	Oil TPH	Naph.	cPAHs	MTBE	EDB	EDC	PCE	TCE	cis-1,2-DCE	Other VOCs[7]	Total Pb	Dissolved Pb	Dissolved As	Other Metals
							B	T	E	X	without silica gel		with silica gel														
DPE 7 (Dual Phase Extraction Well)	12/04-05/07	113.15[6]	27.52	0.00	85.63	**760**	**44**	**1.7**	**28**	**15**	**120,000**	ND<9,900	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/17/07	113.15[6]	27.00	0.00	86.15	**3,800**	**78**	**40**	**97**	**180**	**22,000**	ND<4,700	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/17/06	113.15[6]	----	----	----	**29,000**	**4,500**	**1,800**	**470**	**4,200**	**8,600**	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/28/05	----	----	----	----	**17,000**	----	----	----	----	**6,200**	ND<1,000	----	----	----	----	ND<0.5	----	ND<0.5	ND<0.8	ND<1	ND<0.8	----	----	----	----	----
VP9 Screened Interval 4.5-14.5 feet bgs, 2-Inch Diameter Casing																											
VP9 (Soil Vapor Extraction Well)	11/13/18	145.22	9.54	0.00	135.68	ND<100	ND<1	ND<1	ND<1	ND<3	ND<250	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	01/24-31/05	145.22	10.30	0.00	134.92	**100**	ND<0.5	ND<0.5	ND<0.5	ND<1.5	ND<250	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10/28-11/01/04	145.22	9.82	0.00	135.40	**610**	ND<0.5	ND<0.5	ND<0.5	ND<1.5	ND<800	ND<1,000	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	7/15-16/04	145.22	11.15	0.00	134.07	**1,270**	**1.67**	**0.699**	**2.79**	**5.77**	**259**	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.00	----	----
	4/29-30/04	145.22	9.58	0.00	135.64	**750**	**0.8**	ND<0.500	**13**	ND<1.5	**1,500**	ND<1,000	----	----	----	----	----	----	----	----	----	----	----	----	ND<0.99	----	----
	10/01-02/03	145.22	11.72	0.00	133.50	**1,600**	**5.3**	**1.4**	**2.3**	ND<10	**5,400**	**1,300**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	6/30-07/01/03	145.22	9.74	0.00	135.48	**681**	**1.22**	**0.735**	**5.07**	**3.28**	ND<250	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.00	----	----
	4/23-24/03	145.22	8.28	0.00	136.94	ND<50.0	ND<0.500	ND<0.500	ND<0.500	ND<1.00	ND<250	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.00	----	----
	10/17-18/02	145.22	11.90	0.00	133.32	**1,910**	**11.3**	**2.62**	**8.86**	**14.7**	**13,200**	**786[4]**	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.00	----	----
	06/14/00	145.22	----	----	----	**474**	**4.97**	ND<1.30	**55.6**	**4.48**	**1,420**	ND<1,130	----	----	----	----	----	----	----	----	----	----	----	**15.2**	ND<1.00	----	----
	12/15/99	145.22	----	----	----	**118**	ND<0.500	ND<0.500	ND<0.500	ND<1.00	ND<250	ND<500	----	----	----	----	----	----	----	----	----	----	----	**5.72**	ND<1.00	----	----
Off-Property Wells Situated in Close Proximity to Property Boundary																											
SS1-W1 Screened Interval 10-20 feet bgs, 1.5-Inch Diameter Casing																											
SS1-W1	03/02/20	148.83	10.88	----	137.95	ND<100	ND<1	ND<1	ND<1	ND<3	**62 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/13/18	148.83	11.92	----	136.91	ND<100	ND<1	ND<1	ND<1	ND<3	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	12/06/17	148.83	10.75	----	138.08	ND<100	ND<1.0	ND<2.0	ND<1.0	ND<3.0	ND<200	ND<400	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
SS1-W2 Screened Interval 12-22 feet bgs, 1.5-Inch Diameter Casing																											
SS1-W2	03/02/20	146.93	12.11	----	134.82	ND<100	ND<1	ND<1	ND<1	ND<3	**69 x**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/13/18	146.93	14.54	----	132.39	ND<100	ND<1	ND<1	ND<1	ND<3	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	12/06/17	146.93	13.65	----	133.28	ND<100	ND<1.0	ND<2.0	ND<1.0	ND<3.0	ND<200	ND<400	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MW10 Screened Interval 10-30 feet bgs, 2-Inch Diameter Casing																											
MW10	03/02/20	148.16	12.37	0.00	135.79	ND<100	ND<1	ND<1	ND<1	ND<3	**68 x**	ND<300	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/13/18	148.16	13.33	0.00	134.83	ND<100	ND<1	ND<1	ND<1	ND<3	ND<50	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/06/17	148.16	11.43	0.00	136.73	ND<100	ND<1	ND<1	ND<1	ND<3	----	----	----	----	----	----	----	----	----	ND<1	ND<1	ND<1	ND	----	----	----	----
	11/11-13/13	148.16	12.54	0.00	135.62	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<31	ND<73	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/20-22/13	148.16	12.35	0.00	135.81	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<29	ND<68	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/12-14/12	148.16	12.28	0.00	135.88	**180**	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<30	**230**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/07-08/12	148.16	11.92	0.00	136.24	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<30	ND<70	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/10-12/11	148.16	12.02	0.00	136.14	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<30	ND<69	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	01/17-20/11	148.16	10.62	0.00	137.54	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<59[19]	**250[5]**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/19-22/10	148.16	11.93	0.00	136.23	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<31	ND<73	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10/12-15/09	148.16	12.23	0.00	135.93	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<29	ND<67	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/13-16/09	148.16	12.11	0.00	136.05	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	ND<29	ND<67	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/10/08	148.16	12.66	0.00	135.50	ND<50	**0.7**	ND<0.5	ND<0.5	ND<0.5	ND<30	ND<69	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/28-05/01/08	148.16	12.71[5]	0.00	135.45	ND<50	**0.8**	ND<0.5	ND<0.5	ND<0.5	ND<77	ND<97	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	12/04-05/07	148.16	14.33	0.00	133.83	**150**	**2.0**	ND<2.0	**0.9**	ND<5.0	ND<78	ND<98	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/17-19/07	148.16	13.05	0.00	135.11	**100**	**1.4**	ND<0.5	ND<0.5	ND<1.5	ND<75	ND<94	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	01/24-31/05	148.16	12.36	0.00	135.80	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<1.5	ND<250	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10/21-11/01/04	148.16	13.31	0.00	134.85	**210**	**4.1**	ND<0.5	**1.2**	**2.1**	ND<82	ND<00	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	07/15-16/04	148.16	13.44	0.00	134.72	**362**	**2.75**	ND<0.500	**0.549**	**3.45**	ND<250	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.00	----	----
	04/29-30/04	148.16	13.23	0.00	134.93	ND<50	1.5	ND<0.5	ND<0.5	ND<1.5	ND<250	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	ND<0.99	----	----
	01/21-23/04	148.16	11.99	0.00	136.17	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<1.5	ND<250	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.2	----	----
	10/01-02/03	148.16	13.68	0.00	134.48	**190**	**2.6**	ND<0.5	**0.5**	ND<3.0	ND<250	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.2	----	----
MTCA Method A Cleanup Levels for Ground Water						**800/1,000[1]**	**5**	**1,000**	**700**	**1,000**	**500**	**500**	**500**	**500**	**160**	**0.1**	**20**	**0.01**	**5**	**5**	**5**	**NVE**	**Analyte Specific**	**15**	**15**	**5**	**Analyte Specific**
Applicable or Relevant and Appropriate Requirements (ARARs)[2]						----	**5**	**1,000**	**700**	**10,000**	----	----	----	----	----	----	----	**0.05**	**5**	**5**	**5**	**70**	**Analyte Specific**	**15**	**15**	**10**	**Analyte Specific**

Table 2, Page 5 of 6. Summary of Groundwater Analytical Laboratory Results for the Property
Roystone Redevelopment
631 Queen Anne Avenue North, Seattle, Washington 98109
The Riley Group, Inc. Project No. 2017-015K

Sample Number	Sample Date	TOC Elevation (ft)	Depth to Water Below Well TOC (ft)	LNAPL Thickness (ft)	Groundwater Elevation (ft)	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	Diesel TPH	Oil TPH	Naph.	cPAHs	MTBE	EDB	EDC	PCE	TCE	cis-1,2-DCE	Other VOCs^{7}	Total Pb	Dissolved Pb	Dissolved As	Other Metals
							B	T	E	X	without silica gel		with silica gel														
MW10	06/30-07/01/03	148.16	12.91	0.00	135.25	**255**	**2.01**	ND<0.500	**0.535**	**2.53**	ND<250	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.00	----	----
	04/23-24/03	148.16	11.76	0.00	136.40	ND<50.0	ND<0.500	ND<0.500	ND<0.500	ND<1.00	----	----	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.00	----	----
	01/21/03	148.16	12.46	0.00	135.70	**416**	**3.44**	**0.55**	**0.519**	**3.24**	ND<250	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.00	----	----
	10/17-18/02	148.16	13.59	0.00	134.57	**490**	**3.42**	ND<0.500	**1.34**	**5.00**	**667**	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.00	----	----
	7/24/02^{3}	148.16	13.14	0.00	135.02	**240**	**2.5**	ND<0.500	ND<1.0	ND<1.5	**320**	**600**	----	----	ND<2	----	ND<2	----	ND<2	ND<1	ND<1	**15**	----	----	**1.3**	**4.1**	----
	06/14/00	148.16	----	----	----	**99.2**	**1.56**	ND	ND	ND	ND<250	ND<500	----	----	----	----	----	----	----	----	----	----	----	ND	ND	----	----
	12/15/99	148.16	----	----	----	**618**	**7.02**	ND<0.910	ND<0.850	ND<4.22	**353**	ND<500	----	----	----	----	----	----	----	----	----	----	----	ND<1	ND<1.00	----	----
	11/1997	148.16	----	----	----	**1,000**	**4.2**	**2**	**4.8**	**2.2 J**	----	----	----	----	----	----	----	----	----	----	----	----	----	**4.9**	----	----	----
	07/1997	148.16	----	----	----	**1,100**	**10**	**2.1**	**2.4**	**4.34 J**	----	----	----	----	----	----	----	----	----	----	----	----	----	**1.2 j**	----	----	----
	04/1997	148.16	----	----	----	**420**	**5.1**	**1**	ND<1	**2.0 J**	----	----	----	----	----	----	----	----	----	----	----	----	----	ND<1	----	----	----
	01/1997	148.16	----	----	----	**180**	**1.5**	ND<1	ND<1	ND<2	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10/1995	148.16	----	----	----	**780**	**1.8**	**2.9**	**0.82 J**	**5.6**	----	----	----	----	----	----	----	----	----	ND<1	**0.7**	ND<1	----	ND<1	----	----	----
	07/07/93	115.75^{6}	13.81	0.00	101.94	**380**	**13**	ND<5.0	**11**	**24**	----	----	----	----	----	----	----	----	----	----	----	----	----	**8**	----	----	----
	03/26-28/91^{3}	115.75^{6}	13.14	0.00	102.61	----	ND<5	ND<5	ND<5	ND<5	----	----	----	----	----	----	----	ND<0.01	ND<5	ND<5.0	ND<5.0	----	----	----	**12 j**	**21**	BSL
MW24	**Screened Interval 4.2-14.2 feet bgs, 0.75-Inch Diameter Casing**																										
MW24	01/24-31/05	107.95^{6}	5.58	0.00	102.37	ND<50	ND<0.5	**0.6**	ND<0.5	**1.6**	ND<250	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10/26-27/04	107.95^{6}	----	----	----	**500**	----	----	----	----	ND<800	ND<1,000	----	----	----	----	ND<0.5	ND<0.5	ND<0.5	ND<0.8	ND<1	ND<0.8	----	----	----	----	----
RW2	**Screened Interval Unknown, 8-Inch Diameter Casing**																										
RW2 (Product Recovery Well)	11/11-13/13	106.63^{6}	14.36	0.00	92.27	ND<50	**2**	ND<0.5	ND<0.5	ND<0.5	ND<31	ND<73	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	5/20-22/13	106.63^{6}	12.57	0.00	94.06	ND<50	**1**	ND<0.5	ND<0.5	ND<0.5	ND<30	ND<69	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/12-14/12	106.63^{6}	13.50	0.00	93.13	**87**	**5**	ND<0.5	ND<0.5	**0.9**	ND<29	ND<67	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/07-08/12	106.63^{6}	11.40	0.00	95.23	ND<50	ND<0.5	ND<0.5	**2**	**3**	ND<30	ND<69	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	05/10-12/11	106.63^{6}	11.96	0.00	94.67	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<0.5	**230**	**91**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	01/17-20/11	106.63^{6}	9.70	0.00	96.93	**150**	ND<0.5	ND<0.5	**8**	**16**	**270**	**190**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/19-22/10	106.63^{6}	12.56	0.00	94.07	**160**	**9**	0.7	ND<0.5	ND<0.5	**430**	**240**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10/12-15/09	106.63^{6}	14.75	0.00	91.88	**1,100**	**35**	**4**	**7**	**11**	**4,300**	ND<680	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	4/13-16/09	106.63^{6}	13.80	0.00	92.83	**340**	**21**	**0.9**	**1**	**1**	**840**	ND<65	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	11/04/08	106.63^{6}	15.66	0.00	90.97	**890**	**82**	**9**	**14**	**6**	**1,000**	ND<66	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/28-29/08	106.63^{6}	15.84	0.00	90.79	**190**	**12**	**1**	**0.9**	**2**	**890**	ND<95	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	12/04-06/07	106.63^{6}	15.21	0.00	91.42	ND<50	ND<0.5	ND<0.5	ND<0.5	ND<1.5	**400**	ND<100	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/17-18/07	106.63^{6}	17.12	0.00	89.51	**650**	**54**	**12**	**10**	**35**	**15,000**	ND<1,900	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	04/18-21/05	106.63^{6}	9.18	0.00	97.45	**130**	**0.8**	ND<0.5	**2.3**	**6.1**	**260**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	01/24-31/05	106.63^{6}	11.57	0.00	95.06	**94**	ND<0.5	ND<0.5	ND<2.0	**2.5**	ND<250	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	10/28-11/01/04	106.63^{6}	14.68	0.00	91.95	**26,000**	**410**	**63**	**470**	**950**	**280,000**	ND<40,000	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	07/15-16/04	106.63^{6}	14.41	0.00	92.22	**634**	**25.7**	**2.39**	**6.18**	**3.55**	ND<250	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.00	----	----
	04/29-30/04	106.63^{6}	13.31	0.00	93.32	**81**	**11**	**0.9**	**2.0**	**1.9**	**270**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	ND<0.99	----	----
	01/21-23/04	106.63^{6}	10.22	0.00	96.41	**53**	**1.2**	**0.7**	**1.3**	**8.9**	ND<250	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.2	----	----
	10/01-02/03	106.63^{6}	15.05	0.00	91.58	**2,300**	**75**	**7.3**	**29**	**33**	**1,400**	ND<250	----	----	----	----	----	----	----	----	----	----	----	----	**4.9**	----	----
	06/30-07/01/03	106.63^{6}	13.72	0.00	92.91	**2,380**	**53.5**	**8.72**	**39.8**	**43.2**	**505**	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	**1.43**	----	----
	04/23-24/03	106.63^{6}	10.30	0.00	96.33	**55.7**	ND<0.500	ND<0.500	**0.642**	**2.64**	ND<250	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.00	----	----
	01/21/03	106.63^{6}	10.61	0.00	96.02	**126**	**33.5**	**0.859**	**1.28**	**4.11**	ND<250	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	ND<1.00	----	----
	10/17-18/02	106.63^{6}	14.44	0.00	92.19	**1,380**	**90.5**	**8.05**	**29.2**	**31.5**	**988**	ND<500	----	----	----	----	----	----	----	----	----	----	----	----	**2.23**	----	----
	11/1997	104.54^{6}	----	----	----	**4,400**	**3,140**	**1,200**	**338**	**2,265**	----	----	----	----	----	----	----	----	----	ND<1	ND<1	ND<1	----	----	**15.4**	----	----
	07/1997	104.54^{6}	----	----	----	**24,000**	**4,230**	**2,490**	**398**	**2,732**	----	----	----	----	----	----	----	----	----	ND<25	ND<25	ND<50	----	----	**47.2**	----	----
	04/1997	104.54^{6}	----	----	----	**11,000**	**189**	**243**	**99**	**743**	----	----	----	----	----	----	----	----	----	ND<1	ND<1	ND<1	----	----	**18.2**	----	----
MTCA Method A Cleanup Levels for Ground Water						**800/1,000^{1}**	**5**	**1,000**	**700**	**1,000**	**500**	**500**	**500**	**500**	**160**	**0.1**	**20**	**0.01**	**5**	**5**	**5**	**NVE**	**Analyte Specific**	**15**	**15**	**5**	**Analyte Specific**
Applicable or Relevant and Appropriate Requirements (ARARs)^{2}						**----**	**5**	**1,000**	**700**	**10,000**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**0.05**	**5**	**5**	**5**	**70**	**Analyte Specific**	**15**	**15**	**10**	**Analyte Specific**

Table 2, Page 6 of 6. Summary of Groundwater Analytical Laboratory Results for the Property
Roystone Redevelopment
631 Queen Anne Avenue North, Seattle, Washington 98109
The Riley Group, Inc. Project No. 2017-015K

Sample Number	Sample Date	TOC Elevation (ft)	Depth to Water Below Well TOC (ft)	LNAPL Thickness (ft)	Groundwater Elevation (ft)	Gasoline TPH	BTEX				Diesel TPH	Oil TPH	Diesel TPH	Oil TPH	Naph.	cPAHs	MTBE	EDB	EDC	PCE	TCE	cis-1,2-DCE	Other VOCs^7	Total Pb	Dissolved Pb	Dissolved As	Other Metals
							B	T	E	X	without silica gel		with silica gel														
RW2 (Product Recovery Well)	01/1997	104.54^6	----	----	----	**390**	**31**	**14**	**6**	**49**	----	----	----	----	----	----	----	----	----	ND<1	ND<1	ND<1	----	----	**11**	----	----
	3/26-28/91	104.54^6	10.21	**0.08**	94.39	----	**19,000**	**46,000**	**2,500**	**120,000**	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
	09/1990	104.54^6	12.72	**0.04**	91.85	Not sampled due to the presence of LNAPL																					
P2-W	05/22/17	----	14.00	----	----	ND<100	ND<1	ND<1	ND<1	ND<3	ND<60	ND<300	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
P2-W	05/22/17	----	14.00	----	----	ND<100	ND<1	ND<1	ND<1	ND<3	ND<60	ND<300	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
P3-W	05/22/17	----	13.00	----	----	**1,200**	ND<5	**9.7**	**8.2**	**19**	**1,400**	ND<300	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
Off Property Groundwater Grab Samples																											
SS1-P1	12/02/17	----	----	----	----	ND<100	ND<1.0	ND<2.0	ND<1.0	ND<2.0	ND<200	ND<400	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
SS1-P2	12/02/17	----	----	----	----	ND<100	ND<1.0	ND<2.0	ND<1.0	ND<2.0	ND<200	ND<400	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----
MTCA Method A Cleanup Levels for Ground Water						**800/1,000^1**	**5**	**1,000**	**700**	**1,000**	**500**	**500**	**500**	**500**	**160**	**0.1**	**20**	**0.01**	**5**	**5**	**5**	**NVE**	**Analyte Specific**	**15**	**15**	**5**	**Analyte Specific**
Applicable or Relevant and Appropriate Requirements (ARARs)^2						**----**	**5**	**1,000**	**700**	**10,000**	**----**	**----**	**----**	**----**	**----**	**----**	**----**	**0.05**	**5**	**5**	**5**	**70**	**Analyte Specific**	**15**	**15**	**10**	**Analyte Specific**

Notes:

Samples obtained from 2017 through 2022 were collected by RGI field staff using a peristaltic pump under low-flow conditions. Groundwater samples collected prior to 2017 were obtained by others.

Unless otherwise noted, all analytical results are given in micrograms per liter (ug/L), equivalent to parts per billion (ppb).

TOC = Top of casing

Gasoline-range TPH (total petroleum hydrocarbons) determined using Northwest Test Method NWTPH-Gx.

Diesel- and Oil-range TPH (total petroleum hydrocarbons) determined using Northwest Test Method NWTPH-Dx.

BTEX (benzene, toluene, ethylbenzene, and xylenes) determined using EPA Test Method 8021B.

Naph. (naphthalene), MTBE (methyl tert-butyl ethere), EDB (1,2-dibromoethane), EDC (1,2-dichloroethane), PCE (tetrachloroethene), TCE (trichloroethene), cis-1,2-DCE (cis-1,2-dichloroethene), and other VOCs (volatile organic compounds) determined using EPA Test Method 8260.

LNAPL = Light non-aqueous phase liquid.

Pb (lead), As (arsenic) and other metals determined using EPA 6000/7000 Series Methods.

ve = The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

x = The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

j = The analyte was positively identified. The reported value is an estimate.

P = The analyte was detected above the instrument detection limit, but below the established minimum quantitation limit.

ND = Not detected above the noted laboratory detection limit.

NVE = No value established

---- = Not analyzed or not applicable.

Silica gel = Samle extract passed through a silica gel column prior to analysis. The silica gel column removes naturally occuring biogenic material that can interfere with TPH results when present.

Washington State Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Method A Cleanup Levels for Ground Water (WAC 173-340-900, Table 720-1). Federal and State ARARs obtained from Ecology's Cleanup Level and Risk Calculation (CLARC) database.

ARAR = Applicable or Relevant and Appropriate Requirement. ARARs for the Property are the Federal and State Primary Maximum Contaminant Levels (MCLs) as established under the Environmental Protection Agency (EPA) National Primary Drinking Water Regulations.

[1] The higher cleanup level is applicable if no benzene is detected in groundwater.

[2] No MTCA Method A Cleanup Level has been established. Therefore, the Federal and State ARAR is referenced.

[3] Indicates a duplicate sample was collected. The highest concentration for each analyte was reported.

[4] Laboratory report indicates heavy range organics are due to hydrocarbons primarily in the diesel range.

[5] The reporting limits were raised due to interference in the sample matrix.

[6] Top of casing elevation and groundwater elevation based on arbitrary datum. Not actual elevations.

[7] Only VOCs not factored into the MTCA Method A TPH cleanup levels are reported.

[8] Top of casing elevations for wells MWA through MWF, MW6, MW9, MW13, VP9, SSI-W1, SSI-W2, and MW10 were surveyed by a licensed surveyor using actual elevation data in 2018 and 2021. Reports prepared prior to this time present top of casing elevations based on arbitrary datum.

Bold results indicated concentrations above laboratory detection limits or LNAPL detected in well.

Bold and yellow highlighted results indicate concentrations (if any) that exceed the applicable groundwater screening level.

Table 3 Summary of Soil Vapor Air Analytical Data
Roystone Redevelopment
631 Queen Anne Avenue N, Seattle, WA
The Riley Group, Inc. Project No. 2017-015K Task 6A

Sample Number	Sample Date	Sample Depth (feet below ground surface)	TPHv Fractions[1]				BTEX				Naph.	Fixed Gases[2]					
			Total TPH[1]	C_5 - C_8	C_9 - C_{12}	C_9 - C_{10}	B	T	E	X		Carbon Dioxide	Carbon Monoxide	Methane	Nitrogen	Oxygen	Hydrogen
				aliphatics	aliphatics	aromatics											
SV-1	12/17/22	5	**640**	ND<380	ND<130	ND<130	**3**	ND<9.6	ND<2.2	ND<6.6	ND'<1.3	ND<0.05	ND<0.05	ND<0.05	**76.2**	**23.7**	ND<0.05
SV-2	12/17/22	5	**720**	ND<430	**150**	ND<140	ND<1.8	ND<110	ND<2.5	ND<7.5	ND<1.5	0.253	ND<0.09	ND<0.09	**75.6**	**24.2**	ND<0.09
MTCA Method B Soil Vapor Screening Levels[3] (Residential Exposure Scenario)			**1,500**	----	----	----	**11**	**76,000**	**457**	**45.7**	**2.5**	----	----				
MTCA Method B Indoor Air Cleanup Levels (Residential Exposure Scenario)[3]			**46**	----	----	----	**0.321**	**2,290**	**15,000**	**1,500**	**0.0735**	----	----	----	----	----	----

Notes:

All analytical results are given in micrograms per cubic meter (ug/m^3) unless otherwise indicated.

BTEX (Benzene, toluene, ethylbenzene, and total xylenes) and naphthalenes (naph) determined using EPA Test Method TO-15.

ND = Not detected at a concentration above the laboratory detection limit.

[1] TPH = Total Petroleum Hydrocarbons. Petroleum fractions for aliphatics C5-C8 and C9-C12 and aromatics C9-C12 determined using Air Phase Hydrocarbons (APH) Massachusetts Method by EPA Test Method TO-15. The total TPH concentration provided is the sum of all petroleum fractions and includes the value of the detection limit when petroleum fractions were not detected above the detection limit.

[2] Fixed Gases including carbon dioxide, carbon monoxide, methane, nitrogen, oxygen, and hydrogen analyzed using EPA Method 3C. The value is reported as a percent ratio.

[3] Washington State Department of Ecology (Ecology) Model Toxics Control Act (MTCA) Method B Soil Vapor Screening Levels (SVSLs) and Indoor Air Cleanup Levels (IACULs) were obtained from Ecology's Cleanup Level and Risk Calculation (CLARC) database, which was last updated in January of 2023. The carcinogenic value is referenced (when available).

Bold results indicate soil vapor concentrations above laboratory detection limits.

Bold and highlighted results indicate soil vapor concentrations that exceed MTCA Method B SVSLs, which are considered protective of indoor air at residential properties.

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

In the Matter of Remedial Action by:	AGREED ORDER
ROYSTONE ON QUEEN ANNE, LLC CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY[1]	No. 16537

TO: MR. PUI LEUNG
ROYSTONE ON QUEEN ANNE, LLC
606 MAYNARD AVENUE SOUTH #251
SEATTLE, WA 98104

MR. ERIC HETRICK
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
DOWNSTREAM BUSINESS UNIT
6001 BOLLINGER CANYON ROAD
SAN RAMON, CA 94583

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[1] Chevron Environmental Management Company is acting for itself and as attorney-in-fact for Texaco Inc. under this Order. *See* Section VI.F, *infra*.

TABLE OF CONTENTS

I. INTRODUCTION

The mutual objective of the State of Washington, Department of Ecology (Ecology), Roystone on Queen Anne, LLC (Roystone), and Chevron Environmental Management Company (CEMC), a California corporation acting for itself and as attorney-in-fact for Texaco Inc. (Texaco) (collectively the "Parties") under this Agreed Order (Order) is to provide for remedial action at a facility where there has been a release or threatened release of hazardous substances. This Order requires Roystone and CEMC to conduct an interim action to be performed during development construction, to complete a Site Remedial Investigation (RI), Feasibility Study (FS), and prepare a preliminary Draft Cleanup Action Plan (DCAP) for the Site located at 631 Queen Anne Avenue North in Seattle, Washington. Ecology believes the actions required by this Order are in the public interest.

II. JURISDICTION

This Agreed Order is issued pursuant to the Model Toxics Control Act (MTCA), RCW 70.105D.050(1).

III. PARTIES BOUND

This Agreed Order shall apply to and be binding upon the Parties to this Order, their successors and assigns. The undersigned representative of each party hereby certifies that he or she is fully authorized to enter into this Order and to execute and legally bind such party to comply with this Order. Roystone and CEMC agree to undertake all actions required by the terms and conditions of this Order. No change in ownership or corporate status shall alter Roystone's and CEMC's responsibility under this Order. Roystone and CEMC shall provide a copy of this Order to all agents, contractors, and subcontractors retained to perform work required by this Order, and shall ensure that all work undertaken by such agents, contractors, and subcontractors complies with this Order.

IV. DEFINITIONS

Unless otherwise specified herein, the definitions set forth in RCW 70.105D and WAC 173-340 shall control the meanings of the terms in this Order.

A. Site: The Site is referred to as Texaco 211577 Monterey. The Site constitutes a facility under RCW 70.105D.020(8). The Site is defined by where a hazardous substance, other than a consumer product in consumer use, has been deposited, stored, disposed of, or placed, or otherwise come to be located. Based upon factors currently known to Ecology, the Site is generally located at 631 Queen Anne Avenue North in Seattle, Washington, 98109, as shown in the Site Location Diagram (Exhibit A).

B. Parties: Refers to the State of Washington Department of Ecology, Roystone, and CEMC.

C. Potentially Liable Persons (PLPs): Refers to Roystone, Texaco, CEMC, and the Estates of William F. Arnold and Erma R. Arnold, as identified by Ecology.

D. Property: Refers to King County parcel number 3879900425, which covers 11,070 square feet.

E. Subject PLPs: Refers to PLPs subject to this Order, Roystone and CEMC.

F. Agreed Order or Order: Refers to this Order and each of the exhibits to this Order. All exhibits are integral and enforceable parts of this Order.

G. Light Non-aqueous Phase Liquids (LNAPL): A hazardous substance that is present in the soil, bedrock, groundwater or surface water as a liquid not dissolved in water. An LNAPL is one of a group of organic substances that are relatively insoluble in water and are less dense than water. LNAPLs, such as oil, tend to spread across the surface of the water table and form a layer on top of the water table.

V. FINDINGS OF FACT

Ecology makes the following findings of fact, without any express or implied admissions of such facts by Subject PLPs:

A. Based upon factors currently known to Ecology, the Site is generally located at 631 Queen Anne Avenue North in Seattle, Washington, as shown in the Site Location Diagram (Exhibit A). The Property is located within the Site.

B. Texaco owned and/or operated a gasoline service station at the Property from 1927 until May 1977.

C. William Arnold and Erma Arnold (Arnolds) purchased the Property in 1977. The Arnolds operated the service station until they sold the Property to John Yoo and Young Yoo in 1989. The sale was rescinded in 1993 because of the presence of petroleum hydrocarbon contamination. Roystone acquired the Property in October 2017.

D. From 1927 to 1993, a total of seven generations of underground storage tanks (USTs)/fuel systems/service station/convenience store configurations have existed at the Property, from which, or in relation to which, releases to the environment occurred. In 1993, Ecology ordered the Arnolds to stop selling gasoline and contracted to have the USTs and associated gasoline dispensing equipment removed from the Property. Seven USTs were removed from the Property and one UST was abandoned in place.

E. From 1993 to 2018, a convenience store (Manhattan Express Deli) operated on the Property. The Property is currently occupied by a vacant convenience store building and a paved parking lot.

F. In February 1978, the basement of the southwest-neighboring Monterey Apartment building was noted to have gasoline odors, which were investigated by the Seattle Fire Department. In 1986, Ecology began investigating the source of gasoline odors in the Monterey Apartment building. Environmental investigations revealed that the source of the gasoline odors present in the Monterey Apartment building was the Property. Releases of petroleum hydrocarbons associated with service station operations at the Property have resulted in petroleum hydrocarbons being present in the soil, in soil gas, in indoor air, dissolved in groundwater, and as LNAPL floating on the groundwater.

G. In 1993, Ecology installed and operated a soil vapor extraction (SVE) and groundwater recovery system with a spray aeration vacuum extraction (SAVE) treatment system at the Site. In 1996, the SAVE system was replaced with a catalytic oxidizer, and the SVE system continued operations intermittently until December 1997. In April 2003, CEMC upgraded the SVE system and restarted operations with few interruptions until July 2005. In 2006, CEMC replaced the SVE system with a Dual Phase Extraction system and operated it until April 2008.

H. LNAPL was detected floating on the groundwater surface in several well locations at the Site from 1986 to 2008. An LNAPL sample collected in 1991 indicated the LNAPL consisted of gasoline and diesel. The maximum LNAPL thickness was 2.26 feet, detected in November 1986. LNAPL was not detected in Site wells during the most recent groundwater sampling events, which occurred in 2018 (for the portion of the Site on the Property) and 2013 (for the off-Property areas of the Site).

I. Gasoline, diesel-, and oil range petroleum hydrocarbons, benzene, toluene, ethylbenzene, xylenes (BTEX), and naphthalene have been detected in soil and groundwater samples collected from the Site at concentrations above MTCA cleanup levels. Lead and arsenic have been detected in groundwater samples collected from the Site at concentrations above MTCA cleanup levels. BTEX, and 1,2,4-trimethybenzene have been detected in sub-slab soil gas samples collected from the Site at concentrations above MTCA cleanup levels. These contaminants are hazardous substances under WAC 173-340-200, and may pose a threat to human health and the environment.

J. From 1991 to 2004, tetrachloroethene (PCE) and trichloroethene (TCE) were detected at concentrations above MTCA cleanup levels in groundwater samples collected in wells located west, southwest, and southeast of the Property. PCE has been detected in sub-slab soil gas samples at concentrations above MTCA cleanup levels southwest of the Property. PCE concentrations in the most recent sub-slab soil gas and indoor air samples collected in 2009 were below the MTCA cleanup levels. Based on direction of groundwater flow to the southwest, these contaminants are suspected to be from an upgradient source—a former dry cleaners located northeast of the Property, at 14 Roy Street in Seattle, Washington.

VI. ECOLOGY DETERMINATIONS

Ecology makes the following determinations, without any express or implied admissions of such determinations (and underlying facts) by Subject PLPs.

A. Roystone is an "owner or operator" as defined in RCW 70.105D.020(22) of a "facility" as defined in RCW 70.105D.020(8).

B. Texaco was an "owner or operator" as defined in RCW 70.105D.020(22) of a "facility" as defined in RCW 70.105D.020(8) at the time of disposal or release of the hazardous substances.

C. Based upon all factors known to Ecology, a "release" or "threatened release" of "hazardous substance(s)" as defined in RCW 70.105D.020(32) and (13), respectively, has occurred at the Site.

D. Based upon credible evidence, Ecology issued a PLP Notice letter to Roystone dated March 26, 2019, pursuant to RCW 70.105D.040, .020(26), and WAC 173-340-500. By letter dated March 27, 2019, Roystone voluntarily waived its rights to notice and comment and accepted Ecology's determination that Roystone is a PLP under RCW 70.105D.040. Ecology issued a determination by letter dated April 1, 2019.

E. Based upon credible evidence, Ecology issued a PLP Notice letter to Equiva Services LLC (intended for Texaco Inc.) dated April 27, 1999, pursuant to RCW 70.105D.040, .020(26), and WAC 173-340-500. After providing for notice and opportunity for comment, reviewing comments submitted on August 5, 1999, and concluding that credible evidence supported a finding of potential liability, Ecology issued a determination that Texaco is a PLP under RCW 70.105D.040 by letter dated September 1, 1999.

F. As of the effective date of this Order, Texaco is a corporate subsidiary of the Chevron Corporation (Chevron). CEMC, which is also a subsidiary of Chevron, is a signatory to this Order both for itself and as attorney-in-fact for Texaco, managing environmental matters on Texaco's behalf. By signing this Order, CEMC voluntarily accepts status as a PLP for the Site. Ecology accepts CEMC as a signatory and Subject PLP under this Order at the request of Texaco and its corporate successor(s) without waiving any statutory authority it may have with respect to Texaco or any corporate successor of Texaco, including enforcement against Texaco and any such successors in the event of noncompliance with this Order.

G. Pursuant to RCW 70.105D.030(1) and .050(1), Ecology may require Subject PLPs to investigate or conduct other remedial actions with respect to any release or threatened release of hazardous substances, whenever it believes such action to be in the public interest. Based on the foregoing facts, Ecology believes the remedial actions required by this Order are in the public interest.

H. Under WAC 173-340-430, an interim action is a remedial action that is technically necessary to reduce a threat to human health or the environment by eliminating or substantially reducing one or more pathways for exposure to a hazardous substance, that corrects a problem that may become substantially worse or cost substantially more to address if the remedial action is delayed, or that is needed to provide for completion of a site hazard assessment, remedial investigation/feasibility study, or design of a cleanup action plan. The Property is planned for a redevelopment in August 2019, and an interim action is proposed in conjunction with the Property redevelopment. Based on these circumstances, Ecology has determined that an interim action is warranted under WAC 173-340-430. Either party may propose an additional interim action under this Order. If the Parties are in agreement concerning the additional interim action, the Parties will follow the process in Section VII.I. If the Parties are not in agreement, Ecology reserves its authority to require additional interim action(s) under a separate order or other enforcement action under RCW 70.105D, or to undertake the interim action(s) itself.

VII. WORK TO BE PERFORMED

Based on the Findings of Fact and Ecology Determinations, it is hereby ordered that Subject PLPs take the following remedial actions at the Site. These remedial actions must be conducted in accordance with WAC 173-340:

A. To effectuate the work to be performed under this Order in the most efficient manner, the Subject PLPs have elected to designate lead roles in performing various aspects of the work required under this Order, with Roystone responsible for tasks relating to the Property and CEMC responsible for tasks involving the remaining off-Property areas of the Site. Therefore, CEMC will be the lead PLP for all deliverables under this Order other than the interim action described in Section VII.B below. However, except with respect to the interim action described in Section VII.B below, the Subject PLPs remain strictly, jointly, and severally liable for the performance of any and all obligations under this Order. In the event the party identified as a lead should fail to timely and properly complete performance of all or any portion of its work, all Subject PLPs must perform that remaining work, if any, regardless of designations in this Order.

B. Roystone will prepare an Interim Action Work Plan (IAWP) in accordance with the schedule and as specified in Task 2 of Exhibit B, Scope of Work, for an interim action planned to occur in conjunction with planned redevelopment of the Property. Ecology will provide public notice and opportunity to comment on the IAWP in accordance with WAC 173-340-600(16). Roystone shall not conduct the interim action until Ecology approves the IAWP. Upon approval by Ecology, the IAWP becomes an integral and enforceable part of this Order, and Roystone is required to conduct the interim action in accordance with the approved IAWP. The objective of the IAWP shall be to remediate the Property so that no further on-Property remedial action is required. Upon completion of the IAWP, Roystone shall submit an Agency Review Draft Interim Action Report. Ecology shall review the Draft Interim Action Report and confirm whether Roystone has complied with the IAWP. No later than 30 days after Ecology's approval of the

Agency Review Draft Interim Action Report, Roystone shall submit to Ecology a Final Interim Action Report.

C. Subject PLPs shall submit an Agency Review Draft RI Work Plan to update the RI. In 1990 and 1991, a first phase of RI (Phase I RI) was initiated and performed at the Site by Ecology. The results of the Phase I RI were documented in a Phase I RI Report dated August 1991. CEMC reinitiated RI activities independently in 2002 through 2007 under the Ecology Voluntary Cleanup Program (VCP). The results were documented in a Final RI and Site Summary Report dated August 20, 2007. Groundwater monitoring and additional limited investigation were conducted from 2007 to 2015 by CEMC. The Site was then entered into the VCP by Roystone, which implemented groundwater monitoring and supplemental subsurface investigation. Subject PLPs shall prepare a RI Work Plan based on the prior RI and Site investigation data, and data available from the subsequent interim action by Roystone, to gather current Site data to fully characterize the extent of contamination in all environmental media. After approval of the Final RI Work Plan by Ecology, Subject PLPs shall implement the Final RI Work Plan and complete the investigation in accordance with the requirement of WAC 173-340-350. Subject PLPs shall conduct an FS according to the requirements of WAC 173-340-350(8); the FS shall include a reasonable number and type of cleanup option alternatives for the cleanup action at the Site following the interim action by Roystone. Subject PLPs shall provide Ecology with an Agency Review Draft RI Report and an Agency Review Draft FS Report. These Reports may be submitted together as an Agency Review Draft RI/FS Report. After Ecology has approved the RI and FS Report as a Public Review Draft document, Subject PLPs will prepare a preliminary DCAP. These deliverables will be prepared in accordance with Exhibit B, Scope of Work, which is incorporated by reference as an enforceable part of this Order.

D. The schedule of work performance and list of deliverables is described in Exhibit C, Schedule of Deliverables, and is incorporated by reference as an enforceable part of this Order.

E. All plans or other deliverables submitted by Subject PLPs for Ecology's review and approval under the Scope of Work and Schedule (Exhibits B and C) shall, upon Ecology's approval, become integral and enforceable parts of this Order.

F. If Subject PLPs learn of a significant change in conditions at the Site, including but not limited to a statistically significant increase in contaminant and/or chemical concentrations in soil, groundwater, and/or air, Subject PLPs, within seven (7) days of learning of the change in condition, shall notify Ecology in writing of said change and provide Ecology with any reports or records (including laboratory analyses, sampling results) relating to the change in conditions.

G. Subject PLPs shall submit to Ecology written quarterly Progress Reports that describe the actions taken during the previous quarter to implement the requirements of this Order. All Progress Reports shall be submitted by the tenth (10th) day of the month in which they are due after the effective date of this Order. Unless otherwise specified by Ecology, Progress Reports and any other documents submitted pursuant to this Order shall be sent by certified mail, return receipt requested, to Ecology's project coordinator. The Progress Reports shall include the following:

1. A list of on-site activities that have taken place during the quarter to comply with the AO.

2. Detailed description of any deviations from required tasks not otherwise documented in approved work plans or amendment requests.

3. Description of all deviations from the Scope of Work and Schedule (Exhibits B and C) during the current quarter and any planned deviations in the upcoming quarter.

4. For any deviations in schedule, a plan for recovering lost time and maintaining compliance with the schedule.

5. All raw data (including laboratory analyses) received during the previous quarter (if not previously submitted to Ecology), together with a detailed description of the underlying samples collected.

6. A list of deliverables for the upcoming quarter if different from the schedule.

7. Summaries of contacts with representatives of the local community, public interest groups, press, and federal, state, or tribal government.

8. Changes in key personnel.

H. All plans or other deliverables submitted by Subject PLPs for Ecology's review and approval under the Scope of Work and Schedule (Exhibits B and C) shall, upon Ecology's approval, become integral and enforceable parts of this Order.

I. If the Parties agree on an additional interim action under Section VI.G, Subject PLPs shall prepare and submit to Ecology an Interim Action Work Plan, including a scope of work and schedule, by the date determined by Ecology. Ecology will provide public notice and opportunity to comment on the Interim Action Work Plan in accordance with WAC 173-340-600(16). The Subject PLPs shall not conduct the additional interim action until Ecology approves the Interim Action Work Plan. Upon approval by Ecology, the Interim Action Work Plan becomes an integral and enforceable part of this Order, and the Subject PLPs are required to conduct the interim action in accordance with the approved Interim Action Work Plan.

J. If Ecology determines that a Subject PLP has failed to make sufficient progress or failed to implement the remedial action, in whole or in part, Ecology may, after notice to Subject PLPs, perform any or all portions of the remedial action or at Ecology's discretion allow the Subject PLPs opportunity to correct. In an emergency, Ecology is not required to provide notice to Subject PLPs, or an opportunity for dispute resolution. Subject PLPs shall reimburse Ecology for the costs of doing such work in accordance with Section VIII.A (Payment of Remedial Action Costs). Ecology reserves the right to enforce requirements of this Order under Section X (Enforcement).

K. Except where necessary to abate an emergency situation or where required by law, the Subject PLPs shall not perform any remedial actions at the Site outside those remedial actions required by this Order to address the contamination that is the subject of this Order, unless Ecology concurs, in writing, with such additional remedial actions pursuant to Section VIII.J (Amendment of Order). In the event of an emergency, or where actions are taken as required by law, Subject PLPs must notify Ecology in writing of the event and remedial action(s) planned or taken as soon as practical but no later than within twenty-four (24) hours of the discovery of the event.

VIII. TERMS AND CONDITIONS

A. Payment of Remedial Action Costs

Subject PLPs shall pay to Ecology costs incurred by Ecology pursuant to this Order and consistent with WAC 173-340-550(2). These costs shall include work performed by Ecology or its contractors for, or on, the Site under RCW 70.105D, including remedial actions and Order preparation, negotiation, oversight, and administration. These costs shall include work performed both prior to and subsequent to the issuance of this Order. Ecology's costs shall include costs of direct activities and support costs of direct activities as defined in WAC 173-340-550(2). Ecology has accumulated approximately $12,000 in remedial action costs related to this Site as of May 31, 2019. For all Ecology costs incurred, Subject PLPs shall pay the required amount within thirty (30) days of receiving from Ecology an itemized statement of costs that includes a summary of costs incurred, an identification of involved staff, and the amount of time spent by involved staff members on the project. A general statement of work performed will be provided upon request. Itemized statements shall be prepared quarterly. Pursuant to WAC 173-340-550(4), failure to pay Ecology's costs within ninety (90) days of receipt of the itemized statement of costs will result in interest charges at the rate of twelve percent (12%) per annum, compounded monthly.

In addition to other available relief, pursuant to RCW 19.16.500, Ecology may utilize a collection agency and/or, pursuant to RCW 70.105D.055, file a lien against real property subject to the remedial actions to recover unreimbursed remedial action costs.

B. Designated Project Coordinators

The project coordinator for Ecology is:

Jing Song
Washington Department of Ecology
Northwest Regional Office
Toxics Cleanup Program
3190 160th Avenue SE
Bellevue, WA 98008
Telephone: (425) 649-7109
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The project coordinators for Subject PLPs are:

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Chevron Environmental Management Company
Downstream Environmental Management
6001 Bollinger Canyon Road
San Ramon, CA 94583
Telephone: (925) 842-2418
ehetrick@chevron.com

Each project coordinator shall be responsible for overseeing the implementation of this Order. Ecology's project coordinator will be Ecology's designated representative for the Site. To the maximum extent possible, communications between Ecology and Subject PLPs, and all documents, including reports, approvals, and other correspondence concerning the activities performed pursuant to the terms and conditions of this Order shall be directed through the project coordinators. The project coordinators may designate, in writing, working level staff contacts for all or portions of the implementation of the work to be performed required by this Order.

Any party may change its respective project coordinator. Written notification shall be given to the other party at least ten (10) calendar days prior to the change.

C. Performance

All geologic and hydrogeologic work performed pursuant to this Order shall be under the supervision and direction of a geologist or hydrogeologist licensed by the State of Washington or under the direct supervision of an engineer registered by the State of Washington, except as otherwise provided for by RCW 18.43 and 18.220.

All engineering work performed pursuant to this Order shall be under the direct supervision of a professional engineer registered by the State of Washington, except as otherwise provided for by RCW 18.43.130.

All construction work performed pursuant to this Order shall be under the direct supervision of a professional engineer or a qualified technician under the direct supervision of a professional engineer. The professional engineer must be registered by the State of Washington, except as otherwise provided for by RCW 18.43.130.

Any documents submitted containing geologic, hydrogeologic, or engineering work shall be under the seal of an appropriately licensed professional as required by RCW 18.43 and 18.220.

Subject PLPs shall notify Ecology in writing of the identity of any engineer(s) and geologist(s), contractor(s) and subcontractor(s), and others to be used in carrying out the terms of this Order, in advance of their involvement at the Site.

D. Access

Ecology or any Ecology authorized representative shall have access to enter and freely move about all property at the Site that Subject PLPs either own, control, or have access rights to at all reasonable times for the purposes of, *inter alia*: inspecting records, operation logs, and contracts related to the work being performed pursuant to this Order; reviewing Subject PLPs' progress in carrying out the terms of this Order; conducting such tests or collecting such samples as Ecology may deem necessary; using a camera, sound recording, or other documentary type equipment to record work done pursuant to this Order; and verifying the data submitted to Ecology by Subject PLPs. Subject PLPs shall make all reasonable efforts to secure access rights for those properties within the Site not owned or controlled by Subject PLPs where remedial activities or investigations will be performed pursuant to this Order. Ecology or any Ecology authorized representative shall give reasonable notice before entering any Site property owned or controlled by Subject PLPs unless an emergency prevents such notice. All persons who access the Site pursuant to this section shall comply with any applicable health and safety plan(s). Ecology employees and their representatives shall not be required to sign any liability release or waiver as a condition of Site property access.

E. Sampling, Data Submittal, and Availability

With respect to the implementation of this Order, Subject PLPs shall make the results of all sampling, laboratory reports, and/or test results generated by it or on its behalf available to Ecology. Pursuant to WAC 173-340-840(5), all sampling data shall be submitted to Ecology in both printed and electronic formats in accordance with Section VII (Work to be Performed), Ecology's Toxics Cleanup Program Policy 840 (Data Submittal Requirements), and/or any subsequent procedures specified by Ecology for data submittal.

If requested by Ecology, Subject PLPs shall allow Ecology and/or its authorized representative to take split or duplicate samples of any samples collected by Subject PLPs pursuant to implementation of this Order. Subject PLPs shall notify Ecology seven (7) days in advance of any sample collection or work activity at the Site. Ecology shall, upon request, allow Subject PLPs and/or its authorized representative to take split or duplicate samples of any samples collected by Ecology pursuant to the implementation of this Order, provided that doing so does not interfere with Ecology's sampling. Without limitation on Ecology's rights under Section VIII.D (Access), Ecology shall notify Subject PLPs prior to any sample collection activity unless an emergency prevents such notice.

In accordance with WAC 173-340-830(2)(a), all hazardous substance analyses shall be conducted by a laboratory accredited under WAC 173-50 for the specific analyses to be conducted, unless otherwise approved by Ecology.

F. Public Participation

A Public Participation Plan is required for this Site. Ecology shall review any existing Public Participation Plan to determine its continued appropriateness and whether it requires amendment, or if no plan exists, Ecology shall develop a Public Participation Plan alone or in conjunction with Subject PLPs.

Ecology shall maintain the responsibility for public participation at the Site. However, Subject PLPs shall cooperate with Ecology, and shall:

1. If agreed to by Ecology, develop appropriate mailing lists and prepare drafts of public notices and fact sheets at important stages of the remedial action, such as the submission of work plans, remedial investigation/feasibility study reports, cleanup action plans, and engineering design reports. As appropriate, Ecology will edit, finalize, and distribute such fact sheets and prepare and distribute public notices of Ecology's presentations and meetings.

2. Notify Ecology's project coordinator prior to the preparation of all press releases and fact sheets, and before meetings related to remedial action work to be performed at the Site with the interested public and/or local governments. Likewise, Ecology shall notify Subject PLPs prior to the issuance of all press releases and fact sheets related to the Site, and before meetings related to the Site with the interested public and local governments. For all press releases, fact sheets, meetings, and other outreach efforts by Subject PLPs that do not receive prior Ecology approval, Subject PLPs shall clearly indicate to its audience that the press release, fact sheet, meeting, or other outreach effort was not sponsored or endorsed by Ecology.

3. When requested by Ecology, participate in public presentations on the progress of the remedial action at the Site. Participation may be through attendance at public meetings to assist in answering questions or as a presenter.

4. When requested by Ecology, arrange and/or continue information repositories to be located at the following locations:

a. Seattle Public Library
Queen Anne Branch
400 W. Garfield Street
Seattle, WA 98119

b. Ecology's Northwest Regional Office
3190 160th Avenue SE
Bellevue, WA 98008

At a minimum, copies of all public notices, fact sheets, and documents relating to public comment periods shall be promptly placed in these repositories. A copy of all documents related to this Site shall be maintained in the repository at Ecology's Northwest Regional Office in Bellevue, Washington.

G. Retention of Records

During the pendency of this Order, and for ten (10) years from the date of completion of work performed pursuant to this Order, Subject PLPs shall preserve all records, reports, documents, and underlying data in its possession relevant to the implementation of this Order and shall insert a similar record retention requirement into all contracts with project contractors and subcontractors. Upon request of Ecology, Subject PLPs shall make all records available to Ecology and allow access for review within a reasonable time.

Nothing in this Order is intended to waive any right Subject PLPs may have under applicable law to limit disclosure of documents protected by the attorney work-product privilege and/or the attorney-client privilege. If Subject PLP(s) withholds any requested records based on an assertion of privilege, Subject PLPs shall provide Ecology with a privilege log specifying the records withheld and the applicable privilege. No Site-related data collected pursuant to this Order shall be considered privileged.

H. Resolution of Disputes

1. In the event that Subject PLPs elect to invoke dispute resolution Subject PLPs must utilize the procedure set forth below.

a. Upon the triggering event (receipt of Ecology's project coordinator's written decision or an itemized billing statement), Subject PLPs have fourteen (14) calendar days within which to notify Ecology's project coordinator in writing of its dispute (Informal Dispute Notice).

b. The Parties' project coordinators shall then confer in an effort to resolve the dispute informally. The parties shall informally confer for up to fourteen (14) calendar days from receipt of the Informal Dispute Notice. If the project coordinators cannot resolve the dispute within those 14 calendar days, then within seven (7) calendar days Ecology's project coordinator shall issue a written decision (Informal Dispute Decision) stating: the nature of the dispute; the Subject PLPs' position with regards to the dispute; Ecology's position with regards to the dispute; and the extent of resolution reached by informal discussion.

c. Subject PLPs may then request regional management review of the dispute. This request (Formal Dispute Notice) must be submitted in writing to the Northwest Region Toxics Cleanup Section Manager within seven (7) calendar days of receipt of Ecology's Informal Dispute Decision. The Formal Dispute Notice shall include a written statement of dispute setting forth: the nature of the dispute; the disputing Party's position with respect to the dispute; and the information relied upon to support its position.

d. The Section Manager shall conduct a review of the dispute and shall issue a written decision regarding the dispute (Decision on Dispute) within thirty (30) calendar days of receipt of the Formal Dispute Notice. The Decision on Dispute shall be Ecology's final decision on the disputed matter.

2. The Parties agree to only utilize the dispute resolution process in good faith and agree to expedite, to the extent possible, the dispute resolution process whenever it is used.

3. Implementation of these dispute resolution procedures shall not provide a basis for delay of any activities required in this Order, unless Ecology agrees in writing to a schedule extension.

4. In case of a dispute, failure to either proceed with the work required by this Order or timely invoke dispute resolution may result in Ecology's determination that insufficient progress is being made in preparation of a deliverable and may result in Ecology undertaking the work under Section VII (Work to be Performed) or initiating enforcement under Section X (Enforcement).

I. Extension of Schedule

1. Subject PLPs' request for an extension of schedule shall be granted only when a request for an extension is submitted in a timely fashion, generally at least thirty (30) days prior to expiration of the deadline for which the extension is requested, and good cause exists for granting the extension. All extensions shall be requested in writing. The request shall specify:

a. The deadline that is sought to be extended.

b. The length of the extension sought.

c. The reason(s) for the extension.

d. Any related deadline or schedule that would be affected if the extension were granted.

2. The burden shall be on Subject PLPs to demonstrate to the satisfaction of Ecology that the request for such extension has been submitted in a timely fashion and that good cause exists for granting the extension. Good cause may include, but may not be limited to:

a. Circumstances beyond the reasonable control and despite the due diligence of Subject PLPs including delays caused by unrelated third parties or Ecology, such as (but not limited to) delays by Ecology in reviewing, approving, or modifying documents submitted by Subject PLPs.

b. Acts of God, including fire, flood, blizzard, extreme temperatures, storm, or other unavoidable casualty.

c. Endangerment as described in Section VIII.K (Endangerment).

However, neither increased costs of performance of the terms of this Order nor changed economic circumstances shall be considered circumstances beyond the reasonable control of Subject PLPs.

3. Ecology shall act upon any Subject PLPs' written request for extension in a timely fashion. Ecology shall give Subject PLPs written notification of any extensions granted pursuant to this Order. A requested extension shall not be effective until approved by Ecology. Unless the extension is a substantial change, it shall not be necessary to amend this Order pursuant to Section VIII.J (Amendment of Order) when a schedule extension is granted.

4. At Subject PLPs' request, an extension shall only be granted for such period of time as Ecology determines is reasonable under the circumstances. Ecology may grant schedule extensions exceeding ninety (90) days only as a result of one of the following:

a. Delays in the issuance of a necessary permit which was applied for in a timely manner.

b. Other circumstances deemed exceptional or extraordinary by Ecology.

c. Endangerment as described in Section VIII.K (Endangerment).

J. Amendment of Order

The project coordinators may verbally agree to minor changes to the work to be performed without formally amending this Order. Minor changes will be documented in writing by Ecology within seven (7) days of verbal agreement.

Except as provided in Section VIII.L (Reservation of Rights), substantial changes to the work to be performed shall require formal amendment of this Order. This Order may only be formally amended by the written consent of both Ecology and Subject PLPs. Ecology will provide its written consent to a formal amendment only after public notice and opportunity to comment on the formal amendment.

When requesting a change to the Order, Subject PLPs shall submit a written request to Ecology for approval. Ecology shall indicate its approval or disapproval in writing and in a timely manner after the written request is received. If Ecology determines that the change is substantial, then the Order must be formally amended. Reasons for the disapproval of a proposed change to this Order shall be stated in writing. If Ecology does not agree to a proposed change, the disagreement may be addressed through the dispute resolution procedures described in Section VIII.H (Resolution of Disputes).

K. Endangerment

In the event Ecology determines that any activity being performed at the Site under this Order is creating or has the potential to create a danger to human health or the environment on or surrounding the Site, Ecology may direct Subject PLPs to cease such activities for such period of time as it deems necessary to abate the danger. Subject PLPs shall immediately comply with such direction.

In the event Subject PLPs determine that any activity being performed at the Site under this Order is creating or has the potential to create a danger to human health or the environment, Subject PLPs may cease such activities. Subject PLPs shall notify Ecology's project coordinator as soon as possible, but no later than twenty-four (24) hours after making such determination or ceasing such activities. Upon Ecology's direction, Subject PLPs shall provide Ecology with documentation of the basis for the determination or cessation of such activities. If Ecology disagrees with Subject PLPs' cessation of activities, it may direct Subject PLPs to resume such activities.

If Ecology concurs with or orders a work stoppage pursuant to this section, Subject PLPs' obligations with respect to the ceased activities shall be suspended until Ecology determines the danger is abated, and the time for performance of such activities, as well as the time for any other work dependent upon such activities, shall be extended in accordance with Section VIII.I

(Extension of Schedule) for such period of time as Ecology determines is reasonable under the circumstances.

Nothing in this Order shall limit the authority of Ecology, its employees, agents, or contractors to take or require appropriate action in the event of an emergency.

L. Reservation of Rights

This Order is not a settlement under RCW 70.105D. Ecology's signature on this Order in no way constitutes a covenant not to sue or a compromise of any of Ecology's rights or authority. Ecology will not, however, bring an action against Subject PLPs to recover remedial action costs paid to and received by Ecology under this Order. In addition, Ecology will not take additional enforcement actions against Subject PLPs regarding remedial actions required by this Order, provided Subject PLPs comply with this Order.

Ecology nevertheless reserves its rights under RCW 70.105D, including the right to require additional or different remedial actions at the Site should it deem such actions necessary to protect human health or the environment, and to issue orders requiring such remedial actions. Ecology also reserves all rights regarding the injury to, destruction of, or loss of natural resources resulting from the release or threatened release of hazardous substances at the Site.

By entering into this Order, Subject PLPs do not admit to any liability for the Site. Although Subject PLPs are committing to conducting the work required by this Order under the terms of this Order, Subject PLPs expressly reserve all rights available under law, including but not limited to the right to seek cost recovery or contribution against third parties, and the right to assert any defenses to liability in the event of enforcement.

M. Transfer of Interest in Property

No voluntary conveyance or relinquishment of title, easement, leasehold, or other interest in any portion of the Site shall be consummated by Subject PLPs without provision for continued implementation of all requirements of this Order and implementation of any remedial actions found to be necessary as a result of this Order.

Prior to Subject PLPs' transfer of any interest in all or any portion of the Site, and during the effective period of this Order, Subject PLPs shall provide a copy of this Order to any prospective purchaser, lessee, transferee, assignee, or other successor in said interest; and, at least thirty (30) days prior to any transfer, Subject PLPs shall notify Ecology of said transfer. Upon transfer of any interest, Subject PLPs shall notify all transferees of the restrictions on the activities and uses of the property under this Order and incorporate any such use restrictions into the transfer documents.

N. Compliance with Applicable Laws

1. *Applicable Laws.* All actions carried out by Subject PLPs pursuant to this Order shall be done in accordance with all applicable federal, state, and local requirements, including requirements to obtain necessary permits or approvals, except as provided in RCW 70.105D.090. At this time, no federal, state, or local requirements have been identified as being applicable to the actions required by this Order. Subject PLPs have a continuing obligation to identify additional applicable federal, state, and local requirements which apply to actions carried out pursuant to this Order, and to comply with those requirements. As additional federal, state, and local requirements are identified by Ecology or Subject PLPs, Ecology will document in writing if they are applicable to actions carried out pursuant to this Order, and Subject PLP(s) must implement those requirements.

2. *Relevant and Appropriate Requirements.* All actions carried out by Subject PLPs pursuant to this Order shall be done in accordance with relevant and appropriate requirements identified by Ecology. At this time, no relevant and appropriate requirements have been identified as being applicable to the actions required by this Order. If additional relevant and appropriate requirements are identified by Ecology or Subject PLPs, Ecology will document in writing if they are applicable to actions carried out pursuant to this Order and Subject PLPs must implement those requirements.

3. Pursuant to RCW 70.105D.090(1), Subject PLPs may be exempt from the procedural requirements of RCW 70.94, 70.95, 70.105, 77.55, 90.48, and 90.58 and of any laws requiring or authorizing local government permits or approvals. However, Subject PLPs shall comply with the substantive requirements of such permits or approvals. For permits and approvals covered under RCW 70.105D.090(1) that have been issued by local government, the Parties agree that Ecology has the non-exclusive ability under this Order to enforce those local government permits and/or approvals. At this time, no state or local permits or approvals have been identified as being applicable but procedurally exempt under this section

4. Subject PLPs have a continuing obligation to determine whether additional permits or approvals addressed in RCW 70.105D.090(1) would otherwise be required for the remedial action under this Order. In the event either Ecology or Subject PLPs determine that additional permits or approvals addressed in RCW 70.105D.090(1) would otherwise be required for the remedial action under this Order, it shall promptly notify the other party of its determination. Ecology shall determine whether Ecology or Subject PLPs shall be responsible to contact the appropriate state and/or local agencies. If Ecology so requires, Subject PLPs shall promptly consult with the appropriate state and/or local agencies and provide Ecology with written documentation from those agencies of the substantive requirements those agencies believe are applicable to the remedial action. Ecology shall make the final determination on the additional substantive requirements that must be met by Subject PLPs and on how Subject PLPs must meet those requirements. Ecology shall inform Subject PLPs in writing of these requirements. Once established by Ecology, the additional requirements shall be enforceable requirements of this Order. Subject PLP(s) shall not begin or continue the remedial action potentially subject to the additional requirements until Ecology makes its final determination.

Pursuant to RCW 70.105D.090(2), in the event Ecology determines that the exemption from complying with the procedural requirements of the laws referenced in RCW 70.105D.090(1) would result in the loss of approval from a federal agency that is necessary for the state to administer any federal law, the exemption shall not apply and Subject PLPs shall comply with both the procedural and substantive requirements of the laws referenced in RCW 70.105D.090(1), including any requirements to obtain permits or approvals.

O. Indemnification

Subject PLPs agree to indemnify and save and hold the State of Washington, its employees, and agents harmless from any and all claims or causes of action (1) for death or injuries to persons, or (2) for loss or damage to property, to the extent arising from or on account of acts or omissions of Subject PLPs, their officers, employees, agents, or contractors in entering into and implementing this Order. However, Subject PLPs shall not indemnify the State of Washington nor save nor hold its employees and agents harmless from any claims or causes of action to the extent arising out of the negligent acts or omissions of the State of Washington, or the employees or agents of the State, in entering into or implementing this Order.

IX. SATISFACTION OF ORDER

The provisions of this Order shall be deemed satisfied upon Subject PLPs' receipt of written notification from Ecology that Subject PLPs have completed the remedial activity required by this Order, as amended by any modifications, and that Subject PLPs have complied with all other provisions of this Agreed Order.

X. ENFORCEMENT

Pursuant to RCW 70.105D.050, this Order may be enforced as follows:

A. The Attorney General may bring an action to enforce this Order in a state or federal court.

B. The Attorney General may seek, by filing an action, if necessary, to recover amounts spent by Ecology for investigative and remedial actions and orders related to the Site.

C. A liable party who refuses, without sufficient cause, to comply with any term of this Order will be liable for:

1. Up to three (3) times the amount of any costs incurred by the State of Washington as a result of its refusal to comply.

2. Civil penalties of up to twenty-five thousand dollars ($25,000) per day for each day it refuses to comply.

D. This Order is not appealable to the Washington Pollution Control Hearings Board. This Order may be reviewed only as provided under RCW 70.105D.060.

Effective date of this Order: 8-21-19

ROYSTONE ON QUEEN ANNE, LLC

Date:

Title:
ROYSTONE ON QUEEN ANNE, LLC
606 MAYNARD AVENUE SOUTH #251
SEATTLE, WA 98104

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Date: 8-21-19

ROBERT W. WARREN
SECTION MANAGER
TOXICS CLEANUP PROGRAM
NORTHWEST REGIONAL OFFICE
3190 160th AVENUE SE
BELLEVUE, WA 98008
TELEPHONE: (425) 649-7054

CHEVRON ENVIRONMENTAL
MANAGEMENT COMPANY
for itself and as Attorney-in-Fact for
TEXACO INC.

Date:

Title:
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
6001 BOLLINGER CANYON ROAD
SAN RAMON, CA 94583

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Effective date of this Order: 8-21-19

ROYSTONE ON QUEEN ANNE, LLC

Date: 6-12-2019

Title: Manager
ROYSTONE ON QUEEN ANNE, LLC
606 MAYNARD AVENUE SOUTH #251
SEATTLE, WA 98104

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Date: 8/21/19

ROBERT W. WARREN
SECTION MANAGER
TOXICS CLEANUP PROGRAM
NORTHWEST REGIONAL OFFICE
3190 160th AVENUE SE
BELLEVUE, WA 98008
TELEPHONE: (425) 649-7054

CHEVRON ENVIRONMENTAL
MANAGEMENT COMPANY
for itself and as Attorney-in-Fact for
TEXACO INC.

Date:

Title:
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
6001 BOLLINGER CANYON ROAD
SAN RAMON, CA 94583

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Effective date of this Order: 8-21-19

ROYSTONE ON QUEEN ANNE, LLC

Date:

Title:
ROYSTONE ON QUEEN ANNE, LLC
606 MAYNARD AVENUE SOUTH #251
SEATTLE, WA 98104

STATE OF WASHINGTON
DEPARTMENT OF ECOLOGY

Date: 8/21/19

ROBERT W. WARREN
SECTION MANAGER
TOXICS CLEANUP PROGRAM
NORTHWEST REGIONAL OFFICE
3190 160th AVENUE SE
BELLEVUE, WA 98008
TELEPHONE: (425) 649-7054

CHEVRON ENVIRONMENTAL
MANAGEMENT COMPANY
<u>for itself and as Attorney-in-Fact for</u>
<u>TEXACO INC.</u>

Date: June 13, 2019

Title: Assistant Secretary
CHEVRON ENVIRONMENTAL MANAGEMENT COMPANY
6001 BOLLINGER CANYON ROAD
SAN RAMON, CA 94583

EXHIBIT A – Site Vicinity Map
631 Queen Anne Avenue North, Seattle, WA

Site Vicinity Map
631 Queen Anne Avenue North, Seattle, WA

EXHIBIT B – SCOPE OF WORK
631 Queen Anne Avenue North, Seattle, WA

PURPOSE

The scope of work (SOW) under this Agreed Order (AO) involves conducting a Remedial Investigation (RI) and Feasibility Study (FS), conducting interim action(s), and preparing a preliminary Draft Cleanup Action Plan (DCAP) to select a cleanup alternative. The purpose of the RI, FS and preliminary DCAP is to provide sufficient data, analysis, and evaluations to enable the Washington State Department of Ecology (Ecology) to select a final cleanup alternative for the Site.

The Subject PLPs shall coordinate with Ecology throughout the work under this AO, and will keep Ecology informed of any changes, issues, or problems as they develop.

The SOW is divided into eight major tasks as follows:

Task 1. Implementation of Interim Action Work Plan
Task 2. RI Work Plan
Task 3. Additional Interim Action(s), if any
Task 4. Remedial Investigation
Task 5. Feasibility Study
Task 6. SEPA Compliance
Task 7. Public Participation
Task 8. Preliminary DCAP
Task 9. Progress Reports

To assist with preparation of these documents, Ecology's Toxics Cleanup Program (TCP) has developed checklists, which the Subject PLPs shall use for the following remedial action reports and plans.

- Remedial Investigation Report Checklist
- Feasibility Study Report Checklist
- Cleanup Action Plan Checklist

The Subject PLPs can download the checklists directly from the following website: https://ecology.wa.gov/Spills-Cleanup/Contamination-cleanup/Cleanup-process/Cleanup-options/Voluntary-cleanup-program/Reporting-requirements

Policy 840 Environmental Information Management System (EIM): Ecology has updated Policy 840 related to data submittal requirements for TCP sites. Policy 840 requires environmental monitoring data collected at TCP sites as part of site investigations and cleanups to be submitted into EIM at the time of submittal for Ecology review of any report containing this data.

Following Ecology's Lean Process there are five mandatory meetings:

1. Kickoff meeting held prior to commencement of AO negotiations with the principal contacts for Subject PLPs and Ecology.
2. RI planning and scoping meeting with Ecology Cleanup Project manager and Subject PLPs' consultants.
3. RI pre-report meeting occurs after the completion of RI field activities and prior to writing the RI Report; this will ensure the report can be reviewed and approved by Ecology after one review cycle.
4. FS planning meeting to discuss overall approach and contents of the FS to ensure the report can be reviewed and approved by Ecology after one review cycle. If appropriate, this meeting may be combined with the RI pre-report check-in.
5. DCAP planning meeting held prior to writing the Preliminary DCAP to discuss the contents of the DCAP and to identify the preferred Remedial Alternative.

The first of these Key Project Meeting with be held prior to commencement of AO negotiations. During the meeting Ecology will establish communication protocols, expectations related to Key Project Documents and the timing and purpose of Key Project Meetings.

TASK 1. IMPLEMENTATION OF INTERIM ACTION WORK PLAN

Remedial actions implemented prior to completion of the RI/FS, including those that:

- are technically necessary to reduce a threat to human health or the environment by eliminating or substantially reducing one or more pathways for exposure to a hazardous substance;
- correct a problem that may become substantially worse or cost substantially more to address if the remedial action is delayed; or
- are needed to provide for completion of the remedial investigation/feasibility study or design of the cleanup action

will be considered interim actions, will be implemented in accordance with WAC 173-340-430 and the AO, and will be designed in a manner that will not foreclose reasonable alternatives for any final cleanup action that may be required.

Based upon available information, interim actions pursuant to WAC 173-340-430 will need to be implemented by Roystone on Queen Anne, LLC (Roystone) to remove contaminated soil and groundwater in conjunction with planned Property redevelopment.

The scope of the interim actions include typical source control or containment elements, including but not limited to:

- Contaminant soil removal
- Contaminant groundwater removal and remediation

- Repair, slip lining, replacement, or closure of stormwater conveyances or other structures such as conduit, vaults, catch basins, etc.
- Removal of underground storage tank, hoists, and other service station underground facilities, if discovered
- Proper abandonment of old wells
- Removal of contaminated building or other structural material
- Construction of additional monitoring wells
- Installation of physical barriers to prevent recontamination of on-Property soil and groundwater
- Installation of a vapor barrier and a vapor intrusion mitigation system
- Vapor intrusion pathway evaluation

Attached to the AO is the Public Review Draft Interim Action Work Plan (IAWP) that is subject to public comment and approved by Ecology as part of the AO. After the public notice and comment period, incorporating Ecology's and the public's comments on the Public Review IAWP, and after Ecology approval, Roystone shall prepare three (3) copies of the Final IAWP and submit them, including one electronic copy each in Word (.doc) and Adobe (.pdf) formats. Roystone shall conduct the interim actions in accordance with the approved Final IAWP.

Upon successful completion of the interim actions, Roystone shall submit an Agency Review Draft Interim Action Report as a separate deliverable. Roystone shall prepare two (2) copies of the Agency Review Draft Interim Action Report and submit them, including one electronic copy each in Word (.doc) and Adobe (.pdf) formats, to Ecology for review and approval. Ecology shall review the Draft Interim Action Report and confirm whether Roystone has complied with the IAWP. After incorporating Ecology's comments on the Agency Review Draft Interim Action Report and after Ecology approval, Roystone shall prepare three (3) copies of the Final Interim Action Report and submit them, including one electronic copy each in Word (.doc) and Adobe (.pdf) formats, to Ecology.

TASK 2. RI WORK PLAN

No later than 120 days after the AO is effective, Subject PLPs shall prepare an RI Work Plan (Work Plan).

Two phases of RI activities have been performed at the Site, in 1990 through 1991 by Ecology, and independently in 2002 through 2007 by CEMC. These RI activities and results were documented in a Phase I RI Report dated August 1991, and a Final RI and Site Summary Report dated August 20, 2007, respectively. The RI Work Plan for this AO shall be developed based on the previous RI reports and current data gathered to complete the Site characterization both on and off Property.

The RI Work Plan shall include an overall description and schedule of all RI activities. The Work Plan shall clearly describe the project management strategy for implementing and reporting on RI activities. The responsibility and authority of all organizations and key personnel involved in conducting the RI will be outlined.

The second Key Project Meeting will be held prior to submittal of the RI Work Plan. The purpose of the RI Planning Meeting is to review requirements for the Work Plan and plan RI field work, discuss the preliminary conceptual site model, and identify project data needs and preliminary plans for on-Property interim action. The RI Work Plan shall be completed for the Site and approved by Ecology prior to the submission of additional IAWPs, if applicable.

The RI Work Plan shall describe general facility information; site history and conditions; including previous operations; past field investigations, including any data collection and analysis of soils, air, groundwater, and surface water; a conceptual site model showing contaminants, migration pathways in all environmental media, potential receptors, and screening levels based on the conceptual site model; geology and groundwater system characteristics; past, current, and future land use; identification of natural resources and ecological receptors; hazardous substances and their sources, etc., in compliance with Washington Administrative Code (WAC)173-340-350 and WAC 173-204-560.

As part of the project background, existing environmental data on site soil, groundwater, soil gas, and indoor air will be compiled and evaluated for data gaps. The data gaps will be used as the basis for conducting additional site investigations, if necessary. The Work Plan will also identify specific data collection procedures in a Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP) as part of the Work Plan in compliance with WAC 173-340-820 and WAC 173-204-600 for defining the nature and extent of contamination. The Subject PLPs will also submit a copy of the Health and Safety Plan (HASP) for the project.

The SAP identifies the proposed number and location of all environmental samples and methods, including soil borings, groundwater monitoring wells, soil, groundwater, soil gas, indoor air, stormwater, catch basin, approximate depths, and includes a quality assurance project plan. The SAP will describe the sampling objectives, the rationale for the sampling approach (based upon the identified data gaps), and plans for data use, and shall provide a detailed description of sampling tasks. The SAP shall describe specifications for sample identifiers; sampling equipment; the type, number, and location of samples to be collected; the analyses to be performed; descriptions of sampling equipment and methods to be used; sample documentation; sample containers, collection and handling; data and records management; and schedule.

The Quality Assurance Project Plan (QAPP) will be prepared in accordance with the Guidance for Preparation of Quality Assurance Project Plans, EPA Region 10, Quality Data Management Program, QA/R-5 and requirements of the EPA Contract Laboratory Program. The QAPP will also follow Ecology's Guidelines for Preparing Quality Assurance Project Plans for Environmental Studies (July 2004)[1]. Laboratories must meet

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[1] Found at https://fortress.wa.gov/ecy/publications/documents/0403030.pdf

the accreditation standards established in WAC 173-50. Data quality objectives will reflect the criteria or threshold values used for the source control evaluation.

The SAP, including the QAPP, will be submitted to Ecology for review and approval. As with all environmental work at the Site, work may not begin without written approval from Ecology. The plan shall provide seven (7) days' notice to Ecology prior to beginning sampling. Ecology may obtain split samples.

The Subject PLPs or their contractors shall submit all new sampling data generated under this SAP and any other recently collected data to Ecology for entry into the Environmental Information Management System (EIM) in accordance with WAC 173-340-840(5) and Ecology's Toxics Cleanup Program Policy 840: Data Submittal Requirements. Only validated data will be entered into the EIM database within 30 days of submittal.

RI Work Plan tasks and subtasks will include, but are not limited to, soil, groundwater, soil gas, indoor air, seep, and surface water sampling and analysis as necessary to address data gaps identified in the Work Plan. In addition, the following must be included in the Work Plan:

- Develop a preliminary conceptual site model for the Site including evaluation of all potential pathways and potential receptors that may exist for contaminants of concern at the Site.
- Define the nature and extent of contamination based on screening levels protective of all receptors at and downgradient of the Site.

The Subject PLPs will provide Ecology with an Agency Review Draft Work Plan. Once Ecology reviews and approves the Work Plan, it will be considered the Final Work Plan. The Work Plan shall not be implemented until approved by Ecology. Once approved by Ecology, the Subject PLPs will implement the Final Work Plan according to the schedule contained in Exhibit C. Ecology expects one iteration between preliminary draft and final drafts of the RI Work Plan, RI Report, FS Report, and DCAP.

The Subject PLPs shall prepare two (2) copies of the Agency Review Draft RI Work Plan and submit them, including one electronic copy each in Word (.doc) and Adobe (.pdf) formats, to Ecology for review and comment. After incorporating Ecology's comments on the Agency Review Draft Work Plan and after Ecology approval, the Subject PLPs shall prepare three (3) copies of the Final Work Plan and submit them, including one electronic copy each in Word (.doc) and Adobe (.pdf) formats, to Ecology.

TASK 3. ADDITIONAL INTERIM ACTION(S), IF ANY

Additional interim actions deemed necessary by the Subject PLPs or Ecology shall be conducted commensurate with this task description.

During the second Key Project Meeting (RI planning and scoping meeting), the results of historic and current investigations and preliminary plans may be discussed for additional interim action(s), if necessary. No later than 60 days after the RI Work Plan has been approved by Ecology, the Subject PLPs will prepare and submit for Ecology approval an Agency Review Draft IAWP with detail commensurate with the work to be performed. The Agency Review Draft IAWP shall include, as appropriate:

- Description of the interim action including its purpose, general requirements, and relationship to the (final) cleanup action (to the extent known);
- Summary of relevant RI/FS information, including at a minimum existing site conditions and alternative interim actions considered;
- Information regarding design and construction requirements, including a proposed schedule and personnel roles and responsibilities;
- Compliance Monitoring Plan;
- SAP/QAPP;
- Permits required.

The Subject PLPs will also submit a copy of the HASP for the project. The Subject PLPs will be responsible for complying with the State Environmental Policy Act (SEPA) Rules, including preparing and submitting an environmental checklist for the interim action, and will assist Ecology with presentations at any additional meetings or hearings that might be necessary for SEPA compliance or as part of the Public Participation Plan.

No later than 30 days after receipt of Ecology's comments, the Subject PLPs will incorporate Ecology's required changes into the IAWP and provide Ecology with a Public Review Draft IAWP. After a public notice and comment period for the Public Review Draft IAWP (and SEPA determination), Ecology will approve the IAWP (if appropriate) and the document will be considered Final. Once approved by Ecology, the Subject PLPs will implement the interim action according to the schedule contained in the Final IAWP.

The Subject PLPs shall prepare two (2) copies of the Agency Review Draft IAWP and submit them, including one electronic copy each in Word (.doc) and Adobe (.pdf) formats, to Ecology for review. The Subject PLPs shall incorporate Ecology's comments and then prepare two (2) copies of the Public Review Draft IAWP and submit them, including one electronic copy each in Word (.doc) and Adobe (.pdf) formats, to Ecology. After the public notice and comment period, incorporating Ecology's and the public's comments on the Public Review IAWP, and after Ecology approval, the Subject PLPs shall prepare three (3) copies of the Final IAWP and submit them, including one electronic copy each in Word (.doc) and Adobe (.pdf) formats.

Upon successful completion of the work, an Agency Review Draft Interim Action Report will be prepared as a separate deliverable. The Subject PLPs shall prepare two (2) copies of the Agency Review Draft Interim Action Report and submit them, including one electronic copy each in Word (.doc) and Adobe (.pdf) formats, to Ecology for review and approval. After incorporating Ecology's comments on the Agency Review Draft Interim

Action Report and after Ecology approval, The Subject PLPs shall prepare three (3) copies of the Final Interim Action Report and submit them, including one electronic copy each in Word (.doc) and Adobe (.pdf) formats, to Ecology.

TASK 4. REMEDIAL INVESTIGATION

The Subject PLPs shall conduct an RI that meets the requirements of WAC 173-340-350(7) and WAC 173-204-560 according to the Work Plan approved by Ecology (Task 2). The RI will determine the nature and extent of contamination exceeding preliminary Model Toxics Control Act (MTCA) cleanup levels, and any other regulatory requirements. The RI will provide sufficient data and information to define the nature and extent of contamination. The Final RI Work Plan (Task 1) will be included as an appendix to the RI Report.

Field sampling and analysis will be completed in general accordance with the SAP and QAPP. Deviation(s) from the approved SAP and QAPP must be communicated to Ecology immediately and documented as required by Ecology.

The Subject PLPs shall provide interim data reports and updates to Ecology as new site data and information become available. Laboratory analysis data shall also be provided in electronic format when it has been validated. Raw laboratory data will be provided to Ecology upon request.

Prior to submittal of the Agency Review Draft RI Report, the third Key Project Meeting will be held. During the RI Pre-Report Check-In, Ecology and the Subject PLPs will review available data and an updated conceptual site model and discuss the content and organization of the Draft RI Report. Ecology expects one iteration between the preliminary draft and final draft of the RI report, the FS report, and the DCAP.

The Subject PLPs shall compile the results of the Site investigation into an Agency Review Draft RI Report. The Subject PLPs shall prepare two (2) copies of the Agency Review Draft RI Report and submit them, including one electronic copy each in Word (.doc) and Adobe (.pdf) formats, to Ecology for review and comment.

After incorporating Ecology's comments on the Agency Review Draft RI Report, The Subject PLPs shall prepare three (3) copies of a Public Review Draft RI Report and submit them, including one electronic copy each in Word (.doc) and Adobe (.pdf) formats, to Ecology for distribution and public comment. Electronic survey data for monitoring locations, electronic lab data, and GIS maps of contaminant distribution shall also be provided for both the Agency Review Draft RI Report and Public Review Draft RI Reports. The RI Report will not be considered Final until after a public review and comment period. The Agency Review Draft RI Report and/or Public Review Draft RI Reports may be submitted in conjunction with the Agency Review Draft FS Report and/or Public Review Draft FS Reports, discussed in Task 4 below.

If the data collected during this investigation is insufficient to define the full nature and extent of contamination, and to select a cleanup action plan, an additional phase of investigation shall be conducted to define the extent of contamination.

TASK 5. FEASIBILITY STUDY

The Subject PLPs shall use the information obtained in the RI to prepare an Agency Review Draft FS Report that meets the applicable requirements of WAC 173-340-350(8) according to the approved Work Plan Schedule (Exhibit C). The Agency Review Draft FS Report will evaluate remedial alternatives for site cleanup, consistent with MTCA to ensure protection of human health and the environment by eliminating, reducing, or otherwise controlling risk posed through each exposure pathway and migration route.

Prior to beginning the FS, the fourth Key Project Meeting will be held to review applicable or relevant and appropriate requirements (ARARs), potential remedial alternatives, and points of compliance. If appropriate this Key Project Meeting may be held in conjunction with the RI Pre-Report Planning Key Project Meeting.

The Agency Review Draft FS Report will provide a detailed analysis of each remedial alternative according to the applicable requirements of WAC 173-340-350. The remedial alternatives will take into account the completed on-Property interim action, and will be evaluated for compliance with the applicable requirements of WAC 173-340-360 and WAC 173-204-560(4), including a detailed evaluation of remedial alternatives relative to the following criteria:

- Compliance with Cleanup Standards and Applicable Laws;
- Protection of Human Health and the Environment;
- Provision for a Reasonable Restoration Time Frame;
- Use of Permanent Solutions to the Maximum Extent Practicable;
- The Degree to which Recycling, Reuse, and Waste Minimization are Employed;
- Short-Term Effectiveness;
- Long-Term Effectiveness;
- Net Environmental Benefit;
- Implementability;
- Provision for Compliance Monitoring;
- Cost-Effectiveness; and
- Prospective Community Acceptance.

The remedial alternative that is judged to best satisfy the evaluation criteria will be identified. Justification for the selection will be provided, and the recommended remedial alternative further developed, in the FS Report.

The Subject PLPs shall prepare two (2) copies of an Agency Review Draft FS Report and submit them, including one electronic copy in Word (.doc) and Adobe (.pdf) formats, to Ecology for review and comment.

After incorporating Ecology's comments on the Agency Review Draft FS Report, the Subject PLPs will prepare three (3) copies of a Public Review Draft FS Report and submit them, along with one electronic copy in Word (.doc) and Adobe (.pdf) formats, to Ecology for distribution and public comment.

The FS Report will not be considered final until after the public review and comment period. After that period, the Subject PLPs will incorporate Ecology's and the public's comments on the Public Review Draft FS Report and, after Ecology approval, will prepare three (3) copies of the Final FS Report and submit them along with one electronic copy in Word (.doc) and Adobe (.pdf) formats.

TASK 6. SEPA COMPLIANCE

The Subject PLPs shall be responsible for complying with the SEPA Rules including preparing and submitting an environmental checklist, if required. If the result of the threshold determination is a determination of significance (DS), the Subject PLPs shall be responsible for the preparation of Draft and Final Environmental Impact Statements. The Subject PLPs shall assist Ecology with coordinating SEPA public involvement requirements with MTCA public involvement requirements whenever possible, such that public comment periods and meetings or hearings, as applicable, can be held concurrently.

TASK 7. PUBLIC PARTICIPATION

The Subject PLPs shall assist Ecology to prepare a draft Public Participation Plan that complies with the provisions of WAC 173-340-600(9).

The Subject PLPs shall support Ecology in presenting the Public Review Draft RI Report and the Public Review Draft FS Report and SEPA evaluations at one public meeting or hearing. The Subject PLPs will assist Ecology with presentations at any additional meetings or hearings that might be necessary for SEPA compliance or as part of the Public Participation Plan.

After the public comment periods are completed, at Ecology's request, the Subject PLPs shall prepare a Draft Responsiveness Summary that addresses public comments and if necessary, prepare a second Public Review Draft RI/FS Report that addresses public comments. The Subject PLPs shall prepare two (2) copies of the Draft Responsiveness Summary and if necessary, second Public Review Draft RI/FS Report and submit them to Ecology for review and approval, including one electronic copy each in Word (.doc) and Adobe (.pdf) formats, to Ecology.

After incorporating Ecology's comments and after Ecology approval, the Subject PLPs shall prepare three (3) copies of the Final Responsiveness Summary after public comments are incorporated and submit them to Ecology for distribution, including one electronic copy each in Word (.doc) and Adobe (.pdf) formats.

TASK 8. PRELIMINARY DRAFT CLEANUP ACTION PLAN

Upon Ecology approval of the Public Review Draft RI/FS Report, the fifth Key Project Meeting will be held to discuss the contents of the DCAP and to identify the preferred remedial alternative. The DCAP will address all remedial actions required to be completed subsequent to the on-Property interim action(s).

The Subject PLPs shall prepare an Agency Review preliminary DCAP in accordance with WAC 173-340-380. The Agency Review preliminary DCAP will include a general description of the proposed remedial actions, cleanup standards developed from the RI/FS and rationale regarding their selection, a schedule for implementation, description of any institutional controls proposed, and a summary of applicable local, state, and federal laws pertinent to the proposed cleanup actions.

The Subject PLPs will prepare two (2) copies of the Agency Review preliminary DCAP and submit them, along with one electronic copy in Word (.doc) and Adobe (.pdf) formats, for Ecology review and approval.

After receiving Ecology's comments on the Agency Review preliminary DCAP, if any, the Subject PLPs shall revise the preliminary DCAP to address Ecology's comments and submit three (3) copies of the Public Review DCAP including one electronic copy each in Word (.doc) and Adobe (.pdf) formats.

TASK 9. QUARTERLY PROGRESS REPORTS

The Subject PLPs will submit Progress Reports at a quarterly frequency to Ecology until satisfaction of the AO, in accordance with Section VII.(G) of the AO. In addition, during implementation of the RI field investigations and on-Property interim action(s), the Subject PLPs will provide weekly email status updates to Ecology.

Progress Reports will be submitted to the Ecology project coordinator by the tenth (10th) of the month following the reporting period. If this day is a weekend or holiday, Progress Reports will be submitted to Ecology on the next business day.

EXHIBIT C – SCHEDULE OF DELIVERABLES
631 Queen Anne Avenue North, Seattle, WA

The schedule for notifications to Ecology or submission of major deliverables to Ecology for this Schedule of Deliverables (SOD) is described below. If the date for submission of any item or notification required by this SOD occurs on a weekend, state or federal holiday, the date for submission of that item or notification is extended to the next business day following the weekend or holiday. Where a deliverable due date is triggered by Ecology notification, comments or approval, the starting date for the period shown is the date Subject PLPs received such notification, comments or approval by certified mail, return receipt requested, unless otherwise noted below. Where triggered by Ecology receipt of a deliverable, the starting date for the period shown is the date Ecology receives the deliverable by certified mail, return receipt requested, or the date of Ecology signature on a hand-delivery form.

Table 1 - Schedule for Submission of Major Deliverables

Table 2 - Schedule for Roystone's Submission of Interim Action Deliverables

Table 1

Schedule for Submission of Major Deliverables

	Deliverable	*Due Date*[a]
1.	Agency Review Draft Remedial Investigation (RI) Work Plan	No later than 120 days after the AO[b] effective date
2.	Final Remedial Investigation Work Plan	No later than 45 days after receipt of Ecology comments
3.	Remedial Investigation Field Activities Completed	No later than 180 days after Ecology approval of Final Remedial Investigation Work Plan
4.	Agency Review Draft Remedial Investigation Report	No later than 90 days following receipt of remedial investigation analytical validated data
5.	Public Review Draft Remedial Investigation Report	No later than 45 days after receipt of Ecology comments
6.	Final Remedial Investigation Report	No later than 45 days after receipt of Ecology comments, subsequent to public comment[c]
7.	Agency Review Draft Feasibility Study Report	No later than 90 days following Ecology approval of Public Review Remedial Investigation Report
8.	Public Review Draft Feasibility Study Report	No later than 45 days following Ecology approval of Agency Review Draft Feasibility Study Report
9.	Final Feasibility Study Report	No later than 45 days after receipt of Ecology comments, subsequent to public comment[c]
10.	Agency Review preliminary Draft Cleanup Action Plan (DCAP)	No later than 90 days following approval of Final Feasibility Study
11.	Public Review Draft Cleanup Action Plan	No later than 45 days after receipt of Ecology comments
12.	Quarterly Progress Reports	No later than 10th day of the month following the reporting period

[a] *Due dates shown are for initial draft and final deliverables. This schedule assumes only a single revised document will be submitted following receipt of comments from Ecology. Documents become final only upon approval by Ecology.*

[b] *AO (Agreed Order) is effective upon signature by both Ecology and Subject PLPs.*

[c] *These public comment periods can be combined.*

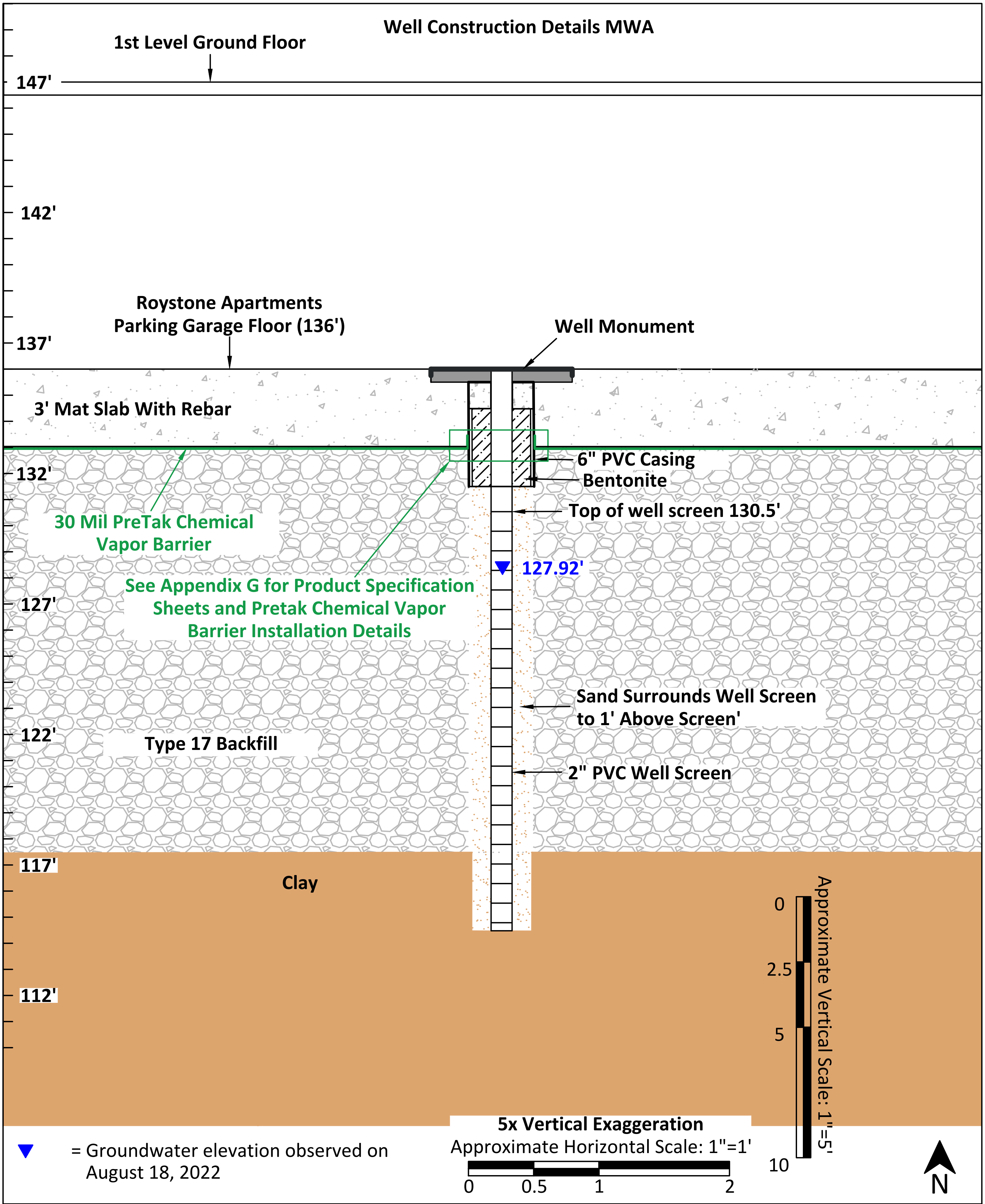
Table 2

Schedule for Roystone's Submission of Interim Action Deliverables

	Deliverable	*Due Date*[a]
1.	Agency Review Draft Interim Action Work Plan (IAWP)	Completed
2.	Public Review Draft Interim Action Work Plan and SEPA Checklist for the interim action	Completed
3.	Final Interim Action Work Plan	No later than 30 days after public notice and comment period closes
4.	Implement Final Interim Action Work Plan	Initiated no later than 30 days following Ecology approval of Final Interim Action Work Plan, subsequent to public comment.
5.	Agency Review Draft Interim Action Report	No later than 60 days following Roystone's receipt of interim action validated analytical data
6.	Final Interim Action Report	No later than 30 days after Ecology's approval of the Agency Review Draft Interim Action Report.

[a] *Due dates shown are for initial draft and final deliverables. This schedule assumes only a single revised document will be submitted following receipt of comments from Ecology. Documents become final only upon approval by Ecology.*

[b] *AO (Agreed Order) is effective upon signature by both Ecology and Subject PLPs.*

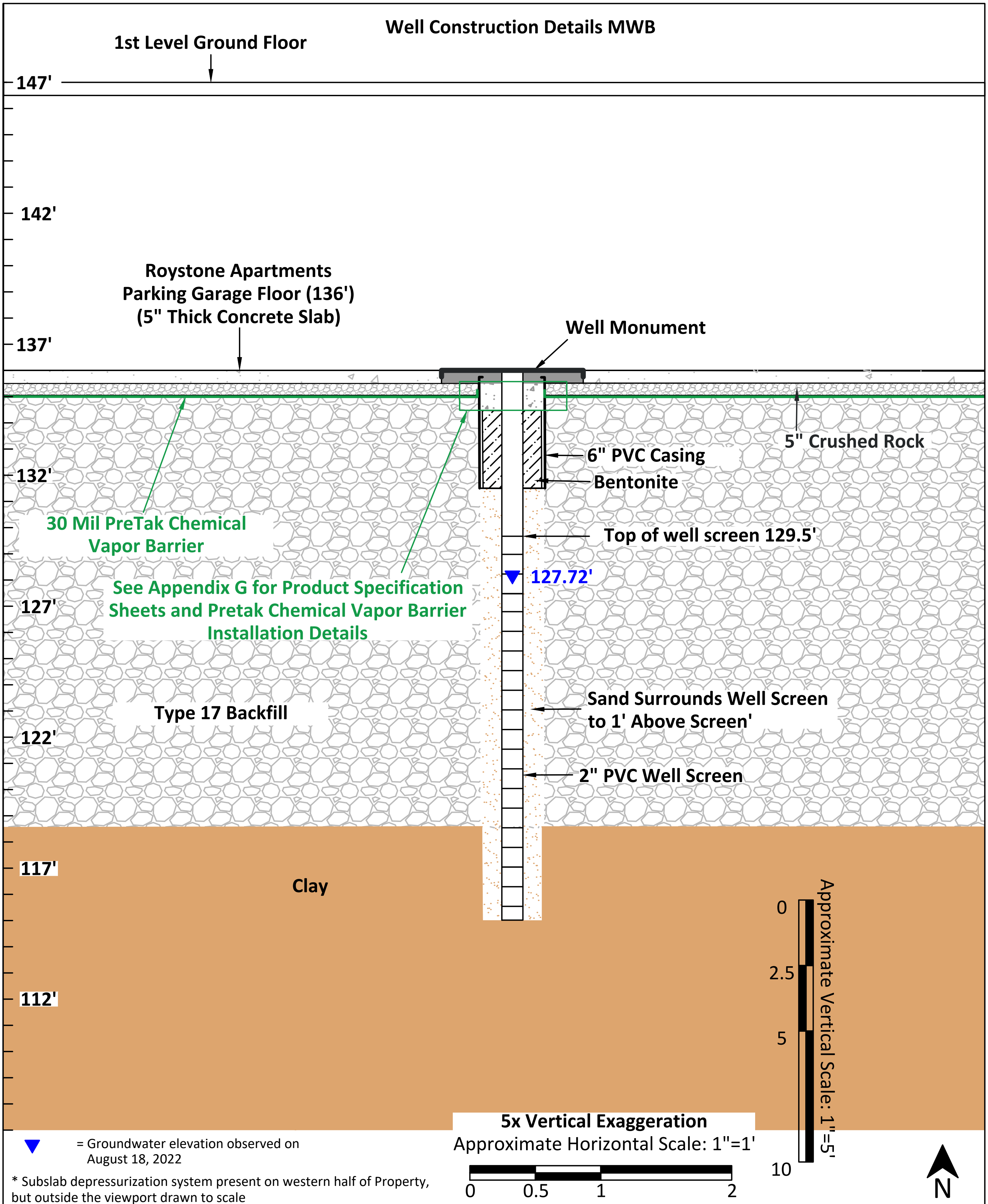


RILEYGROUP

Corporate Office
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

Roystone Redevelopment		Figure B-1
RGI Project Number 2017-015K	MWA Well Construction	Date Drawn: 09/2022
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		

Well Construction Details MWB



▼ = Groundwater elevation observed on August 18, 2022

* Subslab depressurization system present on western half of Property, but outside the viewport drawn to scale

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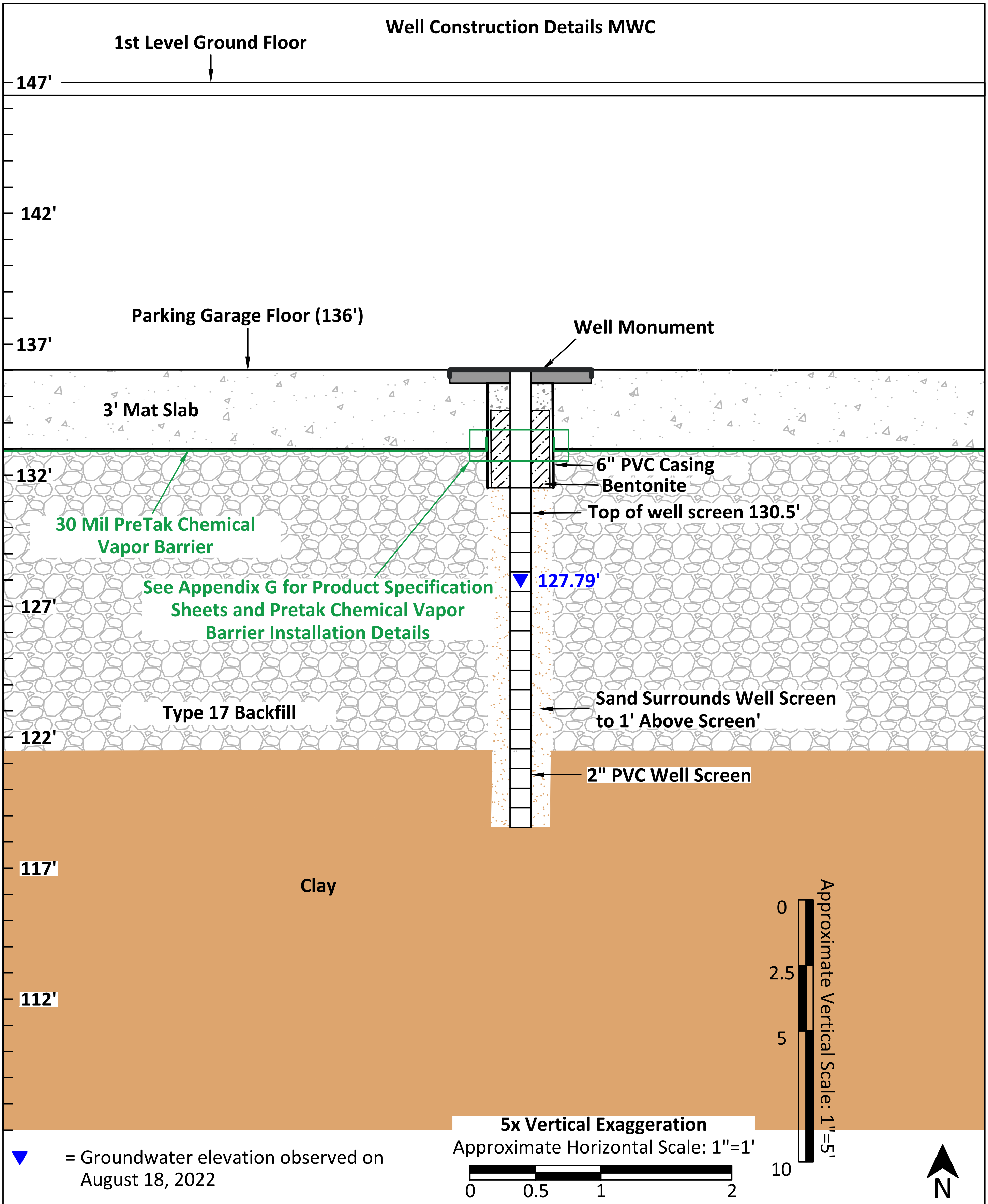
Corporate Office
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

Roystone Redevelopment		Figure B-2
RGI Project Number 2017-015K	MWB Well Construction	Date Drawn: 09/2022
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		

Well Construction Details MWC



▼ = Groundwater elevation observed on August 18, 2022

RILEYGROUP
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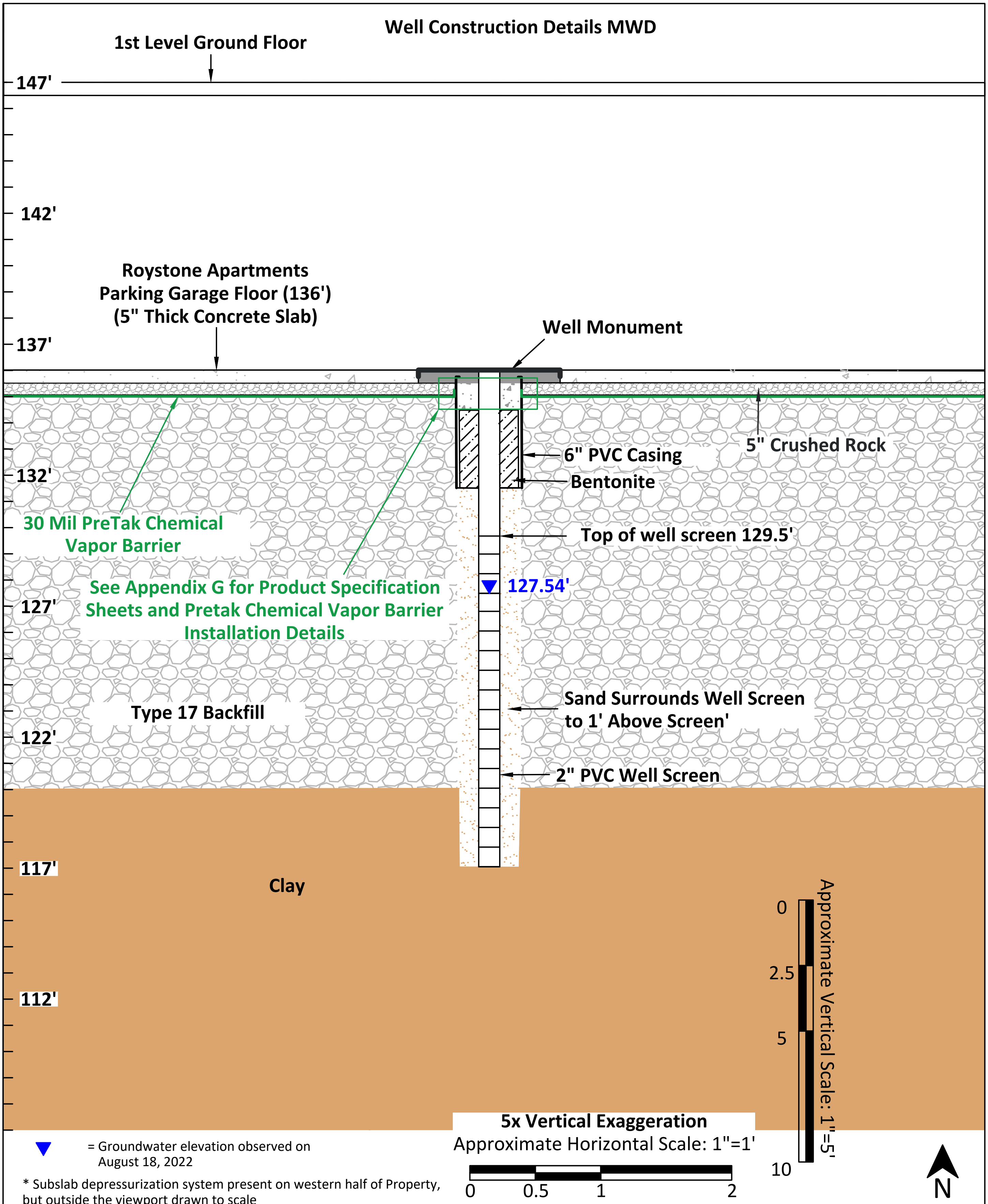
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

Roystone Redevelopment		Figure B-3
RGI Project Number 2017-015K	MWA Well Construction	Date Drawn: 09/2022
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		

Well Construction Details MWD

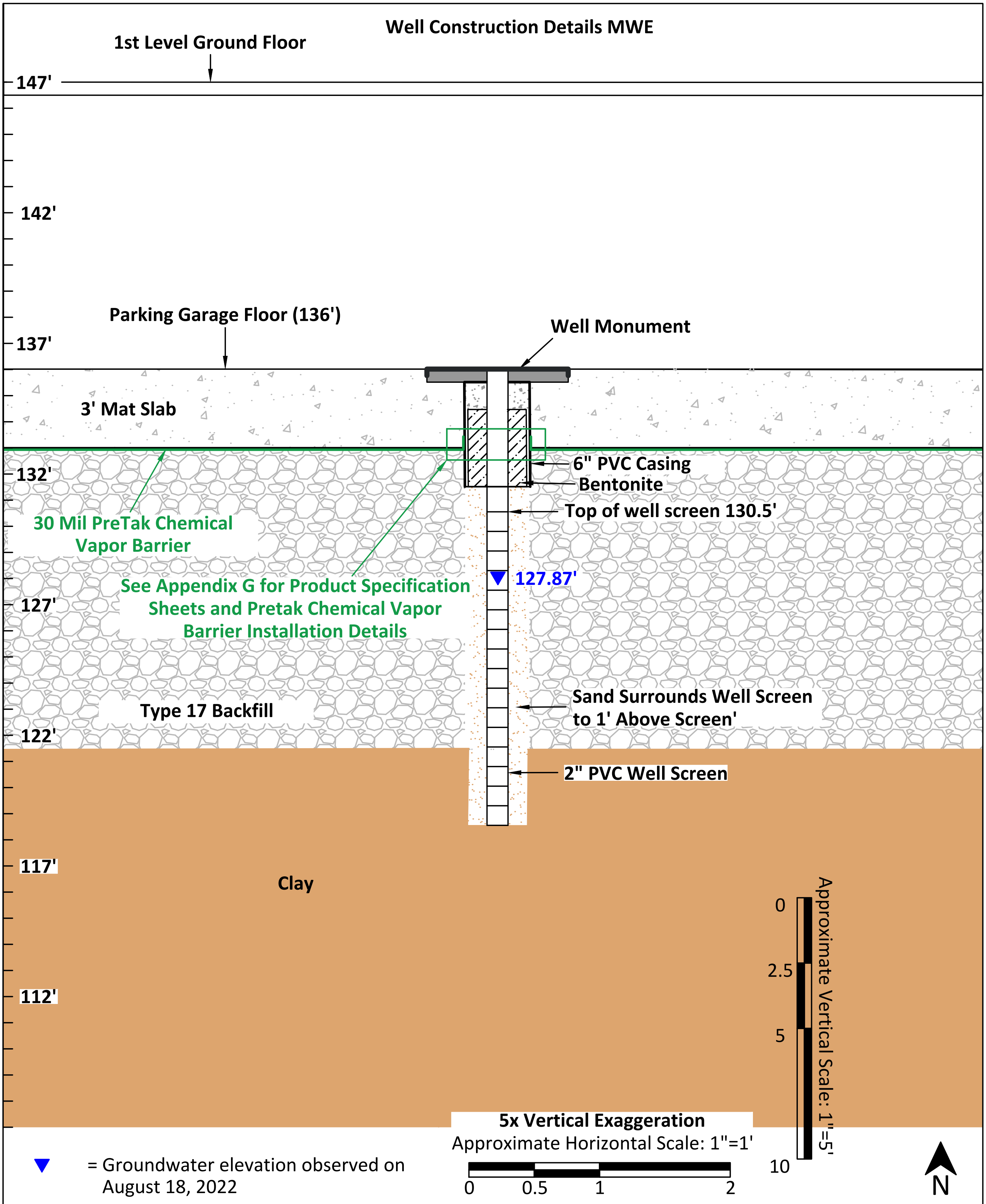


▼ = Groundwater elevation observed on August 18, 2022

* Subslab depressurization system present on western half of Property, but outside the viewport drawn to scale

RILEYGROUP Corporate Office 17522 Bothell Way Northeast Bothell, Washington 98011 Phone: 425.415.0551 Fax: 425.415.0311	Roystone Redevelopment		Figure B-4
	RGI Project Number 2017-015K	MWD Well Construction	Date Drawn: 09/2022
	Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		

Well Construction Details MWE



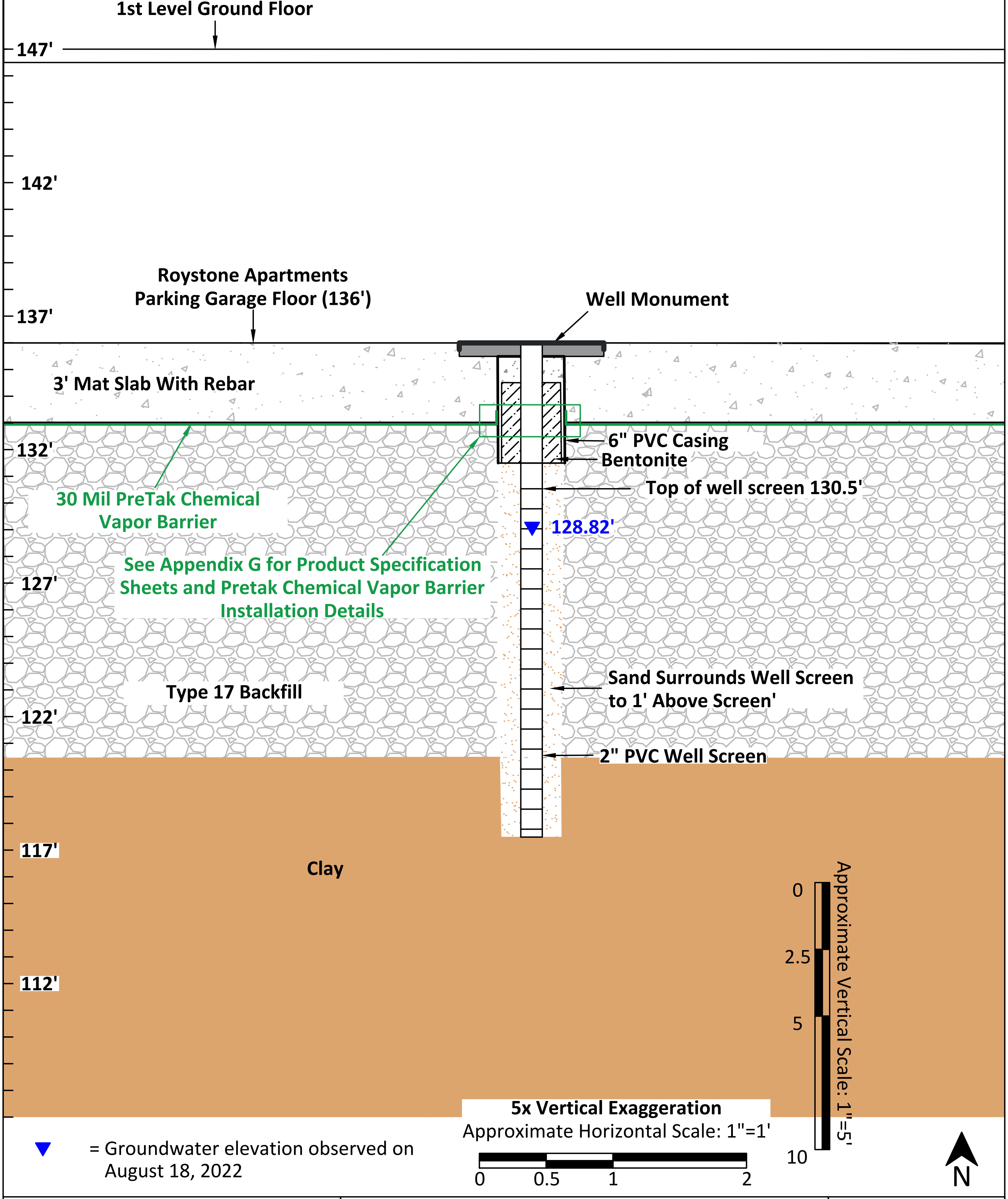
▼ = Groundwater elevation observed on August 18, 2022

RILEYGROUP

Corporate Office
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

Roystone Redevelopment		Figure B-5
RGI Project Number 2017-015K	MWE Well Construction	Date Drawn: 09/2022
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		

Well Construction Details MWF



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17522 Bothell Way Northeast
Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

Roystone Redevelopment

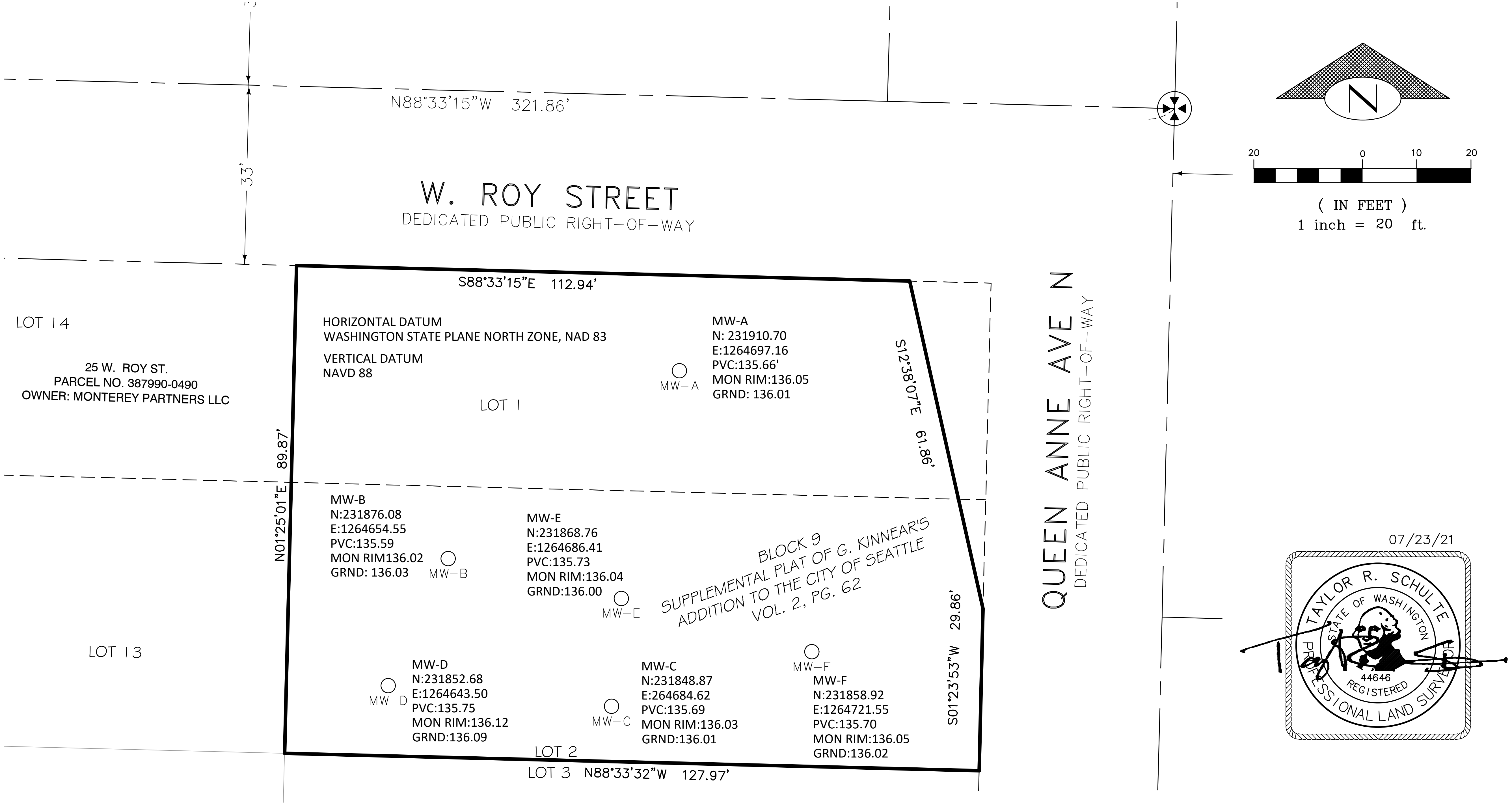
Figure B-6

RGI Project Number
2017-015K

MWF Well Construction

Date Drawn:
09/2022

Address: 631 Queen Anne Avenue North, Seattle, Washington 98109



MONITOR WELL EXHIBIT
ROYSTONE
THE RILEY GROUP
SEATTLE WASHINGTON

BUSH, ROED & HITCHINGS, INC.
LAND SURVEYORS & CIVIL ENGINEERS
2009 MINOR AVE. EAST (206) 323-4144
SEATTLE, Washington DATE:07/23/21
98102-3513 JOB NO.:2017167.04

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FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Arina Podnozova, B.S.
Eric Young, B.S.

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Seattle, WA 98119-2029
(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

July 26, 2021

Jerry Sawetz, Project Manager
The Riley Group, Inc.
17522 Bothell Way NE
Bothell, WA 98011

Dear Mr Sawetz:

Included are the results from the testing of material submitted on July 15, 2021 from the Roystone 2017-015K, F&BI 107246 project. There are 29 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days, or as directed by the Chain of Custody document. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
c: Tait Russell
TRG0726R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on July 15, 2021 by Friedman & Bruya, Inc. from the The Riley Group Roystone 2017-015K, F&BI 107246 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	The Riley Group
107246 -01	MW-A
107246 -02	MW-B
107246 -03	MW-C
107246 -04	MW-D
107246 -05	MW-E
107246 -06	MW-F

Several compounds in the 8260D laboratory control sample, laboratory control sample duplicate, and the associated relative percent difference exceeded the acceptance criteria. The analytes were not detected in the samples, therefore the data were acceptable.

All other quality control requirements were acceptable.

Date of Report: 07/26/21
Date Received: 07/15/21
Project: Roystone 2017-015K, F&BI 107246
Date Extracted: 07/21/21
Date Analyzed: 07/22/21

RESULTS FROM THE ANALYSIS OF WATER SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS AS GASOLINE USING METHOD NWTPH-Gx

Results Reported as ug/L (ppb)

Sample ID Laboratory ID	Gasoline Range	Surrogate (% Recovery) (Limit 51-134)
MW-C 107246-03	<100	80
MW-D 107246-04	<100	77
MW-E 107246-05	<100	79
MW-F 107246-06	<100	78
Method Blank 01-1650 MB	<100	82

Date of Report: 07/26/21
Date Received: 07/15/21
Project: Roystone 2017-015K, F&BI 107246
Date Extracted: 07/21/21
Date Analyzed: 07/22/21

RESULTS FROM THE ANALYSIS OF WATER SAMPLES FOR BENZENE, TOLUENE, ETHYLBENZENE, XYLENES AND TPH AS GASOLINE USING METHODS 8021B AND NWTPH-Gx

Results Reported as ug/L (ppb)

Sample ID Laboratory ID	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Gasoline Range	Surrogate (% Recovery) (Limit 52-124)
MW-A 107246-01	<1	<1	<1	<3	<100	75
MW-B 107246-02	<1	<1	<1	<3	<100	73
Method Blank 01-1650 MB	<1	<1	<1	<3	<100	77

Date of Report: 07/26/21
Date Received: 07/15/21
Project: Roystone 2017-015K, F&BI 107246
Date Extracted: 07/16/21
Date Analyzed: 07/16/21

RESULTS FROM THE ANALYSIS OF WATER SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS AS DIESEL AND MOTOR OIL USING METHOD NWTPH-Dx

Results Reported as ug/L (ppb)

Sample ID Laboratory ID	Diesel Range (C_{10}-C_{25})	Motor Oil Range (C_{25}-C_{36})	Surrogate (% Recovery) (Limit 41-152)
MW-A 107246-01	98 x	<250	109
MW-B 107246-02	250 x	<250	95
MW-C 107246-03 1/1.2	220 x	<300	105
MW-D 107246-04	220 x	<250	94
MW-E 107246-05	150 x	<250	102
MW-F 107246-06	140 x	<250	92
Method Blank 01-1673 MB	<50	<250	95

Analysis For Dissolved Metals By EPA Method 6020B

Client ID:	MW-C	Client:	The Riley Group
Date Received:	07/15/21	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/16/21	Lab ID:	107246-03
Date Analyzed:	07/19/21	Data File:	107246-03.115
Matrix:	Water	Instrument:	ICPMS2
Units:	ug/L (ppb)	Operator:	SP

Analyte:	Concentration ug/L (ppb)
Lead	<1

Analysis For Dissolved Metals By EPA Method 6020B

Client ID:	MW-D	Client:	The Riley Group
Date Received:	07/15/21	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/16/21	Lab ID:	107246-04
Date Analyzed:	07/16/21	Data File:	107246-04.117
Matrix:	Water	Instrument:	ICPMS2
Units:	ug/L (ppb)	Operator:	SP

Analyte:	Concentration ug/L (ppb)
Lead	<1

Analysis For Dissolved Metals By EPA Method 6020B

Client ID:	MW-E	Client:	The Riley Group
Date Received:	07/15/21	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/16/21	Lab ID:	107246-05
Date Analyzed:	07/16/21	Data File:	107246-05.118
Matrix:	Water	Instrument:	ICPMS2
Units:	ug/L (ppb)	Operator:	SP

Analyte:	Concentration ug/L (ppb)
Lead	<1

Analysis For Dissolved Metals By EPA Method 6020B

Client ID:	Method Blank	Client:	The Riley Group
Date Received:	NA	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/16/21	Lab ID:	I1-438 mb
Date Analyzed:	07/16/21	Data File:	I1-438 mb.087
Matrix:	Water	Instrument:	ICPMS2
Units:	ug/L (ppb)	Operator:	SP

Analyte:	Concentration ug/L (ppb)
Lead	<1

Analysis For Total Metals By EPA Method 6020B

Client ID:	MW-C	Client:	The Riley Group
Date Received:	07/15/21	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/20/21	Lab ID:	107246-03
Date Analyzed:	07/21/21	Data File:	107246-03.116
Matrix:	Water	Instrument:	ICPMS2
Units:	ug/L (ppb)	Operator:	SP

Analyte:	Concentration ug/L (ppb)
Lead	<1

Analysis For Total Metals By EPA Method 6020B

Client ID:	MW-D	Client:	The Riley Group
Date Received:	07/15/21	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/20/21	Lab ID:	107246-04
Date Analyzed:	07/21/21	Data File:	107246-04.117
Matrix:	Water	Instrument:	ICPMS2
Units:	ug/L (ppb)	Operator:	SP

Analyte:	Concentration ug/L (ppb)
Lead	<1

Analysis For Total Metals By EPA Method 6020B

Client ID:	MW-E	Client:	The Riley Group
Date Received:	07/15/21	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/20/21	Lab ID:	107246-05
Date Analyzed:	07/21/21	Data File:	107246-05.118
Matrix:	Water	Instrument:	ICPMS2
Units:	ug/L (ppb)	Operator:	SP

Analyte:	Concentration ug/L (ppb)
Lead	<1

Analysis For Total Metals By EPA Method 6020B

Client ID:	Method Blank	Client:	The Riley Group
Date Received:	NA	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/20/21	Lab ID:	I1-442 mb
Date Analyzed:	07/20/21	Data File:	I1-442 mb.101
Matrix:	Water	Instrument:	ICPMS2
Units:	ug/L (ppb)	Operator:	SP

Analyte:	Concentration ug/L (ppb)
Lead	<1

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	MW-C	Client:	The Riley Group
Date Received:	07/15/21	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/19/21	Lab ID:	107246-03 1/2
Date Analyzed:	07/20/21	Data File:	072012.D
Matrix:	Water	Instrument:	GCMS12
Units:	ug/L (ppb)	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	35	11	65
Phenol-d6	31	11	65
Nitrobenzene-d5	91	50	150
2-Fluorobiphenyl	83	44	108
2,4,6-Tribromophenol	86	10	140
Terphenyl-d14	109	50	150

Compounds:	Concentration ug/L (ppb)
Benz(a)anthracene	<0.04
Chrysene	<0.04
Benzo(a)pyrene	<0.04
Benzo(b)fluoranthene	<0.04
Benzo(k)fluoranthene	<0.04
Indeno(1,2,3-cd)pyrene	<0.04
Dibenz(a,h)anthracene	<0.04

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	MW-D	Client:	The Riley Group
Date Received:	07/15/21	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/19/21	Lab ID:	107246-04 1/2
Date Analyzed:	07/20/21	Data File:	072013.D
Matrix:	Water	Instrument:	GCMS12
Units:	ug/L (ppb)	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	28	11	65
Phenol-d6	28	11	65
Nitrobenzene-d5	86	50	150
2-Fluorobiphenyl	86	44	108
2,4,6-Tribromophenol	61	10	140
Terphenyl-d14	109	50	150

Compounds:	Concentration ug/L (ppb)
Benz(a)anthracene	<0.04
Chrysene	<0.04
Benzo(a)pyrene	<0.04
Benzo(b)fluoranthene	<0.04
Benzo(k)fluoranthene	<0.04
Indeno(1,2,3-cd)pyrene	<0.04
Dibenz(a,h)anthracene	<0.04

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	MW-E	Client:	The Riley Group
Date Received:	07/15/21	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/19/21	Lab ID:	107246-05 1/2
Date Analyzed:	07/20/21	Data File:	072014.D
Matrix:	Water	Instrument:	GCMS12
Units:	ug/L (ppb)	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	22	11	65
Phenol-d6	26	11	65
Nitrobenzene-d5	79	50	150
2-Fluorobiphenyl	72	44	108
2,4,6-Tribromophenol	66	10	140
Terphenyl-d14	110	50	150

Compounds:	Concentration ug/L (ppb)
Benz(a)anthracene	<0.04
Chrysene	<0.04
Benzo(a)pyrene	<0.04
Benzo(b)fluoranthene	<0.04
Benzo(k)fluoranthene	<0.04
Indeno(1,2,3-cd)pyrene	<0.04
Dibenz(a,h)anthracene	<0.04

Analysis For Semivolatile Compounds By EPA Method 8270E

Client Sample ID:	Method Blank	Client:	The Riley Group
Date Received:	Not Applicable	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/19/21	Lab ID:	01-1676 mb
Date Analyzed:	07/20/21	Data File:	072009.D
Matrix:	Water	Instrument:	GCMS12
Units:	ug/L (ppb)	Operator:	VM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
2-Fluorophenol	25	11	65
Phenol-d6	16	11	65
Nitrobenzene-d5	89	50	150
2-Fluorobiphenyl	91	44	108
2,4,6-Tribromophenol	91	10	140
Terphenyl-d14	111	50	150

Compounds:	Concentration ug/L (ppb)
Benz(a)anthracene	<0.02
Chrysene	<0.02
Benzo(a)pyrene	<0.02
Benzo(b)fluoranthene	<0.02
Benzo(k)fluoranthene	<0.02
Indeno(1,2,3-cd)pyrene	<0.02
Dibenz(a,h)anthracene	<0.02

Analysis For Volatile Compounds By EPA Method 8260D

Client Sample ID:	MW-C	Client:	The Riley Group
Date Received:	07/15/21	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/19/21	Lab ID:	107246-03
Date Analyzed:	07/19/21	Data File:	071925.D
Matrix:	Water	Instrument:	GCMS11
Units:	ug/L (ppb)	Operator:	JCM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
1,2-Dichloroethane-d4	94	78	126
Toluene-d8	91	87	115
4-Bromofluorobenzene	108	92	112

Compounds:	Concentration ug/L (ppb)	Compounds:	Concentration ug/L (ppb)
Dichlorodifluoromethane	<1	1,3-Dichloropropane	<1
Chloromethane	<10	Tetrachloroethene	<1
Vinyl chloride	<0.2	Dibromochloromethane	<1
Bromomethane	<5	1,2-Dibromoethane (EDB)	<1
Chloroethane	<1	Chlorobenzene	<1
Trichlorofluoromethane	<1	Ethylbenzene	<1
Acetone	<50	1,1,1,2-Tetrachloroethane	<1
1,1-Dichloroethene	<1	m,p-Xylene	<2
Hexane	<5	o-Xylene	<1
Methylene chloride	<5	Styrene	<1
Methyl t-butyl ether (MTBE)	<1	Isopropylbenzene	<1
trans-1,2-Dichloroethene	<1	Bromoform	<5
1,1-Dichloroethane	<1	n-Propylbenzene	<1
2,2-Dichloropropane	<1	Bromobenzene	<1
cis-1,2-Dichloroethene	<1	1,3,5-Trimethylbenzene	<1
Chloroform	<1	1,1,2,2-Tetrachloroethane	<1
2-Butanone (MEK)	<20	1,2,3-Trichloropropane	<1
1,2-Dichloroethane (EDC)	<1	2-Chlorotoluene	<1
1,1,1-Trichloroethane	<1	4-Chlorotoluene	<1
1,1-Dichloropropene	<1	tert-Butylbenzene	<1
Carbon tetrachloride	<1	1,2,4-Trimethylbenzene	<1
Benzene	<0.35	sec-Butylbenzene	<1
Trichloroethene	<1	p-Isopropyltoluene	<1
1,2-Dichloropropane	<1	1,3-Dichlorobenzene	<1
Bromodichloromethane	<1	1,4-Dichlorobenzene	<1
Dibromomethane	<1	1,2-Dichlorobenzene	<1
4-Methyl-2-pentanone	<10	1,2-Dibromo-3-chloropropane	<10
cis-1,3-Dichloropropene	<1	1,2,4-Trichlorobenzene	<1
Toluene	<1	Hexachlorobutadiene	<1
trans-1,3-Dichloropropene	<1	Naphthalene	<1
1,1,2-Trichloroethane	<1	1,2,3-Trichlorobenzene	<1
2-Hexanone	<10		

Analysis For Volatile Compounds By EPA Method 8260D

Client Sample ID:	MW-D	Client:	The Riley Group
Date Received:	07/15/21	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/19/21	Lab ID:	107246-04
Date Analyzed:	07/19/21	Data File:	071926.D
Matrix:	Water	Instrument:	GCMS11
Units:	ug/L (ppb)	Operator:	JCM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
1,2-Dichloroethane-d4	94	78	126
Toluene-d8	92	87	115
4-Bromofluorobenzene	109	92	112

Compounds:	Concentration ug/L (ppb)	Compounds:	Concentration ug/L (ppb)
Dichlorodifluoromethane	<1	1,3-Dichloropropane	<1
Chloromethane	<10	Tetrachloroethene	<1
Vinyl chloride	<0.2	Dibromochloromethane	<1
Bromomethane	<5	1,2-Dibromoethane (EDB)	<1
Chloroethane	<1	Chlorobenzene	<1
Trichlorofluoromethane	<1	Ethylbenzene	<1
Acetone	<50	1,1,1,2-Tetrachloroethane	<1
1,1-Dichloroethene	<1	m,p-Xylene	<2
Hexane	<5	o-Xylene	<1
Methylene chloride	<5	Styrene	<1
Methyl t-butyl ether (MTBE)	<1	Isopropylbenzene	<1
trans-1,2-Dichloroethene	<1	Bromoform	<5
1,1-Dichloroethane	<1	n-Propylbenzene	<1
2,2-Dichloropropane	<1	Bromobenzene	<1
cis-1,2-Dichloroethene	<1	1,3,5-Trimethylbenzene	<1
Chloroform	<1	1,1,2,2-Tetrachloroethane	<1
2-Butanone (MEK)	<20	1,2,3-Trichloropropane	<1
1,2-Dichloroethane (EDC)	<1	2-Chlorotoluene	<1
1,1,1-Trichloroethane	<1	4-Chlorotoluene	<1
1,1-Dichloropropene	<1	tert-Butylbenzene	<1
Carbon tetrachloride	<1	1,2,4-Trimethylbenzene	<1
Benzene	<0.35	sec-Butylbenzene	<1
Trichloroethene	<1	p-Isopropyltoluene	<1
1,2-Dichloropropane	<1	1,3-Dichlorobenzene	<1
Bromodichloromethane	<1	1,4-Dichlorobenzene	<1
Dibromomethane	<1	1,2-Dichlorobenzene	<1
4-Methyl-2-pentanone	<10	1,2-Dibromo-3-chloropropane	<10
cis-1,3-Dichloropropene	<1	1,2,4-Trichlorobenzene	<1
Toluene	<1	Hexachlorobutadiene	<1
trans-1,3-Dichloropropene	<1	Naphthalene	<1
1,1,2-Trichloroethane	<1	1,2,3-Trichlorobenzene	<1
2-Hexanone	<10		

Analysis For Volatile Compounds By EPA Method 8260D

Client Sample ID:	MW-E	Client:	The Riley Group
Date Received:	07/15/21	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/19/21	Lab ID:	107246-05
Date Analyzed:	07/19/21	Data File:	071927.D
Matrix:	Water	Instrument:	GCMS11
Units:	ug/L (ppb)	Operator:	JCM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
1,2-Dichloroethane-d4	93	78	126
Toluene-d8	89	87	115
4-Bromofluorobenzene	115	92	112

Compounds:	Concentration ug/L (ppb)	Compounds:	Concentration ug/L (ppb)
Dichlorodifluoromethane	<1	1,3-Dichloropropane	<1
Chloromethane	<10	Tetrachloroethene	<1
Vinyl chloride	<0.2	Dibromochloromethane	<1
Bromomethane	<5	1,2-Dibromoethane (EDB)	<1
Chloroethane	<1	Chlorobenzene	<1
Trichlorofluoromethane	<1	Ethylbenzene	<1
Acetone	<50	1,1,1,2-Tetrachloroethane	<1
1,1-Dichloroethene	<1	m,p-Xylene	<2
Hexane	<5	o-Xylene	<1
Methylene chloride	<5	Styrene	<1
Methyl t-butyl ether (MTBE)	<1	Isopropylbenzene	<1
trans-1,2-Dichloroethene	<1	Bromoform	<5
1,1-Dichloroethane	<1	n-Propylbenzene	<1
2,2-Dichloropropane	<1	Bromobenzene	<1
cis-1,2-Dichloroethene	<1	1,3,5-Trimethylbenzene	<1
Chloroform	<1	1,1,2,2-Tetrachloroethane	<1
2-Butanone (MEK)	<20	1,2,3-Trichloropropane	<1
1,2-Dichloroethane (EDC)	<1	2-Chlorotoluene	<1
1,1,1-Trichloroethane	<1	4-Chlorotoluene	<1
1,1-Dichloropropene	<1	tert-Butylbenzene	<1
Carbon tetrachloride	<1	1,2,4-Trimethylbenzene	<1
Benzene	<0.35	sec-Butylbenzene	<1
Trichloroethene	<1	p-Isopropyltoluene	<1
1,2-Dichloropropane	<1	1,3-Dichlorobenzene	<1
Bromodichloromethane	<1	1,4-Dichlorobenzene	<1
Dibromomethane	<1	1,2-Dichlorobenzene	<1
4-Methyl-2-pentanone	<10	1,2-Dibromo-3-chloropropane	<10
cis-1,3-Dichloropropene	<1	1,2,4-Trichlorobenzene	<1
Toluene	<1	Hexachlorobutadiene	<1
trans-1,3-Dichloropropene	<1	Naphthalene	<1
1,1,2-Trichloroethane	<1	1,2,3-Trichlorobenzene	<1
2-Hexanone	<10		

Analysis For Volatile Compounds By EPA Method 8260D

Client Sample ID:	MW-F	Client:	The Riley Group
Date Received:	07/15/21	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/19/21	Lab ID:	107246-06
Date Analyzed:	07/19/21	Data File:	071928.D
Matrix:	Water	Instrument:	GCMS11
Units:	ug/L (ppb)	Operator:	JCM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
1,2-Dichloroethane-d4	97	78	126
Toluene-d8	88	87	115
4-Bromofluorobenzene	103	92	112

Compounds:	Concentration ug/L (ppb)	Compounds:	Concentration ug/L (ppb)
Dichlorodifluoromethane	<1	1,3-Dichloropropane	<1
Chloromethane	<10	Tetrachloroethene	<1
Vinyl chloride	<0.2	Dibromochloromethane	<1
Bromomethane	<5	1,2-Dibromoethane (EDB)	<1
Chloroethane	<1	Chlorobenzene	<1
Trichlorofluoromethane	<1	Ethylbenzene	<1
Acetone	<50	1,1,1,2-Tetrachloroethane	<1
1,1-Dichloroethene	<1	m,p-Xylene	<2
Hexane	<5	o-Xylene	<1
Methylene chloride	<5	Styrene	<1
Methyl t-butyl ether (MTBE)	<1	Isopropylbenzene	<1
trans-1,2-Dichloroethene	<1	Bromoform	<5
1,1-Dichloroethane	<1	n-Propylbenzene	<1
2,2-Dichloropropane	<1	Bromobenzene	<1
cis-1,2-Dichloroethene	<1	1,3,5-Trimethylbenzene	<1
Chloroform	<1	1,1,2,2-Tetrachloroethane	<1
2-Butanone (MEK)	<20	1,2,3-Trichloropropane	<1
1,2-Dichloroethane (EDC)	<1	2-Chlorotoluene	<1
1,1,1-Trichloroethane	<1	4-Chlorotoluene	<1
1,1-Dichloropropene	<1	tert-Butylbenzene	<1
Carbon tetrachloride	<1	1,2,4-Trimethylbenzene	<1
Benzene	<0.35	sec-Butylbenzene	<1
Trichloroethene	<1	p-Isopropyltoluene	<1
1,2-Dichloropropane	<1	1,3-Dichlorobenzene	<1
Bromodichloromethane	<1	1,4-Dichlorobenzene	<1
Dibromomethane	<1	1,2-Dichlorobenzene	<1
4-Methyl-2-pentanone	<10	1,2-Dibromo-3-chloropropane	<10
cis-1,3-Dichloropropene	<1	1,2,4-Trichlorobenzene	<1
Toluene	<1	Hexachlorobutadiene	<1
trans-1,3-Dichloropropene	<1	Naphthalene	<1
1,1,2-Trichloroethane	<1	1,2,3-Trichlorobenzene	<1
2-Hexanone	<10		

Analysis For Volatile Compounds By EPA Method 8260D

Client Sample ID:	Method Blank	Client:	The Riley Group
Date Received:	Not Applicable	Project:	Roystone 2017-015K, F&BI 107246
Date Extracted:	07/19/21	Lab ID:	01-1587 mb
Date Analyzed:	07/19/21	Data File:	071907.D
Matrix:	Water	Instrument:	GCMS11
Units:	ug/L (ppb)	Operator:	JCM

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
1,2-Dichloroethane-d4	94	78	126
Toluene-d8	89	87	115
4-Bromofluorobenzene	106	92	112

Compounds:	Concentration ug/L (ppb)	Compounds:	Concentration ug/L (ppb)
Dichlorodifluoromethane	<1	1,3-Dichloropropane	<1
Chloromethane	<10	Tetrachloroethene	<1
Vinyl chloride	<0.2	Dibromochloromethane	<1
Bromomethane	<5	1,2-Dibromoethane (EDB)	<1
Chloroethane	<1	Chlorobenzene	<1
Trichlorofluoromethane	<1	Ethylbenzene	<1
Acetone	<50	1,1,1,2-Tetrachloroethane	<1
1,1-Dichloroethene	<1	m,p-Xylene	<2
Hexane	<5	o-Xylene	<1
Methylene chloride	<5	Styrene	<1
Methyl t-butyl ether (MTBE)	<1	Isopropylbenzene	<1
trans-1,2-Dichloroethene	<1	Bromoform	<5
1,1-Dichloroethane	<1	n-Propylbenzene	<1
2,2-Dichloropropane	<1	Bromobenzene	<1
cis-1,2-Dichloroethene	<1	1,3,5-Trimethylbenzene	<1
Chloroform	<1	1,1,2,2-Tetrachloroethane	<1
2-Butanone (MEK)	<20	1,2,3-Trichloropropane	<1
1,2-Dichloroethane (EDC)	<1	2-Chlorotoluene	<1
1,1,1-Trichloroethane	<1	4-Chlorotoluene	<1
1,1-Dichloropropene	<1	tert-Butylbenzene	<1
Carbon tetrachloride	<1	1,2,4-Trimethylbenzene	<1
Benzene	<0.35	sec-Butylbenzene	<1
Trichloroethene	<1	p-Isopropyltoluene	<1
1,2-Dichloropropane	<1	1,3-Dichlorobenzene	<1
Bromodichloromethane	<1	1,4-Dichlorobenzene	<1
Dibromomethane	<1	1,2-Dichlorobenzene	<1
4-Methyl-2-pentanone	<10	1,2-Dibromo-3-chloropropane	<10
cis-1,3-Dichloropropene	<1	1,2,4-Trichlorobenzene	<1
Toluene	<1	Hexachlorobutadiene	<1
trans-1,3-Dichloropropene	<1	Naphthalene	<1
1,1,2-Trichloroethane	<1	1,2,3-Trichlorobenzene	<1
2-Hexanone	<10		

Date of Report: 07/26/21
Date Received: 07/15/21
Project: Roystone 2017-015K, F&BI 107246

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR BENZENE, TOLUENE, ETHYLBENZENE, XYLENES, AND TPH AS GASOLINE USING EPA METHOD 8021B AND NWTPH-Gx

Laboratory Code: 107303-01 (Duplicate)

Analyte	Reporting Units	Sample Result	Duplicate Result	RPD (Limit 20)
Benzene	ug/L (ppb)	<1	<1	nm
Toluene	ug/L (ppb)	<1	<1	nm
Ethylbenzene	ug/L (ppb)	<1	<1	nm
Xylenes	ug/L (ppb)	<3	<3	nm
Gasoline	ug/L (ppb)	<100	100	nm

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Benzene	ug/L (ppb)	50	92	65-118
Toluene	ug/L (ppb)	50	98	72-122
Ethylbenzene	ug/L (ppb)	50	96	73-126
Xylenes	ug/L (ppb)	150	93	74-118
Gasoline	ug/L (ppb)	1,000	94	69-134

Date of Report: 07/26/21
Date Received: 07/15/21
Project: Roystone 2017-015K, F&BI 107246

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS AS DIESEL EXTENDED USING METHOD NWTPH-Dx

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Diesel Extended	ug/L (ppb)	2,500	104	108	63-142	4

Date of Report: 07/26/21
Date Received: 07/15/21
Project: Roystone 2017-015K, F&BI 107246

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR DISSOLVED METALS USING EPA METHOD 6020B

Laboratory Code: 107250-01 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Lead	ug/L (ppb)	10	<1	85	84	75-125	1

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Lead	ug/L (ppb)	10	100	80-120

Date of Report: 07/26/21
Date Received: 07/15/21
Project: Roystone 2017-015K, F&BI 107246

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR TOTAL METALS USING EPA METHOD 6020B

Laboratory Code: 107240-01 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result	Percent Recovery MS	Percent Recovery MSD	Acceptance Criteria	RPD (Limit 20)
Lead	ug/L (ppb)	100	<1	83	81	75-125	2

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Lead	ug/L (ppb)	100	99	80-120

Date of Report: 07/26/21
Date Received: 07/15/21
Project: Roystone 2017-015K, F&BI 107246

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR SEMIVOLATILES BY EPA METHOD 8270E

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Benz(a)anthracene	ug/L (ppb)	5	96	97	70-130	1
Chrysene	ug/L (ppb)	5	94	95	70-130	1
Benzo(a)pyrene	ug/L (ppb)	5	99	98	70-130	1
Benzo(b)fluoranthene	ug/L (ppb)	5	98	98	70-130	0
Benzo(k)fluoranthene	ug/L (ppb)	5	97	98	70-130	1
Indeno(1,2,3-cd)pyrene	ug/L (ppb)	5	89	86	70-130	3
Dibenz(a,h)anthracene	ug/L (ppb)	5	88	86	70-130	2

Date of Report: 07/26/21
Date Received: 07/15/21
Project: Roystone 2017-015K, F&BI 107246

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR VOLATILES BY EPA METHOD 8260D

Laboratory Code: 107278-01 (Matrix Spike)

Analyte	Reporting Units	Spike Level	Sample Result	Percent Recovery MS	Acceptance Criteria
Dichlorodifluoromethane	ug/L (ppb)	10	<1	108	10-172
Chloromethane	ug/L (ppb)	10	<10	98	25-166
Vinyl chloride	ug/L (ppb)	10	<0.2	98	36-166
Bromomethane	ug/L (ppb)	10	<5	150	47-169
Chloroethane	ug/L (ppb)	10	<1	108	46-160
Trichlorofluoromethane	ug/L (ppb)	10	<1	106	44-165
Acetone	ug/L (ppb)	50	<50	55	10-182
1,1-Dichloroethene	ug/L (ppb)	10	<1	100	58-142
Hexane	ug/L (ppb)	10	<5	97	38-152
Methylene chloride	ug/L (ppb)	10	<5	103	50-145
Methyl t-butyl ether (MTBE)	ug/L (ppb)	10	<1	100	61-136
trans-1,2-Dichloroethene	ug/L (ppb)	10	<1	106	61-136
1,1-Dichloroethane	ug/L (ppb)	10	<1	102	63-135
2,2-Dichloropropane	ug/L (ppb)	10	<1	114	36-154
cis-1,2-Dichloroethene	ug/L (ppb)	10	<1	104	63-134
Chloroform	ug/L (ppb)	10	<1	100	61-135
2-Butanone (MEK)	ug/L (ppb)	50	<20	78	10-129
1,2-Dichloroethane (EDC)	ug/L (ppb)	10	<1	103	48-149
1,1,1-Trichloroethane	ug/L (ppb)	10	<1	111	60-146
1,1-Dichloropropene	ug/L (ppb)	10	<1	103	69-133
Carbon tetrachloride	ug/L (ppb)	10	<1	110	56-152
Benzene	ug/L (ppb)	10	<0.35	103	57-135
Trichloroethene	ug/L (ppb)	10	<1	102	66-135
1,2-Dichloropropane	ug/L (ppb)	10	<1	100	59-136
Bromodichloromethane	ug/L (ppb)	10	<1	100	61-150
Dibromomethane	ug/L (ppb)	10	<1	101	66-141
4-Methyl-2-pentanone	ug/L (ppb)	50	<10	103	10-185
cis-1,3-Dichloropropene	ug/L (ppb)	10	<1	97	52-147
Toluene	ug/L (ppb)	10	<1	96	50-137
trans-1,3-Dichloropropene	ug/L (ppb)	10	<1	92	53-142
1,1,2-Trichloroethane	ug/L (ppb)	10	<1	98	68-131
2-Hexanone	ug/L (ppb)	50	<10	94	10-185
1,3-Dichloropropane	ug/L (ppb)	10	<1	97	60-135
Tetrachloroethene	ug/L (ppb)	10	<1	96	10-226
Dibromochloromethane	ug/L (ppb)	10	<1	89	52-145
1,2-Dibromoethane (EDB)	ug/L (ppb)	10	<1	99	62-135
Chlorobenzene	ug/L (ppb)	10	<1	98	63-130
Ethylbenzene	ug/L (ppb)	10	<1	98	60-133
1,1,1,2-Tetrachloroethane	ug/L (ppb)	10	<1	99	56-143
m,p-Xylene	ug/L (ppb)	20	<2	97	69-135
o-Xylene	ug/L (ppb)	10	<1	96	60-140
Styrene	ug/L (ppb)	10	<1	98	60-133
Isopropylbenzene	ug/L (ppb)	10	<1	98	65-142
Bromoform	ug/L (ppb)	10	<5	94	54-148
n-Propylbenzene	ug/L (ppb)	10	<1	94	58-144
Bromobenzene	ug/L (ppb)	10	<1	98	61-130
1,3,5-Trimethylbenzene	ug/L (ppb)	10	<1	96	59-134
1,1,2,2-Tetrachloroethane	ug/L (ppb)	10	<1	100	51-154
1,2,3-Trichloropropane	ug/L (ppb)	10	<1	99	53-150
2-Chlorotoluene	ug/L (ppb)	10	<1	97	66-127
4-Chlorotoluene	ug/L (ppb)	10	<1	96	65-130
tert-Butylbenzene	ug/L (ppb)	10	<1	96	65-137
1,2,4-Trimethylbenzene	ug/L (ppb)	10	<1	95	59-146
sec-Butylbenzene	ug/L (ppb)	10	<1	95	64-140
p-Isopropyltoluene	ug/L (ppb)	10	<1	95	65-141
1,3-Dichlorobenzene	ug/L (ppb)	10	<1	96	60-131
1,4-Dichlorobenzene	ug/L (ppb)	10	<1	97	60-129
1,2-Dichlorobenzene	ug/L (ppb)	10	<1	97	60-130
1,2-Dibromo-3-chloropropane	ug/L (ppb)	10	<10	99	32-164
1,2,4-Trichlorobenzene	ug/L (ppb)	10	<1	94	52-138
Hexachlorobutadiene	ug/L (ppb)	10	<1	97	60-143
Naphthalene	ug/L (ppb)	10	<1	95	44-164
1,2,3-Trichlorobenzene	ug/L (ppb)	10	<1	91	69-148

Date of Report: 07/26/21
Date Received: 07/15/21
Project: Roystone 2017-015K, F&BI 107246

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR VOLATILES BY EPA METHOD 8260D

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Dichlorodifluoromethane	ug/L (ppb)	10	140	128	25-158	9
Chloromethane	ug/L (ppb)	10	126	105	45-156	18
Vinyl chloride	ug/L (ppb)	10	121	105	50-154	14
Bromomethane	ug/L (ppb)	10	186 vo	162 vo	55-143	14
Chloroethane	ug/L (ppb)	10	131	115	58-146	13
Trichlorofluoromethane	ug/L (ppb)	10	129	118	50-150	9
Acetone	ug/L (ppb)	50	68	59	22-155	14
1,1-Dichloroethene	ug/L (ppb)	10	114	100	67-136	13
Hexane	ug/L (ppb)	10	80	76	57-137	5
Methylene chloride	ug/L (ppb)	10	129	105	19-178	21 vo
Methyl t-butyl ether (MTBE)	ug/L (ppb)	10	121	105	64-147	14
trans-1,2-Dichloroethene	ug/L (ppb)	10	118	105	68-128	12
1,1-Dichloroethane	ug/L (ppb)	10	119	104	74-135	13
2,2-Dichloropropane	ug/L (ppb)	10	146 vo	122	55-143	18
cis-1,2-Dichloroethene	ug/L (ppb)	10	121	104	74-136	15
Chloroform	ug/L (ppb)	10	120	102	74-134	16
2-Butanone (MEK)	ug/L (ppb)	50	91	80	37-150	13
1,2-Dichloroethane (EDC)	ug/L (ppb)	10	120	103	66-129	15
1,1,1-Trichloroethane	ug/L (ppb)	10	129	113	74-142	13
1,1-Dichloropropene	ug/L (ppb)	10	117	105	77-129	11
Carbon tetrachloride	ug/L (ppb)	10	131	115	75-158	13
Benzene	ug/L (ppb)	10	119	102	69-134	15
Trichloroethene	ug/L (ppb)	10	118	99	67-133	18
1,2-Dichloropropane	ug/L (ppb)	10	119	101	71-134	16
Bromodichloromethane	ug/L (ppb)	10	119	102	66-126	15
Dibromomethane	ug/L (ppb)	10	121	105	68-132	14
4-Methyl-2-pentanone	ug/L (ppb)	50	122	107	65-138	13
cis-1,3-Dichloropropene	ug/L (ppb)	10	116	101	74-140	14
Toluene	ug/L (ppb)	10	110	94	72-122	16
trans-1,3-Dichloropropene	ug/L (ppb)	10	109	91	80-136	18
1,1,2-Trichloroethane	ug/L (ppb)	10	114	101	75-124	12
2-Hexanone	ug/L (ppb)	50	109	94	60-136	15
1,3-Dichloropropane	ug/L (ppb)	10	112	96	76-126	15
Tetrachloroethene	ug/L (ppb)	10	105	91	76-121	14
Dibromochloromethane	ug/L (ppb)	10	107	92	84-133	15
1,2-Dibromoethane (EDB)	ug/L (ppb)	10	115	101	82-115	13
Chlorobenzene	ug/L (ppb)	10	110	95	83-114	15
Ethylbenzene	ug/L (ppb)	10	112	95	77-124	16
1,1,1,2-Tetrachloroethane	ug/L (ppb)	10	114	98	84-127	15
m,p-Xylene	ug/L (ppb)	20	110	95	81-112	15
o-Xylene	ug/L (ppb)	10	111	95	81-121	16
Styrene	ug/L (ppb)	10	112	97	84-119	14
Isopropylbenzene	ug/L (ppb)	10	110	96	80-117	14
Bromoform	ug/L (ppb)	10	115	100	69-121	14
n-Propylbenzene	ug/L (ppb)	10	105	90	74-126	15
Bromobenzene	ug/L (ppb)	10	114	95	80-121	18
1,3,5-Trimethylbenzene	ug/L (ppb)	10	108	92	78-123	16
1,1,2,2-Tetrachloroethane	ug/L (ppb)	10	116	98	66-126	17
1,2,3-Trichloropropane	ug/L (ppb)	10	115	99	67-124	15
2-Chlorotoluene	ug/L (ppb)	10	110	93	77-127	17
4-Chlorotoluene	ug/L (ppb)	10	107	92	78-128	15
tert-Butylbenzene	ug/L (ppb)	10	110	95	80-123	15
1,2,4-Trimethylbenzene	ug/L (ppb)	10	109	92	79-122	17
sec-Butylbenzene	ug/L (ppb)	10	105	90	80-116	15
p-Isopropyltoluene	ug/L (ppb)	10	104	90	81-123	14
1,3-Dichlorobenzene	ug/L (ppb)	10	108	92	83-113	16
1,4-Dichlorobenzene	ug/L (ppb)	10	108	94	81-112	14
1,2-Dichlorobenzene	ug/L (ppb)	10	111	94	84-112	17
1,2-Dibromo-3-chloropropane	ug/L (ppb)	10	115	100	57-141	14
1,2,4-Trichlorobenzene	ug/L (ppb)	10	98	87	72-130	12
Hexachlorobutadiene	ug/L (ppb)	10	99	86	53-141	14
Naphthalene	ug/L (ppb)	10	106	91	64-133	15
1,2,3-Trichlorobenzene	ug/L (ppb)	10	102	88	65-136	15

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The analyte is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits due to sample matrix effects.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

107246

SAMPLE CHAIN OF CUSTODY

ME 07-15-21

VW3 AI2/E03

Page # 1 of 1

Report To Jerry Sawetz

Company RGI

Address 17522 Bothell Way

City, State, ZIP Bothell, WA

Phone 425-415-0551 Email jsawetz@riley-grou

SAMPLERS (*signature*)

PROJECT NAME	PO #
Roystone	2017-015K

REMARKS	INVOICE TO
cc=truesdell@riley-group.com Project specific RLs? - Yes / [✓ No]	

TURNAROUND TIME
☒ Standard turnaround
☐ RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
☐ Archive samples
☐ Other
Default: Dispose after 30 days

Sample ID	Lab ID (NP)	Date Sampled	Time Sampled	Sample Type	# of Jars	NWTPH-Dx	NWTPH-Gx	BTEX EPA 8021	NWTPH-HCID	VOCs EPA 8260	PAHs EPA 8270	PCBs EPA 8082	cPAHs EPA 8270	Total Pb 6020	Dissolved Pb 6020		Notes
MW-A	01 A→E	7/14	1615	Water	5	X	X	X									
MW-B	02 ↓	↓	1150	↓	5	X	X	X									
MW-C	03 A→H		1340		8	X	X			X			X	X	X		Field filtered for dissolved.
MW-D	04 ↓		1240		8	X	X			X			X	X	X		" "
MW-E	05 ↓		1450		8	X	X			X			X	X	X		" "
MW-F	06 A→E		1535		5	X	X			X							
																	Samples received at 4 °C

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Tait R	RGI	7/15	940
Received by:	DO VO	FB+I	7-15-21	16:10
Relinquished by:				
Received by:				

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Arina Podnozova, B.S.
Eric Young, B.S.

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(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

July 29, 2022

Jerry Sawetz, Project Manager
The Riley Group, Inc.
17522 Bothell Way NE
Bothell, WA 98011

Dear Mr Sawetz:

Included are the amended results from the testing of material submitted on October 15, 2021 from the Roystone 2017-015K, F&BI 110322 project. The case narrative was updated.

We appreciate this opportunity to be of service to you and hope you will call if you have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
TRG1111R.DOC

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Arina Podnozova, B.S.
Eric Young, B.S.

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fbi@isomedia.com
www.friedmanandbruya.com

November 11, 2021

Jerry Sawetz, Project Manager
The Riley Group, Inc.
17522 Bothell Way NE
Bothell, WA 98011

Dear Mr Sawetz:

Included are the additional results from the testing of material submitted on October 15, 2021 from the Roystone 2017-015K, F&BI 110322 project. There are 8 pages included in this report.

We appreciate this opportunity to be of service to you and hope you will call if you have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
TRG1111R.DOC

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

CASE NARRATIVE

This case narrative encompasses samples received on October 15, 2021 by Friedman & Bruya, Inc. from the The Riley Group Roystone 2017-015K, F&BI 110322 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	The Riley Group
110322 -01	MWA
110322 -02	MWB
110322 -03	MWC
110322 -04	MWD
110322 -05	MWE
110322 -06	MWF

The NWTPH-Dx results were qualified due to the material not resembling the standard used for quantitation. Review of the NWTPH-Dx chromatogram for sample MWD showed a pattern of peaks indicating the possible presence of polar organics. The MWD sample extract was passed through silica gel and the quantifiable material was removed, indicating the material quantified without silica gel cleanup was polar.

All quality control requirements were acceptable.

Date of Report: 11/11/21
Date Received: 10/15/21
Project: Roystone 2017-015K, F&BI 110322
Date Extracted: 10/19/21
Date Analyzed: 10/19/21

RESULTS FROM THE ANALYSIS OF WATER SAMPLES FOR BENZENE, TOLUENE, ETHYLBENZENE, XYLENES AND TPH AS GASOLINE USING METHODS 8021B AND NWTPH-Gx

Results Reported as ug/L (ppb)

Sample ID Laboratory ID	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Gasoline Range	Surrogate (% Recovery) (Limit 52-124)
MWA 110322-01	<1	<1	<1	<3	<100	82
MWB 110322-02	<1	1.2	<1	<3	110	83
MWC 110322-03	<1	<1	<1	<3	<100	82
MWD 110322-04	<1	8.1	<1	22	290	85
MWE 110322-05	<1	<1	<1	<3	<100	83
MWF 110322-06	<1	<1	<1	<3	<100	81
Method Blank 01-2308 MB	<1	<1	<1	<3	<100	81

Date of Report: 11/11/21
Date Received: 10/15/21
Project: Roystone 2017-015K, F&BI 110322
Date Extracted: 10/18/21
Date Analyzed: 10/18/21

RESULTS FROM THE ANALYSIS OF WATER SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS AS DIESEL AND MOTOR OIL USING METHOD NWTPH-Dx

Results Reported as ug/L (ppb)

Sample ID Laboratory ID	Diesel Range (C_{10}-C_{25})	Motor Oil Range (C_{25}-C_{36})	Surrogate (% Recovery) (Limit 47-140)
MWA 110322-01 1/1.2	<60	<300	116
MWB 110322-02 1/1.2	440 x	<300	106
MWC 110322-03	110 x	<250	110
MWD 110322-04	510 x	<250	116
MWE 110322-05 1/1.2	190 x	<300	107
MWF 110322-06 1/1.2	110 x	<300	124
Method Blank 01-2422 MB	<50	<250	116

Date of Report: 11/11/21
Date Received: 10/15/21
Project: Roystone 2017-015K, F&BI 110322
Date Extracted: 10/18/21
Date Analyzed: 10/22/21 and 11/09/21

RESULTS FROM THE ANALYSIS OF WATER SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS AS DIESEL AND MOTOR OIL USING METHOD NWTPH-Dx

Sample Extracts Passed Through a Silica Gel Column Prior to Analysis

Results Reported as ug/L (ppb)

Sample ID Laboratory ID	Diesel Range (C_{10}-C_{25})	Motor Oil Range (C_{25}-C_{36})	Surrogate (% Recovery) (Limit 47-140)
MWB 110322-02 1/1.2	<60	<300	126
MWC 110322-03	<50	<250	119
MWD 110322-04	<50	<250	98
MWE 110322-05 1/1.2	<60	<300	126
MWF 110322-06 1/1.2	<60	<300	132
Method Blank 01-2422 MB	<50	<250	125

Date of Report: 11/11/21
Date Received: 10/15/21
Project: Roystone 2017-015K, F&BI 110322

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR BENZENE, TOLUENE, ETHYLBENZENE, XYLENES, AND TPH AS GASOLINE USING EPA METHOD 8021B AND NWTPH-Gx

Laboratory Code: 110337-01 (Duplicate)

Analyte	Reporting Units	Sample Result	Duplicate Result	RPD (Limit 20)
Benzene	ug/L (ppb)	<1	<1	nm
Toluene	ug/L (ppb)	<1	<1	nm
Ethylbenzene	ug/L (ppb)	<1	<1	nm
Xylenes	ug/L (ppb)	<3	<3	nm
Gasoline	ug/L (ppb)	<100	<100	nm

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Benzene	ug/L (ppb)	50	101	65-118
Toluene	ug/L (ppb)	50	105	72-122
Ethylbenzene	ug/L (ppb)	50	105	73-126
Xylenes	ug/L (ppb)	150	99	74-118
Gasoline	ug/L (ppb)	1,000	99	69-134

Date of Report: 11/11/21
Date Received: 10/15/21
Project: Roystone 2017-015K, F&BI 110322

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS AS DIESEL EXTENDED USING METHOD NWTPH-Dx

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Diesel Extended	ug/L (ppb)	2,500	112	108	61-133	4

Date of Report: 11/11/21
Date Received: 10/15/21
Project: Roystone 2017-015K, F&BI 110322

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS AS DIESEL EXTENDED USING METHOD NWTPH-Dx

Laboratory Code: Laboratory Control Sample Silica Gel

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Diesel Extended	ug/L (ppb)	2,500	112	108	61-133	4

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The analyte is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits due to sample matrix effects.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

110322
[redacted]

SAMPLE CHAIN OF CUSTODY

ME 10/15/21 [redacted] # 1 of 1 VW3

Report To Jerry Sewetz
Company RGI
Address 17522 Bothell Way
City, State, ZIP Bothell, WA
Phone 425-415-0551 / Email Jerry

SAMPLERS (signature)	
PROJECT NAME Roystone	PO # 2017-015K
REMARKS wstrussell@rgi.com Project specific RLs? - Yes / No	INVOICE TO

TURNAROUND TIME E03
☒ Standard turnaround
☐ RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
☐ Archive samples
☐ Other
Default: Dispose after 30 days

						ANALYSES REQUESTED											
Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	NWTPH-Dx	NWTPH-Gx	BTEX EPA 8021	NWTPH-HCID	VOCs EPA 8260	PAHs EPA 8270	PCBs EPA 8082	Dx w/ Silica Gel				Notes
mwA	01 A-D	10/15	1400	Water	4	X	X	X									● per JS
mwB	02		1010			X	X	X					(X)				10/21/21 ME
mwC	03		1220			X	X	X					(X)				
mwD	04		1050			X	X	X					●				(X) per JS
mwE	05		1130			X	X	X					(X)				11/5/21 ME
mwF	06	↓	1315	↓	↓	X	X	X					(X)				

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Jatt R	RGI	10/15	1435
Received by:	Nhan Phan	FeBI	10/15/21	1435
Relinquished by:				
Received by:		Samples received at 4 °C		

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Vineta Mills, M.S.
Eric Young, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

March 1, 2022

Jerry Sawetz, Project Manager
The Riley Group, Inc.
17522 Bothell Way NE
Bothell, WA 98011

Dear Mr Sawetz:

Included are the results from the testing of material submitted on February 24, 2022 from the Roystone Development 2017-015K, F&BI 202453 project. There are 6 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days, or as directed by the Chain of Custody document. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
c: jdavies@riley-group.com
TRG0301R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on February 24, 2022 by Friedman & Bruya, Inc. from the The Riley Group Roystone Development 2017-015K, F&BI 202453 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	The Riley Group
202453 -01	MW-A
202453 -02	MW-B
202453 -03	MW-C
202453 -04	MW-D
202453 -05	MW-E
202453 -06	MW-F

All quality control requirements were acceptable.

Date of Report: 03/01/22
Date Received: 02/24/22
Project: Roystone Development 2017-015K, F&BI 202453
Date Extracted: 02/24/22
Date Analyzed: 02/25/22

RESULTS FROM THE ANALYSIS OF WATER SAMPLES FOR BENZENE, TOLUENE, ETHYLBENZENE, XYLENES AND TPH AS GASOLINE USING METHODS 8021B AND NWTPH-Gx

Results Reported as ug/L (ppb)

Sample ID Laboratory ID	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Gasoline Range	Surrogate (% Recovery) (Limit 52-124)
MW-A 202453-01	<1	<1	<1	<3	<100	71
MW-B 202453-02	<1	<1	<1	<3	<100	73
MW-C 202453-03	<1	<1	<1	<3	<100	71
MW-D 202453-04	<1	<1	<1	<3	<100	71
MW-E 202453-05	<1	<1	<1	<3	<100	71
MW-F 202453-06	<1	<1	<1	<3	<100	70
Method Blank 02-342 MB	<1	<1	<1	<3	<100	72

Date of Report: 03/01/22
Date Received: 02/24/22
Project: Roystone Development 2017-015K, F&BI 202453
Date Extracted: 02/25/22
Date Analyzed: 02/25/22

RESULTS FROM THE ANALYSIS OF WATER SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS AS DIESEL AND MOTOR OIL USING METHOD NWTPH-Dx

Results Reported as ug/L (ppb)

Sample ID Laboratory ID	Diesel Range (C_{10}-C_{25})	Motor Oil Range (C_{25}-C_{36})	Surrogate (% Recovery) (Limit 41-152)
MW-A 202453-01	97 x	<250	122
MW-B 202453-02	310 x	<250	128
MW-C 202453-03	130 x	<250	111
MW-D 202453-04	210 x	<250	125
MW-E 202453-05	380 x	<250	128
MW-F 202453-06	160 x	<250	125
Method Blank 02-525 MB	<50	<250	107

Date of Report: 03/01/22
Date Received: 02/24/22
Project: Roystone Development 2017-015K, F&BI 202453

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR BENZENE, TOLUENE, ETHYLBENZENE, XYLENES, AND TPH AS GASOLINE USING EPA METHOD 8021B AND NWTPH-Gx

Laboratory Code: 202448-02 (Duplicate)

Analyte	Reporting Units	Sample Result	Duplicate Result	RPD (Limit 20)
Benzene	ug/L (ppb)	<1	<1	nm
Toluene	ug/L (ppb)	<1	<1	nm
Ethylbenzene	ug/L (ppb)	<1	<1	nm
Xylenes	ug/L (ppb)	<3	<3	nm
Gasoline	ug/L (ppb)	<100	<100	nm

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Benzene	ug/L (ppb)	50	105	65-118
Toluene	ug/L (ppb)	50	102	72-122
Ethylbenzene	ug/L (ppb)	50	106	73-126
Xylenes	ug/L (ppb)	150	97	74-118
Gasoline	ug/L (ppb)	1,000	119	69-134

Date of Report: 03/01/22
Date Received: 02/24/22
Project: Roystone Development 2017-015K, F&BI 202453

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS AS DIESEL EXTENDED USING METHOD NWTPH-Dx

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Diesel Extended	ug/L (ppb)	2,500	116	114	63-142	2

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The analyte is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits due to sample matrix effects.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

202453

SAMPLE CHAIN OF CUSTODY 02.24.22

VW3/D02

Report To Jerry Sewetz

Company RGI

Address 17522 Bothell Way

City, State, ZIP Bothell, WA

Phone 425-416-0551 Email jsewetz@riley-groupcom

SAMPLERS (*signature*) Jaycob Davies

PROJECT NAME	PO #
Roystone Development	2017-015K

REMARKS	INVOICE TO
cc: jdavies@riley-groupcom Project specific RLs? - Yes / No	

Page # 1 of 1

TURNAROUND TIME
☒ Standard turnaround
☐ RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
☐ Archive samples
☐ Other
Default: Dispose after 30 days

						ANALYSES REQUESTED											
Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	NWTPH-Dx	NWTPH-Gx	BTEX EPA 8021	NWTPH-HCID	VOCs EPA 8260	PAHs EPA 8270	PCBs EPA 8082					Notes
MW-A	01A-D	2/23	1245	Water	4	X	X	X									
MW-B	02		1055			X	X	X									
MW-C	03		1450			X	X	X									
MW-D	04		1532			X	X	X									
MW-E	05		1145			X	X	X									
MW-F	06 ↓	↓	1340	↓	↓	X	X	X									

Samples received at 6 °C

Friedman & Bruya, Inc.
Ph. (206) 285-8282

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by: Jaycob Davies	Jaycob Davies	RGI	2/23	17:15
Received by: D Sams	D Sams	FedEx SDC	2/23	13:15
Relinquished by:				
Received by: Tokala C.	Tokala Christensen	F+B	02.24.22	14:20

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Vineta Mills, M.S.
Eric Young, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

June 2, 2022

Jerry Sawetz, Project Manager
The Riley Group, Inc.
17522 Bothell Way NE
Bothell, WA 98011

Dear Mr Sawetz:

Included are the results from the testing of material submitted on May 24, 2022 from the Roystone 2017-015K, F&BI 205410 project. There are 6 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days, or as directed by the Chain of Custody document. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
TRG0602R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on May 24, 2022 by Friedman & Bruya, Inc. from the The Riley Group Roystone 2017-015K, F&BI 205410 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	The Riley Group
205410 -01	MW-A
205410 -02	MW-B
205410 -03	MW-C
205410 -04	MW-D
205410 -05	MW-E
205410 -06	MW-F

All quality control requirements were acceptable.

Date of Report: 06/02/22
Date Received: 05/24/22
Project: Roystone 2017-015K, F&BI 205410
Date Extracted: 05/25/22
Date Analyzed: 05/25/22

RESULTS FROM THE ANALYSIS OF WATER SAMPLES FOR BENZENE, TOLUENE, ETHYLBENZENE, XYLENES AND TPH AS GASOLINE USING METHODS 8021B AND NWTPH-Gx

Results Reported as ug/L (ppb)

Sample ID Laboratory ID	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Gasoline Range	Surrogate (% Recovery) (Limit 52-124)
MW-A 205410-01	<1	<1	<1	<3	<100	126
MW-B 205410-02	<1	<1	<1	<3	<100	120
MW-C 205410-03	<1	<1	<1	<3	<100	120
MW-D 205410-04	<1	<1	<1	<3	<100	124
MW-E 205410-05	<1	<1	<1	<3	<100	119
MW-F 205410-06	<1	<1	<1	<3	<100	121
Method Blank 02-1132 MB	<1	<1	<1	<3	<100	90

Date of Report: 06/02/22
Date Received: 05/24/22
Project: Roystone 2017-015K, F&BI 205410
Date Extracted: 05/25/22
Date Analyzed: 05/25/22 and 06/02/22

RESULTS FROM THE ANALYSIS OF WATER SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS AS DIESEL AND MOTOR OIL USING METHOD NWTPH-Dx

Results Reported as ug/L (ppb)

Sample ID Laboratory ID	Diesel Range (C_{10}-C_{25})	Motor Oil Range (C_{25}-C_{36})	Surrogate (% Recovery) (Limit 41-152)
MW-A 205410-01 1/1.2	98 x	<300	133
MW-B 205410-02 1/1.2	300 x	<300	148
MW-C 205410-03	90 x	<250	146
MW-D 205410-04	220 x	<250	133
MW-E 205410-05 1/1.2	290 x	<300	144
MW-F 205410-06 1/1.2	130 x	<300	144
Method Blank 02-1275 MB	<50	<250	132

Date of Report: 06/02/22
Date Received: 05/24/22
Project: Roystone 2017-015K, F&BI 205410

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR BENZENE, TOLUENE, ETHYLBENZENE, XYLENES, AND TPH AS GASOLINE USING EPA METHOD 8021B AND NWTPH-Gx

Laboratory Code: 205363-01 (Duplicate)

Analyte	Reporting Units	Sample Result	Duplicate Result	RPD (Limit 20)
Benzene	ug/L (ppb)	<1	<1	nm
Toluene	ug/L (ppb)	<1	<1	nm
Ethylbenzene	ug/L (ppb)	<1	<1	nm
Xylenes	ug/L (ppb)	<3	<3	nm
Gasoline	ug/L (ppb)	<100	<100	nm

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Benzene	ug/L (ppb)	50	103	65-118
Toluene	ug/L (ppb)	50	105	72-122
Ethylbenzene	ug/L (ppb)	50	110	73-126
Xylenes	ug/L (ppb)	150	108	74-118
Gasoline	ug/L (ppb)	1,000	116	69-134

Date of Report: 06/02/22
Date Received: 05/24/22
Project: Roystone 2017-015K, F&BI 205410

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS AS DIESEL EXTENDED USING METHOD NWTPH-Dx

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Diesel Extended	ug/L (ppb)	2,500	112	120	63-142	7

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The analyte is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits due to sample matrix effects.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

205410

SAMPLE CHAIN OF CUSTODY

05-24-22

E03/VW4

Report To Jerry Sawetz

Company RGI

Address 17522 Bothell Way

City, State, ZIP Bothell, WA

Phone 425-415-0551 Email jsawetz@rileygroup.com

SAMPLERS (*signature*)	
PROJECT NAME Roystone	PO # 2017-015K
REMARKS cc: tcrussell@rileygroup.com Project specific RLs? - Yes / No	INVOICE TO

Page # 1 of 1

TURNAROUND TIME

☒ Standard turnaround

☐ RUSH

Rush charges authorized by:

SAMPLE DISPOSAL

☐ Archive samples

☐ Other

Default: Dispose after 30 days

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	NWTPH-Dx	NWTPH-Gx	BTEX EPA 8021	NWTPH-HCID	VOCs EPA 8260	PAHs EPA 8270	PCBs EPA 8082					Notes
MW-A	01 A-D	5/23	1125	water	4	X	X	X									
MW-B	02	↓	1045	↓	↓	X	X	X									
MW-C	03	↓	1210	↓	↓	X	X	X									
MW-D	04	↓	1420	↓	↓	X	X	X									
MW-E	05	↓	1300	↓	↓	X	X	X									
MW-F	06	↓	1330	↓	↓	X	X	X									

Samples received at 6 °C

Friedman & Bruya, Inc.
Ph. (206) 285-8282

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Tait K	RGI	5/24	930
Received by:	DAVID NICACIO	FEDEX	5/24	11:49
Relinquished by:				
Received by:	Alan W Bruya	FDB	5/24/22	1400

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Vineta Mills, M.S.
Eric Young, B.S.

3012 16th Avenue West
Seattle, WA 98119-2029
(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

August 29, 2022

Jerry Sawetz, Project Manager
The Riley Group, Inc.
17522 Bothell Way NE
Bothell, WA 98011

Dear Mr Sawetz:

Included are the results from the testing of material submitted on August 19, 2022 from the Roystone on Queen Anne Redevelopment 2017-015K, F&BI 208298 project. There are 6 pages included in this report. Any samples that may remain are currently scheduled for disposal in 30 days, or as directed by the Chain of Custody document. If you would like us to return your samples or arrange for long term storage at our offices, please contact us as soon as possible.

We appreciate this opportunity to be of service to you and hope you will call if you have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
TRG0829R.DOC

CASE NARRATIVE

This case narrative encompasses samples received on August 19, 2022 by Friedman & Bruya, Inc. from the The Riley Group Roystone on Queen Anne Redevelopment 2017-015K, F&BI 208298 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	The Riley Group
208298 -01	MW-D

All quality control requirements were acceptable.

Date of Report: 08/29/22
Date Received: 08/19/22
Project: Roystone on Queen Anne Redevelopment 2017-015K, F&BI 208298
Date Extracted: 08/26/22
Date Analyzed: 08/26/22

RESULTS FROM THE ANALYSIS OF WATER SAMPLES FOR BENZENE, TOLUENE, ETHYLBENZENE, XYLENES AND TPH AS GASOLINE USING METHODS 8021B AND NWTPH-Gx

Results Reported as ug/L (ppb)

Sample ID Laboratory ID	Benzene	Toluene	Ethyl Benzene	Total Xylenes	Gasoline Range	Surrogate (% Recovery) (Limit 52-124)
MW-D 208298-01	<1	<1	<1	<3	<100	95
Method Blank 02-1746 MB	<1	<1	<1	<3	<100	97

Date of Report: 08/29/22
Date Received: 08/19/22
Project: Roystone on Queen Anne Redevelopment 2017-015K, F&BI 208298
Date Extracted: 08/19/22
Date Analyzed: 08/19/22

RESULTS FROM THE ANALYSIS OF WATER SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS AS DIESEL AND MOTOR OIL USING METHOD NWTPH-Dx

Results Reported as ug/L (ppb)

Sample ID Laboratory ID	Diesel Range (C_{10}-C_{25})	Motor Oil Range (C_{25}-C_{36})	Surrogate (% Recovery) (Limit 41-152)
MW-D 208298-01	270 x	<250	117
Method Blank 02-2010 MB	<50	<250	134

Date of Report: 08/29/22
Date Received: 08/19/22
Project: Roystone on Queen Anne Redevelopment 2017-015K, F&BI 208298

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR BENZENE, TOLUENE, ETHYLBENZENE, XYLENES, AND TPH AS GASOLINE USING EPA METHOD 8021B AND NWTPH-Gx

Laboratory Code: 208339-01 (Duplicate)

Analyte	Reporting Units	Sample Result	Duplicate Result	RPD (Limit 20)
Benzene	ug/L (ppb)	<1	<1	nm
Toluene	ug/L (ppb)	<1	<1	nm
Ethylbenzene	ug/L (ppb)	<1	<1	nm
Xylenes	ug/L (ppb)	<3	<3	nm
Gasoline	ug/L (ppb)	<100	<100	nm

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Benzene	ug/L (ppb)	50	106	65-118
Toluene	ug/L (ppb)	50	106	72-122
Ethylbenzene	ug/L (ppb)	50	108	73-126
Xylenes	ug/L (ppb)	150	105	74-118
Gasoline	ug/L (ppb)	1,000	90	69-134

Date of Report: 08/29/22
Date Received: 08/19/22
Project: Roystone on Queen Anne Redevelopment 2017-015K, F&BI 208298

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF WATER SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS AS DIESEL EXTENDED USING METHOD NWTPH-Dx

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Percent Recovery LCSD	Acceptance Criteria	RPD (Limit 20)
Diesel Extended	ug/L (ppb)	2,500	132	136	63-142	3

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The analyte is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits due to sample matrix effects.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

208298

SAMPLE CHAIN OF CUSTODY

08/19/22 E04/1 UW1

Page # 1 of 1

Report To Jerry Sawetz
Company The Riley Group, Inc.
Address 17522 Bothell Way NE
City, State, ZIP Bothell, WA 98011
Phone 425-415-0551 Email jsawetz@riley-group.com

SAMPLERS (*signature*) Sierra Kindley

PROJECT NAME Roystone on Queen Anne Redevelopment

PO # 2017-015K

REMARKS

INVOICE TO

Project specific RLs? - Yes / No

TURNAROUND TIME
☒ Standard turnaround
☐ RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
☐ Archive samples
☐ Other
Default: Dispose after 30 days

Sample ID	Lab ID	Date Sampled	Time Sampled	Sample Type	# of Jars	NWTPH-Dx	NWTPH-Gx	BTEX EPA 8021	NWTPH-HCID	VOCs EPA 8260	PAHs EPA 8270	PCBs EPA 8082					Notes
MW-D	01 A-F	8/18/2022	13:08	water	6	X	X	X									

ANALYSES REQUESTED

Samples received at 4 °C

Friedman & Bruya, Inc.
Ph. (206) 285-8282

	SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Sierra Kindley	Sierra Kindley	RGI	8/18/22	15:14
Received by:	Najea Wynn	NAJEA WYNN	FEDEX OFFICE	8/19/22	10:08
Relinquished by:					
Received by:	Hong	HONG NGUYEN	FBI	8/19/22	11:27

Data Validation Report

Roystone Redevelopment Interim Action
July 2021 Groundwater Sampling

Prepared for:

The Riley Group, Inc.
17522 Bothell Way Northeast
Bothell, Washington 98011

Prepared by:

Pyron Environmental, Inc.
3530 32nd Way, NW
Olympia, WA 98502

Approved By: Mingta Lin Date*:* ***August/11/2021***
Mingta Lin

ACRONYMS

%R	percent recovery
CLP	U.S. EPA Contract Laboratory Program
COC	chain-of-custody
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
EPA	U.S. Environmental Protection Agency
GC/FID	gas chromatograph/flame ionization detector
GC/MS	gas chromatograph/mass spectrometer
GC/PID	gas chromatograph/photo ionization detector
ICP/MS	inductively coupled plasma/ mass spectrometer
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MRL	method reporting limit
MS	matrix spike
MSD	matrix spike duplicate
NFGs	CLP National Functional Guidelines for Data Review (EPA 2017a – Inorganics; EPA 2017b – Organics)
QA/QC	quality assurance/quality control
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group
SIM	selective ion monitoring
VOCs	volatile organic compounds

INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for groundwater samples collected on July 14, 2021, for the referenced project. The laboratory reports validated herein were submitted by Friedman & Bruya, Inc. in Seattle, Washington.

A level II (or Level 2A as defined in EPA 2009) data validation was performed on this laboratory reports. The validation followed the procedures specified in USEPA CLP Functional Guidelines ([NFGs], EPA 2017a for Organics and EPA 2017b for Inorganics), with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits) and the Interim Action Work Plan ([Work Plan]; The Riley Group, Inc.; 2019). The frequency of QC analyses and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed in each section pertinent to the QC parameter for each type of analysis. Qualified data with applied data qualifiers are summarized in the **SUMMARY** section at the end of this report. Samples and the associated analyses validated herein are summarized as follows:

				Analysis				
Field Sample ID	**Laboratory Sample ID**	**Sampling Date**	**Sample Type**	**BTEX**	**TPH**	**Total & Dissolved Lead**	**VOCs**	**cPAHs**
MW-A	107246-01	07/14/21	Water	X	X			
MW-B	107246-02	07/14/21	Water	X	X			
MW-C	107246-03	07/14/21	Water		X	X	X	X
MW-D	107246-04	07/14/21	Water		X	X	X	X
MW-E	107246-05	07/14/21	Water		X	X	X	X
MW-F	107246-06	07/14/21	Water		X		X	

Notes:

BTEX – Benzene, toluene, ethylbenzene, *o-* & *p*-xylene, and *m*-xylene.

cPAHs – Carcinogenic polycyclic aromatic hydrocarbons including benz(a)anthracene, chrysene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluorene, indeno(1,2,3-cd)pyrene, and dibenz(a,h)anthracene.

TPH – Total petroleum hydrocarbons, including gasoline, diesel, and motor oil ranges.

VOCs – Volatile organic compounds (project specific)

X - The analysis was requested and performed on the sample.

The analytical parameters requested for the samples, the respective analytical methods, and the analytical laboratories are summarized below:

Parameter	Analytical Method	Analytical Laboratory
Volatile Organic Compounds (VOCs)	SW846 Method 8260D	Friedman & Bruya, Inc. Seattle, WA
BTEX	SW846 Method 8021B	
Polycyclic Aromatic Hydrocarbons (PAHs)	SW846 Method 8270E–SIM	
TPH - Diesel & Motor Oil Range	NWTPH-Dx	
TPH - Gasoline Range	NWTPH-Gx	
Total & Dissolved Lead	SW846 Method 6020B	

Notes:

1. SW846 - *USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition, December 1996.
2. NWTPH Methods – *Washington State Department of Ecology, Analytical Methods for Petroleum Hydrocarbons*, Publication No. ECY 97-602, June 1997.

DATA VALIDATION FINDINGS

1. VOCs by GC/MS (EPA Method SW 8260D)

1.1 Sample Management and Holding Time

Samples were received in the laboratory intact and in consistence with the accompanying chain-of-custody (COC) documentation based on sample receipt documentation.

Water samples should be preserved to pH <2 at the time of collection and analyzed within 14 days of collection. All samples were preserved properly and analyzed within the required holding times.

1.2 Method Blanks

Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the reporting limits (RLs).

1.3 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD were prepared and analyzed as required by the method. Percent recovery (%R) and relative percent difference (RPD) values either met the project control limits, or the outliers had no adverse effects on data usability (*e.g.,* biased high recovery for a compound not detected in samples).

1.4 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

1.5 Matrix Spike (MS)

MS analyses were performed on a batch QC sample. All %R values were within the project control limits.

1.6 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for VOCs analyses.

1.7 Overall Assessment of VOCs Data Usability

Based on the information provided by the laboratory, VOCs data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

2. cPAHs by GC/MS (EPA Method SW 8270E-SIM)

2.1 Holding Times

Water samples should be extracted within 7 days of collection and extracts analyzed within 40 days of extraction. All samples were extracted and analyzed within the required holding times.

2.2 Method Blank

Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the RLs in the method blank.

2.3 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

2.4 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD were prepared and analyzed as required by the method. All %R and RPD values met the project control criteria.

2.5 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for cPAHs analyses.

2.6 Overall Assessment of PAHs Data Usability

Based on the information provided by the laboratory, PAHs data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

3. BTEX by GC/PID (EPA Method SW 8021B)

3.1 Holding Times

Water samples should be preserved to pH <2 at the time of collection and analyzed within 14 days of collection. All samples were preserved properly and analyzed within the required holding times.

3.2 Method Blanks

Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the RLs in the method blanks.

3.3 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. The %R values were within the laboratory control limits.

3.4 Laboratory Duplicate Analysis

Laboratory duplicate analyses were performed on a batch QC sample. All RPD values met the project control criteria.

3.5 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. The %R values were within the project control limits.

3.6 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for BTEX analyses.

3.7 Overall Assessment of EDB Data Usability

Based on the information provided by the laboratory, BTEX data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

4. TPH-Diesel & Motor Oil by GC/FID (Method NWTPH-Dx)

4.1 Holding Times

Acid-preserved water samples should be extracted within 14 days and extracts be analyzed within 40 days of extraction. All samples were extracted and analyzed within the recommended holding times.

4.2 Method Blanks

Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the RLs in the method blanks.

4.3 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

4.4 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

4.5 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for TPH-Dx analyses.

4.6 Overall Assessment of TPH-Diesel and TPH- Motor Oil Data Usability

Based on the information provided by the laboratory, TPH-Diesel and TPH-Motor Oil data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

5. TPH-Gasoline by GC/FID (Method NWTPH-Gx)

5.1 Holding Times

Water samples should be preserved to pH <2 at the time of collection and analyzed within 14 days of collection. All samples were preserved properly and analyzed within the required holding times.

5.2 Method Blanks

Method blanks were prepared and analyzed as required. TPH-Gasoline was not detected at or above the RL in the method blank.

5.3 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

5.4 Laboratory Duplicate Analysis

Laboratory duplicate analyses were performed on a batch QC sample. All RPD values met the project control criteria.

5.5 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values were within the project control limits.

5.6 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for TPH-Gasoline analyses.

5.7 Overall Assessment of TPH-Gasoline Data Usability

Based on the information provided by the laboratory, TPH-Gasoline data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

6. Total and Dissolved Lead by ICP/MS (EPA Method SW 6020B)

6.1 Holding Times

Acid-preserved water samples should be analyzed within 180 days of collection. All samples were analyzed within the required holding time.

6.2 Method Blanks

Method blanks were prepared and analyzed as required. Total and ,dissolved lead were not detected at or above the RLs in the method blanks.

6.3 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values were within the project control limits, or the exceedance had no adverse effects on data usability (e.g., high-bias %R value where the target compound was not detected in associated sample).

6.4 Matrix Spike (MS) and Matrix Spike Duplicate (MSD)

MS and MSD analyses were performed on batch QC samples. The %R and RPD values met the project control limits.

6.5 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for total and dissolve lead analyses.

6.6 Overall Assessment of Total and Dissolved Lead Data Usability

Based on the information provided by the laboratory, total and dissolved lead data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

SUMMARY

Table I. Data Affected by QC Anomalies:

Laboratory ID	Sample ID	Analytical Method	Analyte	Data Qualifier	Reason Code
No data qualifiers were assigned as results of QC anomaly.					

EFERENCES

United States Environmental Protection Agency (USEPA). 2017a. *Contract Laboratory Program National Functional Guidelines for Inorganic Superfund Methods Data Review.* Office of Superfund Remediation and Technical Innovation. January 2017. OLEM 9355.0-135. EPA-540-R-201 7-001.

USEPA. 2017b. *Contract Laboratory Program National Functional Guidelines for Organic Superfund Data Review.* Office of Superfund Remediation and Technical Innovation. January 2017. OLEM 9355.0-136. EPA-540-R-2017-002.

USEPA. 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. January 13, 2009. USEPA 540-R-08-005.

USEPA. 1996. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition, December 1996.

Ecology (Washington State Department of). 1997. *Analytical Methods for Petroleum Hydrocarbons.* Publication No. ECY 97-602. June 1997.

The Riley Group, Inc. 2019. *Interim Action Work Plan, Roystone Redevelopment.* The Riley Group, Inc., Bothell, Washington. Prepared for Roystone On Queen Anne, LLC. August 29, 2019.

Data Validation Report

Roystone Redevelopment Interim Action
October 2021 Groundwater Sampling

Prepared for:

The Riley Group, Inc.
17522 Bothell Way Northeast
Bothell, Washington 98011

Prepared by:

Pyron Environmental, Inc.
3530 32nd Way, NW
Olympia, WA 98502

Mingta Lin

Approved By: ____________________ Date: ***November/12/2021***
Mingta Lin

ACRONYMS

%R	percent recovery
BTEX	benzene, toluene, ethylbenzene, *o*- & *p*-xylene, and *m*-xylene
CLP	U.S. EPA Contract Laboratory Program
COC	chain-of-custody
EPA	U.S. Environmental Protection Agency
GC/FID	gas chromatograph/flame ionization detector
GC/PID	gas chromatograph/photo ionization detector
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MRL	method reporting limit
NFGs	CLP National Functional Guidelines for Organic Data Review (EPA 2017)
QA/QC	quality assurance/quality control
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group

INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for groundwater samples collected on October 15, 2021, for the referenced project. The laboratory reports validated herein were submitted by Friedman & Bruya, Inc. in Seattle, Washington.

A level II (or Level 2A as defined in EPA 2009) data validation was performed on this laboratory reports. The validation followed the procedures specified in USEPA CLP Functional Guidelines ([NFGs], EPA 2017), with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits) and the Interim Action Work Plan ([Work Plan]; The Riley Group, Inc.; 2019). The frequency of QC analyses and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed in each section pertinent to the QC parameter for each type of analysis. Qualified data with applied data qualifiers are summarized in the **SUMMARY** section at the end of this report. Samples and the associated analyses validated herein are summarized as follows:

Field Sample ID	**Laboratory Sample ID**	**Sampling Date**	**Sample Type**	**Analysis**		
				BTEX	**TPH-GX**	**TPH-Dx**
MWA	110322-01	10/15/21	Water	X	X	X
MWB	110322-01	10/15/21	Water	X	X	X[(A)]
MWC	110322-01	10/15/21	Water	X	X	X[(A)]
MWD	110322-01	10/15/21	Water	X	X	X[(A)]
MWE	110322-01	10/15/21	Water	X	X	X[(A)]
MWF	110322-01	10/15/21	Water	X	X	X[(A)]

Notes:

[(A)] – The sample extract also went through a silica gel cleanup in addition, to remove non-polar organic materials.

BTEX – Benzene, toluene, ethylbenzene, *o*- & *p*-xylene, and *m*-xylene.

TPH – Total petroleum hydrocarbons, including gasoline (TPH-Gx); and diesel and motor oil (TPH-Dx) ranges.

X - The analysis was requested and performed on the sample.

The analytical parameters requested for the samples, the respective analytical methods, and the analytical laboratories are summarized below:

Parameter	Analytical Method	Analytical Laboratory
BTEX	SW846 Method 8021B	Friedman & Bruya, Inc. Seattle, WA
TPH - Diesel & Motor Oil Range	NWTPH-Dx	
TPH - Gasoline Range	NWTPH-Gx	

Notes:

1. SW846 - *USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition, December 1996.
2. NWTPH Methods – *Washington State Department of Ecology, Analytical Methods for Petroleum Hydrocarbons*, Publication No. ECY 97-602, June 1997.

DATA VALIDATION FINDINGS

1. BTEX by GC/PID (EPA Method SW 8021B)

1.1 Sample Management and Holding Time

Samples were received in the laboratory intact and in consistence with the accompanying chain-of-custody (COC) documentation based on sample receipt documentation.

Water samples should be preserved to pH <2 at the time of collection and analyzed within 14 days of collection. All samples were preserved properly and analyzed within the required holding times.

1.2 Method Blanks

Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the reporting limits (RLs).

1.3 Laboratory Control Sample (LCS)

LCS was prepared and analyzed as required by the method. Percent recovery (%R) values met the project control limits.

1.4 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

1.5 Laboratory Duplicates

Laboratory duplicate analyses were performed on a batch QC sample. All relative percent difference (RPD) values were within the project control limits.

1.6 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for BTEX analyses.

1.7 Overall Assessment of BTEX Data Usability

Based on the information provided by the laboratory, BTEX data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

2. TPH-Diesel & Motor Oil by GC/FID (Method NWTPH-Dx)

2.1 Holding Times

Acid-preserved water samples should be extracted within 14 days and extracts be analyzed within 40 days of extraction. All samples were extracted and analyzed within the recommended holding times.

2.2 Method Blanks

Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the RLs in the method blanks.

2.3 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

2.4 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

2.5 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for TPH-Dx analyses.

2.6 Overall Assessment of TPH-Diesel and TPH- Motor Oil Data Usability

Based on the information provided by the laboratory, TPH-Diesel and TPH-Motor Oil data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

3. TPH-Gasoline by GC/FID (Method NWTPH-Gx)

3.1 Holding Times

Water samples should be preserved to pH <2 at the time of collection and analyzed within 14 days of collection. All samples were preserved properly and analyzed within the required holding times.

3.2 Method Blanks

Method blanks were prepared and analyzed as required. TPH-Gasoline was not detected at or above the RL in the method blank.

3.3 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

3.4 Laboratory Duplicate Analysis

Laboratory duplicate analyses were performed on a batch QC sample. All RPD values met the project control criteria.

3.5 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values were within the project control limits.

3.6 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for TPH-Gasoline analyses.

3.7 Overall Assessment of TPH-Gasoline Data Usability

Based on the information provided by the laboratory, TPH-Gasoline data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

SUMMARY

Table I. Data Affected by QC Anomalies:

Laboratory ID	Sample ID	Analytical Method	Analyte	Data Qualifier	Reason Code
No data qualifiers were assigned as results of QC anomaly.					

EFERENCES

United States Environmental Protection Agency (USEPA). 2017. *Contract Laboratory Program National Functional Guidelines for Organic Superfund Data Review.* Office of Superfund Remediation and Technical Innovation. January 2017. OLEM 9355.0-136. EPA-540-R-2017-002.

USEPA. 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. January 13, 2009. USEPA 540-R-08-005.

USEPA. 1996. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition, December 1996.

Ecology (Washington State Department of). 1997. *Analytical Methods for Petroleum Hydrocarbons.* Publication No. ECY 97-602. June 1997.

The Riley Group, Inc. 2019. *Interim Action Work Plan, Roystone Redevelopment.* The Riley Group, Inc., Bothell, Washington. Prepared for Roystone On Queen Anne, LLC. August 29, 2019.

Data Validation Report

Roystone Redevelopment Interim Action
February 2022 Groundwater Sampling

Prepared for:

The Riley Group, Inc.
17522 Bothell Way Northeast
Bothell, Washington 98011

Prepared by:

Pyron Environmental, Inc.
3530 32nd Way, NW
Olympia, WA 98502

Approved By: ____________________ Date: ***March/4/2022***
Mingta Lin

ACRONYMS

%R	percent recovery
BTEX	benzene, toluene, ethylbenzene, *o*- & *p*-xylene, and *m*-xylene
CLP	U.S. EPA Contract Laboratory Program
COC	chain-of-custody
EPA	U.S. Environmental Protection Agency
GC/FID	gas chromatograph/flame ionization detector
GC/PID	gas chromatograph/photo ionization detector
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MRL	method reporting limit
NFGs	CLP National Functional Guidelines for Organic Data Review (EPA 2017)
QA/QC	quality assurance/quality control
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group

INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for groundwater samples collected on February 23, 2022, for the referenced project. The laboratory reports validated herein were submitted by Friedman & Bruya, Inc. in Seattle, Washington.

A level II (or Level 2A as defined in EPA 2009) data validation was performed on this laboratory reports. The validation followed the procedures specified in USEPA CLP Functional Guidelines ([NFGs], EPA 2017), with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits) and the Interim Action Work Plan ([Work Plan]; The Riley Group, Inc.; 2019). The frequency of QC analyses and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed in each section pertinent to the QC parameter for each type of analysis. Qualified data with applied data qualifiers are summarized in the **SUMMARY** section at the end of this report. Samples and the associated analyses validated herein are summarized as follows:

Field Sample ID	Laboratory Sample ID	Sampling Date	Sample Type	Analysis		
				BTEX	TPH-GX	TPH-Dx
MWA	202453-01	2/23/22	Water	X	X	X
MWB	202453-02	2/23/22	Water	X	X	X(A)
MWC	202453-03	2/23/22	Water	X	X	X(A)
MWD	202453-04	2/23/22	Water	X	X	X(A)
MWE	202453-05	2/23/22	Water	X	X	X(A)
MWF	202453-06	2/23/22	Water	X	X	X(A)

Notes:

(A) – The sample extract also went through a silica gel cleanup in addition, to remove non-polar organic materials.
BTEX – Benzene, toluene, ethylbenzene, *o- & p*-xylene, and *m*-xylene.
TPH – Total petroleum hydrocarbons, including gasoline (TPH-Gx); and diesel and motor oil (TPH-Dx) ranges.
X - The analysis was requested and performed on the sample.

The analytical parameters requested for the samples, the respective analytical methods, and the analytical laboratories are summarized below:

Parameter	**Analytical Method**	**Analytical Laboratory**
BTEX	SW846 Method 8021B	Friedman & Bruya, Inc. Seattle, WA
TPH - Diesel & Motor Oil Range	NWTPH-Dx	
TPH - Gasoline Range	NWTPH-Gx	

Notes:

1. SW846 - *USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition, December 1996.
2. NWTPH Methods – *Washington State Department of Ecology, Analytical Methods for Petroleum Hydrocarbons*, Publication No. ECY 97-602, June 1997.

DATA VALIDATION FINDINGS

1. BTEX by GC/PID (EPA Method SW 8021B)

1.1 Sample Management and Holding Time

Samples were received in the laboratory intact and in consistence with the accompanying chain-of-custody (COC) documentation based on sample receipt documentation.

Water samples should be preserved to pH <2 at the time of collection and analyzed within 14 days of collection. All samples were preserved properly and analyzed within the required holding times.

1.2 Method Blanks

Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the reporting limits (RLs).

1.3 Laboratory Control Sample (LCS)

LCS was prepared and analyzed as required by the method. Percent recovery (%R) values met the project control limits.

1.4 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

1.5 Laboratory Duplicates

Laboratory duplicate analyses were performed on a batch QC sample. All relative percent difference (RPD) values were within the project control limits.

1.6 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for BTEX analyses.

1.7 Overall Assessment of BTEX Data Usability

Based on the information provided by the laboratory, BTEX data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

2. TPH-Diesel & Motor Oil by GC/FID (Method NWTPH-Dx)

2.1 Holding Times

Acid-preserved water samples should be extracted within 14 days and extracts be analyzed within 40 days of extraction. All samples were extracted and analyzed within the recommended holding times.

2.2 Method Blanks

Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the RLs in the method blanks.

2.3 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

2.4 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

2.5 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for TPH-Dx analyses.

2.6 Overall Assessment of TPH-Diesel and TPH- Motor Oil Data Usability

As noted by the laboratory, the detected TPH-Diesel in samples do not resemble the same chromatographical patterns as those of the quantitation standards. Based on the information provided by the laboratory, TPH-Diesel and TPH-Motor Oil data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

3. TPH-Gasoline by GC/FID (Method NWTPH-Gx)

3.1 Holding Times

Water samples should be preserved to pH <2 at the time of collection and analyzed within 14 days of collection. All samples were preserved properly and analyzed within the required holding times.

3.2 Method Blanks

Method blanks were prepared and analyzed as required. TPH-Gasoline was not detected at or above the RL in the method blank.

3.3 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

3.4 Laboratory Duplicate Analysis

Laboratory duplicate analyses were performed on a batch QC sample. All RPD values met the project control criteria.

3.5 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values were within the project control limits.

3.6 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for TPH-Gasoline analyses.

3.7 Overall Assessment of TPH-Gasoline Data Usability

Based on the information provided by the laboratory, TPH-Gasoline data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

SUMMARY

Table I. Data Affected by QC Anomalies:

Laboratory ID	Sample ID	Analytical Method	Analyte	Data Qualifier	Reason Code
No data qualifiers were assigned as results of QC anomaly.					

EFERENCES

United States Environmental Protection Agency (USEPA). 2017. *Contract Laboratory Program National Functional Guidelines for Organic Superfund Data Review.* Office of Superfund Remediation and Technical Innovation. January 2017. OLEM 9355.0-136. EPA-540-R-2017-002.

USEPA. 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. January 13, 2009. USEPA 540-R-08-005.

USEPA. 1996. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition, December 1996.

Ecology (Washington State Department of). 1997. *Analytical Methods for Petroleum Hydrocarbons.* Publication No. ECY 97-602. June 1997.

The Riley Group, Inc. 2019. *Interim Action Work Plan, Roystone Redevelopment.* The Riley Group, Inc., Bothell, Washington. Prepared for Roystone On Queen Anne, LLC. August 29, 2019.

Data Validation Report

Roystone Redevelopment Interim Action
May 2022 Groundwater Sampling

Prepared for:

The Riley Group, Inc.
17522 Bothell Way Northeast
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Prepared by:

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Approved By: Mingta Lin Date: ***June/13/2022***

Mingta Lin

ACRONYMS

%R	percent recovery
BTEX	benzene, toluene, ethylbenzene, *o*- & *p*-xylene, and *m*-xylene
CLP	U.S. EPA Contract Laboratory Program
COC	chain-of-custody
EPA	U.S. Environmental Protection Agency
GC/FID	gas chromatograph/flame ionization detector
GC/PID	gas chromatograph/photo ionization detector
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MRL	method reporting limit
NFGs	CLP National Functional Guidelines for Organic Data Review (EPA 2017)
QA/QC	quality assurance/quality control
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group

INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for groundwater samples collected on May 23, 2022, for the referenced project. The laboratory report validated herein was submitted by Friedman & Bruya, Inc. in Seattle, Washington.

A level II (or Level 2A as defined in EPA 2009) data validation was performed on this laboratory reports. The validation followed the procedures specified in USEPA CLP Functional Guidelines ([NFGs], EPA 2017), with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits) and the Interim Action Work Plan ([Work Plan]; The Riley Group, Inc.; 2019). The frequency of QC analyses and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed in each section pertinent to the QC parameter for each type of analysis. Qualified data with applied data qualifiers are summarized in the **SUMMARY** section at the end of this report. Samples and the associated analyses validated herein are summarized as follows:

Field Sample ID	Laboratory Sample ID	Sampling Date	Sample Type	Analysis		
				BTEX	TPH-GX	TPH-Dx
MW-A	205410-01	5/23/2022	Water	X	X	X
MW-B	205410-02	5/23/2022	Water	X	X	X
MW-C	205410-03	5/23/2022	Water	X	X	X
MW-D	205410-04	5/23/2022	Water	X	X	X
MW-E	205410-05	5/23/2022	Water	X	X	X
MW-F	205410-06	5/23/2022	Water	X	X	X

Notes:

BTEX – Benzene, toluene, ethylbenzene, *o*- & *p*-xylene, and *m*-xylene.
TPH – Total petroleum hydrocarbons, including gasoline (TPH-Gx); and diesel and motor oil (TPH-Dx) ranges.
X - The analysis was requested and performed on the sample.

The analytical parameters requested for the samples, the respective analytical methods, and the analytical laboratories are summarized below:

Parameter	Analytical Method	Analytical Laboratory
BTEX	SW846 Method 8021B	Friedman & Bruya, Inc. Seattle, WA
TPH - Diesel & Motor Oil Range	NWTPH-Dx	
TPH - Gasoline Range	NWTPH-Gx	

Notes:

1. SW846 - *USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition, December 1996.
2. NWTPH Methods – *Washington State Department of Ecology, Analytical Methods for Petroleum Hydrocarbons*, Publication No. ECY 97-602, June 1997.

DATA VALIDATION FINDINGS

1. BTEX by GC/PID (EPA Method SW 8021B)

1.1 Sample Management and Holding Time

Samples were received in the laboratory intact and in consistence with the accompanying chain-of-custody (COC) documentation based on sample receipt documentation.

Water samples should be preserved to pH <2 at the time of collection and analyzed within 14 days of collection. All samples were preserved properly and analyzed within the required holding times.

1.2 Method Blanks

Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the reporting limits (RLs).

1.3 Laboratory Control Sample (LCS)

LCS was prepared and analyzed as required by the method. Percent recovery (%R) values met the project control limits.

1.4 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

1.5 Laboratory Duplicates

Laboratory duplicate analyses were performed on a batch QC sample. All relative percent difference (RPD) values were within the project control limits.

1.6 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for BTEX analyses.

1.7 Overall Assessment of BTEX Data Usability

Based on the information provided by the laboratory, BTEX data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

2. TPH-Diesel & Motor Oil by GC/FID (Method NWTPH-Dx)

2.1 Holding Times

Acid-preserved water samples should be extracted within 14 days and extracts be analyzed within 40 days of extraction. All samples were extracted and analyzed within the recommended holding times.

2.2 Method Blanks

Method blanks were prepared and analyzed as required. Target compounds were not detected at or above the RLs in the method blanks.

2.3 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

2.4 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

2.5 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for TPH-Dx analyses.

2.6 Overall Assessment of TPH-Diesel and TPH- Motor Oil Data Usability

As noted by the laboratory, the detected TPH-Diesel in samples do not resemble the same chromatographical patterns as those of the quantitation standards. Based on the information provided by the laboratory, TPH-Diesel and TPH-Motor Oil data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

3. TPH-Gasoline by GC/FID (Method NWTPH-Gx)

3.1 Holding Times

Water samples should be preserved to pH <2 at the time of collection and analyzed within 14 days of collection. All samples were preserved properly and analyzed within the required holding times.

3.2 Method Blanks

Method blanks were prepared and analyzed as required. TPH-Gasoline was not detected at or above the RL in the method blank.

3.3 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

3.4 Laboratory Duplicate Analysis

Laboratory duplicate analyses were performed on a batch QC sample. All RPD values met the project control criteria.

3.5 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. All %R values were within the project control limits.

3.6 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for TPH-Gasoline analyses.

3.7 Overall Assessment of TPH-Gasoline Data Usability

Based on the information provided by the laboratory, TPH-Gasoline data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

SUMMARY

Table I. Data Affected by QC Anomalies:

Laboratory ID	Sample ID	Analytical Method	Analyte	Data Qualifier	Reason Code
No data qualifiers were assigned as results of QC anomaly.					

EFERENCES

United States Environmental Protection Agency (USEPA). 2017. *Contract Laboratory Program National Functional Guidelines for Organic Superfund Data Review.* Office of Superfund Remediation and Technical Innovation. January 2017. OLEM 9355.0-136. EPA-540-R-2017-002.

USEPA. 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. January 13, 2009. USEPA 540-R-08-005.

USEPA. 1996. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition, December 1996.

Ecology (Washington State Department of). 1997. *Analytical Methods for Petroleum Hydrocarbons.* Publication No. ECY 97-602. June 1997.

The Riley Group, Inc. 2019. *Interim Action Work Plan, Roystone Redevelopment.* The Riley Group, Inc., Bothell, Washington. Prepared for Roystone On Queen Anne, LLC. August 29, 2019.

Data Validation Report

TRG Roystone on Queen Anne Redevelopment
August 2022 Groundwater Sampling

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Approved By: ______________________ Date: ***August/31/2022***
Mingta Lin

ACRONYMS

%R	percent recovery
BTEX	benzene, toluene, ethylbenzene, *o*- & *p*-xylene, and *m*-xylene
CLP	U.S. EPA Contract Laboratory Program
COC	chain-of-custody
EPA	U.S. Environmental Protection Agency
GC/FID	gas chromatograph/flame ionization detector
GC/PID	gas chromatograph/photo ionization detector
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
MRL	method reporting limit
NFGs	CLP National Functional Guidelines for Organic Data Review (EPA 2017)
QA/QC	quality assurance/quality control
RL	reporting limit
RPD	relative percent difference
SDG	sample delivery group

INTRODUCTION

This report presents and discusses findings of the data validation performed on analytical data for groundwater samples collected on August 18, 2022, for the referenced project. The laboratory report validated herein was submitted by Friedman & Bruya, Inc. in Seattle, Washington.

A Stage 2A (as defined in EPA 2009) data validation was performed on this laboratory report. The validation followed the procedures specified in USEPA CLP Functional Guidelines ([NFGs], EPA 2020), with modifications to accommodate project and analytical method requirements. The numerical quality assurance/quality control (QA/QC) criteria applied to the validation were in accordance with the current performance-based control limits established by the laboratory (laboratory control limits) and the Interim Action Work Plan ([Work Plan]; The Riley Group, Inc.; 2019). The frequency of QC analyses and analytical sequence requirements were evaluated against the respective analytical methods.

Validation findings are discussed in each section pertinent to the QC parameter for each type of analysis. Qualified data with applied data qualifiers are summarized in the **SUMMARY** section at the end of this report. Samples and the associated analyses validated herein are summarized as follows:

Field Sample ID	Laboratory Sample ID	Sampling Date	Sample Type	Analysis		
				BTEX	TPH-GX	TPH-Dx
MW-D	208298-01	8/18/2022	Water	X	X	X

Notes:

BTEX – Benzene, toluene, ethylbenzene, *o- & p*-xylene, and *m*-xylene.
TPH – Total petroleum hydrocarbons, including gasoline (TPH-Gx); and diesel and motor oil (TPH-Dx) ranges.
X - The analysis was requested and performed on the sample.

The analytical parameters requested for the samples, the respective analytical methods, and the analytical laboratories are summarized below:

Parameter	Analytical Method	Analytical Laboratory
BTEX	SW846 Method 8021B	Friedman & Bruya, Inc. Seattle, WA
TPH - Diesel & Motor Oil Range	NWTPH-Dx	
TPH - Gasoline Range	NWTPH-Gx	

Notes:

1. SW846 - *USEPA Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition, December 1996.
2. NWTPH Methods – *Washington State Department of Ecology, Analytical Methods for Petroleum Hydrocarbons*, Publication No. ECY 97-602, June 1997.

DATA VALIDATION FINDINGS

1. BTEX by GC/PID (EPA Method SW 8021B)

1.1 Sample Management and Holding Time

Samples were received in the laboratory intact and in consistence with the accompanying chain-of-custody (COC) documentation based on sample receipt documentation.

Water samples should be preserved to pH <2 at the time of collection and analyzed within 14 days of collection. The sample was preserved properly and analyzed within the required holding times.

1.2 Method Blanks

A method blank was prepared and analyzed as required. Target compounds were not detected at or above the reporting limits (RLs) in the method blank.

1.3 Laboratory Control Sample (LCS)

LCS was prepared and analyzed as required by the method. Percent recovery (%R) values met the project control limits.

1.4 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

1.5 Laboratory Duplicates

Laboratory duplicate analyses were performed on a batch QC sample. All relative percent difference (RPD) values were within the project control limits.

1.6 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for BTEX analyses.

1.7 Overall Assessment of BTEX Data Usability

Based on the information provided by the laboratory, BTEX data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

2. TPH-Diesel & Motor Oil by GC/FID (Method NWTPH-Dx)

2.1 Holding Times

Acid-preserved water samples should be extracted within 14 days and extracts be analyzed within 40 days of extraction. The sample was extracted and analyzed within the recommended holding times.

2.2 Method Blanks

A method blank was prepared and analyzed as required. Target compounds were not detected at or above the RLs in the method blank.

2.3 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

2.4 Laboratory Control Sample (LCS) and LCS Duplicate (LCSD)

LCS and LCSD analyses were performed as required by the method. All %R and RPD values were within the laboratory control limits.

2.5 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for TPH-Dx analyses.

2.6 Overall Assessment of TPH-Diesel and TPH- Motor Oil Data Usability

As noted by the laboratory, the detected TPH-Diesel in samples do not resemble the same chromatographical patterns as those of the quantitation standards. Based on the information provided by the laboratory, TPH-Diesel and TPH-Motor Oil data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

3. TPH-Gasoline by GC/FID (Method NWTPH-Gx)

3.1 Holding Times

Water samples should be preserved to pH <2 at the time of collection and analyzed within 14 days of collection. The sample was preserved properly and analyzed within the required holding times.

3.2 Method Blanks

A method blank was prepared and analyzed as required. TPH-Gasoline was not detected at or above the RL in the method blank.

3.3 Surrogate Spikes

Surrogate spikes were added to all samples as required by the method. All surrogate spike %R values were within the project control limits.

3.4 Laboratory Duplicate Analysis

Laboratory duplicate analyses were performed on a batch QC sample. All RPD values met the project control criteria.

3.5 Laboratory Control Sample (LCS)

LCS analyses were performed as required by the method. The %R value was within the project control limits.

3.6 Method Reporting Limits

Sample specific RLs met the Work Plan requirements for TPH-Gasoline analyses.

3.7 Overall Assessment of TPH-Gasoline Data Usability

Based on the information provided by the laboratory, TPH-Gasoline data are of known quality at the level of quality evaluation (*i.e.,* Stage 2A) and acceptable for use.

SUMMARY

Table I. Data Affected by QC Anomalies:

Laboratory ID	Sample ID	Analytical Method	Analyte	Data Qualifier	Reason Code
No data qualifiers were assigned as results of QC anomaly.					

EFERENCES

United States Environmental Protection Agency (USEPA). 2020. *Contract Laboratory Program National Functional Guidelines for Organic Superfund Data Review.* Office of Superfund Remediation and Technical Innovation. November 2020. OLEM 9240.0-51. EPA-540-R-20-005.

USEPA. 2009. *Guidance for Labeling Externally Validated Laboratory Analytical Data for Superfund Use*. January 13, 2009. USEPA 540-R-08-005.

USEPA. 1996. *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods,* SW-846, Third Edition, December 1996.

Ecology (Washington State Department of). 1997. *Analytical Methods for Petroleum Hydrocarbons.* Publication No. ECY 97-602. June 1997.

The Riley Group, Inc. 2019. *Interim Action Work Plan, Roystone Redevelopment.* The Riley Group, Inc., Bothell, Washington. Prepared for Roystone on Queen Anne, LLC. August 29, 2019.

Groundwater
Monitoring&Remediation

Nature and Estimated Human Toxicity of Polar Metabolite Mixtures in Groundwater Quantified as TPHd/DRO at Biodegrading Fuel Release Sites

by Dawn A. Zemo, Kirk T. O'Reilly, Rachel E. Mohler, Asheesh K. Tiwary, Renae I. Magaw, and Karen A. Synowiec

Abstract

Polar metabolites resulting from petroleum biodegradation are measured in groundwater samples as TPHd unless a silica gel cleanup (SGC) is used on the sample extract to isolate hydrocarbons. Even though the metabolites can be the vast majority of the dissolved organics present in groundwater, SGC has been inconsistently applied because of regulatory concern about the nature and toxicity of the metabolites. A two-step approach was used to identify polar compounds that were measured as TPHd in groundwater extracts at five sites with biodegrading fuel sources. First, gas chromatography with mass spectrometry (GC-MS) was used to identify and quantify 57 individual target polar metabolites. Only one of these compounds—dodecanoic acid, which has low potential human toxicity—was detected. Second, nontargeted analysis was used to identify as many polar metabolites as possible using both GC-MS and GC×GC-MS. The nontargeted analysis revealed that the mixture of polar metabolites identified in groundwater source areas at these five sites is composed of approximately equal average percentages of organic acids, alcohols and ketones, with few phenols and aldehydes. The mixture identified in downgradient areas at these five sites is dominated by acids, with fewer alcohols, far fewer ketones, and very few aldehydes and phenols. A ranking system consistent with systems used by USEPA and the United Nations was developed for evaluating the potential chronic oral toxicity to humans of the different classes of identified polar metabolites. The vast majority of the identified polar metabolites have a "Low" toxicity profile, and the mixture of identified polar metabolites present in groundwater extracts at these five sites is unlikely to present a significant risk to human health.

Introduction

Total petroleum hydrocarbons (TPH) has long been a routinely required groundwater monitoring parameter at petroleum release sites. For the semi-volatile (or extractable) fraction, a common analytical approach is to use USEPA Method 3510C for solvent extraction, followed by USEPA Method 8015B/C or equivalent (gas chromatography with flame ionization detection [GC-FID]) for quantitation. The purpose of the analysis, called either TPH as diesel (TPHd) or diesel-range organics (DRO), is to measure C10 to C28 hydrocarbons dissolved in the groundwater. The TPHd concentration is then usually compared to hydrocarbon-based regulatory criteria. However, neither Method 3510C nor 8015B/C is specific for hydrocarbons, and the TPHd analysis actually measures all extractable organics within the prescribed boiling-point range (170 to 430 °C in the case of Method 8015B/C).

In order to compare sample TPHd results to hydrocarbon-based water quality objectives, a silica gel cleanup (SGC) must be applied to the sample extract prior to analysis. This was documented in a study of 21 sites (Zemo and Foote 2003), where the application of SGC to the sample extract prior to analysis for TPHd showed that the majority of samples with elevated concentrations of TPHd in groundwater at sites with biodegrading petroleum sources were composed almost entirely of dissolved polar, nonhydrocarbon compounds and not dissolved diesel-range hydrocarbons. The polar compounds were typically found in groundwater directly within the source area and downgradient from biodegraded petroleum; therefore, it was concluded that they were most likely biodegradation metabolites. This finding was confirmed by Lundegard and Sweeney (2004), Haddad et al. (2007), and Lang et al. (2009). These studies showed that the concentration of polar metabolites, quantified as TPHd, typically ranged from 100s to 10,000s micrograms per liter (µg/L), with a maximum of about 100,000 µg/L.

In addition to presumed biodegradation metabolites, other studies have demonstrated that nonhydrocarbons measured as TPHd may include natural organics, laboratory or sample equipment artifacts (e.g., phthalates), or nonpetroleum chemicals (Zemo et al. 1995; Uhler et al. 1998). Zemo and Foote (2003) recommended the routine use of SGC for TPHd analysis to facilitate comparison of the concentration of the hydrocarbons in the sample to hydrocarbon-based regulatory

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doi: 10.1111/gwmr.12030

criteria. However, over the last decade SGC has been applied inconsistently because of regulatory concern about the nature and toxicity of the polar metabolites. This regulatory approach can result in expensive and potentially unnecessary additional investigation or remediation, or protracted site closures.

Polar compounds naturally present in crude oil (nitrogen-, sulfur-, or oxygen-containing heteromolecules) are largely eliminated in the refining processes used to produce gasoline, jet fuel, and diesel because they are deleterious to fuel performance (Hamilton and Falkiner 2003; Strauss 2003; Westbrook and LeCren 2003). Therefore, the water-soluble fraction of these fresh unbiodegraded fuels typically contains few or virtually no oxygen-containing polar compounds, except for chemicals such as oxygenates purposely added to the fuel. The presence of a high proportion of oxygen-containing polar compounds other than additives at fuel release sites is direct evidence that biodegradation is occurring (Barcelona et al. 1995; Beller et al. 1995; Beller 2002). The oxidative biodegradation of petroleum hydrocarbons has been studied extensively, and intrinsic and enhanced biodegradation are widely accepted remediation methods for petroleum releases (Wiedemeier et al. 1995; USEPA 1999). Both aerobic and anaerobic biodegradation processes involve transformation of the hydrocarbon molecules by sequential oxidative reactions, ultimately producing small organic acids, which are transformed to carbon dioxide and water (Atlas 1981; Dragun 1988; Cozzarelli et al. 1994; Barcelona et al. 1995; Beller et al. 1995). Intermediate steps result in the formation and subsequent biodegradation of oxygen-containing polar compounds (metabolites) that can be categorized by chemical structure into five families: acids/esters, alcohols, phenols (from aromatic hydrocarbons only), aldehydes, and ketones (Healy et al. 1980; Harayama et al. 1999; Griebler et al. 2004; Young and Phelps 2005; Chakraborty and Coates 2005; Callaghan et al. 2006; Geig et al. 2009). These five families can be further subdivided into structural classes (normal and branched, cyclic, aromatic, bicyclic and polycyclic aromatic) based on precursor hydrocarbon structures, which results in a total of 22 structural classes for the potential polar metabolites as shown in Table 1. Individual metabolites are transient. Because fuels are mixtures of hundreds of individual hydrocarbons, thousands of individual transient polar metabolites are possible.

Identifying polar metabolites produced by biodegrading fuels in environmental samples using traditional analytical techniques is challenging because of the large number of potential compounds that can be present at low concentrations, that is, µg/L. Most work on metabolites has focused on identifying organic acids in groundwater using derivatization procedures followed by GC (Barcelona et al. 1995; Cozzarelli et al. 1995; Beller 2002; Martus and Puttmann 2003; Alumbaugh et al. 2004; McKelvie et al. 2005). Using GC-MS, Langbehn and Steinhart (1995) identified acids and ketones in soil affected by biodegrading diesel. Recently, the availability of two-dimensional separation techniques, such as two-dimensional gas chromatography with time-of-flight mass spectrometry (GC×GC-MS), has increased the ability to characterize an increased number of compounds. GC×GC performs complimentary separations in two dimensions simultaneously and results in a greater sensitivity than traditional one-dimensional GC (Marriott et al. 2012; Ryan and Marriott 2003). Mao et al. (2009) identified acids/esters, alcohols, phenols, aldehydes, and ketones in a laboratory-generated leachate of diesel-containing soil undergoing aerobic biodegradation using high-performance liquid chromatography followed by two-dimensional gas chromatography with flame ionization detection (HPLC-GC×GC-FID) and GC×GC-MS.

The purpose of this study is to characterize the chemical structure and potential toxicity of polar metabolites measured as TPHd in groundwater samples at five fuel-impacted sites. A two-step analytical approach was used, in which groundwater samples were analyzed quantitatively for a target list of potential individual polar metabolites for which toxicity information and analytical standards were available using traditional GC-MS analyses, and additional polar compounds were tentatively identified using nontargeted (Hoh et al. 2012) GC-MS and GC×GC-MS techniques. The potential human toxicity of the mixtures of identified polar metabolites was then assessed. Due to

Table 1

Structural Classes of Polar Metabolites from Biodegradation of Fuels and Expected Chronic Oral Toxicity to Humans

Polar Family	Specific Structural Class	Expected Chronic Oral Toxicity to Humans
Alcohols (and diols)	Alkyl alcohols	Low
	Cycloalkyl alcohols	Low
	Bicyclic alkyl alcohols	Low
	Aromatic alcohols	Low
	Polycyclic aromatic alcohols	Low to Moderate
Acids (and esters)	Alkyl acids	Low
	Cycloalkyl acids	Low
	Bicyclic alkyl acids	Low
	Aromatic acids	Low
	Polycyclic aromatic acids	Low to Moderate
Ketones	Alkyl ketones	Low to Moderate
	Cycloalkyl ketones	Low
	Bicyclic alkyl ketones	Low
	Aromatic ketones	Low to Moderate
	Polycyclic aromatic ketones	Low to Moderate
Aldehydes	Alkyl aldehydes	Low to Moderate
	Cycloalkyl aldehydes	Low to Moderate
	Bicyclic alkyl aldehydes	Low to Moderate
	Aromatic aldehydes	Low to Moderate
	Polycyclic aromatic aldehydes	Low to Moderate
Phenols	Alkyl phenols	Moderate
	Phenol	Low

Notes: Toxicity ranking system and criteria for Expected Chronic Oral Toxicity to Humans are explained in the body of the article. Low: RfD≥0.1; Low to Moderate: 0.1>RfD≥0.01; Moderate: 0.01>RfD≥0.001.

the transient nature of the polar metabolites and uncertainty associated with specific isomeric identification, the nontargeted investigation focused on the five families and 22 structural classes presented in Table 1, rather than on individual compounds.

Methods

Selection of Target Compounds

An initial list of individual "target" polar compounds was developed for quantitative analysis based on a review of the literature, first by identifying the chemical structures of expected polar metabolites, and then by collecting existing toxicology information for individual compounds with the identified structures. USEPA and other regulatory program databases served as the primary sources for toxicology information. All potential polar metabolites for which reference doses (RfDs) are listed on the USEPA table of regional screening levels (USEPA 2012) were included. Additional compounds for which sufficient toxicology information was available in the scientific literature were added to the list, to make certain that representative compounds from each structural class were included wherever possible. An initial list of 83 compounds was reduced to 65 based on the availability of chemical standards, and to a final list of 57 compounds based on compound boiling points and solvent extraction results (described later) (Table 2). The final list of compounds consisted of 11 organic acids/esters, 14 alcohols, 12 phenols, 11 ketones, and 9 aldehydes.

Table 2

List of Target Polar Compounds for GC-MS Quantitative Analysis

Analyte	
Alcohols	**Ketones**
Cyclopentanol	5,6-Dimethoxy-1-indanone
1-Decanol[1]	2-Dodecanone[1]
2,4-Dimethyl-3-pentanol	9-Fluorenone[1]
1-Dodecanol	2-Hexanone
1-Heptanol[1]	2-Methyl-1-indanone
1-Hexanol[1]	3-Methylacetophenone
2-Methyl-1-pentanol	4-Methylacetophenone
2-Methyl-2-hexanol	2-Nonanone[1]
1-Nonanol[1]	2-Pentadecanone
1-Octanol[1]	2,6,8-Trimethyl-4-nonanone
2-Phenylethanol (benzene ethanol)	2-Undecanone[1]
1-Tetradecanol [50]	*Phenols*
2,4,4-Trimethyl-1-pentanol[1] [50]	4-Tert-amylphenol[1]
1-Undecanol[1]	4-Tert-butylphenol[1]
Acids	4-Cumylphenol[1]
Cyclohexaneacetic acid[1]	2,4-Dimethylphenol[1]
Cyclohexanecarboxylic acid [100]	2,6-Dimethylphenol
Dodecanoic acid	3,4-Dimethylphenol
2-Hydoxy-1-naphthoic acid	2-Methylphenol
1-Hydroxy-2-naphthoic acid [50]	4-Methylphenol
4-MCacetic acid	4-Octylphenol
4-Methyl hexanoic acid[1]	4-Pentylphenol[1]
Pentanoic acid [250]	2-Phenylphenol
Phenylacetic acid [50]	2,3,5-Trimethylphenol[1]
Undecanoic acid [100]	
Methylbenzoate (ester)[1]	*Compounds not included due to BP << 170 °C*
Aldehydes	1-Propanol
Benzaldehyde	Formaldehyde
Decanal[1]	Propanal
Dodecanal[1]	*Compounds not included due to poor extraction*
Heptanal[1]	Catechol
Hexanal	Hydroquinone
Nonanal[1]	1,5-Pentanediol
Octanal[1]	2-Methyl resorcinol
3,5,5-Trimethylhexanal[1]	2,5-Dimethyl resorcinol
Undecanal[1]	

Notes: Limit of Quantitation is 10 μg/L unless bracketed value is shown.

[1] Standard also run on GC×GC-MS (27 on this table plus nonylphenol; see text).

Collection of Groundwater Samples

Groundwater was sampled at five fuel terminals (four active and one inactive) with known historical fuel releases of both gasoline and diesel. All five sites are located in California; four sites are in upland settings, and one site (Site 5) is immediately adjacent to marine surface water. Multiple years of TPHd data were available from groundwater monitoring at each site, and plume configurations were known. Monitoring wells were selected for sampling at each terminal to represent source and downgradient areas. For the purpose of this study, source-area wells were those where free product or sheen had been observed within the past 10 years. However, because these are large terminal sites, it is likely that multiple source areas exist along the groundwater flow paths between wells. To account for this, the presence of relatively elevated methane in a groundwater sample was used as a secondary criterion for defining source areas, reflecting the fact that source areas are often methanogenic (Wiedemeier et al. 1995). Downgradient wells are those generally hydraulically downgradient of the source area with relatively lower or no methane, but still within the TPHd plume. All monitoring wells were screened at or near the water table; the depth to the water table was generally shallow (<40 feet) and seasonally fluctuating.

A total of 22 groundwater samples were collected for the study. Samples were collected at each site during a quarterly monitoring event by the same sampling contractor and by routinely used methods, in order to replicate as closely as possible the previous TPHd results. Most wells were purged and sampled using disposable bailers and a few wells were purged using a centrifugal pump and sampled with a disposable bailer. Groundwater from each well was collected into four, unpreserved 1 L amber bottles. Samples to be analyzed for natural attenuation parameters (nitrate, ferrous iron, sulfate, and methane) were collected into appropriate containers and preserved as required. One blind field duplicate sample was collected at each site. Samples from each site were shipped separately to a commercial laboratory under chain-of-custody procedures.

Chemical Analysis

Sample analyses included both targeted quantitative and nontargeted qualitative methods. To replicate as closely as possible the mixture of organic compounds present in the previous sample extracts analyzed for TPHd at the study sites, and to be consistent with previous analytical procedures used for the study sites, the state-certified commercial laboratory that routinely performs the regulatory compliance analyses for these sites was used to (1) extract all samples, (2) perform the SGC, and (3) perform the quantitative analysis of the samples.

The laboratory combined all four 1 L amber bottles for each well prior to extraction to homogenize the sample, and then split the sample into four 1 L portions. The samples were extracted using methylene chloride (DCM) in accordance with USEPA Method 3510C. Extracts were analyzed for: (1) TPHd using USEPA Method 8015B without and with a column SGC (based on USEPA Method 3630C), (2) the 57 target polars using a modification of USEPA Method 8270C, and (3) an open-scan GC-MS library search with reporting of the top 40 tentatively identified compounds (TICs). In addition, the silica gel column was eluted with methanol in an attempt to remove the polars, and the methanol eluate was analyzed for the target polars and the GC-MS library search. Finally, aliquots of all extracts and the methanol eluate for each well were sent to the Chevron Energy Technology Company (CETC) in-house laboratory for analysis by two-dimensional gas chromatography with time-of-flight mass spectrometry (GC×GC-MS) to qualitatively identify polar compounds.

Targeted Quantitative Analyses

TPHd by USEPA Method 8015B was performed on the DCM extract and DCM with SGC (discussed below) extract for each sample by the state-certified commercial laboratory using GC-FID in accordance with USEPA SW-846 methods. The carbon range for quantitation was C10 to C28 (boiling points of 170 to 430 °C), and diesel fuel #2 was used as the standard. The internal method recovery surrogate was *ortho*-terphenyl (OTP). Gas chromatograms were provided for each sample.

Silica gel cleanup was performed on one of the duplicate extracts for each sample according to USEPA Method 3630C. Briefly, a glass column was packed with 10 g of activated silica gel, the packed column was pre-rinsed with pentane, a capric acid reverse surrogate was spiked into the DCM extract, and the DCM extract was placed onto the silica gel column. The column was then eluted with a DCM:pentane mixture. Acceptable retention of polars onto the silica gel was evaluated for each sample, as defined by a capric acid recovery range of 0% to 1%. Recovery greater than 1% indicates that the removal of polars may not have been complete. Acceptable recovery of the hydrocarbons in the cleaned-up extract was evaluated for each sample batch by laboratory control samples (LCSs) and LCS duplicates (LCSDs) spiked with diesel fuel.

Extracts and the methanol eluate for each well were analyzed quantitatively at the commercial laboratory by GC-MS using modified USEPA Method 8270C for the target polars. The GC-MS was equipped with a 20 m × 0.18 mm × 0.18 μm df DB-5MS column and a split/splitless injector. A 1 mL splitless injection was made into the GC. Standards for 65 target polar compounds (Ultra Scientific, North Kingstown, RI) were prepared in DCM and methanol. A 5-point calibration was constructed to determine the method detection limit, relative response factor, and amenability of each compound to analysis on a GC. The chromatography study and an extraction efficiency study showed that 8 of the 65 target polars would not be included in a TPHd quantitation due to either boiling points below 170 °C or inefficient extraction using Method 3510, and these were dropped from further evaluation. The final list of 57 target polars, their respective limits of quantitation (LOQs), and the eight compounds dropped, are shown in Table 2. Except for five acids and two alcohols, the LOQs for all of the analytes are 10 μg/L. QA/QC was performed using LCS spikes/LCS duplicates and recovery surrogates.

Nontargeted Qualitative Analyses

An automated mass spectral library search function was used by the commercial laboratory as part of its GC-MS analysis to tentatively identify the compounds present. Any peak identified with a mass spectral match greater than 75% was assigned the compound name. The laboratory reported the top 40 TICs for each sample.

All DCM extracts and the methanol eluate for each well were analyzed at the CETC in-house laboratory using comprehensive GC×GC-MS to tentatively identify the compounds present. Two microliters of the extract were injected into the GC×GC. The first column was a 40 m × 0.18 mm × 0.2 mm RTX-1, and the second column a 1.5 m × 0.1 mm × 0.1 mm BPX-50. An automated search was performed of the National Institute of Standards and Technology mass spectral library, and peaks with a quantitative signal-to-noise ratio of greater than or equal to 5 and spectra that matched with a mass spectral similarity value of at least 750 were tentatively assigned compound names. The match similarity value of 750 was set as a balance between the confidence in identification and the signal-to-noise ratio of compounds present in the samples. Any compound with a match less than 750 was considered to be an unknown. For this study, only the total ion count chromatogram was used for the library search, and individual mass channels were not studied.

The GC×GC-MS results are not quantitative; however, a subset of 28 standards (Table 2) were injected into the GC×GC to evaluate (1) the estimated LOQ for the TICs, and (2) compare the relative response factors for the various classes of compounds, to ascertain the differences in detector responses. Based on the standards run, the LOQ for the TICs ranged from 1 to 11 μg/L, with all but two TICs ranging from 1 to 5 μg/L. The average relative response factor for the tested standards in each of the five polar families in the C8 to C12 carbon range varied by only a factor of about 2, signifying that a direct comparison of response could be made for the majority of the classes.

To be comprehensive, for each well, all TICs above the signal-to-noise ratio threshold were reported for each extract and the methanol eluate. The results for the extracts and eluate were compared, and the unique polars were identified for each well. This compilation resulted in a larger population of TICs than just the methanol eluate from the silica gel column, captured as many TICs as possible from each well, and did not require reliance on the unknown effectiveness of the commercial lab's methanol elution to represent the polar fraction. The compiled unique TICs in each well were assigned to their respective polar families and structural classes, and the results were tallied.

Human Toxicity Evaluation

A conservative relative ranking system for the potential chronic human toxicity of polar compounds was developed based on agency-derived toxicity criteria and, in their absence, toxicity information available in the open scientific literature. Human health risk assessments for contaminants at remediation sites are generally screened using toxicity criteria known as RfDs, defined as "an estimate of a daily oral exposure for a given duration to the human population (including sensitive subgroups) that is likely to be without an appreciable risk of adverse health effects over a lifetime" (USEPA 1989). The USEPA's regional screening level (RSL) and the Texas Commission on Environmental Quality Risk Reduction Program's protective concentration level (TCEQ PCL) tables were thus reviewed to identify potential polar metabolites for which agency-developed RfDs were available (USEPA 2012a; TCEQ 2012). Equivalent risk-based tap water concentrations for the range of identified RfDs were derived using the USEPA equation used to derive tap water RSLs (SLwater-nc-ing) (USEPA 2012b). The RfDs and calculated tap water equivalent concentrations for potential individual polar metabolites identified from these literature sources are presented in Figure 1. Note that the individual compounds shown in Figure 1 were not necessarily identified in groundwater samples during this study. Note also that the calculated tap water equivalent concentrations shown in Figure 1 are provided simply for context, for the benefit of those less familiar with RfDs. This study did not develop "screening levels" for the polar metabolites in groundwater for site management purposes (which would be a significantly more complex effort than appropriate for this study), and does not recommend the use of the concentrations shown in Figure 1 as "screening levels" for mixtures of polar metabolites in groundwater.

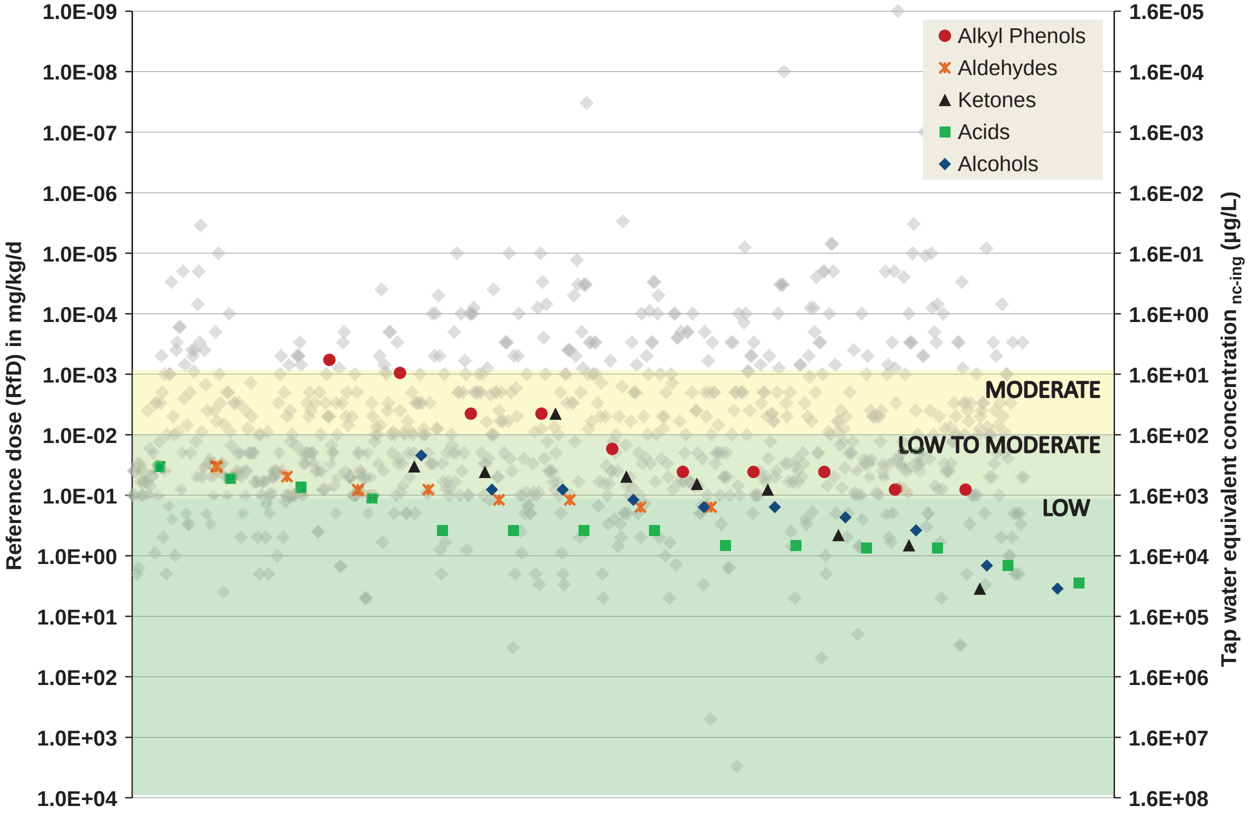

Figure 1. RfDs for polar metabolite families, toxicity rankings, and calculated tap water equivalent concentrations. Background (gray) dots represent the entire universe of chemicals for which RfDs have been established, as listed on the USEPA RSLs Table or the Texas CEQ PCLs Table (including pesticides, chlorinated compounds, etc.). Colored symbols are individual chemicals with RfDs that are potential polar metabolites within each of the five polar families. The individual chemicals shown here were not necessarily identified in this study, but are representative of the polar family. The tap water equivalent concentrations were calculated from the RfDs and are shown for context only. These values should not be construed as regulatory "screening levels" for mixtures of polar metabolites in groundwater.

A conservative RfD-based toxicity ranking system was then developed consistent with similar systems developed by USEPA and the United Nations for use in other non-RfD based regulatory programs (Tiwary et al. 2013). Summary rankings of "Low," "Low to Moderate," and "Moderate" were assigned to the identified RfDs. Figure 1 shows that polars with RfDs ≥0.1 mg/kg/d were defined as being of Low toxicity. Polars in the range of 0.1>RfD≥0.01 mg/kg/d were defined as Low to Moderate toxicity, and those in the range of 0.01>RfD≥0.001 mg/kg/d were defined as Moderate toxicity. These three ranking groups include essentially all the potential polar metabolites for which RfDs were available.

These summary rankings are consistent with USEPA (USEPA OPPT 2009, 2012) criteria and the United Nations' Globally Harmonized System of Classification and Labeling of Chemicals (UNECE 2011). For example, under the USEPA Office of Pollution Prevention and Toxics (OPPT) Chemical Assessment and Management Program, a chemical that produces a lowest observed adverse effect level (LOAEL) of >100 mg/kg/d in 13-week or 90-d repeated-dose toxicology studies is defined as presenting low chronic toxicity potential. For purposes of this study, the LOAEL-based criterion of 100 mg/kg/d can be converted to an RfD-equivalent criterion of 0.1 mg/kg/d by applying an uncertainty factor of 1000, consistent with USEPA procedures (USEPA 1989). The toxicity ranking system developed in this study is consistent with and generally more conservative than the criteria put forth by the USEPA OPPT approach as shown in Table 3. For example, specific alkyl phenols such as xylenols and cresols that are classified as "Low to Moderate" or "Moderate to High" under our ranking system would be classified as presenting "Low" chronic toxicity under the USEPA OPPT system.

The Low, Low to Moderate, and Moderate summary toxicity rankings were assigned to all 22 structural classes of potential polar metabolites as shown in Table 1. This step required additional toxicity information in some cases. For compounds that did not have an agency-derived RfD, but for which published toxicology test data were available either for the chemical itself or for a structurally and/or functionally related chemical, a provisional RfD was derived based on the reported no-adverse-effect level from repeated-dose animal studies and applying an uncertainty factor of 1000. An overall ranking was assigned to each structural class based on the collective weight of the evidence for representative compounds in that class.

Finally, as a validation exercise, USEPA summary documents were reviewed for selected compounds with known RfDs, and the corresponding toxicity ranking assigned in this study was compared to USEPA opinions expressed in their documents. For example, propanoic acid (RfD >0.1 mg/kg/d ranked as "Low" toxicity) belongs to the *n*-(alkyl) carboxylic acid category summarized by USEPA to have "*low* repeated-dose, reproductive and developmental toxicity" (USEPA 2008a). Similarly, alkyl phenols with RfDs ranging from >0.1 mg/kg/d ("Low" toxicity) to 0.001 mg/kg/d ("Moderate" toxicity) are summarized as having "*low to moderate* hazard potential for acute and repeated-dose toxicity" (USEPA 2008b).

Results and Discussion

Results for the polar compounds that are potential metabolites, which were the vast majority of the polar TICs in these samples, are presented and discussed herein. Other polar compounds that were infrequently identified and that are not potential metabolites (chlorinated compounds, benzothiophenes, plasticizers, pesticides) are not presented or discussed. These nonmetabolites were not a significant component of these samples either in terms of numbers of TICs or detector response (peak area), with the exception of the plasticizers in a few samples. Except for the

Table 3

Comparison of Toxicity Rankings Between USEPA/UN Systems and This Study

Polar Compound	LOAEL	EPA/UN Ranking Based on LOAEL	RfD	RfD-Based Ranking (This Study)
Dimethylphenol, 2,4-	180	Low	0.02	Low to Moderate
Dimethylphenol, 2,6-	400	Low	0.0006	Moderate to High
Cresol, *m*-	150	Low	0.05	Low to Moderate
Cresol, *o*-	175	Low	0.05	Low to Moderate
Phenol	280	Low	0.3	Low
Benzaldehyde	400	Low	0.1	Low
Acetone	1700	Low	0.9	Low
Methyl ethyl ketone (2-Butanone)	1771	Low	0.6	Low
Acrylic acid	240	Low	0.5	Low
Ethyl acetate	3600	Low	0.9	Low
Methanol	2500	Low	0.5	Low
Butanol, *N*-	500	Low	0.1	Low
Isobutyl alcohol	1000	Low	0.3	Low

benzothiophenes, which were very infrequently identified, the nonmetabolites have no relationship to the presence of the residual fuel at these sites and thus would have no role in risk management associated with the residual fuel.

Detailed analytical results for the commercial lab are shown in Table 4. The GC×GC-MS analytical results and toxicity evaluation results are summarized in Tables 5 and 6. Esters, which are reversibly formed from an acid and an alcohol, were classified with the acids for this study.

Based on the results for the natural attenuation parameters (Table 4), all wells were within the zone of biodegradation. The redox conditions were generally anaerobic and varied from nitrate-reducing to methanogenic, depending on the site and the relative position of each well with respect to the source area.

TPHd Results

All TPHd results (Table 4), including those with SGC, were within the laboratory's acceptable control ranges. The TPHd concentrations for each groundwater sample were similar to previous monitoring events. The TPHd concentrations without SGC (representing all organics extracted by Method 3510C and with boiling points between 170 and 430 °C) for samples containing only dissolved organics ranged from 1000 to 8100 µg/L in source-area samples, and from 98 to 1700 µg/L in downgradient samples. A review of the chromatograms revealed that 4 of the 13 source-area samples contained a nondissolved product component (Site 2 MW-6, Site 1 MW-5A, Site 1 MW-100/5A duplicate, Site 1 MW-26A). Nondissolved product is characterized by a chromatogram with a distinctive fuel pattern (dominated by an unresolved complex mixture [UCM] in the appropriate carbon range in the case of middle distillates) and not by the individual hydrocarbon peaks that correspond to the water-soluble fraction of fuels (primarily the C14 and smaller aromatics and very small aliphatics). The inclusion of a nondissolved component was an artifact of sheen or petroleum-impacted soil particles (turbidity) in the samples caused by the act of sampling. These four samples had TPHd concentrations ranging from 2000 to 27,000 µg/L.

Except for the samples with entrained nondissolved product, the TPHd chromatograms for the study samples were all dominated by a prominent UCM that was not representative of a fuel pattern or dissolved hydrocarbon pattern but is typical for complex mixtures of polar compounds at sites with biodegrading petroleum sources (see Figure 4 of Zemo and Foote 2003). Except for Site 5 (discussed below) and samples with entrained nondissolved product, TPHd concentrations for all samples but one were reduced to nondetect (<100 µg/L) after the SGC. This indicates that virtually all of the organics in groundwater and the components of the UCM at these sites are polars, and not dissolved hydrocarbons. Based on the difference between the TPHd concentration without SGC and with SGC for each sample, the percentage of the dissolved organics that were polars ranged from 84 to 100% in source-area samples and was 100% in downgradient samples. Samples with entrained nondissolved product (Site 2 MW-6, Site 1 MW-5A, Site 1 MW-26A) had less reduction in TPHd concentration after SGC because of the hydrocarbons present.

At Site 5, the TPHd concentrations were significantly reduced after SGC, but remained above 100 µg/L. The SGC was incomplete for all of the Site 5 samples, as indicated by either a capric acid recovery greater than 1% or the chromatogram pattern. The reason for the incomplete SGC at Site 5 is unclear. Even with an incomplete SGC, the percentage of dissolved polar compounds in the Site 5 samples ranged from at least 65% to at least 91%.

Targeted GC-MS Analysis

The quantitative results from Modified EPA Method 8270C for the 57 target polars (Table 4) show that, except for 11 µg/L dodecanoic acid in one sample, none of the individual compounds were detected in any of the extracts/eluates for any groundwater sample (most reporting limits were 10 µg/L). The LCS/LCSD recoveries and the Method 8270C surrogate recoveries were generally within the laboratory's acceptable range.

Dodecanoic acid (also known as lauric acid CASRN 143-07-7) is a C12 saturated fatty acid. Based on the toxicity ranking system, this compound and its structural class (alkyl acid) are of Low toxicity. It is equally important to note that included among the 57 target polars were 12 alkyl phenols, representing the relatively more toxic polar metabolites (as shown on Figure 1), none of which were detected in any sample at a reporting limit of 10 µg/L.

Nontargeted GC-MS Analysis

Combining the GC-MS Library Search results for the DCM extracts and methanol eluates for all wells at each site, the number of polar metabolite TICs for each site ranged from 4 (Site 2) to 27 (Site 5) (Table 4). The number of unique polar metabolite TICs in a single well ranged from 1 to 8. The three Site 5 source area samples had the largest number of TICs and included organic acids, ketones, phenols, and one aldehyde. Organic acids were the only compounds tentatively identified in other samples, except for one phenol in Site 2 MW-6. Most of the organic acids were identified as "unknown carboxylic acid"; "naphthalene carboxylic acid" was identified in four samples.

Nontargeted GC×GC-MS Analysis

Because of the uncertainty associated with MS library matching, inability to distinguish among potential isomers, and lack of standard-based confirmation, specific individual TICs are not discussed in detail here but rather are reported by family and structural class. TIC concentrations could not be calculated because standards were not available, which prevented the generation of calibration curves; however, based on the 28 standards that were run, it was determined that the LOQ for a majority of the identified compounds is in the range of 1 to 5 µg/L. The GC×GC also detected several of the 57 target polar metabolites that were not detected by the traditional GC at detection limits of 10 µg/L, further suggesting that the target polars identified by the GC×GC were present at single digit µg/L levels. A complete list of unique TICs from this study and additional details about the GC×GC-MS analysis are presented in Mohler et al. (in press). DOI: 10.1021/es401706m.

Table 4

Results of Commercial Lab Analyses

	TPHd/DRO		Field Readings		Bio Parameters				GC-MS Quant	GC-MS Library Search					
Site and Well	**TPHd**	**TPHd with SGC**	**ORP**	**DO**	**Nitrate**	**Iron +2**	**Sulfate**	**Methane**	**Detected Target Polars**	**K**	**Ph**	**Ald**	**Alc**	**Acids /Est**	**# Unique TICs**
Site 1															
MW-26A	4400 p	690 p (0%)	−163/−161	1.2/1.2	<0.5ht	1.6	59	1.9	11 µg/L dodecanoic acid; all others ND	0	0	0	0	3	3
MW-5A	2100 p	2000 p (1%)	−99/−97	0.7/0.6	<0.5ht	0.2	115	<0.015	All ND	0	0	0	0	3	3
MW-100/5A	2000 p	540 p (0%)			<0.5ht	0.2	106	<0.015	All ND	0	0	0	0	6	6
MW-50A	1300	<98	−94/−57	1.5/1.3	<0.5ht	2	184	0.053	All ND	0	0	0	0	2	2
MW-71A	380	<100	30/23	1.3/1.3	5	<0.1	425	<0.015	All ND	0	0	0	0	1	1
Site 2															
MW-6	27,000 p	20,000 p	86/103	0.9/1.1	<0.5	4	10	0.71	All ND	0	1	0	0	0	1
MW-8	1200	<98	93/138	1.0/1.2	2.1	<0.1	34.6	0.025	All ND	0	0	0	0	1	1
MW-100/8	1100	<98			2	<0.1	33.5	0.022	All ND	0	0	0	0	1	1
MW-7	98	<100	93/128	0.8/1.1	2	<0.1	22.8	<0.015	All ND	0	0	0	0	1	1
Site 3															
MW-8	2600	410 (0%) ?	−5/13	1.0/1.4	1.4	27.8	19.2	2.9	All ND	0	0	0	0	4	4
MW-21	1000	<97	84/63	1.2/1.5	<0.5	6.8	5.8	3.1	All ND	0	0	0	0	3	3
MW-100/21	1100	<97			1.6	6.2	20.5	3.2	All ND	0	0	0	0	3	3
Site 4															
MW-3	3200	<96	184 pre	1.6 pre	2.2	4.6	73.7	5.1	All ND	0	0	0	0	7	7
MW-100/3	2900	<120							All ND	0	0	0	0	2	2
MW-41	3300	<96	−24 pre	1.7 pre	5.9	11.7	19.9	1.2	All ND	0	0	0	0	1	1
MW-26	210	<100	108 pre	1.2 pre	16.1	0.17	31.5	0.021	All ND	0	0	0	0	2	2
MW-31	470	<100	93 pre	1.9 pre	1.3	10.5	94.9	0.74	All ND	0	0	0	0	2	2
Site 5															
MW-21	8100	840 (0.7%)	163 pre	1.4 pre	<0.5	41.1	<5.0	3.5	All ND	3	0	1	0	4	8
MW-22	6000	800 (1.2%)	142 pre	1.2 pre	0.6	23.2	20	4.8	All ND	2	3	0	0	3	8
MW-100/22	6300	840 (1.3%)			<0.5	22.1	16.9	5.5	All ND	2	1	0	0	3	7
MW-5	1700	150 (0%) ?	107 pre	1.2 pre	<0.5	<0.1	41	<0.015	All ND	0	0	0	0	2	2
MW-13	1100	380 (0%) ?	159 pre	1.3 pre	<0.5	2.2	1660	<0.015	All ND	0	0	0	0	2	2

Notes: Shaded rows are source area wells; MW-100/xx is blind field duplicate of well xx. TPHd/DRO in µg/L using Method 8015 (C10 to C28); SGC= Method 3630C (capric acid recovery 0% unless stated); p= Product (nondissolved) component present. Oxidation Reduction Potential (ORP) in mV; Dissolved Oxygen (DO), Nitrate, Ferrous Iron, Sulfate, and Methane in µg/L. Detected Target Polars = 57 compounds analyzed using GC-MS (Mod Method 8270), quantified against standards, in µg/L; analysis performed on a DCM (no SGC) extract and the methanol eluate off the SG column. All ND = all compounds non-detect for both the DCM extract and the methanol eluate; detection limits mostly 10 µg/L. K = ketones; Ph = phenols; Ald = aldehydes; Alc = alcohols; Acids/Est = acids and esters. Library Search = Open scan GC-MS, attempt to identify top 40 peaks; number of unique individual tentatively identified compounds (TICs) in each polar family; results for DCM extracts and methanol eluate are combined. pre = pre-purge measurement; other shown as pre-purge/post-purge. ?= SGC at Site 5 MW-5 and MW-13 did not completely remove high-boiling polars UCM. ?= SGC at Site 3 MW-8 did not completely remove high-boiling polars UCM.

Table 5

Summary of GC×GC-MS Results: Average per Well % of TICs by Polar Families and by Expected Human Chronic Oral Toxicity

			Polar Chemical Families					Expected Chronic Oral Toxicity		
Site	**Avg TPHd wo/w SGC**	**Total # TICs**	**Acids**	**Alcohols**	**Phenols**	**Ketones**	**Aldehydes**	**Low**	**Low to Moderate**	**Moderate**
	µg/L	**#**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
Total Results—All Samples and All Sites										
Site 1	—	207	50	23	2	22	3	82	17	1
Site 2	—	213	56	32	1	9	2	92	7	1
Site 3	—	80	43	23	0	28	6	80	20	0
Site 4	—	181	47	24	3	21	5	90	10	0
Site 5	—	772	34	25	5	31	4	78	17	5
Average % all sites			*46*	*25*	*2*	*22*	*4*	*84*	*14*	*1*
Source Zone Samples										
Site 1	2800 p / 1100 p	173	36	30	2	28	3	78	20	2
Site 2	27,000 p / 20,000 p	173	25	31	3	32	8	72	25	3
Site 3	1600 / 200	80	43	23	0	28	6	80	20	0
Site 4	3100 / <100	153	31	29	0	32	8	86	14	0
Site 5	6800/830 nc	737	13	26	8	45	7	65	26	8
Average % source area			*30*	*28*	*3*	*33*	*6*	*76*	*21*	*3*
Downgradient Samples										
Site 1	840 / <100	34	70	13	2	13	2	88	12	0
Site 2	800 / <100	40	66	32	0	2	0	98	2	0
Site 4	340 / <100	28	71	16	8	6	0	98	2	0
Site 5	1400 / 270 nc	35	65	23	0	12	0	97	3	0
Average % downgradient area			68	21	2	8	1	95	5	0

Notes: TICs = tentatively identified compounds; Avg TPHd wo/w SGC = average concentration of total petroleum hydrocarbons as diesel (TPHd) without silica gel cleanup (SGC) and with SGC. "Without SGC" includes hydrocarbons and polars, "with SGC" represents hydrocarbons only; µg/L = micrograms per liter; # = number; % = percent; -- = not calculated; p = sample contained a product (nondissolved) component; nc = SGC was not complete; both wells at Site 3 were classified as source area; Low, Low to Moderate, and Moderate toxicity are defined in the body of the article; "Phenols" in downgradient samples were phenol only and no alkyl phenols. Alkyl phenols were identified only in source area samples.

The GC×GC-MS analysis resulted in a greatly increased number of polar metabolite TICs for each site, ranging from 80 (Site 3) to 772 (Site 5). The number of unique polar metabolite TICs in a single well ranged from 5 to 310. The greatly increased number of TICs for the GC×GC-MS as compared to the GC-MS confirms that two-dimensional chromatography is necessary to resolve individual compounds in these complex mixtures of polar metabolites. The highest number of polar metabolite TICs (and highest concentration of polars measured as TPHd) was present in source-area samples at each site, with significantly fewer TICs (and very low concentrations of polars as TPHd) in downgradient samples at each site.

Summaries of the average percentage of TICs in each of the polar metabolite families for each site, and separately for the source and downgradient areas at each site, are shown in Table 5. For this study, average percentage calculations are always based on the percentage for each individual well at each site, and not on the total number of TICs for the site as a whole, so that results for the downgradient samples (with fewer TICs) are weighted equally with source-area samples. The average TPHd concentration without and with SGC for each area at each site is also shown in Table 5 to provide context regarding the "bulk" concentration of polar compounds in each area.

The site-wide results for all five sites were similar and indicate that an average of 46% of the polar metabolite TICs were acids/esters, 25% were alcohols, 2% were phenols, 22% were ketones, and 4% were aldehydes (Table 5, Figure 2). All five sites also showed that there is a marked difference in the distribution of the identified polar metabolite families between source-area and downgradient samples at each site. In source-area samples, the acids/esters (average of 30% of the polar metabolite TICs), alcohols (28%), and ketones (33%) are approximately equally distributed, with far fewer phenols (3%, including alkyl phenols) or aldehydes (6%). In

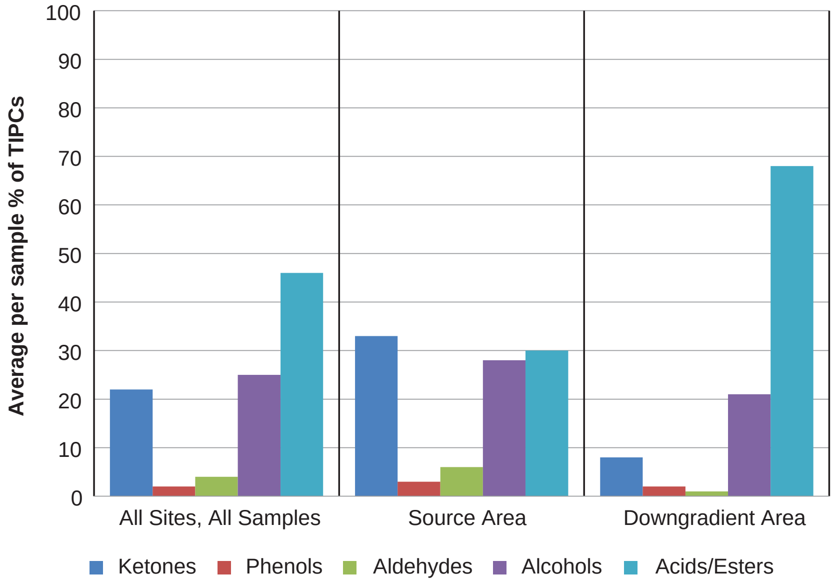

Figure 2. Summary of GC×GC-MS results for polar families: distributions overall and in source and downgradient areas.

downgradient samples, the acids/esters dominate (average of 68% of the polar metabolite TICs), with fewer alcohols (21%), and far fewer ketones (8%), phenols (2%, all as phenol and no alkyl phenols), and aldehydes (1%). Although the GC×GC results are not quantitative, the relative response factors show that it is reasonable to compare trends for each family and class within samples in the C8 to C12 carbon range.

A summary of the average percentage of identified structural classes in the source and downgradient areas for all five sites combined is shown in Table 6. All 22 expected structural classes were tentatively identified. The most frequently identified structure was alkyl acids/esters, which averaged about 21% of the polar metabolite TICs in the source area and about 56% of the polar metabolite TICs in the downgradient-area samples. The results show that, when identified, the more complex bicyclic and polycyclic aromatic structures are primarily in source-area samples, as would be expected due to their proximity to the residual hydrocarbon source, with less complex structures predominating in downgradient samples. Alkyl phenols were identified in only five samples, all of which were in source areas and two of which contained a nondissolved product component.

Because the relative response factors for each polar metabolite family were reasonably similar, the GC×GC-MS results were also evaluated by reviewing each sample to determine the polar families that were represented in the top 5, 10, and/or 20 peaks by peak area response. This showed that for each sample the acids and/or alcohols were typically a higher percentage of the highest peak area response than their percentage based on the number of TICs. Conversely, the ketones, aldehydes, and phenols were typically a smaller percentage of the highest peak area response than their percentage based on the number of TICs. This means that the results as presented in this paper based on numbers of TICs may underestimate the proportion of acids and/or alcohols, and may overestimate the proportion of ketones, aldehydes, and phenols, actually present in each sample.

Toxicity Evaluation

A summary of the average percentage of the total number of polar metabolite TICs in each toxicity ranking (Low, Low to Moderate, and Moderate) for each site, and separately for source and downgradient areas at each site, is shown in Table 5. For all five sites combined, an average of 84% of the polar metabolite TICs are ranked as "Low" toxicity, 14% as "Low to Moderate" toxicity, and only 1% as "Moderate" toxicity. In source-area samples, the average percentages are 76% "Low" toxicity, 21% "Low to Moderate" toxicity, and 3% "Moderate" toxicity. In downgradient samples, the profile shifts toward a lower toxicity, with average percentages of 95% "Low" toxicity, 5% "Low to Moderate" toxicity, and 0% "Moderate" toxicity. The increase in the average percentage of "Low" toxicity compounds and the decrease in the "Low to Moderate" and "Moderate" toxicity compounds in the downgradient samples is due to the dominance of acids/esters, and the virtual lack of aromatic/polycyclic aromatic ketones, alkyl phenols, and aldehydes in downgradient samples (Table 6).

Conclusions

The purposes of this study were to (1) identify as well as possible the polar compounds in the DCM extracts of groundwater samples from five sites with biodegrading fuel sources that are quantified as TPHd unless a SGC is used to separate the polars from hydrocarbons, and (2) estimate the potential chronic human toxicity of the identified polar compounds. The GC×GC-MS analysis provided detail not previously available for actual groundwater samples, and documented that the vast majority of polar compounds identified in the groundwater sample extracts were oxygen-containing metabolites of biodegradation. The mixture of identified polar metabolites is composed of organic acids/esters, with variable alcohols and ketones, and very few phenols and aldehydes. The analytical results were similar among the five sites. The mixture of identified polar

Table 6

GC×GC-MS Results—Avg% for Each Structural Class in Source and Downgradient Areas

Polar Family	Specific Structural Class	Expected Chronic Oral Toxicity to Humans	Source Area Samples Avg % per Sample	Downgradient Samples Avg % per Sample
Alcohols (and diols)	Alkyl alcohols	Low	13	11
	Cycloalkyl alcohols	Low	10	5
	Bicyclic alkyl alcohols	Low	2	6
	Aromatic alcohols	Low	3	<1
	Polycyclic aromatic alcohols	Low to Moderate	<1	0
Acids (and esters)	Alkyl acids	Low	21	56
	Cycloalkyl acids	Low	2	<1
	Bicyclic alkyl acids	Low	2	0
	Aromatic acids	Low	3	12
	Polycyclic aromatic acids	Low to Moderate	<1	0
Ketones	Alkyl ketones	Low to Moderate	6	3
	Cycloalkyl ketones	Low	9	2
	Bicyclic alkyl ketones	Low	9	2
	Aromatic ketones	Low to Moderate	8	<1
	Polycyclic aromatic ketones	Low to Moderate	<1	0
Aldehydes	Alkyl aldehydes	Low to Moderate	4	<1
	Cycloalkyl aldehydes	Low to Moderate	<1	0
	Bicyclic alkyl aldehydes	Low to Moderate	<1	0
	Aromatic aldehydes	Low to Moderate	2	0
	Polycyclic aromatic aldehydes	Low to Moderate	<1	0
Phenols	Alkyl phenols	Moderate	3	0
	Phenol	Low	<1	2

Average % per sample is based on the % by number of TICs for each well.

metabolites in the source area samples had approximately equal average percentages of organic acids/esters, alcohols, and ketones, which reflects the ongoing sequential oxidation reactions proximal to the residual hydrocarbon molecules. The mixture of identified polar metabolites in the downgradient area samples was dominated by organic acids/esters. The observed spatial trend in the relative proportions of the polar families, combined with the predominant simpler structures and decreasing bulk concentrations of polar compounds (measured as TPHd) seen in downgradient samples, documents the continued biodegradation of the polar metabolites themselves and their ultimate natural attenuation with migration away from the residual hydrocarbon in the source area. The oxidation of the various polar families to small organic acids, and their ultimate transformation to carbon dioxide and water, is consistent with known metabolic pathways.

An RfD-based toxicity ranking system that is consistent with systems used by USEPA and the United Nations was developed and applied to each of the identified polar metabolite structural classes. The results from this study show that the vast majority of the hundreds of polar metabolites that were identified using GC×GC-MS in groundwater sample extracts from these five biodegrading fuel sites are in structural classes of "Low" toxicity hazard to humans. These results indicate that the mixtures of polar metabolites identified in groundwater extracts at these five sites are unlikely to present a significant human health risk, assuming that the affected groundwater were to be consumed as drinking water.

The results from this study also show (and confirm results from previous studies) that the organics in groundwater quantified as TPHd at these five sites were primarily polar metabolites and not dissolved hydrocarbons. Therefore, a SGC is necessary if groundwater sample TPHd results are to be compared to hydrocarbon-based regulatory criteria.

Acknowledgments

Financial support for this work was provided by Chevron Energy Technology Company via the Remediation Technology Development Initiative. The authors acknowledge the significant technical contribution of Sungwoo Ahn (Exponent) for his assistance with structural classifications and the constructive comments provided by three anonymous reviewers.

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Biographical Sketches

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Photograph 1: View of the eastern portion of the property prior to installation of the chemical vapor barrier.

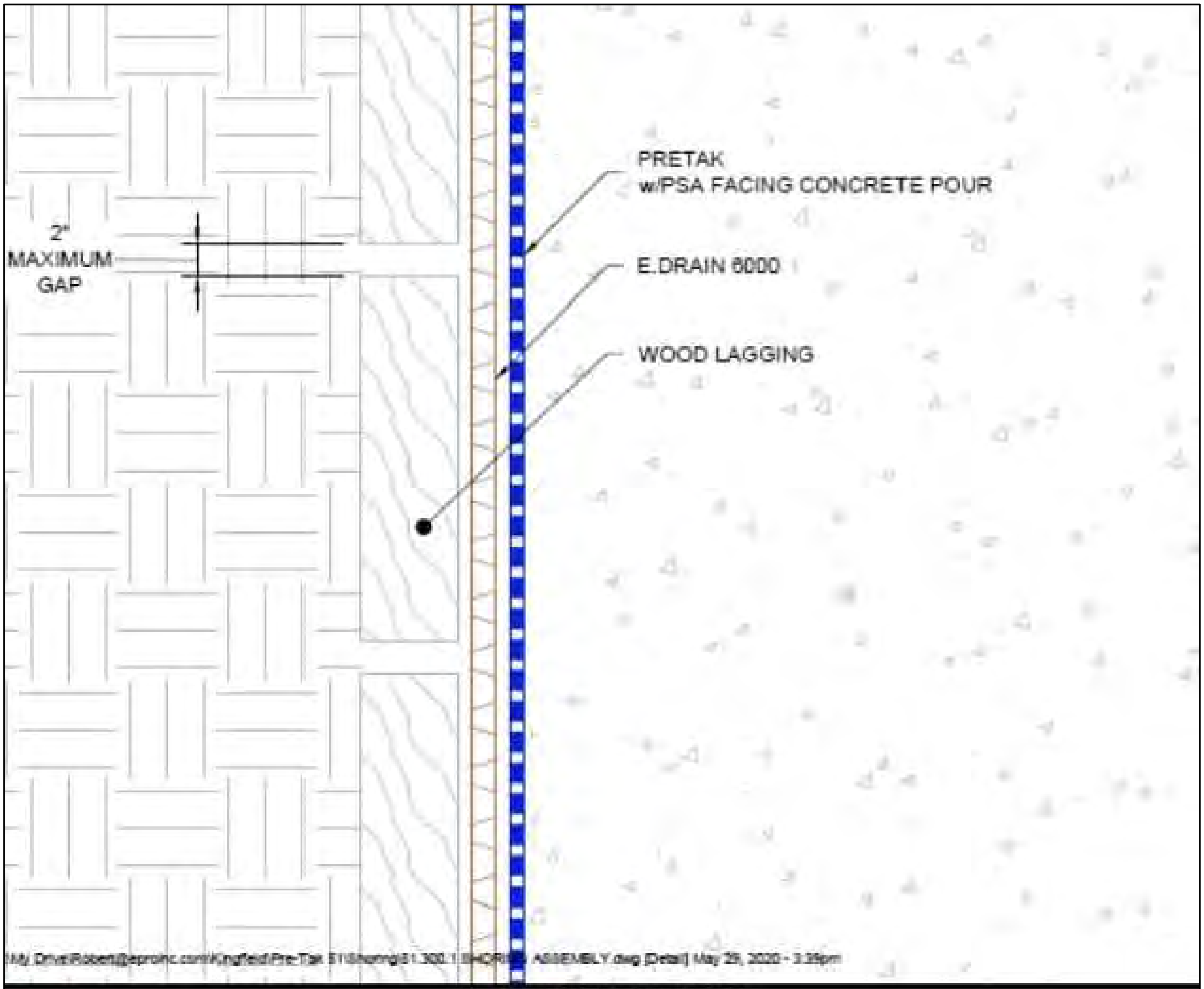
Photograph 2: View of E Drain 6000 being installed along the south and east shoring walls.

RILEYGROUP Corporate Office 17522 Bothell Way Northeast Bothell, Washington 98011 Phone: 425.415.0551 Fax: 425.415.0311	Roystone Redevelopment		Figure G-1
	RGI Project Number: 2017-015K	Chemical Vapor Barrier Installation Photographs	Date Drawn: 01/2023
	Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		

Photograph 3: View of Pretak sheet being installed along the south and east shoring walls in the location where the slab was to be poured.

Photograph 4: View showing penetrations in the shoring wall that were sealed using Pretak tape, Benotak, and Estop GU as part of the chemical vapor barrier installation.

RILEYGROUP Corporate Office 17522 Bothell Way Northeast Bothell, Washington 98011 Phone: 425.415.0551 Fax: 425.415.0311	Roystone Redevelopment		Figure G-2
	RGI Project Number: 2017-015K	Chemical Vapor Barrier Installation Photographs	Date Drawn: 01/2023
	Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		



SHORING ASSEMBLY

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SYSTEM NAME	DRAWING NUMBER
PRETAK	51.300.1
DRAFTER	DATE
RJT	05/15/2020

PRETAK

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Roystone Redevelopment

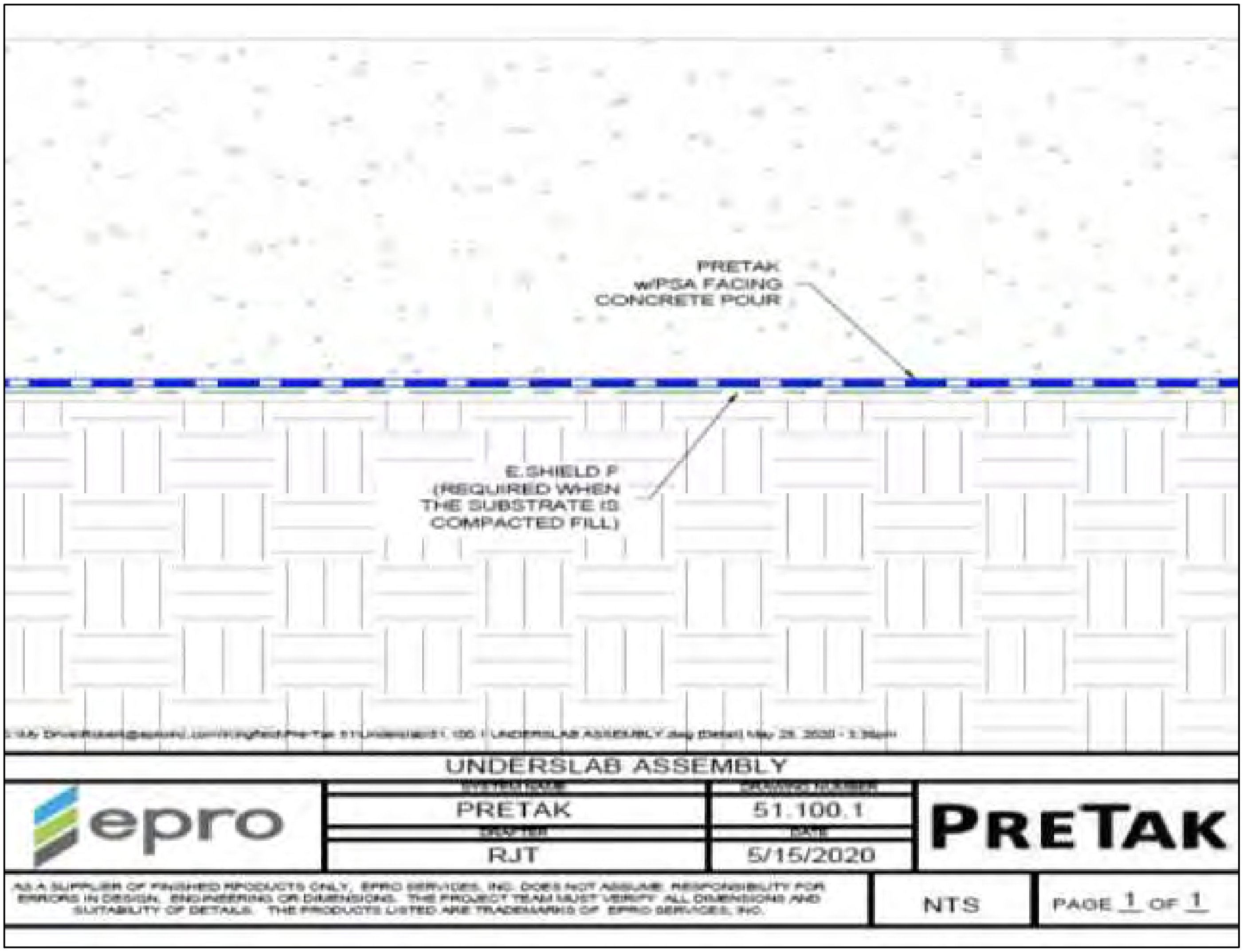
Figure G-3

RGI Project Number
2017-015K

Pre-Tak Chemical Vapor Barrier
Specifications Along Parking Garage Walls

Date Drawn:
09/2022

Address: 631 Queen Anne Avenue North, Seattle, Washington 98109



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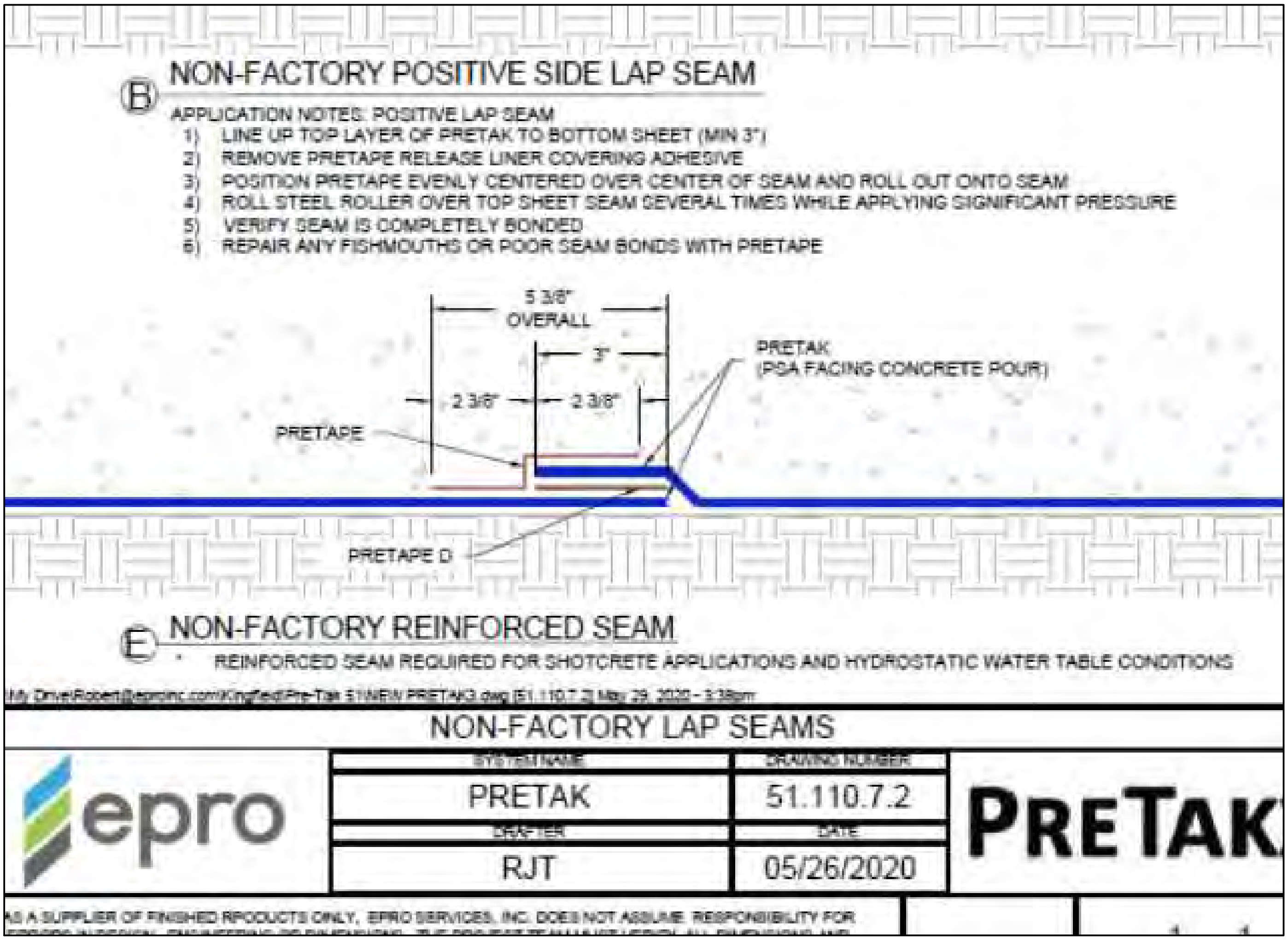
Roystone Redevelopment		Figure G-4
RGI Project Number 2017-015K	Pre-Tak Chemical Vapor Barrier Specifications Under Parking Garage Floor Slab	Date Drawn: 09/2022
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		



Ⓑ NON-FACTORY POSITIVE SIDE LAP SEAM

APPLICATION NOTES: POSITIVE LAP SEAM

1) LINE UP TOP LAYER OF PRETAK TO BOTTOM SHEET (MIN 3")
2) REMOVE PRETAPE RELEASE LINER COVERING ADHESIVE
3) POSITION PRETAPE EVENLY CENTERED OVER CENTER OF SEAM AND ROLL OUT ONTO SEAM
4) ROLL STEEL ROLLER OVER TOP SHEET SEAM SEVERAL TIMES WHILE APPLYING SIGNIFICANT PRESSURE
5) VERIFY SEAM IS COMPLETELY BONDED
6) REPAIR ANY FISHMOUTHS OR POOR SEAM BONDS WITH PRETAPE

Ⓔ NON-FACTORY REINFORCED SEAM

- REINFORCED SEAM REQUIRED FOR SHOTCRETE APPLICATIONS AND HYDROSTATIC WATER TABLE CONDITIONS

\My Drive\Robert@eproinc.com\Kingfield\Pre-Tak 51\NEW PRETAK3.dwg [51.110.7.2] May 29, 2020 - 3:38pm

NON-FACTORY LAP SEAMS

epro

SYSTEM NAME	DRAWING NUMBER
PRETAK	51.110.7.2
DRAFTER	DATE
RJT	05/26/2020

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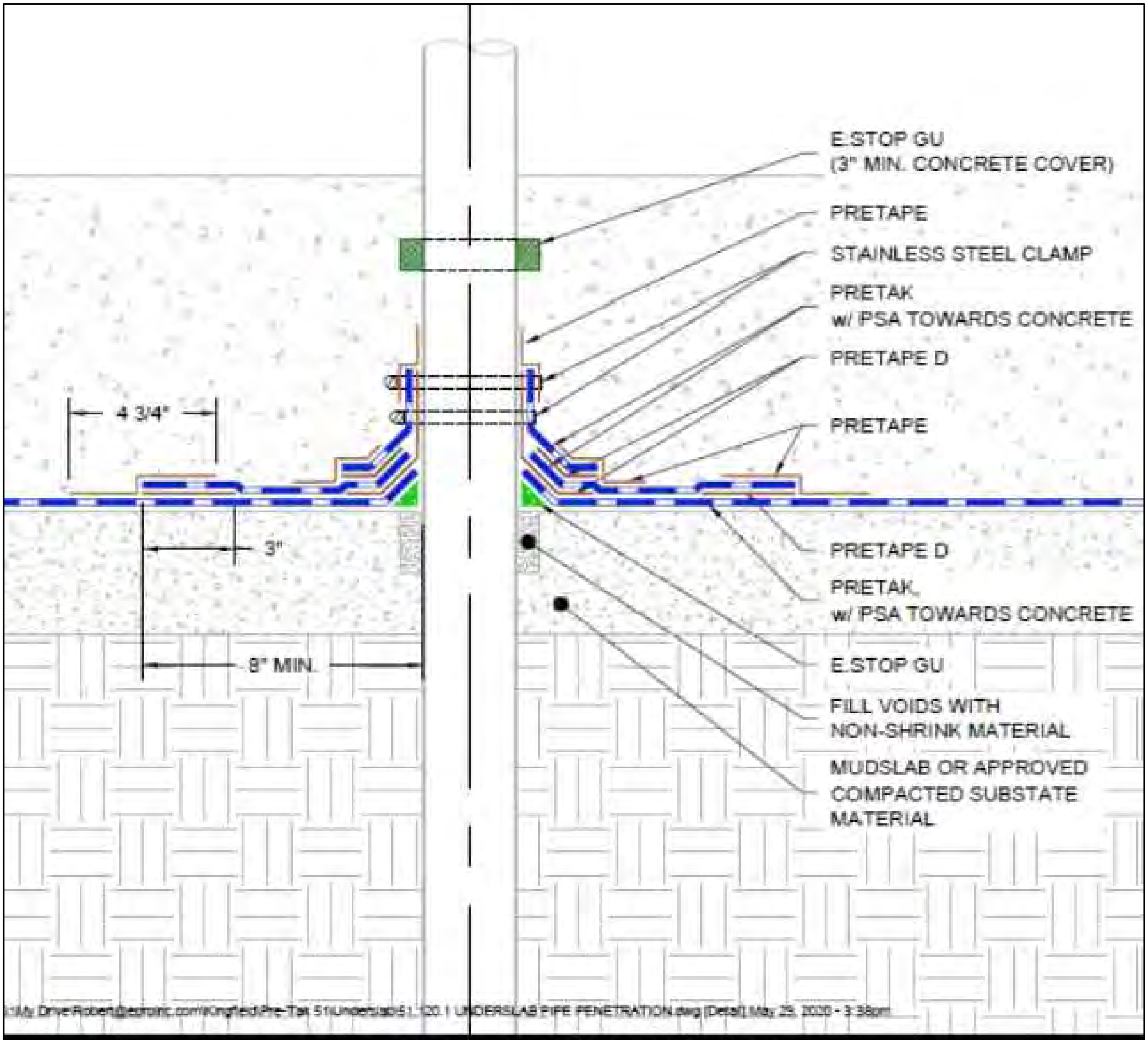
Roystone Redevelopment		Figure G-5
RGI Project Number 2017-015K	Pre-Tak Chemical Vapor Barrier Specifications for Sealing Groundwater Monitoring Well Casings	Date Drawn: 09/2022
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		



UNDERSLAB PIPE PENETRATION

SYSTEM NAME	DRAWING NUMBER
PRETAK	51.120.1
DRAFTER	DATE
RJT	5/26/2020

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PRETAK

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Roystone Redevelopment		Figure G-6
RGI Project Number 2017-015K	Pre-Tak Chemical Vapor Barrier Specifications for Non-Factory Lap Seams	Date Drawn: 09/2022

Address: 631 Queen Anne Avenue North, Seattle, Washington 98109

PreTak

Product Description

Basic Use: PreTak is utilized as a pre-applied sheet membrane for blindside vertical wall waterproofing and pre-applied underslab waterproofing and methane gas protection for horizontal applications. PreTak can be applied directly to a wide variety of substrates and utilizes high density polyethylene (HDPE) sheet that once installed provides a tough and durable waterproofing membrane. Combined with a Pressure Sensitive Adhesive (PSA), PreTak becomes fully adhered when freshly placed concrete or shotcrete is applied to directly to it, eliminating the potential for lateral water migration.

Installation is efficient and reliable with a manufacturer marked adhesive selvedge allowing for an watertight bond at seam overlaps. PreTak delivers superior performance in harsh conditions without the need for specialized equipment, heat, or power.

Utilizing heat welded seams, PreTak is LADBS-approved as a gas and methane barrier (LARR #26164) and for shotcrete.

Composition: PreTak (46 mil/1.2mm) is a fully adhered waterproofing sheet membrane comprised of a long fiber HDPE film coated with a PSA gel and protected by a plastic release liner. The edges of PreTak are treated with a 3-inch (70mm) wide pre-adhered seam (selvedge). PreTak HD is a 60 mil thicker version of PreTak and is available upon request.

Benefits

- Proven and effective, PreTak has an over 25-year successful track record of performance on projects around the world.
- PreTak is suitable for a variety of critical building envelope applications, challenging site conditions, and contaminated soils.
- Not affected by rain or ponding water.
- Surpasses other fully adhered HDPE membrane systems by achieving the ideal blend between value and performance.
- Prevents lateral water migration by forming a continuous adhesive bond to poured-in-place concrete.
- Versatile seam options for hydrostatic, non-hydrostatic, and shotcrete applications.

Limitations

- Limited to underslab and single-sided formwork.
- Do not leave exposed for longer than 60 days.
- Remove excessive substrate moisture prior to application.

Technical Data

Properties: See physical properties table.

Coverages: One roll covers 258 square feet (24 square meters), not including overlaps or waste.
Wider and thicker roll sizes are available upon request.

Storage and Handling: Store raised off the floor away from sun and moisture, between 40-90°F (5-32°C), maximum 5 rolls high.

Specification Writer: Contact EPRO before writing specifications on this product. PreTak HDPE Pre-Applied Waterproofing System should be reviewed in order to meet project specific site conditions.

Installation

Preparation: Please refer to manufacturer's specifications for substrate requirements. Rolls should be inspected for cosmetic damage prior to application.

Application: Please refer to manufacturer's specifications.
Side laps, end laps, and cut ends have several seaming options depending on the application.

Installation: Roll PreTak out with the release liner facing the concrete pour. Line up the sheet edges and overlap a minimum of 3-inches (75 mm) for cut ends and endlap taped seams. For seldvedge seams, line up top sheet to pre-adhered selvedge guideline. Remove release liner and roll to adhere seam.

Heat Weld Seams: For guidance on the heat welding option of PreTak,consult manufacturer's specifications.

Availability and Packaging

Contact EPRO sales representative for local distributors or authorized applicators (www.eproinc.com).

Roll Size: 46 mil (1.2 mm), 3'11" x 65'-6" (1.2 x 20 m), 75 lbs (34 kg)

Warranty

Limited Warranty: EPRO Services, Inc. believes to the best of its knowledge that performance tables are accurate and reliable. EPRO warrants this product to be free from defects. EPRO makes no other warranties with respect to this product, express or implied, including without limitation the implied warranties of MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. EPRO's liability shall be limited in all events to supplying sufficient product to retreat the specific areas to which defective product has been applied. EPRO shall have no other liability, including liability for incidental or resultant damages, whether due to breach of warranty or negligence. This warranty may not be modified or extended by representatives of EPRO or its distributors.

Equipment

Seaming: 4" heavy seam roller.

Heat Welding: Leister, Hot air wedge welder, extrusion weld, etc.

Underslab Smoke Testing: EPRO Smoke Test Machine.

Technical Services and Information

Complete technical services and information are available by contacting EPRO at 800.882.1896 or www.eproinc.com.

This product was formally known as Pre-tak by Kingfield Construction Products.

epro

PreTak

Physical Property	Test Method	Value
Material		HDPE
Color		White
Thickness		46 Mil
Resistance to Hydrostatic Head	ASTM D 751	431 ft (131 m)
Tensile Strength, Film	ASTM D 412	4742 psi (32.7 MPa) Force
Elongation	ASTM D 412	722%
Puncture Resistance	ASTM E 154	276 lbs (1227 N)
Resistance to Lateral Water Migration	ASTM D 5385	Pass at 231 ft (71 m) of HH pressure
Peel Adhesion to Concrete	ASTM D 903	23 lbs/in. (4028 N/m)
Permeance to Water Vapor Transmission	ASTM E 96, method B	0.087 perms (4.97 ng/(Pa x s x m2))
Bonded Seam Strength (Heat Weld)	ASTM D 6392	Pass (Break in Sheet)
Dead Load Seam Strength (Heat Weld)*	ASTM D 751	Pass
Microorganism Resistance (Soil Burial)*	ASTM D 4068	Pass
Methane Permeability*	ASTM D 1434	Pass
Oil Resistance*	ASTM D 543	Pass
Heat Resistance*	ASTM D 4068	Pass
Environmental Stress Cracking*	ASTM D 1693	Pass

*Tested to City of Los Angeles Department of Building and Safety Methane Testing Criteria.

Dimensions: Standard: 3’-11” x 65’-6” (1.2 m x 20 m), XL: 7’-10” x 65’-6” (2.4 m x 20 m)
Weight: Standard: 75 lbs (34 kg), XL: 150 lbs (68 kg)

e.drain 6000

Product Description

Basic Use: e.drain 6000 is applied in negative side applications to blindside shoring walls, in positive side applications to over excavated walls, and over plaza decks. e.drain 6000 prefabricated drainage composite is designed to protect the E.Series system assembly, while effectively eliminating the buildup and ponding of water against the membrane assembly.

Composition: e.drain 6000 features a lightweight three-dimensional, high-compressive strength polypropylene core and bonded non-woven geotextile fabric. The bonded filter fabric allows water to pass freely into the molded drain while preventing soil particles from entering and clogging the core structure.

Benefits

- Provides extremely high compressive strength to meet a wide variety of project conditions
- Polypropylene provides greater chemical resistance than traditional polystyrene
- Maintains flexibility in freezing temperatures

Limitations

- Long-term UV exposure is not recommended

Technical Data

Properties: See physical properties table

Coverages: 6’ x 50’ roll covers 300 square feet; 8’ x 50’ roll covers 400 square feet, not including overlaps or waste

Specification Writer: Contact EPRO before writing specifications on this product. E.Series system assemblies should be reviewed in order to meet project specific site conditions.

Installation

Preparation: Please refer to manufacturer’s specifications for substrate requirements. Rolls should be inspected for cosmetic damage prior to application. Substrate must be inspected prior to application to make certain it is in accordance with manufacturer’s requirements.

Application: Please refer to manufacturer’s specifications. Drainage panels may run horizontally or vertically. In blindside shoring applications, secure e.drain to shoring using 2-inch flat washer fasteners every 24 inches on center on seams and terminations and a minimum of every 48 inches on center in the field.

Availability and Packaging

Contact EPRO sales representative for local distributors or authorized applicators (www.eproinc.com).

Roll: 6' x 50', 8' X 50'

Weight: 6' rolls = 64 lbs, 8' rolls = 81 lbs

Warranty

Limited Warranty: EPRO Services, Inc. believes to the best of its knowledge that performance tables are accurate and reliable. EPRO warrants this product to be free from defects. EPRO makes no other warranties with respect to this product, express or implied, including without limitation the implied warranties of MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. EPRO’s liability shall be limited in all events to supplying sufficient product to retreat the specific areas to which defective product has been applied. EPRO shall have no other liability, including liability for incidental or resultant damages, whether due to breach of warranty or negligence. This warranty may not be modified or extended by representatives of EPRO or its distributors.

Equipment

Secure with shot pins using power-actuated fastener or by hand.

Technical Services and Information

Complete technical services and information are available by contacting EPRO at 800.882.1896 or www.eproinc.com.

This product was formally known as Ecodrain-S6000.

e.drain 6000

Typical Physical Properties

Physical Property	Test Method	Value
	Dimpled Core	
Core Material		Polypropylene
Color		Black
Dimple Height	ASTM D1777	0.4" (10.16 mm)
Compressive Strength	ASTM D1621	16,500 psf (790 kN/m²)
Flow rate	ASTM D4716	21 gal/min/ft
	Filter Fabric	
Grab Tensile	ASTM D4632	100 lbs
CBR Puncture Resistance	ASTM D6241	250 lbs
Apparent Operating Size	ASTM D4751	70 US Sieve (.0212mm)
Water Flow Rate	ASTM D4491	140 gpm/ft² (5704 l/min/m²)
UV Resistance	ASTM D4355	70% (500 hrs)

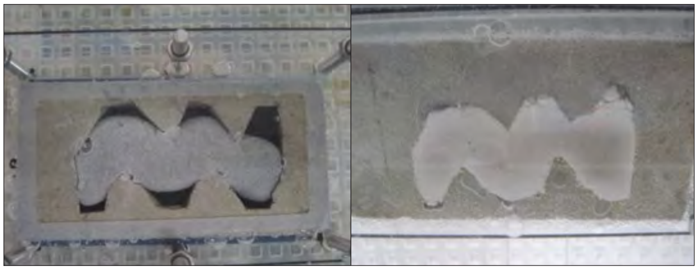
Dimensions: 6' x 50', 8' X 50'
Weight: 6' rolls = 64 lbs, 8' rolls = 81 lbs

BENTOTAK

Delayed-swell hydrophilic polymer modified bentonite waterstop strip
Self-adhesive, swelling, water tight for construction joints and penetrations

BentoTak self-adhesive water stop strip

BentoTak is a self-adhesive, delayed swell hydrophilic polymer modified bentonite waterstop strip specially blended from the highest grade Wyoming sodium bentonite and mineral oils. Suitable for application in construction joints and around penetrations, after wetting **BentoTak's** self adhesive film, the waterstop strip will adhere and conform to the substrate without the use of additional adhesives or mechanical fastening. **BentoTak** is not only effective in fresh water hydrostatic conditions, but also salt water and contaminated soils conditions.



Day 1 Day 4

4 days post submersion demonstrates BenoTak's superior hydrophilic swelling ability to seal and prevent the passage of water.

Productive and effective

- **Self-adhesive coating.** Application is fast and simple. No need for mechanical fastening or adhesives. BentoTak's water soluble adhesive coating makes application as easy as **"Dip it and Stick it."**
- **Hydrophilic swelling ability.** Unlike typical rubber gasket style water stops, BentoTak's hydrophilic swelling bentonite infiltrates and fills gaps and cracks in concrete to stop the passage of water.
- **Naturally chemically resistant.** As a bentonite based product, BentoTak is naturally resistant to many hydrocarbons and organic solvents.
- **Adheres to multiple substrates.** Pliable physical characteristic makes BentoTak adhere and conform well to rough substrates reducing surface prep and speeding application.
- **Rain and ponding water resistant.** Unlike most bentonite based waterstops, BentoTak's delayed swell bentonite polymer blend can withstand up to 7-days of ponding water.

epro

EPRO Services Inc. Kansas City, MO 64129
www.eproinc.com tel 800.882.1896

e.stop gu

Product Description

Basic Use: e.stop gu is a self-adhering gunnable expanding waterstop paste designed to stop water infiltration through cast-in-place concrete at construction joints and penetrations. It expands upon contact with water to form a positive seal against the concrete. The key to e.stop gu's effectiveness is that it is highly expansive, which seals and fills voids in cracks and concrete, and is easy to apply using caulking equipment.

e.stop gu can be applied over rough and smooth concrete, steel piles, dowels and Nelson Studs, and on iron or PVC pipes.

For shotcrete applications, e.stop gu requires a double layer application with a minimum 1-inch separation.

Composition: e.stop gu is a gray hydrophilic expanding urethane waterstop sealant.

Benefits

- Active swelling waterstop is fully encased in concrete to seal off water ingress.
- Self-adhering over concrete, iron, steel, and PVC.
- Fast and easy installation.
- Conforms to irregular surfaces.
- Seals around pipe penetrations.
- Ideal when pouring against existing concrete.
- High resistance to hydrostatic pressure.

Limitations

- Not an expansion joint sealant.
- It is designed for structural concrete with a minimum of 2,600 psi compressive strength.
- Requires a minimum of 3-inch (75 mm) of concrete coverage depending on the size of the bead used.
- Must be fully cured before concrete pour.
- Not resistant to pre-hydration.

Technical Data

Properties: See physical properties table.

Coverages: Coverage is dependent on the size of application bead. Applied material skins over after two hours and moisture cures in ten hours.

Minimum bead size and estimated linear coverage:

- 1/2" x 1/2": 6'-6" (2 m)
- 3/8" x 3/4": 5'-11" (1.8 m)

Storage and Handling: Store raised off the floor, away from moisture and sun, between 55-80°F (13-27°C).

Shelf Life: 12 months.

Specification Writer: Contact EPRO before writing specifications on this product. EPRO System selection should be reviewed in order to meet project specific site conditions.

Installation

Preparation: Please refer to manufacturer's specifications for substrate requirements. Tubes should be inspected for cosmetic damage prior to application.

Application: Please refer to manufacturer's specifications. Substrate Preparation: Wipe substrates to receive e.stop gu clean to remove any dirt, dust, or moisture. Clean the surface of penetrations or protrusions with a wire brush to remove dirt, dust, rust, and loose particles. Surface must be free of frost or ice. No priming is necessary.

Installation: e.stop gu is used as a waterstop for penetrations, piles, dowels, and all concrete construction joints.

Availability and Packaging

Contact EPRO sales representative for local distributors or authorized applicators (www.eproinc.com).

Tube Size: 10.8 oz (320 ml), 0.68 lbs (0.31 kg)
Case Size: 24 tubes, 16.2 lbs (7.35 kg)

Warranty

Limited Warranty: EPRO Services, Inc. believes to the best of its knowledge that performance tables are accurate and reliable. EPRO warrants this product to be free from defects. EPRO makes no other warranties with respect to this product, express or implied, including without limitation the implied warranties of MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. EPRO's liability shall be limited in all events to supplying sufficient product to retreat the specific areas to which defective product has been applied. EPRO shall have no other liability, including liability for incidental or resultant damages, whether due to breach of warranty or negligence. This warranty may not be modified or extended by representatives of EPRO or its distributors.

Equipment

Caulking gun (10.8 oz. tube capactiy).

Technical Services and Information

Complete technical services and information are available by contacting EPRO at 800.882.1896 or www.eproinc.com.

This product was formally known as SepaSeal SH-100 by Kingfield Construction Products.

Physical Properties	
Hydrostatic Head Resistance	
1/2 x 1/2	100 feet (43 psi / 30.5 m)
3/8 x 3/4	150 feet (65 psi / 46 m)

PreTape D

Product Description

Basic Use: PreTape D is a seaming, detailing, and repair tape that is used for sandwich seam applications. PreTak seams and detailing patches are adhered to both sides of the tape to form a continuous and integral seal to the structure eliminating lateral water migration.

PreTape D is a double-sided thick adhesive tape formulated with an aggressive adhesive that bonds strongly to HDPE, PSA, metal, penetrations, protrusions, and detailing and repairing PreTak membranes and is protected with a release liner.

PreTape D can be used to seal seam overlaps, end laps, penetrations, details, damage to the membrane, adhere to soldier pile flanges, and more.

Composition: PreTape D is 15-mil (0.4 mm) tape comprised of a single layer of aggressive adhesive protected with a release liner.

Benefits

- Dual sided adhesive tape for high strength sandwich seams and penetration detailing.
- Forms a continuous adhesive bond to prevent lateral water migration.
- Chemical resistant - effective in most types of soils, including hydrocarbon-laden soils.
- Strong HDPE adhesive prevents seam popping due to environmental exposure.
- Easy to apply, fully-adhered, watertight adhesive seams .
- Provides a barrier to water, moisture, gas, and vapor.
- Flexible and easily applied for detailing and seaming.

Limitations

- Surfaces must be clean and dry.
- Do not leave exposed for longer than 60 days.

Technical Data

Coverages: One roll covers 164 linear feet (50 linear meters), not including overlaps or waste.

Storage and Handling: Store raised off the floor away from sun and moisture, between 40-90°F (5-32°C).

Specification Writer: Contact EPRO before writing specifications on this product. PreTak HDPE Pre-Applied Waterproofing System should be reviewed in order to meet project specific site conditions.

Installation

Preparation: Please refer to manufacturer’s specifications for substrate requirements. Rolls should be inspected for cosmetic damage prior to application.

Application: Please refer to manufacturer’s specifications.

Substrate Preparation: Wipe substrates to receive PreTape D clean to remove any dirt, dust, or moisture. Clean the surface of penetrations or protrusions with a wire brush to remove dirt, dust, rust, and loose particles.

Installation: Unroll the tape and adhere to the exposed PSA surface of the PreTak membrane or exposed surface of the penetration. The release liner protected top surface of the tape should face toward the lap seam or detail patch. Line the top sheet or patch over the tape and adhere to the tape by removing the release liner and use a heavy roller to maximize adhesion. Ensure the plastic release liner is removed from all areas of the applied PreTape D prior to the concrete pour.

Availability and Packaging

Contact EPRO sales representative for local distributors or authorized applicators (www.eproinc.com).

Roll Size: 15 mil (0.4 mm), 3.15” x 164’ (80 mm x 50 m), 6 lbs (2.7 kg)
Box Size: 12 rolls, 72 lbs (32.4 kg)

Warranty

Limited Warranty: EPRO Services, Inc. believes to the best of its knowledge that performance tables are accurate and reliable. EPRO warrants this product to be free from defects. EPRO makes no other warranties with respect to this product, express or implied, including without limitation the implied warranties of MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. EPRO’s liability shall be limited in all events to supplying sufficient product to retreat the specific areas to which defective product has been applied. EPRO shall have no other liability, including liability for incidental or resultant damages, whether due to breach of warranty or negligence. This warranty may not be modified or extended by representatives of EPRO or its distributors.

Equipment

Seaming: 4” heavy seam roller.

Technical Services and Information

Complete technical services and information are available by contacting EPRO at 800.882.1896 or www.eproinc.com.

This product was formally known as Pre-tak Tape DS by Kingfield Construction Products.

epro

PreTape

Product Description

Basic Use: PreTape is a seaming, detailing, and repair tape that is used for positive applications. Concrete is cast directly against the tape and the aggressive adhesive layers work together to form a continuous and integral seal to the structure eliminating lateral water migration.

PreTape is an HDPE reinforced tape with an aggressive adhesive that bonds strongly to HDPE, PSA, metal, PVC, and other subtrates. The top side of the tape is coated with PreTak's weather resistant pressure sensitive adhesive (PSA) and is designed to bond drectly to concrete.

PreTape can be used to reinforce manufacture adhesive seam overlaps, end laps, penetrations, details, damage to the membrane, adhere to soldier pile flanges, and more.

Composition: PreTape is a 15 mil (0.4 mm) triple layer tape comprised of a PSA coated HDPE reinforcement membrane with a tenacious adhesive protected with a release liner.

Benefits

- Dual sided adhesive tape: PSA for concrete adhesion, HDPE adhesive for seam and penetration detailing.
- PreTape forms a continuous adhesive bond to poured-in-place concrete to prevent lateral water migration.
- Strong HDPE adhesive prevents seam popping due to environmental exposure.
- PreTape is easy to apply and creates fully-adhered, watertight adhesive seams.
- PreTape is flexible and easily applied for detailing and seaming.

Limitations

- Surfaces must by clean and dry.
- Do not leave exposed for longer than 60 days.

Technical Data

Coverages: One roll covers 164 linear feet (50 linear meters), not including overlaps or waste.

Storage and Handling: Store raised off the floor away from sun and moisture, between 40-90°F (5-32°C).

Specification Writer: Contact EPRO before writing specifications on this product. PreTak HDPE Pre-Applied Waterproofing System should be reviewed in order to meet project specific site conditions.

Installation

Preparation: Please refer to manufacturer's specifications for substrate requirements. Rolls should be inspected for cosmetic damage prior to application.

Application: Please refer to manufacturer's specifications.

Substrate Preparation: Wipe substrates to receive PreTape clean to remove any dirt, dust, or moisture. Clean the surface of penetrations or protrusions with a wire brush to remove dirt, dust, rust, and loose particles.

Installation: Unroll the tape and adhere centered along the top of the lap seam, to the exposed PSA surface to the PreTak detail patch, or penetration. The release liner protected PSA top surface of the tape should face toward the concrete pour. The use of heavy rollers is required to maximize adhesion. Remove the release liner during application and ensure the plastic release liner is removed from all areas of the applied PreTape prior to the concrete pour.

Availability and Packaging

Contact EPRO sales representative for local distributors or authorized applicators (www.eproinc.com).

Roll Size: 15 mil (0.4 mm), 4.7" x 164' (120 mm x 50 m), 3.75 lbs (1.7 kg)
Box Size: 8 rolls, 30 lbs (13.6 kg)

Warranty

Limited Warranty: EPRO Services, Inc. believes to the best of its knowledge that performance tables are accurate and reliable. EPRO warrants this product to be free from defects. EPRO makes no other warranties with respect to this product, express or implied, including without limitation the implied warranties of MERCHANTABILITY OR FITNESS FOR PARTICULAR PURPOSE. EPRO's liability shall be limited in all events to supplying sufficient product to retreat the specific areas to which defective product has been applied. EPRO shall have no other liability, including liability for incidental or resultant damages, whether due to breach of warranty or negligence. This warranty may not be modified or extended by representatives of EPRO or its distributors.

Equipment

Seaming: 4" heavy seam roller.

Technical Services and Information

Complete technical services and information are available by contacting EPRO at 800.882.1896 or www.eproinc.com.

This product was formally known as Pre-tak Tape by Kingfield Construction Products.

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EPRO Services Inc.
(800) 882-1896
eproinc.com

August 26, 2022

Jerry Sawetz
The Riley Group
17522 Bothell Way NE
Bothell, WA 98011

Re: Roystone – PreTak Chemical Resistance

Dear Jerry,

This letter is in response to your inquiry regarding the level of vapor intrusion protection provided by the PreTak chemical vapor barrier/waterproofing system installed at the Roystone Redevelopment project beneath the parking garage floor slab and along the sides of all the parking garage walls.

PreTak provides excellent vapor intrusion protection against common contaminants of concern found soil and groundwater at contaminated sites. Third-party testing demonstrates that diffusion rates for PreTak are extremely low; reported PCE diffusion rates after 120 days at a challenge concentration of 90,800,000 ug/m^3 results in a diffusion rate of 1.1×10^{-14} m^2/sec.

When inputting a diffusion rate of 1.1×10^{-14} m^2/sec, this diffusion rate into the Johnson and Ettinger model or EPA VISL calculator, the result will indicate that PreTak will reduce indoor air concentrations of contaminants to safe levels.

We trust this will meet your needs; please contact us with any questions.

Sincerely,

Peter Grant
Vice President of Marketing & Sales

DATA ENTRY SHEET

SL-SCREEN
Version 3.0; 04/03

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES ☐

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES ☒

ENTER Chemical CAS No. (numbers only, no dashes)	**ENTER** Initial soil conc., C_R (µg/kg)	Chemical
110543	1.57E+07	Hexane

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	**ENTER** Depth below grade to top of contamination, L_t (cm)	**ENTER** Average soil temperature, T_S (°C)	**ENTER** Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	**ENTER** User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	15	20			1.00E-08

MORE ↓

ENTER Vandose zone SCS soil type Lookup Soil Parameters	**ENTER** Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	**ENTER** Vadose zone soil total porosity, n^V (unitless)	**ENTER** Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	**ENTER** Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)	**ENTER** Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
	1.5	0.43	0.3	0.002	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	**ENTER** Averaging time for noncarcinogens, AT_{NC} (yrs)	**ENTER** Exposure duration, ED (yrs)	**ENTER** Exposure frequency, EF (days/yr)	**ENTER** Target risk for carcinogens, TR (unitless)	**ENTER** Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based soil concentration.

END

INTERMEDIATE CALCULATIONS SHEET

HEXANE (TPH) MODEL OUTPUT

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
1	0.130	#N/A	#N/A	#N/A	1.00E-08	4,000	1.57E+07	2.78E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	4.00E-04	15	7,603	1.34E+00	5.55E+01	1.78E-04	1.10E-10	1

Convection path length, L_p (cm)	Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, exp(Pe^f) (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)
15	8.67E-02	1.71E+11	0.10	8.33E+01	1.10E-10	4.00E+02	#NUM!	3.95E-10	6.76E+01

Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
NA	2.0E-01

END

DATA ENTRY SHEET

SL-SCREEN
Version 3.0; 04/03

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES ☐

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES ☒ X

ENTER Chemical CAS No. (numbers only, no dashes)	**ENTER** Initial soil conc., C_R (μg/kg)	Chemical
71432	2.00E+03	Benzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	**ENTER** Depth below grade to top of contamination, L_t (cm)	**ENTER** Average soil temperature, T_S (^{o}C)	**ENTER** Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	**ENTER** User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	15	20			1.00E-08

MORE ↓

ENTER Vandose zone SCS soil type Lookup Soil Parameters	**ENTER** Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	**ENTER** Vadose zone soil total porosity, n^V (unitless)	**ENTER** Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	**ENTER** Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)	**ENTER** Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
	1.5	0.43	0.3	0.002	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	**ENTER** Averaging time for noncarcinogens, AT_{NC} (yrs)	**ENTER** Exposure duration, ED (yrs)	**ENTER** Exposure frequency, EF (days/yr)	**ENTER** Target risk for carcinogens, TR (unitless)	**ENTER** Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based soil concentration.	

END

INTERMEDIATE CALCULATIONS SHEET

BENZENE MODEL OUTPUT

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (μg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
1	0.130	#N/A	#N/A	#N/A	1.00E-08	4,000	2.00E+03	2.78E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	4.00E-04	15	8,019	4.39E-03	1.83E-01	1.78E-04	1.10E-10	1

Convection path length, L_p (cm)	Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)
15	1.18E-01	1.10E+06	0.10	8.33E+01	1.10E-10	4.00E+02	#NUM!	3.95E-10	4.33E-04

Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
7.8E-06	NA

END

DATA ENTRY SHEET

SL-SCREEN
Version 3.0; 04/03

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES ☐

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES ☒ X

ENTER Chemical CAS No. (numbers only, no dashes)	**ENTER** Initial soil conc., C_R (µg/kg)	Chemical
108883	5.20E+04	Toluene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	**ENTER** Depth below grade to top of contamination, L_t (cm)	**ENTER** Average soil temperature, T_S (°C)	**ENTER** Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	**ENTER** User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	15	20			1.00E-08

MORE ↓

ENTER Vandose zone SCS soil type Lookup Soil Parameters	**ENTER** Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	**ENTER** Vadose zone soil total porosity, n^V (unitless)	**ENTER** Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	**ENTER** Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)	**ENTER** Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
	1.5	0.43	0.3	0.002	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	**ENTER** Averaging time for noncarcinogens, AT_{NC} (yrs)	**ENTER** Exposure duration, ED (yrs)	**ENTER** Exposure frequency, EF (days/yr)	**ENTER** Target risk for carcinogens, TR (unitless)	**ENTER** Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1

Used to calculate risk-based soil concentration.

END

INTERMEDIATE CALCULATIONS SHEET

TOLUENE MODEL OUTPUT

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
1	0.130	#N/A	#N/A	#N/A	1.00E-08	4,000	5.20E+04	2.78E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	4.00E-04	15	9,045	5.10E-03	2.12E-01	1.78E-04	1.10E-10	1

Convection path length, L_p (cm)	Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (µg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (µg/m^3)
15	3.64E-01	1.89E+07	0.10	8.33E+01	1.10E-10	4.00E+02	#NUM!	3.95E-10	7.49E-03

Unit risk factor, URF (µg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
NA	4.0E-01

END

DATA ENTRY SHEET

SL-SCREEN
Version 3.0; 04/03

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES ☐

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES ☒ X

ENTER Chemical CAS No. (numbers only, no dashes)	**ENTER** Initial soil conc., C_R (μg/kg)	Chemical
100414	4.10E+04	Ethylbenzene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	**ENTER** Depth below grade to top of contamination, L_t (cm)	**ENTER** Average soil temperature, T_S (°C)	**ENTER** Vadose zone SCS soil type (used to estimate soil vapor permeability)	OR	**ENTER** User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	15	20			1.00E-08

MORE ↓

ENTER Vandose zone SCS soil type Lookup Soil Parameters	**ENTER** Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	**ENTER** Vadose zone soil total porosity, n^V (unitless)	**ENTER** Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	**ENTER** Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)	**ENTER** Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
	1.5	0.43	0.3	0.002	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	**ENTER** Averaging time for noncarcinogens, AT_{NC} (yrs)	**ENTER** Exposure duration, ED (yrs)	**ENTER** Exposure frequency, EF (days/yr)	**ENTER** Target risk for carcinogens, TR (unitless)	**ENTER** Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based soil concentration.	

END

INTERMEDIATE CALCULATIONS SHEET
ETHYLBENZENE MODEL OUTPUT

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (μg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
1	0.130	#N/A	#N/A	#N/A	1.00E-08	4,000	4.10E+04	2.78E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	4.00E-04	15	10,040	5.89E-03	2.45E-01	1.78E-04	1.10E-10	1

Convection path length, L_p (cm)	Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} (μg/m^3)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ (μg/m^3)
15	7.26E-01	1.06E+07	0.10	8.33E+01	1.10E-10	4.00E+02	#NUM!	3.95E-10	4.19E-03

Unit risk factor, URF (μg/m^3)$^{-1}$	Reference conc., RfC (mg/m^3)
1.1E-06	1.0E+00

END

DATA ENTRY SHEET

SL-SCREEN
Version 3.0; 04/03

Reset to Defaults

CALCULATE RISK-BASED SOIL CONCENTRATION (enter "X" in "YES" box)

YES ☐

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL SOIL CONCENTRATION (enter "X" in "YES" box and initial soil conc. below)

YES ☒ X

ENTER Chemical CAS No. (numbers only, no dashes)	**ENTER** Initial soil conc., C_R (µg/kg)	Chemical
95476	1.10E+05	o-Xylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (15 or 200 cm)	**ENTER** Depth below grade to top of contamination, L_t (cm)	**ENTER** Average soil temperature, T_S (^{o}C)	**ENTER** Vadose zone SCS soil type (used to estimate soil vapor permeability)		**ENTER** User-defined vadose zone soil vapor permeability, k_v (cm^2)
15	15	20		OR	1.00E-08

MORE ↓

ENTER Vandose zone SCS soil type Lookup Soil Parameters	**ENTER** Vadose zone soil dry bulk density, ρ_b^A (g/cm^3)	**ENTER** Vadose zone soil total porosity, n^V (unitless)	**ENTER** Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)	**ENTER** Vadose zone soil organic carbon fraction, f_{oc}^V (unitless)	**ENTER** Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
	1.5	0.43	0.3	0.002	5

MORE ↓

ENTER Averaging time for carcinogens, AT_C (yrs)	**ENTER** Averaging time for noncarcinogens, AT_{NC} (yrs)	**ENTER** Exposure duration, ED (yrs)	**ENTER** Exposure frequency, EF (days/yr)	**ENTER** Target risk for carcinogens, TR (unitless)	**ENTER** Target hazard quotient for noncarcinogens, THQ (unitless)
70	30	30	350	1.0E-06	1
				Used to calculate risk-based soil concentration.	

END

INTERMEDIATE CALCULATIONS SHEET

XYLENES MODEL OUTPUT

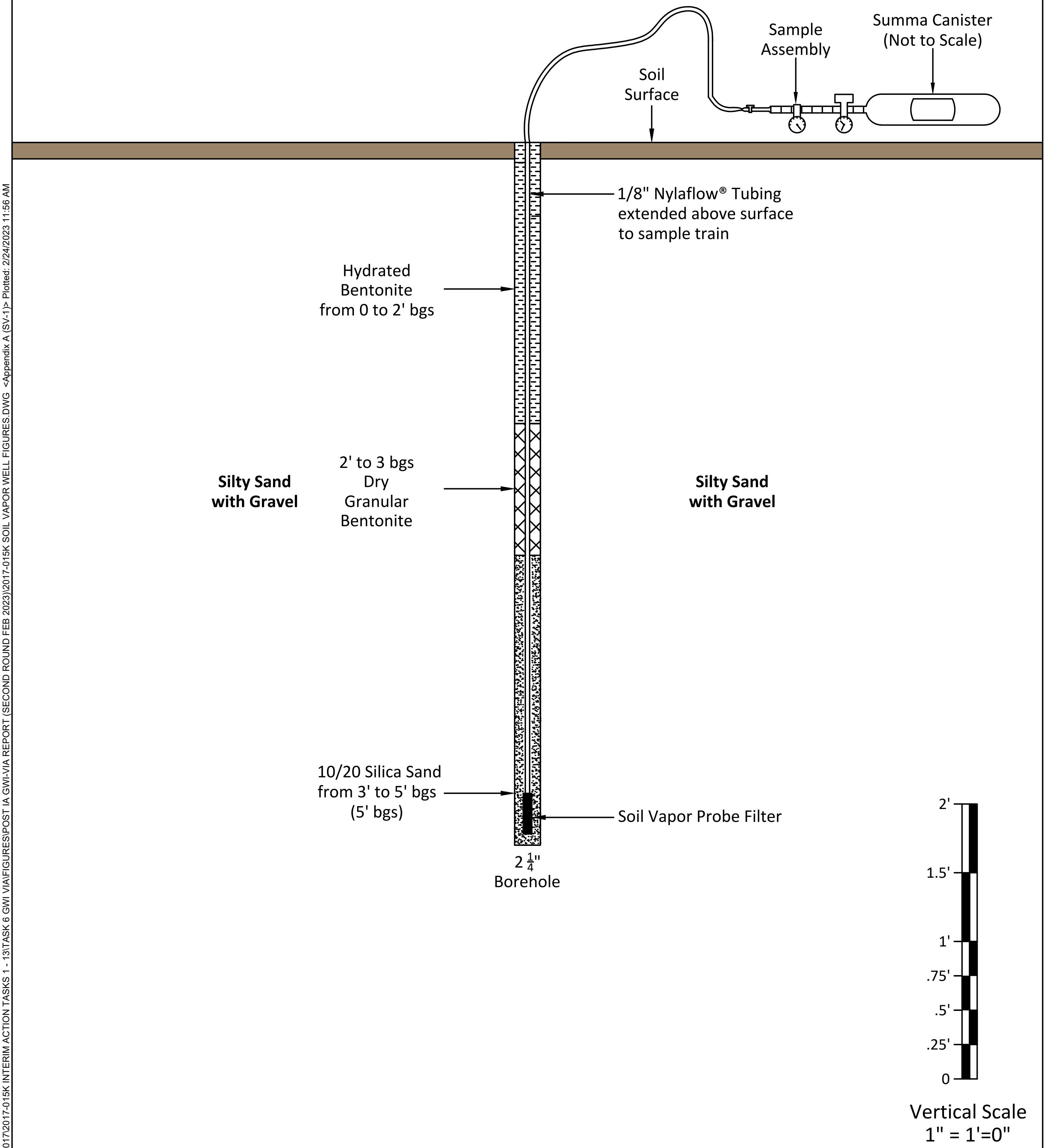
Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Floor-wall seam perimeter, X_{crack} (cm)	Initial soil concentration used, C_R (µg/kg)	Bldg. ventilation rate, $Q_{building}$ (cm^3/s)
1	0.130	#N/A	#N/A	#N/A	1.00E-08	4,000	1.10E+05	2.78E+05

Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. soil temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. soil temperature, H_{TS} ($atm\text{-}m^3/mol$)	Henry's law constant at ave. soil temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Diffusion path length, L_d (cm)
1.00E+06	4.00E-04	15	10,291	3.85E-03	1.60E-01	1.78E-04	1.10E-10	1

Convection path length, L_p (cm)	Soil-water partition coefficient, K_d (cm^3/g)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)
15	7.26E-01	1.87E+07	0.10	8.33E+01	1.10E-10	4.00E+02	#NUM!	3.95E-10	7.40E-03

Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
NA	7.0E+00

END



RILEYGROUP

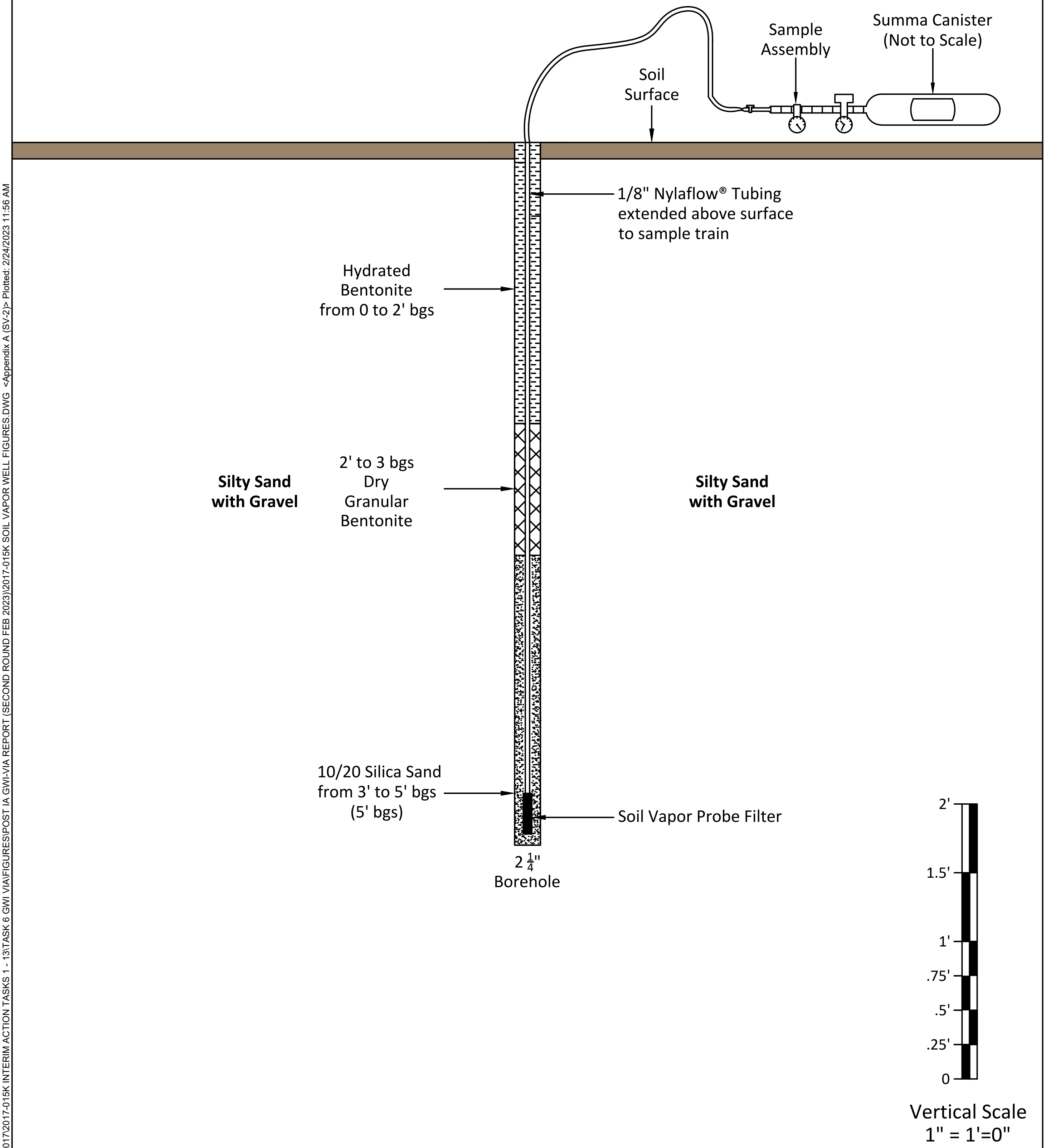
Corporate Office
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

Roystone Redevelopment		Figure I-1
RGI Project Number 2017-015K	SV-1 Soil Vapor Probe Construction	Date Drawn: 03/2023

Address: 631 Queen Anne Avenue North, Seattle, Washington 98109

\\RGI4\DATA\PROJECTS\2017\2017-015K INTERIM ACTION TASKS 1 - 13\TASK 6 GWI VIA\FIGURES\POST IA GWI-VIA REPORT (SECOND ROUND FEB 2023)\2017-015K SOIL VAPOR WELL FIGURES.DWG <Appendix A (SV-1)> Plotted: 2/24/2023 11:56 AM

\\RGI4\DATA\PROJECTS\2017\2017-015K INTERIM ACTION TASKS 1 - 13\TASK 6 GWI VIA\FIGURES\POST IA GWI-VIA REPORT (SECOND ROUND FEB 2023)\2017-015K SOIL VAPOR WELL FIGURES.DWG <Appendix A (SV-2)> Plotted: 2/24/2023 11:56 AM



Corporate Office
17522 Bothell Way Northeast
Bothell, Washington 98011
Phone: 425.415.0551
Fax: 425.415.0311

Roystone Redevelopment		Figure I-2
RGI Project Number 2017-015K	SV-2 Soil Vapor Probe Construction	Date Drawn: 03/2023
Address: 631 Queen Anne Avenue North, Seattle, Washington 98109		

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

James E. Bruya, Ph.D.
Yelena Aravkina, M.S.
Michael Erdahl, B.S.
Vineta Mills, M.S.
Eric Young, B.S.

5500 4th Avenue South
Seattle, WA 98108
(206) 285-8282
fbi@isomedia.com
www.friedmanandbruya.com

December 19, 2022

Jerry Sawetz, Project Manager
The Riley Group, Inc.
17522 Bothell Way NE
Bothell, WA 98011

Dear Mr Sawetz:

Included are the results from the testing of material submitted on December 7, 2022 from the Roystone Redevelopment 2017.015K.6A, F&BI 212098 project. There are 10 pages included in this report.

We appreciate this opportunity to be of service to you and hope you will call if you have any questions.

Sincerely,

FRIEDMAN & BRUYA, INC.

Michael Erdahl
Project Manager

Enclosures
TRG1219R.DOC

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

CASE NARRATIVE

This case narrative encompasses samples received on December 7, 2022 by Friedman & Bruya, Inc. from the The Riley Group Roystone Redevelopment 2017.015K.6A, F&BI 212098 project. Samples were logged in under the laboratory ID's listed below.

Laboratory ID	The Riley Group
212098 -01	SV-1
212098 -02	SV-2

The samples were sent to Fremont Analytical for major gasses analysis. The report is enclosed.

All quality control requirements were acceptable.

Analysis For Volatile Compounds By Method MA-APH

Client Sample ID:	SV-1	Client:	The Riley Group
Date Received:	12/07/22	Project:	2017.015K.6A, F&BI 212098
Date Collected:	12/07/22	Lab ID:	212098-01 1/5.1
Date Analyzed:	12/09/22	Data File:	120821.D
Matrix:	Air	Instrument:	GCMS7
Units:	ug/m3	Operator:	bat

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
4-Bromofluorobenzene	90	70	130

Compounds:	Concentration ug/m3
APH EC5-8 aliphatics	<380
APH EC9-12 aliphatics	<130
APH EC9-10 aromatics	<130

Analysis For Volatile Compounds By Method MA-APH

Client Sample ID:	SV-2	Client:	The Riley Group
Date Received:	12/07/22	Project:	2017.015K.6A, F&BI 212098
Date Collected:	12/07/22	Lab ID:	212098-02 1/5.7
Date Analyzed:	12/09/22	Data File:	120822.D
Matrix:	Air	Instrument:	GCMS7
Units:	ug/m3	Operator:	bat

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
4-Bromofluorobenzene	87	70	130

Compounds:	Concentration ug/m3
APH EC5-8 aliphatics	<430
APH EC9-12 aliphatics	150
APH EC9-10 aromatics	<140

Analysis For Volatile Compounds By Method MA-APH

Client Sample ID:	Method Blank	Client:	The Riley Group
Date Received:	Not Applicable	Project:	2017.015K.6A, F&BI 212098
Date Collected:	Not Applicable	Lab ID:	02-2862 MB
Date Analyzed:	12/08/22	Data File:	120811.D
Matrix:	Air	Instrument:	GCMS7
Units:	ug/m3	Operator:	bat

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
4-Bromofluorobenzene	87	70	130

Compounds:	Concentration ug/m3
APH EC5-8 aliphatics	<75
APH EC9-12 aliphatics	<25
APH EC9-10 aromatics	<25

Analysis For Volatile Compounds By Method TO-15

Client Sample ID:	SV-1	Client:	The Riley Group
Date Received:	12/07/22	Project:	2017.015K.6A, F&BI 212098
Date Collected:	12/07/22	Lab ID:	212098-01 1/5.1
Date Analyzed:	12/09/22	Data File:	120821.D
Matrix:	Air	Instrument:	GCMS7
Units:	ug/m3	Operator:	bat

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
4-Bromofluorobenzene	89	70	130

Compounds:	Concentration ug/m3	Concentration ppbv
Benzene	3.0	0.93
Toluene	<96	<25
Ethylbenzene	<2.2	<0.51
m,p-Xylene	<4.4	<1
o-Xylene	<2.2	<0.51
Naphthalene	<1.3	<0.25

Analysis For Volatile Compounds By Method TO-15

Client Sample ID:	SV-2	Client:	The Riley Group
Date Received:	12/07/22	Project:	2017.015K.6A, F&BI 212098
Date Collected:	12/07/22	Lab ID:	212098-02 1/5.7
Date Analyzed:	12/09/22	Data File:	120822.D
Matrix:	Air	Instrument:	GCMS7
Units:	ug/m3	Operator:	bat

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
4-Bromofluorobenzene	86	70	130

Compounds:	Concentration ug/m3	Concentration ppbv
Benzene	<1.8	<0.57
Toluene	<110	<28
Ethylbenzene	<2.5	<0.57
m,p-Xylene	<5	<1.1
o-Xylene	<2.5	<0.57
Naphthalene	<1.5	<0.28

Analysis For Volatile Compounds By Method TO-15

Client Sample ID:	Method Blank	Client:	The Riley Group
Date Received:	Not Applicable	Project:	2017.015K.6A, F&BI 212098
Date Collected:	Not Applicable	Lab ID:	02-2862 MB
Date Analyzed:	12/08/22	Data File:	120811.D
Matrix:	Air	Instrument:	GCMS7
Units:	ug/m3	Operator:	bat

Surrogates:	% Recovery:	Lower Limit:	Upper Limit:
4-Bromofluorobenzene	86	70	130

Compounds:	Concentration ug/m3	Concentration ppbv
Benzene	<0.32	<0.1
Toluene	<19	<5
Ethylbenzene	<0.43	<0.1
m,p-Xylene	<0.87	<0.2
o-Xylene	<0.43	<0.1
Naphthalene	<0.26	<0.05

Date of Report: 12/19/22
Date Received: 12/07/22
Project: Roystone Redevelopment 2017.015K.6A, F&BI 212098

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF AIR SAMPLES FOR VOLATILES BY METHOD MA-APH

Laboratory Code: 211388-01 1/4.9 (Duplicate)

Analyte	Reporting Units	Sample Result	Duplicate Result	RPD (Limit 30)
APH EC5-8 aliphatics	ug/m3	2,800	2,800	0
APH EC9-12 aliphatics	ug/m3	650	600	8
APH EC9-10 aromatics	ug/m3	<120	120	nm

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
APH EC5-8 aliphatics	ug/m3	67	76	70-130
APH EC9-12 aliphatics	ug/m3	67	99	70-130
APH EC9-10 aromatics	ug/m3	67	103	70-130

Date of Report: 12/19/22
Date Received: 12/07/22
Project: Roystone Redevelopment 2017.015K.6A, F&BI 212098

QUALITY ASSURANCE RESULTS FOR THE ANALYSIS OF AIR SAMPLES FOR VOLATILES BY METHOD TO-15

Laboratory Code: 211388-01 1/4.9 (Duplicate)

Analyte	Reporting Units	Sample Result	Duplicate Result	RPD (Limit 30)
Benzene	ug/m3	51	50	2
Toluene	ug/m3	200	200	0
Ethylbenzene	ug/m3	31	32	3
m,p-Xylene	ug/m3	110	110	0
o-Xylene	ug/m3	33	33	0
Naphthalene	ug/m3	<1.3	<1.3	nm

Laboratory Code: Laboratory Control Sample

Analyte	Reporting Units	Spike Level	Percent Recovery LCS	Acceptance Criteria
Benzene	ug/m3	43	112	70-130
Toluene	ug/m3	51	108	70-130
Ethylbenzene	ug/m3	59	106	70-130
m,p-Xylene	ug/m3	120	108	70-130
o-Xylene	ug/m3	59	111	70-130
Naphthalene	ug/m3	71	81	70-130

Data Qualifiers & Definitions

a - The analyte was detected at a level less than five times the reporting limit. The RPD results may not provide reliable information on the variability of the analysis.

b - The analyte was spiked at a level that was less than five times that present in the sample. Matrix spike recoveries may not be meaningful.

ca - The calibration results for the analyte were outside of acceptance criteria. The value reported is an estimate.

c - The presence of the analyte may be due to carryover from previous sample injections.

cf - The sample was centrifuged prior to analysis.

d - The sample was diluted. Detection limits were raised and surrogate recoveries may not be meaningful.

dv - Insufficient sample volume was available to achieve normal reporting limits.

f - The sample was laboratory filtered prior to analysis.

fb - The analyte was detected in the method blank.

fc - The analyte is a common laboratory and field contaminant.

hr - The sample and duplicate were reextracted and reanalyzed. RPD results were still outside of control limits. Variability is attributed to sample inhomogeneity.

hs - Headspace was present in the container used for analysis.

ht – The analysis was performed outside the method or client-specified holding time requirement.

ip - Recovery fell outside of control limits due to sample matrix effects.

j - The analyte concentration is reported below the lowest calibration standard. The value reported is an estimate.

J - The internal standard associated with the analyte is out of control limits. The reported concentration is an estimate.

jl - The laboratory control sample(s) percent recovery and/or RPD were out of control limits. The reported concentration should be considered an estimate.

js - The surrogate associated with the analyte is out of control limits. The reported concentration should be considered an estimate.

lc - The presence of the analyte is likely due to laboratory contamination.

L - The reported concentration was generated from a library search.

nm - The analyte was not detected in one or more of the duplicate analyses. Therefore, calculation of the RPD is not applicable.

pc - The sample was received with incorrect preservation or in a container not approved by the method. The value reported should be considered an estimate.

ve - The analyte response exceeded the valid instrument calibration range. The value reported is an estimate.

vo - The value reported fell outside the control limits established for this analyte.

x - The sample chromatographic pattern does not resemble the fuel standard used for quantitation.

212098

SAMPLE CHAIN OF CUSTODY

12/07/22

Report To Jerry Sawetz
Company The Riley Group
Address 17522 Bothell way NE
City, State, ZIP Bothell, Wa
Phone 425-415-0551 ext 325 Email Jsawetz@Riley-group.com

SAMPLERS (*signature*) Cole N

PROJECT NAME & ADDRESS Royslane Redevelopment

PO # 2017-015K-6A

NOTES:

INVOICE TO RGI

Page # 1 of 1

TURNAROUND TIME
[✓ Standard]
RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
Default:Clean following final report delivery
Hold (Fee may apply):

SAMPLE INFORMATION / ANALYSIS REQUESTED

Sample Name	Lab ID	Canister ID	Flow Cont. ID	Reporting Level: IA=Indoor Air SG=Soil Gas (Circle One)	Date Sampled	Initial Vac. ("Hg)	Field Initial Time	Final Vac. ("Hg)	Field Final Time	TO15 Full Scan	TO15 BTEXN	TO15 cVOCs	APH	Helium		Oxygen, Carbon dioxide, methane by EPA Method 3C	Notes
SV-1	01A-B	204		IA / [✓ SG]	12/7	29.5	10:55	5	11:01		X		X			X	Suma + 1 Tedlar
SV-2	02	299		IA / [✓ SG]		26.5	12:09	4.5	12:15		X		X			X	Suma + 1 Tedlar
				IA / SG													
				IA / SG													
				IA / SG													
				IA / SG													
				IA / SG													
				IA / SG													

Friedman & Bruya, Inc.
5500 4th Avenue South
Seattle, WA 98108
Ph. (206) 285-8282
Fax (206) 283-5044

SIGNATURE		PRINT NAME	COMPANY	DATE	TIME
Relinquished by	Cole Nelson	Cole Nelson	RGI	12/07	17:36
Received by		ANH PHAN	FBI	12/07/22	13:36
Relinquished by					
Received by:					

Samples received at 19 °C

FORMS\COC\COCTO-15.DOC

3600 Fremont Ave. N.
Seattle, WA 98103
T: (206) 352-3790
F: (206) 352-7178
info@fremontanalytical.com

Friedman & Bruya
Michael Erdahl
5500 4th Ave S
Seattle, WA 98108

RE: 212098
Work Order Number: 2212166

December 15, 2022

Attention Michael Erdahl:

Fremont Analytical, Inc. received 2 sample(s) on 12/8/2022 for the analyses presented in the following report.

Major Gases by EPA Method 3C

This report consists of the following:

- Case Narrative
- Analytical Results
- Applicable Quality Control Summary Reports
- Chain of Custody

All analyses were performed consistent with the Quality Assurance program of Fremont Analytical, Inc. Please contact the laboratory if you should have any questions about the results.

Thank you for using Fremont Analytical.

Sincerely,

Brianna Barnes
Project Manager

DoD-ELAP Accreditation #79636 by PJLA, ISO/IEC 17025:2017 and QSM 5.3 for Environmental Testing
ORELAP Certification: WA 100009 (NELAP Recognized) for Environmental Testing
Washington State Department of Ecology Accredited for Environmental Testing, Lab ID C910

Original

Date: *12/15/2022*

CLIENT: Friedman & Bruya
Project: 212098
Work Order: 2212166

Work Order Sample Summary

Lab Sample ID	Client Sample ID	Date/Time Collected	Date/Time Received
2212166-001	SV-1	12/07/2022 11:01 AM	12/08/2022 1:55 PM
2212166-002	SV-2	12/13/2022 1:00 PM	12/13/2022 2:24 PM

Note: If no "Time Collected" is supplied, a default of 12:00AM is assigned

Case Narrative

WO#: **2212166**
Date: **12/15/2022**

CLIENT: Friedman & Bruya
Project: 212098

I. SAMPLE RECEIPT:
Samples receipt information is recorded on the attached Sample Receipt Checklist.

II. GENERAL REPORTING COMMENTS:
Major gases are reported as % ratio of the Major Gases analyzed (Carbon dioxide, Carbon Monoxide, Methane, Nitrogen, Oxygen and Hydrogen).

The validity of the analytical procedures for which data is reported in this analytical report is determined by the Laboratory Control Sample (LCS). The LCS is processed with the samples to ensure method criteria are achieved throughout the entire analytical process.

III. ANALYSES AND EXCEPTIONS:
Exceptions associated with this report will be footnoted in the analytical results page(s) or the quality control summary page(s) and/or noted below.

Note: The estimated BTU calculation is based off of the methane result.

Qualifiers & Acronyms

Qualifiers:

* - Flagged value is not within established control limits
B - Analyte detected in the associated Method Blank
D - Dilution was required
E - Value above quantitation range
H - Holding times for preparation or analysis exceeded
I - Analyte with an internal standard that does not meet established acceptance criteria
J - Analyte detected below Reporting Limit
N - Tentatively Identified Compound (TIC)
Q - Analyte with an initial or continuing calibration that does not meet established acceptance criteria
S - Spike recovery outside accepted recovery limits
ND - Not detected at the Reporting Limit
R - High relative percent difference observed

Acronyms:

%Rec - Percent Recovery
CCB - Continued Calibration Blank
CCV - Continued Calibration Verification
DF - Dilution Factor
DUP - Sample Duplicate
HEM - Hexane Extractable Material
ICV - Initial Calibration Verification
LCS/LCSD - Laboratory Control Sample / Laboratory Control Sample Duplicate
MCL - Maximum Contaminant Level
MB or MBLANK - Method Blank
MDL - Method Detection Limit
MS/MSD - Matrix Spike / Matrix Spike Duplicate
PDS - Post Digestion Spike
Ref Val - Reference Value
REP - Sample Replicate
RL - Reporting Limit
RPD - Relative Percent Difference
SD - Serial Dilution
SGT - Silica Gel Treatment
SPK - Spike
Surr - Surrogate

Analytical Report

Work Order: **2212166**
Date Reported: **12/15/2022**

CLIENT: Friedman & Bruya
Project: 212098

Lab ID: 2212166-001
Collection Date: 12/7/2022 11:01:00 AM
Client Sample ID: **SV-1**
Matrix: SVE

Major Gases by EPA Method 3C

Batch ID: R80393 Analyst: SG

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Carbon Dioxide	ND	0.0500		%	1	12/9/2022 3:34:00 PM
Carbon Monoxide	ND	0.0500		%	1	12/9/2022 3:34:00 PM
Methane	ND	0.0500		%	1	12/9/2022 3:34:00 PM
Nitrogen	76.2	0.0500		%	1	12/9/2022 3:34:00 PM
Oxygen	23.7	0.0500		%	1	12/9/2022 3:34:00 PM
Hydrogen	ND	0.0500		%	1	12/9/2022 3:34:00 PM
BTU	ND			BTU/ft³	1	12/9/2022 3:34:00 PM

Lab ID: 2212166-002
Collection Date: 12/13/2022 1:00:00 PM
Client Sample ID: **SV-2**
Matrix: SVE

Major Gases by EPA Method 3C

Batch ID: R80521 Analyst: LB

Analyses	Result	RL	Qual	Units	DF	Date Analyzed
Carbon Dioxide	0.253	0.0990	D	%	1.98	12/15/2022 2:39:00 PM
Carbon Monoxide	ND	0.0990	D	%	1.98	12/15/2022 2:39:00 PM
Methane	ND	0.0990	D	%	1.98	12/15/2022 2:39:00 PM
Nitrogen	75.6	0.0990	D	%	1.98	12/15/2022 2:39:00 PM
Oxygen	24.2	0.0990	D	%	1.98	12/15/2022 2:39:00 PM
Hydrogen	ND	0.0990	D	%	1.98	12/15/2022 2:39:00 PM
BTU	ND		D	BTU/ft³	1.98	12/15/2022 2:39:00 PM

Work Order: 2212166
CLIENT: Friedman & Bruya
Project: 212098

QC SUMMARY REPORT

Major Gases by EPA Method 3C

Sample ID: **LCSB** SampType: **LCS** Units: **%** Prep Date: **12/9/2022** RunNo: **80393**
Client ID: **LCSW** Batch ID: **R80393** Analysis Date: **12/9/2022** SeqNo: **1661118**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Carbon Dioxide	100	0.0500	100.0	0	100	70	130				
Carbon Monoxide	101	0.0500	100.0	0	101	70	130				
Methane	100	0.0500	100.0	0	100	70	130				
Nitrogen	100	0.0500	100.0	0	100	70	130				
Oxygen	101	0.0500	100.0	0	101	70	130				
Hydrogen	96.3	0.0500	100.0	0	96.3	70	130				

Sample ID: **2212157-001AREP** SampType: **REP** Units: **%** Prep Date: **12/9/2022** RunNo: **80393**
Client ID: **BATCH** Batch ID: **R80393** Analysis Date: **12/9/2022** SeqNo: **1661114**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Carbon Dioxide	30.2	0.0500						30.14	0.0304	30	
Carbon Monoxide	ND	0.0500						0		30	
Methane	69.4	0.0500						69.44	0.0136	30	
Nitrogen	0.292	0.0500						0.2867	1.92	30	
Oxygen	0.122	0.0500						0.1276	4.21	30	
Hydrogen	ND	0.0500						0		30	
BTU	702							702.3	0.0136		

Sample ID: **2212166-001AREP** SampType: **REP** Units: **%** Prep Date: **12/9/2022** RunNo: **80393**
Client ID: **SV-1** Batch ID: **R80393** Analysis Date: **12/9/2022** SeqNo: **1661116**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Carbon Dioxide	ND	0.0500						0		30	
Carbon Monoxide	ND	0.0500						0		30	
Methane	ND	0.0500						0		30	
Nitrogen	76.3	0.0500						76.22	0.142	30	
Oxygen	23.6	0.0500						23.75	0.428	30	
Hydrogen	ND	0.0500						0		30	
BTU	ND							0	0		

Work Order: 2212166
CLIENT: Friedman & Bruya
Project: 212098

QC SUMMARY REPORT

Major Gases by EPA Method 3C

Sample ID: **LCS** SampType: **LCS** Units: **%** Prep Date: **12/15/2022** RunNo: **80521**
Client ID: **LCSW** Batch ID: **R80521** Analysis Date: **12/15/2022** SeqNo: **1664893**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Carbon Dioxide	99.8	0.0500	100.0	0	99.8	70	130				
Carbon Monoxide	99.6	0.0500	100.0	0	99.6	70	130				
Methane	99.7	0.0500	100.0	0	99.7	70	130				
Nitrogen	98.3	0.0500	100.0	0	98.3	70	130				
Oxygen	99.0	0.0500	100.0	0	99.0	70	130				
Hydrogen	99.1	0.0500	100.0	0	99.1	70	130				

Sample ID: **2212276-001AREP** SampType: **REP** Units: **%** Prep Date: **12/15/2022** RunNo: **80521**
Client ID: **BATCH** Batch ID: **R80521** Analysis Date: **12/15/2022** SeqNo: **1664881**

Analyte	Result	RL	SPK value	SPK Ref Val	%REC	LowLimit	HighLimit	RPD Ref Val	%RPD	RPDLimit	Qual
Carbon Dioxide	ND	0.0500						0		30	
Carbon Monoxide	ND	0.0500						0		30	
Methane	ND	0.0500						0		30	
Nitrogen	84.8	0.0500						84.72	0.0837	30	
Oxygen	15.2	0.0500						15.21	0.246	30	
Hydrogen	ND	0.0500						0		30	
BTU	0.0525							0.3313	145		

Fremont Analytical

Sample Log-In Check List

Client Name:	**FB**	Work Order Number:	**2212166**
Logged by:	**Clare Griggs**	Date Received:	**12/8/2022 1:55:00 PM**

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Coolers are present?	Yes ☐	No ☑	NA ☐
		Air Sample		
4.	Shipping container/cooler in good condition?	Yes ☑	No ☐	
5.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
6.	Was an attempt made to cool the samples?	Yes ☐	No ☐	NA ☑
7.	Were all items received at a temperature of >2°C to 6°C *	Yes ☐	No ☐	NA ☑
8.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
9.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
10.	Are samples properly preserved?	Yes ☑	No ☐	
11.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
12.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
13.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
14.	Does paperwork match bottle labels?	Yes ☑	No ☐	
15.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
16.	Is it clear what analyses were requested?	Yes ☑	No ☐	
17.	Were all holding times able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

18.	Was client notified of all discrepancies with this order?	Yes ☑	No ☐	NA ☐

Person Notified: Michael Erdahl   Date: 12/13/2022

By Whom: Clare Griggs   Via: ☑ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding: Tedlar for sample SV-2 compromised.

Client Instructions: Client to bring additional volume.

19. Additional remarks:

Item Information

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

Fremont Analytical

Sample Log-In Check List

Client Name:	**FB**	Work Order Number:	**2212166**
Logged by:	**Clare Griggs**	Date Received:	**12/8/2022 1:55:00 PM**

Chain of Custody

1.	Is Chain of Custody complete?	Yes ☑	No ☐	Not Present ☐
2.	How was the sample delivered?	Client		

Log In

3.	Coolers are present?	Yes ☐	No ☑	NA ☐
		Air Sample		
4.	Shipping container/cooler in good condition?	Yes ☑	No ☐	
5.	Custody Seals present on shipping container/cooler? (Refer to comments for Custody Seals not intact)	Yes ☐	No ☐	Not Present ☑
6.	Was an attempt made to cool the samples?	Yes ☐	No ☐	NA ☑
7.	Were all items received at a temperature of >2°C to 6°C *	Yes ☐	No ☐	NA ☑
8.	Sample(s) in proper container(s)?	Yes ☑	No ☐	
9.	Sufficient sample volume for indicated test(s)?	Yes ☑	No ☐	
10.	Are samples properly preserved?	Yes ☑	No ☐	
11.	Was preservative added to bottles?	Yes ☐	No ☑	NA ☐
12.	Is there headspace in the VOA vials?	Yes ☐	No ☐	NA ☑
13.	Did all samples containers arrive in good condition(unbroken)?	Yes ☑	No ☐	
14.	Does paperwork match bottle labels?	Yes ☑	No ☐	
15.	Are matrices correctly identified on Chain of Custody?	Yes ☑	No ☐	
16.	Is it clear what analyses were requested?	Yes ☑	No ☐	
17.	Were all holding times able to be met?	Yes ☑	No ☐	

Special Handling (if applicable)

18.	Was client notified of all discrepancies with this order?	Yes ☐	No ☐	NA ☑

Person Notified: Date:

By Whom: Via: ☐ eMail ☐ Phone ☐ Fax ☐ In Person

Regarding:

Client Instructions:

19. Additional remarks:

Item Information

* Note: DoD/ELAP and TNI require items to be received at 4°C +/- 2°C

SUBCONTRACT SAMPLE CHAIN OF CUSTODY

2212166

Send Report To Michael Erdahl

Company Friedman and Bruya, Inc.

Address 3012 16th Ave W

City, State, ZIP Seattle, WA 98119

Phone # (206) 285-8282 merdahl@friedmanandbruya.com

SUBCONTRACTER Fremont

PROJECT NAME/NO. 212098

PO # D-34

REMARKS

Please Email Results

Page # 1 of 1

TURNAROUND TIME

☒ Standard TAT

RUSH

Rush charges authorized by:

SAMPLE DISPOSAL

Dispose after 30 days

Return samples

Will call with instructions

						ANALYSES REQUESTED										
Sample ID	Lab ID	Date Sampled	Time Sampled	Matrix	# of jars	Dioxins/Furans	EPH	VPH	Major Gasses 3C							Notes
SV-1		12/7/22	1101	air	1				x							
SV-2		↓	1215	↓	·				x							
									X							

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Michael Erdahl	Friedman & Bruya	12/8/22	0900 AM
Received by:	Lily Baumgart	FAI	12/8/22	13:50
Relinquished by:				
Received by:				

SUBCONTRACT SAMPLE CHAIN OF CUSTODY

2212166

Send Report To Michael Erdahl
Company Friedman and Bruya, Inc.
Address 3012 16th Ave W
City, State, ZIP Seattle, WA 98119
Phone # (206) 285-8282 merdahl@friedmanandbruya.com

SUBCONTRACTER Fremont
PROJECT NAME/NO. 212098
PO # D-34
REMARKS
Please Email Results

Page # 1 of 1

TURNAROUND TIME
☒ Standard TAT
RUSH
Rush charges authorized by:

SAMPLE DISPOSAL
Dispose after 30 days
Return samples
Will call with instructions

Sample ID	Lab ID	Date Sampled	Time Sampled	Matrix	# of jars	ANALYSES REQUESTED										Notes
						Dioxins/Furans	EPH	VPH	Major Gases 3C							
SV-1		12/7/22	1101	air	1				x							
SV-2		↓	~~1215~~	↓	·				x	— Dilution 1.98						
		12/13/22	1300						~~x~~							Addition tedlar submitted for popped tedlar ME 12/13/22

Friedman & Bruya, Inc.
3012 16th Avenue West
Seattle, WA 98119-2029
Ph. (206) 285-8282
Fax (206) 283-5044

SIGNATURE	PRINT NAME	COMPANY	DATE	TIME
Relinquished by:	Michael Erdahl	Friedman & Bruya	12/8/22	0900AM
Received by:	Lily Baumgart	FAI	12/8/22	13:50
Relinquished by: Kath	Katherine Porter	FAI	12/13/22	14:24
Received by:				