BEFORE THE WASHINGTON
UTILITIES AND TRANSPORTATION COMMISSION

In the Matter of	DOCKET UW-110436
OLYMPIC WATER AND SEWER, INC.	DECLARATION OF MICHAEL STATON, L.G.

I, MICHAEL STATON, hereby declare and state as follows:

1. I am over the age of 18 and otherwise competent to testify herein and I have personal knowledge of the facts stated herein.

2. I am a Licensed Geologist in Washington State and Principal Geologist with SLR International Corporation. A copy of my CV is attached.

3. SLR International Corporation (SLR) was retained to investigate and characterize the environmental conditions at the Olympic Water and Sewer, Inc. owned property located at 781 Walker Way, Port Ludlow, in Jefferson County, Washington. Specifically, SLR was tasked with (1) assessing the gasoline concentrations in the soil at the area of the northern former gasoline underground storage tanks (USTs) as the apparent source of gasoline-impacted perched groundwater, (2) delineating the lateral extent of the gasoline-impacted soil, (3) delineating the lateral and vertical extent of the gasoline-impacted perched groundwater, and (4) characterizing any seasonal effects on the perched groundwater elevations and groundwater concentrations.

4. The 781 Walker Way property is an approximate 2.2 acre parcel partially developed with a utility operation and maintenance facility owned and operated by OWSI, including a public water supply well (Well #2).

5. In the course of SLR's investigation and site characterization, SLR reviewed the previous environmental activities and reports associated with the property, including the *Applied Geotechnology, Inc., Hydrocarbon Contamination Assessment and Underground Storage Tank Removal* (March 4, 1991) (1991 AGI Report). The 1991 AGI Report detailed the removal of three gasoline underground storage tanks (USTs) formerly located at the property . During the removal of the USTs, soil contamination was encountered around the northern USTs, located near and underneath the existing garage structure, and the impacted soil was removed to the extent possible without endangering the structural integrity of the building. AGI conducted subsequent investigation activities to delineate the vertical extent of the remaining impacted soil. No soil contamination was located near the southern UST. The AGI Report notes that no groundwater was encountered during the soil excavation or investigation. In 1991, OWSI personnel collected a water sample from supply well #2 to make sure that there were no gasoline impacts to the aquifer beneath the property, and the analytical results showed that there were no detectable analytes in the sample (1991 AGI Report).

6. Based on the results of the 1990 tank and soil removal activities, the 1991 investigation to delineate the vertical extent of the remaining impacted soil, and the 1991 sampling of the supply well #2, there was no evidence of any gasoline-impacted shallow groundwater at the property prior to the drilling of the replacement water supply well in 2009.

7. Based on the 1991 AGI Report, there was no evidence that the remaining soil contamination beneath the garage had migrated to shallow perched groundwater, and that the impacted groundwater had migrated over 110 feet to the southwest, to the location of planned replacement well #17.

8. In April of 2009, gasoline contamination was discovered in the course of the drilling of Well #17 at the 781 Walker Way property. Well #17 was located approximately 115 feet to the southwest from the northern former gasoline USTs. The existing Well #2 is located approximately 85 feet to the northwest of the northern former gasoline USTs. At the time of the discovery of gasoline contamination in groundwater underlying the subject property in 2009, OWSI was actively using Well #2 as a public water supply source.

9. After discovery and reporting of the groundwater contamination, the Department of Ecology added the 781 Walker Way property to Ecology's Confirmed or Suspected Contaminated Sites database. In 2011, Jefferson County Public Health Department conducted a site hazard assessment, and applied the Washington Ranking Method to calculate an overall hazard ranking of "2" for the site.

10. The shallow groundwater characteristics at the property were unknown at the property prior to SLR's 2010 investigation.

11. In 2010, SLR personnel installed 4 perched groundwater monitoring wells at the property and conducted groundwater sampling events on June 14, and October 20, 2010. *See* attached Figure 3 (SLR, Site Characterization Report (Dec. 17, 2010)), attached to this declaration as Exhibit A. At those times, the groundwater table beneath the property occurred within sand to gravel units, and appeared to be perched on top of an underlying silt unit. On June 14th, the depths to the perched groundwater in the wells ranged from approximately 23 to 41 feet below the tops of the well casings, and the groundwater elevations ranged from approximately 252 to 271 feet above the NAVD 88 datum. On October 20th, the depths to the perched groundwater in the wells ranged from approximately 26 to 40 feet below the tops of the well casings, and the groundwater elevations ranged from approximately 253 to 268 feet above the NAVD 88 datum.

12. SLR's investigation concluded that groundwater flow at the property appears to be controlled by the geometry of the surface of the silt unit, with flow converging into the low point of the top of the silt unit. The elevation of the silt is about 10 feet lower at monitoring wells MW-1 and MW-2 than at wells MW-3 and MW-4. *See* attached Figure 6 (SLR, Site Characterization Report (Dec. 17, 2010)), attached to this declaration as Exhibit B. From June to October, the perched groundwater elevations beneath the property decreased 2.75 feet at MW-4 and 3.51 feet at MW-3, while groundwater levels in wells located at the low point of the clayey to gravelly silt unit showed substantially less decline (1.08 feet at MW-2) or an increase (1.03 foot rise at MW-1).

13. These water level changes are consistent with groundwater migrating from the higher parts of the silt unit and collecting in the lower parts of the silt. This interpretation is consistent with the greatest hydrocarbon impacts occurring at wells MW-1 and MW-2. The 2010 investigation showed that the hydrogeologic conditions of the perched groundwater beneath the property are complex.

14. In 2011, SLR conducted an additional investigation that included installing an additional perched groundwater monitoring well (MW-5) and conducting a groundwater sampling event in April 2011. The results of the sampling event showed that there was 4 to 5 feet of variability in perched groundwater elevations due to seasonal effects. *See* attached Figure 5 (SLR, Additional Investigation Report (Aug. 2, 2011)), attached to this declaration as Exhibit C.

15. The characteristics and conditions of the shallow perched groundwater beneath the property were not known prior to the drilling of replacement well #17 in 2009.

16. Based on the investigation activities in 2010 and 2011, the flow direction of the perched groundwater beneath the property appears to be controlled by the geometry of the surface of the silt unit. The hydrogeologic characteristics of the perched groundwater are

complex and without the investigation activities, it would not likely have been possible to predict the perched groundwater flow directions.

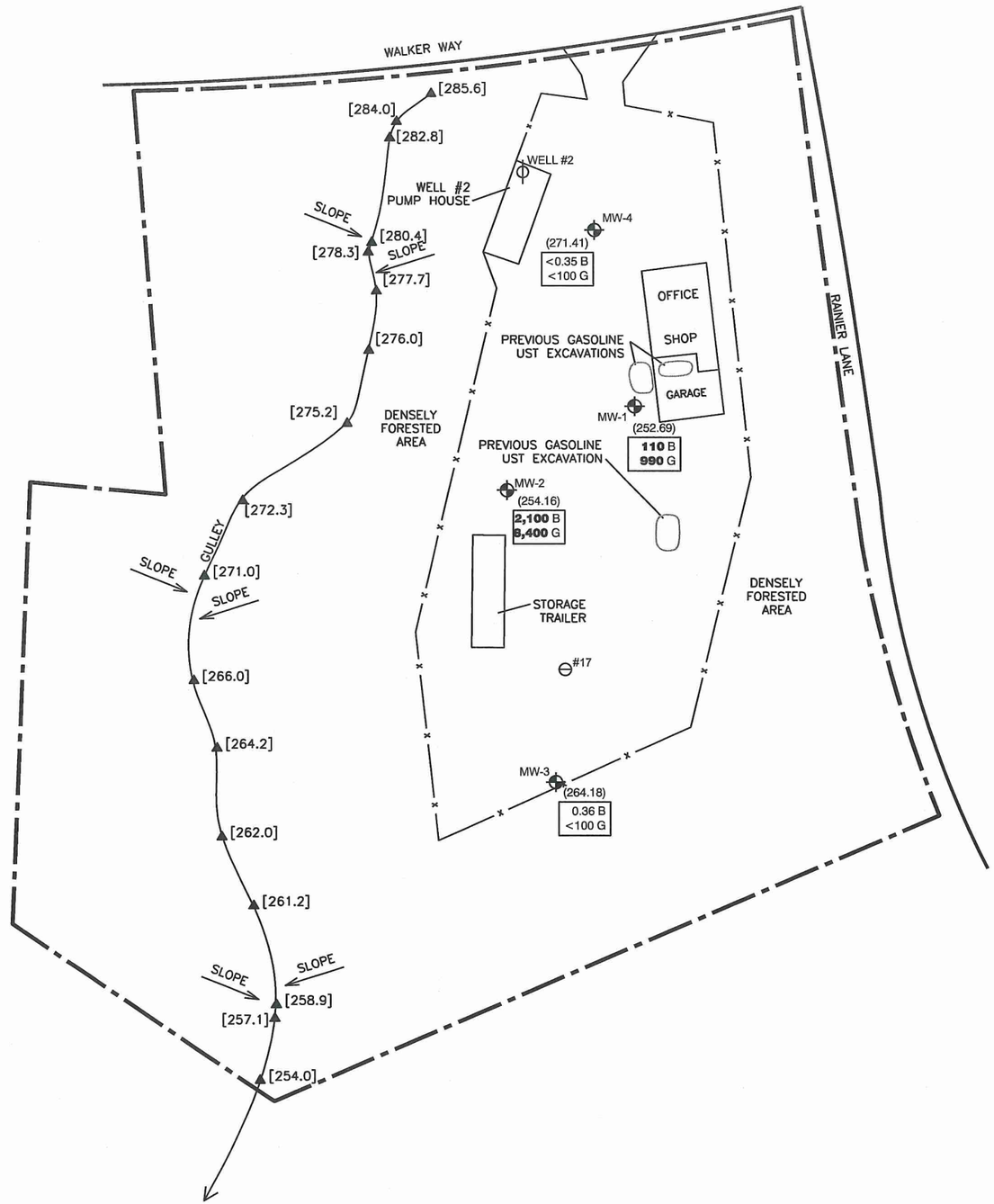
17. SLR completed a Site Characterization Report dated December 17, 2010, and an Additional Investigation Report dated August 2, 2011.

I declare under penalty of perjury under the laws of the State of Washington that the foregoing is true and correct.

DATED this 9th day of May, 2014, at Bothell, Washington.

MICHAEL STATON

EXHIBIT A



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NOTES

LEGEND

- PROPERTY BOUNDARY
- MW-1 — GROUNDWATER MONITORING WELL LOCATION AND DESIGNATION
- (271.41) — PERCHED GROUNDWATER ELEVATION (IN FEET ABOVE NAVD 88 DATUM)
- **110** B / **990** G — B=BENZENE CONCENTRATION IN GROUNDWATER SAMPLE (IN µg/L) G=GRO CONCENTRATION IN GROUNDWATER SAMPLE (IN µg/L)
- #17 — EXISTING CASING LOCATION AND DESIGNATION
- WELL #2 — EXISTING WATER SUPPLY WELL LOCATION AND DESIGNATION
- FENCE
- [285.6] — BOTTOM OF GULLEY ELEVATION (IN FEET ABOVE NAVD 88 DATUM)

NOTE: CONCENTRATIONS IN BOLD EXCEED THE MTCA METHOD A GROUNDWATER CLEANUP LEVELS

THIS DRAWING IS FOR CONCEPTUAL PURPOSES ONLY. ACTUAL LOCATIONS MAY VARY AND NOT ALL STRUCTURES ARE SHOWN.

SCALE: 1" = 50'
WHEN PLOTTED AT 11" x 17" PAGE SIZE
0 50 100 150'

OLYMPIC WATER & SEWER, INC. PROPERTY
781 WALKER WAY
PORT LUDLOW, WASHINGTON

Report: SITE CHARACTERIZATION REPORT

Drawing: PERCHED GROUNDWATER SAMPLING RESULTS - JUNE 2010

Date: July 12, 2010	Scale: AS SHOWN	Fig. No. 3
File Name: 101.00433.03901101-02.DWG	Project No.: 101.00433.00001	

SLR

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EXHIBIT B

NORTH
A

SOUTH
A'

MW-4

MW-1
(PROJECTED 19
FEET)

MW-2
(PROJECTED 26
FEET)

OFFICE/GARAGE BUILDING
(PROJECTED 30 FEET)

MW-3

ELEVATION (FEET)

300
295
290
285
280
275
270
265
260
255
250
245
240
235
230

[<0.03]
[0.49*]
[<0.03]
[0.21]
[<0.03]
[<0.03]
[0.21]
[<0.03]
[0.036]

?
?

LEGEND

INFERRED LITHOLOGIC CONTACT

MW-4
EXPLORATION LOCATION AND DESIGNATION

SCREEN LOCATION

INFERRED GROUNDWATER TABLE SURFACE IN 2010

[**0.21**] BENZENE CONCENTRATIONS IN SOIL SAMPLE (IN MG/KG)

GRAVEL AND SANDY GRAVEL (GP)

SAND, GRAVELLY SAND, AND SAND AND GRAVEL (SP)

SILTY SAND (SM) AND SILTY GRAVEL (GM)

SILT, CLAYEY SILT, SAND SILT, AND GRAVELLY SILT (ML)

NOTES

1) CROSS SECTION LOCATION IS SHOWN ON FIGURE 5
2.) ELEVATIONS ARE RELATIVE TO NAVD 88 DATUM
3.) CONCENTRATIONS IN BOLD EXCEED THE MTCA METHOD A SOIL CLEANUP LEVEL.
4.) *= SAMPLE COLLECTED FROM ADJACENT BORING MW-1B.

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0 20 40 60'
HORIZONTAL SCALE (FEET)

0 10 20 30'
VERTICAL SCALE (FEET)

OLYMPIC WATER & SEWER, INC. PROPERTY
781 WALKER WAY
PORT LUDLOW, WASHINGTON

Report
SITE CHARACTERIZATION REPORT

Drawing
GEOLOGIC CROSS SECTION A-A'

Date July 12, 2010
File Name 101.00433.00001\01-02.DWG
Scale AS SHOWN
Project No. 101.00433.00001
Fig. No. 6

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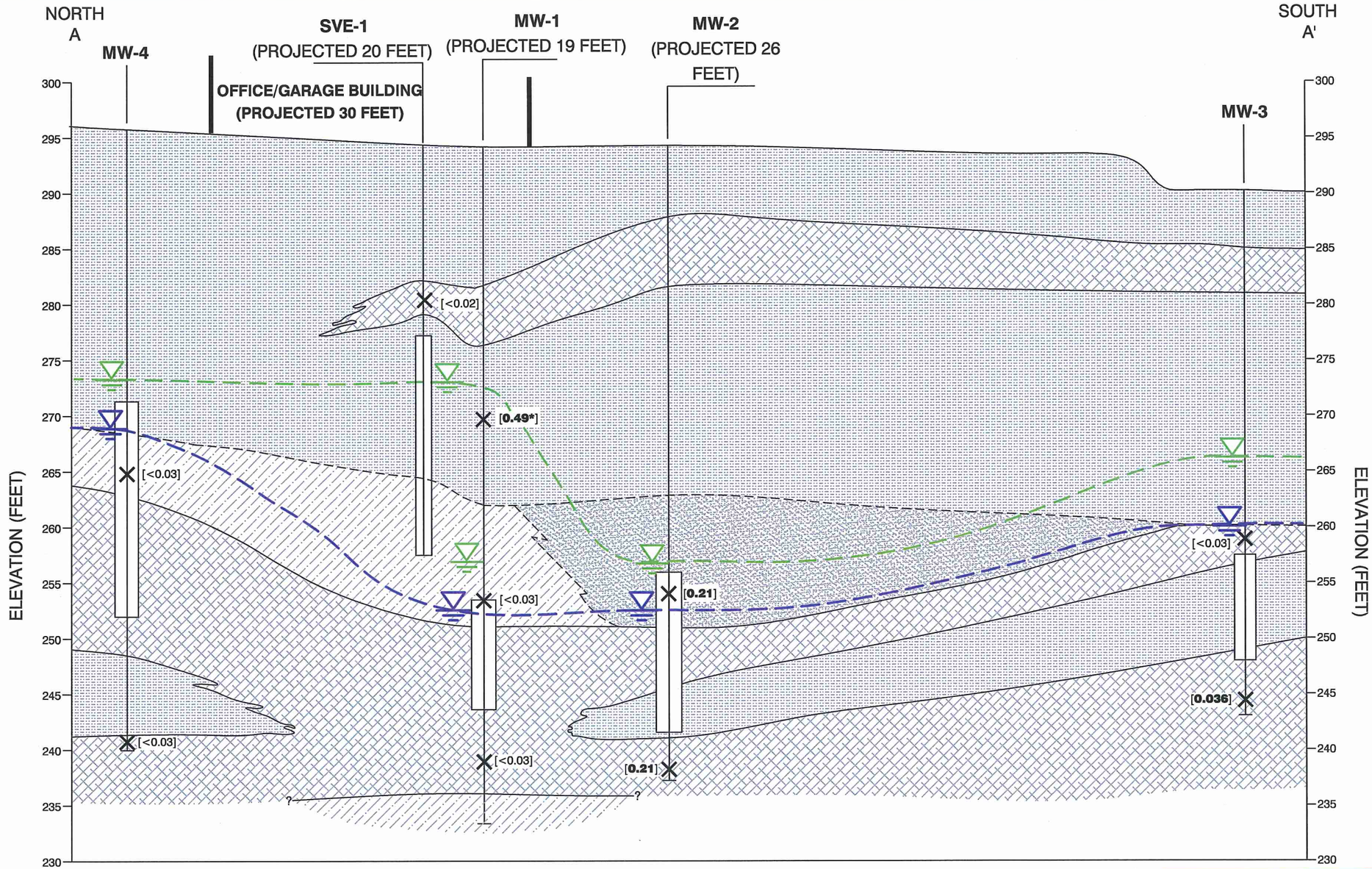
EXHIBIT C



LEGEND

- INFERRED LITHOLOGIC CONTACT
- MW-4 — EXPLORATION LOCATION AND DESIGNATION
- SCREEN LOCATION
- INFERRED GROUNDWATER TABLE SURFACE DURING APRIL 2011
- INFERRED GROUNDWATER TABLE SURFACE DURING OCTOBER 2010
- [0.21] BENZENE CONCENTRATIONS IN SOIL SAMPLE (IN MG/KG)
- GRAVEL AND SANDY GRAVEL (GP)
- SAND, GRAVELLY SAND, AND SAND AND GRAVEL (SP)
- SILTY SAND (SM) AND SILTY GRAVEL (GM)
- SILT, CLAYEY SILT, SAND SILT, AND GRAVELLY SILT (ML)

NOTES

1) CROSS SECTION LOCATION IS SHOWN ON FIGURE 6 OF SLR, 2010
2.) ELEVATIONS ARE RELATIVE TO NAVD 88 DATUM
3.) CONCENTRATIONS IN BOLD EXCEED THE MTCA METHOD A SOIL CLEANUP LEVEL.
4.) *= SAMPLE COLLECTED FROM ADJACENT BORING MW-1B.

0 20 40 60'
HORIZONTAL SCALE (FEET)

0 10 20 30'
VERTICAL SCALE (FEET)

OLYMPIC WATER & SEWER, INC. PROPERTY
781 WALKER WAY
PORT LUDLOW, WASHINGTON

Report
ADDITIONAL INVESTIGATION REPORT

Drawing
HYDROGEOLOGIC CONDITIONS IN APRIL 2011

Date	MAY 17, 2011	Scale	AS SHOWN
File Name	06-05.DWG	Project No.	101.00433.00003
		Fig. No.	5

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CV – Michael D. Staton, R.G.

MICHAEL D. STATON, R.G.

PRINCIPAL GEOLOGIST

Mr. Staton has over 25 years of experience in environmental consulting with technical emphasis on environmental due diligence, remedial investigations, feasibility studies, site remediation, and litigation support services. He has a solutions-oriented approach to consulting that is guided by risk management and the client's business objectives. Mr. Staton has extensive experience managing complex, multiple-party projects that are conducted under an agreed order or consent decree. His negotiation skills and knowledge of environmental regulations have been used on numerous projects to develop and conduct focused scopes of work, and obtain elevated risk-based cleanup levels. He has developed several innovative techniques for site remediation and is the co-inventor of a patented, automatic-draining, condensate collector used in soil vapor extraction systems (U.S. Patent #5372621).

SELECTED PROJECT EXPERIENCE

Litigation Support Projects

- **Litigation Support, Former Bulk Fuel Terminal and Asphalt Plant, Edmonds, Washington.** Provided technical support in the client's preparation for litigation pertaining to subsurface contamination at a former bulk fuel terminal and asphalt plant. The work consisted of reviewing the previous environmental reports, evaluating the previous remediation activities that were completed at the site, developing MTCA Method B risk-based soil cleanup levels and groundwater cleanup levels based on protection of surface water, and estimating the cost to remediate the site to the cleanup levels. Observed additional soil excavation activities that were conducted by the opposing party to remove Bunker C-impacted soil, and documented that most of the excavated soil should have been used as backfill rather than hauled off site for disposal. Based in part to our work and field observations, the case settled prior to going to court, and our client paid less than they had anticipated.
- **Technical Support, Arbitration Hearing, Seattle, Washington.** Assisted client in preparation for an arbitration hearing concerning the scope of work and financial responsibility to remediate subsurface contamination at a gas station site in Seattle, Washington. The work consisted of reviewing the opposing party's recommended scope of work and evaluating if the scope was appropriate for the site and contaminant conditions. The opposing party was proposing to remediate the soil and groundwater to MTCA Method A cleanup levels, which would cost more than $9,000,000. Identified weaknesses in the opposing party's approach, calculated site-specific, risk-based Method B cleanup levels for the impacted soil, justified groundwater cleanup levels based on protection of surface water, and developed two remediation alternatives to meet the recommended cleanup levels. The estimated remediation costs to meet the recommended cleanup levels ranged from approximately $1,400,000 to $3,500,000. The parties independently settled on a scope of work and remediation cost significantly below $9,000,000 prior to the hearing.
- **Technical Support, Settlement Agreement, Tacoma, Washington**. Assisted a multiple party group in negotiating a financial settlement for remediation of a previous property owner's 17,740-gallon release of ethanol blend product at an active bulk fuel terminal. The work initially consisted of two years of quarterly groundwater monitoring to evaluate the impacts of the release and the migration of the main contaminant of

concern (benzene), and an extensive records review to document and evaluate the site conditions before and after the release. The impacts from the ethanol blend release were difficult to determine due to the presence of soil and groundwater contamination at the site prior to the release. Prepared a report that summarized the results of our evaluation of the soil and groundwater impacts from the release, and also conducted a feasibility study to evaluate several remediation alternatives and the costs to obtain project closure. The report and estimated cost to obtain project closure (based on the selected remediation alternative) were critical components to the successful settlement negotiations.

- **Technical Support for Cost Recovery Action, Former Gas Station, Seattle, Washington.** Provided technical support in a cost recovery action against a previous owner of a gas station in Seattle, Washington. The work consisted of reviewing the previous environmental reports, conducting a subsurface investigation to assess the age and current extent of the contamination, and estimating the costs to remediate the contamination. The results of the assessment showed that the contaminant release occurred during the previous ownership, and our client received over $160,000 to cover the investigation and remediation costs. After the settlement, the work consisted of excavating and off-site recycling of 300 tons of impacted soil, extracting over 1,600 gallons of impacted groundwater from the excavation, and groundwater monitoring. Assisted the client in successfully negotiating risk-based MTCA Method B soil cleanup levels that were significantly greater than Method A cleanup levels, and obtaining a “no further action” opinion letter from the Department of Ecology.
- **Litigation Support, Former Auto Repair Facility, Olympia, Washington.** Provided technical support to defendant in litigation case concerning claimed environmental damages to a property in downtown Olympia. The work initially consisted of reviewing the environmental reports for the claimant’s property and the defendant’s neighboring property, and conducting a site visit. Developed technical arguments that were the basis for concluding that the remaining soil and groundwater contamination beneath the claimant’s property is limited and that active remediation is not required to protect human health and the environment. The technical arguments allowed the case to settle out-of-court for a relatively low amount that was acceptable to our client.
- **Technical Support for Cost Recovery Action, Former Gas Station, Bellevue, Washington.** Provided technical support in a cost recovery action against a previous tenant of a former gas station in Bellevue, Washington. The work consisted of reviewing the previous environmental reports and invoices; assessing the appropriateness of the previous work and costs; and evaluating the age of the contaminant release. The purpose of the work was to determine if any of the site soil and groundwater contamination was due to a release that may have occurred when the previous tenant operated the site (1982 to 1989). Directed the sampling of groundwater from site wells to allow a laboratory to conduct forensics analysis of the groundwater contamination. Based on the results of the forensics analysis and our evaluation of the previous soil and groundwater sample analytical data, we determined that at least a portion of the contamination was released from 1982 to 1989. The results of the evaluation were used in a cost recovery mediation that resulted in our client receiving over $140,000.

- **Technical Support for Cost Recovery Action, SeaTac International Airport.** Provided technical support for a cost recovery action against our client. The property owner excavated and disposed over 100,000 tons of "contaminated" soil during their construction activities, and demanded reimbursement from a tenant. The work consisted of reviewing the field notes and laboratory analytical reports from the excavation work, evaluating the invoices submitted to the tenant, and conducting statistical analyses to show that a field instrument (photoionization detector) could not be solely used to effectively determine if soil contains petroleum concentrations greater than MTCA Method A cleanup levels or the Class 3 end use criteria. During the invoice review, discovered that the owner did not deduct the cost that they would have incurred for hauling and disposal of the excavated soil if it had been clean, which was over $1,000,000. Presented a technical argument that over 50 percent of the excavated soil did not contain petroleum concentrations greater than Method A cleanup levels or the Class 3 end use criteria. The case went to mediation, and at least partly due to the technical arguments, the action settled for over $3,000,000 less than the initially demanded value.
- **Litigation Support, Biodiesel Manufacturing Facility, Arlington, Washington.** Provided technical support in a legal action against the client. The owner of the facility property claimed that our client contaminated their land with diesel fuel, which was justification for immediate eviction. The work consisted of reviewing the environmental reports and a declaration by the technical expert for the plaintiff, and preparing a declaration that refuted the actual presence of diesel fuel in the soil. Presented a case that the detected diesel concentrations were actually due to non-petroleum organics (e.g., waste vegetable oils used in making biodiesel and naturally occurring organics) in the soils. The court ruled in favor of our client and they were not evicted.
- **Litigation Support, Former Gasoline Service Station, Snohomish, Washington.** Provided technical support in the client's preparation for litigation pertaining to a former gasoline service station site. The work initially consisted of reviewing and evaluating environmental reports for the site and a neighboring site. Developed an opinion concerning the source of the contamination and recommended a scope of work to verify the source based on the hydrogeologic conditions beneath the site area and the distribution of the soil and groundwater contamination. Conducted a site investigation to identify the source of the contamination, and prepared a declaration in support of client's motion for partial summary judgment.
- **Technical Support, Mediation of Cost Recovery Action, Seattle, Washington.** Retained by all parties in a multi-party mediation to provide technical support to the mediator. The work initially consisted of reviewing the mediation statements and supporting environmental reports, preparing a summary of the primary issues of the case and each party's best supporting arguments, and meeting with the mediator to discuss the strengths and weaknesses of each party's arguments. Based on the results of the meeting with the mediator, prepared a list of questions to ask each party during the mediation. Participated in technical discussions with both sides during the successful mediation.

Environmental Due Diligence Projects

- **Due Diligence Support, 13-Mile-Long Parcel, Buckley/Sumner, Washington.** Provided environmental services in support of a prospective purchaser's due diligence evaluation of water rights and other assets within a 13-mile-long stretch of parcels (the Conveyance Area) in Buckley and Sumner, Washington. The assets included a diversion dam on the White River, a surface water transport system (flowline) that runs from the dam to a downstream location on the White River, the properties located along the flowline, and a power plant and related structures. The flowline consisted of a flume, several settling basins and canals, two underground piped sections, and Lake Tapps. The due diligence efforts focused on establishing the environmental conditions within and adjacent to the Conveyance Area. The work initially consisted of reviewing project documents; reviewing local, state, and federal records/databases; conducting site visits; and interviewing current and former site personnel to identify and evaluate any recognized environmental conditions within and near the Conveyance Area. After completing the initial assessment, several data gaps were identified and investigation activities were conducted to resolve the data gaps. Based on the investigation results, several areas of contamination were encountered within or near the Conveyance Area, including two areas that were previously unidentified. The due diligence findings were used by the client to effectively minimize their environmental liabilities prior to purchasing the water rights and assets.
- **Acquisition Due Diligence Support, 13 Heavy Equipment Storage and Rental Facilities, Western United States and Alaska.** Managed team that provided environmental services in support of a prospective purchaser's due diligence of a company that rented cranes and heavy equipment in the western United States and Alaska. The due diligence efforts focused on establishing the known and potential environmental conditions at each of the 13 leased facilities, and identifying regulatory issues and best management practices that should be addressed. The work initially consisted of reviewing local, state, and federal records/databases; conducting site visits; and interviewing current and former site personnel to identify and evaluate any recognized environmental conditions within and near each facility. After the acquisition was completed, assisted the acquired company obtain the necessary permits to comply with state regulations, and provided oversight of soil remediation activities at a facility in Seattle, Washington.
- **Environmental Due Diligence Support, 17 Agriculture Chemical Storage Facilities in Washington, Oregon, and Idaho.** Provided environmental services to support the sale of 17 agriculture chemical storage and distribution facilities in Washington, Oregon, and Idaho. Reviewed the environmental claims made by the prospective buyer for each facility, and provided technical arguments against many of the claims. Estimated the costs associated with each of the mutually accepted claims and assisted with the negotiations of a reduced purchase price to account for environmental liabilities.
- **Due Diligence and Technical Support, Aircraft Part Manufacturer, Kent, Washington.** Provided environmental services in support of a prospective purchaser's due diligence evaluation of a former aircraft parts manufacturing facility in Kent, Washington. The work initially consisted of reviewing the previous environmental reports, identifying investigation data gaps, and recommending additional investigation

activities to address the data gaps. After the seller conducted the recommended activities, the work consisted of reviewing the sample analytical results and evaluating the appropriateness and accuracy of risk-based MTCA soil cleanup levels that were calculated by the seller's consultant. Assisted the client in the negotiation of an indemnification agreement. The work subsequently consisted of reviewing work plans and reports of a neighboring property owner's remedial investigation and cleanup action under a MTCA consent decree, and providing comments to the Department of Ecology to try to ensure that the groundwater contamination that had migrated beneath our client's property was adequately addressed.

- **Environmental Due Diligence and Permitting Support, Biodiesel Manufacturing Facility, Seattle, Washington.** Managed a Phase I environmental site assessment (ESA) of a former biodiesel manufacturing plant in Seattle, Washington, for a start-up biodiesel company that was in the process of negotiating a lease agreement. The results of the Phase I ESA identified several recognized environmental conditions and historical recognized environmental conditions at the property. To assess the environmental conditions immediately prior to our client signing the lease agreement, a baseline assessment was conducted to characterize the soil and groundwater beneath the property. The results of the baseline assessment showed that diethylene glycol and ethylene glycol were present in the groundwater at concentrations greater than appropriate state cleanup levels. After further evaluation, we determined that the glycols were due to an off-site source. The client leased the property, and we subsequently prepared NEPA, air emission, and water discharge permitting documents to obtain the permits required to expand the facility.
- **Acquisition Due Diligence Support, Three Heavy Equipment Storage and Rental Facilities, Idaho, Wyoming, and Montana.** Provided environmental services in support of a prospective purchaser's due diligence of a company that rented cranes and heavy equipment in Idaho, Wyoming, and Montana. The due diligence efforts focused on establishing the known and potential environmental conditions at each of the three leased facilities, and identifying regulatory issues and best management practices that should be addressed. The work initially consisted of reviewing local, state, and federal records/databases; conducting site visits; and interviewing current and former site personnel to identify and evaluate any recognized environmental conditions within and near each facility. After completed the initial due diligence activities, conducted a subsurface investigation to assess the potential presence of contamination at the Idaho facility.

Remedial Investigation, Feasibility Study, and/or Remediation Projects

- **Remedial Investigation/Feasibility Study, Former Bulk Fuel Terminal, Edmonds, Washington**. Managed a remedial investigation and feasibility study at a 47-acre, former bulk fuel terminal in Edmonds, Washington, that was conducted in accordance with a MTCA agreed order. Negotiated a focused scope of work for soil, groundwater, surface water and sediment sampling to address remaining data gaps, and directed the investigation activities. Prior to the completion of the feasibility study, several interim actions were conducted at the site to reduce the threat to human health and the environment, and to allow for the sale and redevelopment of a 22-acre portion of the

site. The interim actions included the excavation and off-site disposal of over 150,000 tons of TPH- and metals-impacted soil, and the recovery of over 200,000 gallons of free product and impacted groundwater. Due to the success of the interim actions at remediating the soil and groundwater, we were able to apply risk-based remediation levels that were significantly greater than the cleanup levels that were proposed by the Department of Ecology.

- **Soil and Groundwater Remediation, Former Aluminum Anodizing and Coating Facility, Seattle, Washington.** Member of team that designed a remediation system to recover DNAPL (tetrachloroethene), remove dissolved-phase chlorinated solvents, and extract solvent-impacted soil vapors. DNAPL was present in shallow perched groundwater zone that was tidally influenced. The recovery system consisted of over 10 recovery wells that were screened either near the bottom of the perched zone (DNAPL recovery wells) or at shallower depths of elevated dissolved-phase solvent concentrations. The DNAPL and groundwater extracted from the recovery wells was pumped into a storage tank, and the water in the tank was transferred into a treatment system that included ozone injection and carbon adsorption.
- **Remediation of Petroleum Free Product, Former Railyard, Tacoma, Washington.** Managed the operation and maintenance of a vacuum-enhanced free product (diesel and oil) and groundwater recovery/treatment system at a former railyard in Tacoma, Washington. At system startup, the product plume extended over an area of approximately 6.2 acres. The work, which was conducted in accordance with a MTCA consent decree, initially consisted of evaluating the problems with an existing system that shut down frequently and could not consistently meet water discharge limits, and designing and installing cost effective modifications to several components of the recovery and treatment systems. After modifying the system, system operation and maintenance and groundwater monitoring activities were conducted. The modifications significantly increased the total product pumping rates while consistently maintaining system effluent concentrations below the discharge limits.
- **Remedial Investigation, Industrial Property, Seattle, Washington.** Managed a remedial investigation (RI) at an industrial property that is located adjacent to the Lower Duwamish Waterway Superfund site. The property was used for wood treating, chain and pipe manufacturing, concrete products manufacturing, and wood products manufacturing from the early 1900s through the 1970s. Since a sediment remedial action is being conducted adjacent to the property, the Department of Ecology required our client to enter into an agreed order to conduct a remedial investigation, feasibility study, and draft cleanup action plan. Assisted our client with the negotiation of a scope of work for the order, and during the negotiation, conducted a groundwater investigation at the property to provide data that showed that there was minimal potential for contamination from the property to enter the waterway. The groundwater investigation primarily consisted of the installation of seven monitoring wells near the waterway, conducting a tidal study and groundwater sampling event, and inspecting a sheet pile seawall and riprap bank for seeps and exposed soil. The results of the investigation were used to try to reduce the scope of the RI. After negotiating the RI/FS Work Plan for over two years, the first phase of the RI was conducted to further assess contaminant fate and transport and to identify appropriate preliminary cleanup levels. The first phase of the RI consisted of drilling of 30 soil borings, installing 11 shallow and 5 deep

groundwater monitoring wells, conducting low tide and high tide groundwater monitoring events, collecting catch basin solids, storm water, and sediment samples, and preparing a report that presented the results and identified the remaining data gaps for the second phase of the RI. The primary contaminants of concern included PCBs, PAHs, metals, dioxins/furans, SVOCs, and VOCs.

- **Soil and Groundwater Remediation, Former Road Paint Striping Company, Seattle, Washington.** Managed the investigation and remediation of a site containing chlorinated solvent (PCE) and petroleum hydrocarbon-impacted soil and groundwater. The investigation consisted of drilling and sampling 16 soil borings, and installing and sampling 14 monitoring wells. The soil remediation consisted of excavation and off-site disposal of approximately 100 cubic yards of impacted soil. Based on potability testing results, successfully negotiated elevated groundwater cleanup levels based on protection of surface water. Groundwater concentrations were below the cleanup levels at surface water compliance wells, and the Department of Ecology issued a "no further action" opinion.

- **Remediation of Petroleum Free Product, Shipyard, Seattle, Washington.** Provided technical support to a responsible party who was paying a significant portion of the cost to remediate a large free product (kerosene) plume at a shipyard located adjacent to Puget Sound. The remedial action was being conducted in accordance with a MTCA consent decree. Initially reviewed and evaluated the site investigation reports, the design of the existing vacuum-enhanced product recovery system, and the system performance reports. The performance of the system was inhibited by significant iron fouling and large tidal fluctuations, and it was not effectively capturing the product area. Collaborated with the primary site consultant to develop a work plan for a vacuum-enhanced groundwater/product pumping test, evaluated and interpreted the pumping test data, and provided recommendations for design and operation of a modified and expanded system. The system modifications significantly increased the product recovery rates and the total radius of vacuum-enhanced pumping influence captured the entire plume. A total of over 200,000 gallons of product were recovered by the system.

- **Groundwater Investigation and Remediation, Bulk Fuel Terminal, Tacoma, Washington**. Managed the operation and maintenance of a groundwater and free product (gasoline and diesel) recovery/treatment system and a soil vapor extraction system at a bulk fuel terminal in Tacoma, Washington. The work was conducted in accordance with a MTCA consent decree. The work initially consisted of evaluating the performance of the existing systems, negotiating system modifications and reductions in all of the sampling programs with the Department of Ecology, designing and installing cost effective modifications to components of the systems, and obtaining permission to deactivate the vapor treatment system. Obtained a sanitary sewer discharge permit to eliminate the high costs associated with NPDES discharge monitoring, and designed and directed the installation of system discharge piping and the connection to a sewer main. Based on the system modifications, the total groundwater and product pumping rates from 25 recovery wells significantly increased and the project costs decreased by approximately $50,000 per year. The work also consisted of the negotiation, development, and completion of an assessment of a deeper aquifer beneath the site and

the hydrogeological connection between the impacted shallow aquifer and the deeper aquifer.

- **Soil Remediation, Bus Station, Phoenix, Arizona.** Managed and designed the installation and operation of an in-situ bioventing system to remediate diesel-impacted soil at an active bus station in Phoenix, Arizona. The system consisted of six nested bioventing points that were screened to depths between 5 and 60 feet. The nested points were designed to equally distribute oxygen in shallow silty soil and deeper gravelly soil. The system equipment was installed on the roof of the station building, and the drilling and trenching work was conducted at night and during slower bus arrival periods to minimize impacts to the facility operations. The bioventing system operated for two years and the soil concentrations were reduced to below risk-based cleanup levels.
- **Design of Groundwater Remediation System, Naval Air Station, Adak, Alaska**. Managed a team that designed a groundwater and free product (jet fuel JP-5) recovery/treatment system at the Naval Air Station in Adak, Alaska. The recovery system included 26 recovery wells within 6 separate plumes, and the total pumping rate exceeded 250 gallons per minute. The water and product was pumped into 6 heated product collection enclosures that each contained an oil/water separator tank, a product storage tank, and a water transfer system. The water was then pumped through several miles of underground piping to a dissolved air flotation unit for treatment. The system included remote monitoring by a programmable logic controller. The design package included a total of 23 drawings, written design specifications, and an operation and maintenance plan. The project team received a Certificate of Appreciation from the Department of the Navy recognizing the quality of this work.
- **Remedial Investigation/Feasibility Study, Closed Municipal Landfill, Yakima, Washington.** Managed a remedial investigation/feasibility study (RI/FS) at a closed municipal landfill that occupied the southern portion of a former sawmill facility in Yakima, Washington. The work initially consisted of reviewing the previous environmental reports for the landfill and sawmill sites, and identifying investigation data gaps for the landfill site. To resolve the data gaps, the RI consisted of excavating 56 test pits and drilling 46 soil borings to define the lateral extents and thickness of the municipal solid waste (MSW), installing 18 soil vapor probes and 7 groundwater monitoring wells, and conducting several soil vapor and groundwater sampling events. The results of the RI showed that the indicator hazardous substances (IHSs) that were due to the MSW only included nitrate in groundwater and methane gas. The FS included development of a conceptual site model, identification and evaluation of four remedial alternatives to remediate the IHS concentrations to below cleanup levels; and selection of a recommended remedial alternative.
- **Remedial Investigation and Corrective Action, Former Gas Station Property, Seattle, Washington.** Conducted a remedial investigation at a former gas station property in Seattle, Washington. The investigation consisted of drilling and sampling 11 soil borings and conducting a soil gas survey near the property building. The investigation results showed that gasoline-impacted soil was present near a former tank basin and dispenser island, and that benzene concentrations in soil gas adjacent to the property building exceed the Department of Ecology's sub-slab soil gas screening levels.

To prevent the benzene-impacted soil gas from entering the property building and a neighboring building, installed a soil vapor abatement system along the buildings that we will operate until a soil remedial action is conducted. Delineated the lateral and vertical extents of the impacted soil and estimated remediation costs associated with future development of the property as a hotel that contains an underground parking lot.

- **Feasibility Study, Vegetable Oil Production Facility, Portland, Oregon.** Conducted a feasibility study to develop and evaluate three alternatives to remediate soil and groundwater that are impacted with petroleum hydrocarbons and chlorinated solvents. The metals recycling facility is located adjacent to the Portland Harbor Superfund Site. The shallow aquifer beneath the site is impacted with free product (gasoline and diesel) and dissolved-phase hydrocarbons and solvents (trichloroethylene and vinyl chloride), and a deeper aquifer is impacted with dissolved-phase solvents. Both aquifers that are tidally influenced. High vacuum dual-phase extraction was the recommended remedial alternative. After obtaining approval from the Oregon Department of Environmental Quality, the system will be installed and activated.
- **Remedial Investigation, Feasibility Study, and Remedial Action, Former Gas Station, Longview Washington.** Conducted remedial investigation and remediation activities at a former gas station site in Longview, Washington, and provided technical support to the property owner (the client) in negotiations with an insurance company and a previous tenant regarding cost recovery. The client is currently unable to sell the site due to the presence of soil and groundwater contamination. The work initially consisted of reviewing the previous environmental reports, identifying investigation data gaps, and recommending additional investigation activities to address the data gaps. Due to the previous owner's unwillingness to conduct the recommended actions, we conducted the investigation activities, completed a feasibility study, and conducted site remediation activities. To date, the client has received reimbursement for all of the work from their insurance company. The investigation consisted of the drilling and sampling of over 30 soil borings, and installation and sampling of 14 shallow and deep groundwater monitoring wells. The initial remedial action consisted of excavation and off-site disposal of almost 4,000 tons of petroleum-impacted soil, and extraction and treatment of approximately 40,000 gallons of impacted shallow groundwater from the open excavation, and installation and operation of a deep groundwater recovery/treatment system. The deep groundwater recovery/treatment system operated for almost three years and over 7,000,000 gallons of water were extracted and treated. We are currently conducting quarterly groundwater monitoring prior to applying for a "no further action" status from the Department of Ecology.
- **Soil and Groundwater Remediation, Former Truck Manufacturing Facility, Seattle, Washington.** Designed and directed the installation and operation and maintenance of a groundwater and free product (diesel) recovery/treatment system at a former truck manufacturing facility in Seattle, Washington. The system included vacuum-enhanced groundwater and product extraction from two recovery wells, groundwater treatment by iron precipitation (pH adjustment) and carbon adsorption, and reinfiltration of the treated water. The system recovered over 2,000 gallons of product. The site remediation activities also included the excavation of over 1,000 cubic yards of impacted soil and the extraction of groundwater and product from the open excavation. After the soil and

groundwater concentrations had been reduced to below risk-based cleanup levels, the Washington Department of Ecology issued a "cleanup completed" status for the site.

- **Soil Remediation, Former Auto Wrecking Yard, Auburn, Washington.** Managed the remediation of lead- and cadmium-impacted soil at a former auto wrecking yard in Auburn, Washington. The impacted soil occurred throughout most of the 2-acre parcel, and extended to depths of up to 1 foot below ground surface. The soil was remediated by excavation and off-site disposal. Prior to conducting the excavation, an excavation/sampling grid was established throughout the site to allow for a confirmation sampling program that would be acceptable to the Department of Ecology. The site was divided into 252 grid cells, and each full-sized cell covered an area of 400 square feet (20 feet by 20 feet). Each impacted grid cell was initially excavated to a depth ranging from 3 to 12 inches below ground surface, based on the previous investigation results. After excavating each cell, a sample from the center of the cell for laboratory analysis. The excavation was completed when all of the cells contained contaminant concentrations below the cleanup levels. A total of 3,292 tons of soil were excavated and hauled off-site for disposal as a non-hazardous waste. Based on the results of the remediation activities, the client was able to develop the site.

- **Remedial Investigation, Vehicle Maintenance Facility, Port Ludlow, Washington.** Managed subsurface investigations to identify the source and lateral extents of gasoline-impacted soil and groundwater at an equipment and vehicle maintenance facility in Port Ludlow, Washington. The impacted perched groundwater occurred at multiple depths due to complex hydrogeologic conditions. After finding the source and delineating the extents of contamination, conducted a dual-phase extraction (DPE) pilot test to determine if DPE could effectively remove the impacted groundwater and expose the residual impacted soil to the applied vacuum.

- **Emergency Response Remedial Action, Bulk Fuel Terminal, Seattle, Washington.** Designed and directed the installation and operation of a groundwater and free product (gasoline) recovery system at a bulk fuel terminal in Seattle, Washington. The work was conducted on an emergency basis to remediate a release from an underground pipeline located less than five feet from a retaining wall adjacent to Puget Sound. The system included vacuum-enhanced groundwater and product extraction from six recovery wells. The extracted fluids were hauled off-site for disposal and product recycling. The extracted vapors were treated by a catalytic oxidizer. The system was operating within one week of the release, and effectively prevented impacts to Puget Sound.

- **Due Diligence, Investigation, and Remedial Action, Former Bulk Terminal, Seattle, Washington.** Managed a Phase I environmental site assessment (ESA) for a client who was interested in selling three adjacent properties in Seattle, Washington. The results of the Phase I ESA showed that one of the properties previously contained a bulk fuel terminal for over 50 years and another property previously contained a wood treating facility. Conducted a remedial investigation to assess all of the recognized environmental conditions from the Phase I ESA and found that petroleum hydrocarbon-impacted soil and groundwater were present at two areas of the properties, and that the impacted groundwater extended off-site to near the Lake Washington Ship Canal. Obtained the permits and directed a soil and groundwater remedial action at one area of

the properties, including within an adjacent street, that consisted of excavation of over 1,500 cubic yards of impacted soil, extraction and treatment of over 50,000 gallons of impacted groundwater that collected in the open excavation, and groundwater monitoring. An additional soil and groundwater remedial action will be conducted at the other area of contamination after obtaining the necessary permits. Provided technical assistance to the client in the negotiation of the sale of the properties.

- **Groundwater Remediation, Bulk Fuel Storage Facility, Tacoma, Washington.** Managed the operation and maintenance of a free product (diesel and oil) and groundwater recovery/treatment system at an active bulk fuel terminal in Tacoma, Washington. The work was conducted in accordance with a MTCA consent decree. Upon project takeover, the treatment system effluent could not meet the sanitary sewer discharge standards. The initial work included evaluating the performance of the system and designing and installing cost effective modifications. The modifications included an initial product separation tank, a more efficient product coalescing media in the existing oil/water separator tank, and a more effective pump control system at each recovery well. After implementing the modifications, the product recovery rate increased and the treatment system effectively reduced the contaminant concentrations to below the sewer discharge standards.

- **Treatment Technology Assessment, Former Locomotive Maintenance Shop, Castle Rock, Washington.** Conducted a technology assessment for treatment of extracted groundwater (the facility water supply) that contained carbon tetrachloride and chloroform. The assessment included an evaluation of effectiveness, potential limitations, and estimated capital, installation, and operation and maintenance costs of five treatment technologies. Conducted bench scale testing of the preferred technology, and assisted in the client's design and construction of the full-scale treatment system.

Airline/Airport Projects

- **Investigation and Remedial Action, Former Fuel Farm Area, SeaTac International Airport.** Managed the investigation activities to identify the sources of three Jet A free product plumes at a former fuel farm area at SeaTac International Airport. The work was also conducted to delineate the lateral extents of each plume. After completing the investigation and conducting a dual-phase extraction (DPE) pilot test, the work consisted of designing and installing a DPE system to remove the free product and reduce the petroleum hydrocarbon concentrations in the soil to below risk-based cleanup levels. The DPE system consists of 16 extraction points that are plumbed to two 7.5-horsepower liquid ring pumps. Successfully negotiated the use of groundwater compliance points located over 200 feet from the product areas to prevent the need to remediate the dissolved-phase concentrations. System operation and maintenance and groundwater monitoring activities are ongoing.
- **Remediation of Petroleum-Impacted Soil, Bulk Fuel Farm, Spokane International Airport, Washington.** Managed the remediation of petroleum hydrocarbon-impacted soil and groundwater at a former bulk fuel farm at Spokane International Airport. The work initially consisted of performing a risk evaluation of the impacted soil in accordance with the Department of Ecology's Interim TPH Policy; monitoring groundwater conditions

in perched and deep monitoring wells; and negotiating a cleanup action plan with the Department of Ecology. Successfully negotiated perched groundwater cleanup levels based on protection of surface water and installed a surface water compliance well approximately 500 feet downgradient of the groundwater plume. To recover free product (Jet A fuel) from the groundwater and remove the soil that contained total petroleum hydrocarbon concentrations greater than a risk-based cleanup action level, the remediation work consisted of excavating approximately 15,000 tons of soil, hauling over 9,600 tons of impacted soil off site for thermal treatment, pumping over 20,000 gallons of free product and impacted groundwater from one of the excavations, and backfilling the excavations with "clean" excavated soil and the thermally treated soil. After completing the remediation work and one year of groundwater monitoring, the Department of Ecology issued a "no further action" status for the site.

- **Remedial Investigations, Bulk Fuel Farm and Aircraft Maintenance Hangars, SeaTac International Airport, Washington.** Managed remedial investigations at a bulk fuel farm and associated closed and abandoned hydrant line systems, and at two aircraft maintenance hangars at SeaTac International Airport. The investigations consisted of preparing work plans and negotiating scopes of work with the Port of Seattle and the Department of Ecology. In addition, the project included extensive permitting and coordination for work in the airport operations area; drilling and sampling a total of 130 soil borings; installing several groundwater monitoring wells; sampling groundwater from wells and temporary wellpoints; evaluating the direct contact and protection of groundwater risks associated with the TPH-impacted soil, and preparing reports. Based on the results of the risk analyses, soil cleanup levels of up to 13,500 milligrams per kilogram TPH have been proposed for the sites.
- **Carbon Management Services, Major U.S. Airline.** Managed a team that provided carbon management services to a major U.S. airline that allowed them to understand their ecological footprint and inform their stakeholders of the beneficial impact of their efforts to reduce their footprint. The work initially consisted of calculating the annual total greenhouse gas (GHG) emissions of their operations and the operations of a subsidiary regional U.S. airline for the period of 2004 through 2008. The emissions inventory included direct fuel emissions from aircraft, ground support equipment, other company vehicles, and from facility heating, and indirect emissions from electricity usage. The calculated GHG emissions were compared to productivity metrics to account for changes in air travel demand and operational capacity. The primary emission sources and the effectiveness of previous emission reduction efforts were evaluated. The work also included an evaluation of all of the airline's environmental programs and preparation of text about those programs, as well as about the GHG emissions inventory, for their website and for a Corporate Environmental Responsibility Report. SLR calculated the client's GHG emissions on an annual basis from 2009 through 2012.
- **Decommissioning of Bulk Fuel Farm, SeaTac International Airport, Seattle, Washington.** Managed a team that designed the scope of work, obtained the permits, prepared the contractor bid plans and specifications, and conducted contractor oversight for decommissioning of a bulk fuel farm and associated fuel hydrant line system at SeaTac International Airport. The decommissioning activities included demolishing and disposing the aboveground components of the fuel farm (e.g., electrical control shed, fuel filter sheds, and aboveground pumps and piping), removing and disposing fourteen

30,000-gallon underground Jet A fuel storage tanks, backfilling the excavation, capping the site surface with asphalt, and inerting and capping the underground hydrant lines. The project also included designing, installing, and operating an in-situ bioventing system to remediate the backfilled petroleum hydrocarbon-impacted soil and the impacted soil outside of the tank excavation area. Within 5 months of system operation, the hydrocarbon concentrations in the soil were reduced to below risk-based cleanup levels.

- **Remedial Investigation, Kotzebue Airport, Kotzebue, Alaska.** Managed a remedial investigation and exposure pathway assessment of the petroleum hydrocarbon-impacted soil and groundwater beneath an aircraft terminal in Kotzebue, Alaska. The work consisted of negotiating a scope of work with the Alaska Department of Environmental Conservation, preparing a work plan, drilling and sampling soil borings, completing several of the borings as temporary wells, collecting groundwater samples from the temporary wells and existing monitoring well, and collecting air samples from inside of the terminal building. Based on the results of the investigation, a conceptual site model was developed, preliminary chemicals of potential concern (COPCs) were identified for soil, groundwater and air, and potential human and ecological receptors and exposure pathways were evaluated for the COPCs. Based on acceptable risks to human and ecological receptors, active remediation of the contamination was not required.
- **Soil and Groundwater Remediation, SeaTac International Airport, Seattle, Washington.** Managed the design, installation, and operation and maintenance of a dual-phase extraction system to remediate chlorinated solvent (tetrachloroethene and trichloroethene) and petroleum hydrocarbon-impacted soil and perched groundwater at a former solvent and petroleum storage area at SeaTac International Airport. The system consisted of a 10-horsepower, liquid-ring pump that extracted product, groundwater, and soil vapors from two recovery wells. The extracted water and product were pumped into a storage tank, and the extracted vapors were treated by two carbon-filled canisters prior to emission. After five months of operation, the system was deactivated because the recoverable product was removed and the hydrocarbon and solvent concentrations in the extracted vapors had decreased to asymptotic conditions. The system recovered a total of approximately 3,500 gallons of product and groundwater, and a total of approximately 7,770 pounds (1,160 gallons) of volatile organic compounds in the vapor phase.
- **Groundwater Study, SeaTac International Airport, Seattle, Washington.** Manager and hydrogeologist of a team that conducted peer review of the Port of Seattle's (Port's) groundwater study at SeaTac International Airport. The purpose of the groundwater study, which was conducted in accordance with a MTCA agreed order, is to provide a more comprehensive understanding of the fate and transport of groundwater contamination beneath the airport. Phase I of the groundwater study consisted of creating an extensive database containing hydrogeologic conditions and groundwater receptor locations within a 10-mile radius of the airport, and environmental investigation results within a 1-mile radius of the airport. The database was used to model contaminant fate and transport beneath the airport. The objectives of peer review work were to ensure that the terms of the agreed order were met but not exceeded, to identify areas where significant cost savings could be realized, and to review and provide comment on the database and the model results. Phase II of the modeling work was

annual groundwater monitoring at sentinel wells to verify the model results. The Port contracted SLR to conduct the Phase II work, which consisted of installing 6 new sentinel wells, conducting annual groundwater sampling at 11 sentinel wells, and reporting.

- **Site Remediation and Cost Recovery, Aircraft Hangar, SeaTac International Airport.** Managed the soil and groundwater remediation activities that were conducted during the demolition of an aircraft maintenance hangar building at SeaTac International Airport. The work consisted of the removal of an underground diesel storage tank, the remediation of gasoline free product on the perched groundwater, and the excavation of petroleum hydrocarbon and chlorinated solvent-impacted soil at known source areas. The product remediation work consisted of excavating approximately 1,370 cubic yards of hydrocarbon-impacted soil and pumping the product from the groundwater that collected in the excavation. Managed the soil assessment work that was conducted during construction of a new hangar complex at the site. The work consisted of screening over 5,000 tons of excavated soil for the presence of petroleum hydrocarbons and chlorinated solvents, and collecting soil samples to assess the post-excavation soil conditions and to determine the appropriate end use/disposal classification of the excavated soil. After completing the project, assisted the client in successful cost recovery negotiations with the previous site owner.

Wood Products Facility Projects

- **Remedial Investigation/Feasibility Study, Former Plywood Mill, Longview, Washington.** Managed a remedial investigation/feasibility study (RI/FS) at a former plywood mill in Longview, Washington. The RI included drilling and sampling 16 soil borings, sampling groundwater from temporary wells in several of the borings, evaluating the direct contact and protection of groundwater risks associated with the petroleum hydrocarbon-impacted soil, and evaluating the impacts of naturally occurring organic debris in soil on the total petroleum hydrocarbons as diesel and oil concentrations. The FS consisted of determining alternative soil cleanup action levels by using the results of the risk analysis and a substantial and disproportionate cost analysis, and developing and evaluating four soil remediation alternatives. The work also consisted of negotiations with the Department of Ecology to establish a MTCA consent decree and cleanup action plan with soil and groundwater cleanup levels.
- **Remedial Investigation and Remedial Action, Sawmill Facility, Toutle, Washington.** Managed a remedial investigation and soil remediation at a former locomotive fueling station at a sawmill near Toutle, Washington. The investigation consisted of excavating and sampling 18 test pits to delineate the lateral and vertical extents of diesel- and oil-impacted soil. The remediation work consisted of soil excavation and off-site treatment by bioremediation methods. The work was conducted in a short time period to accommodate site construction activities. After completing the project, the project team received a Letter of Appreciation from the client.
- **Remedial Investigation/Feasibility Study and Remedial Action, Former Sawmill, Longview, Washington.** Managed a remedial investigation/feasibility study (RI/FS) and soil remediation at a former sawmill in Longview, Washington. The work initially

consisted of negotiating a MTCA consent decree and an RI/FS work plan with the Department of Ecology. The RI consisted of drilling over 20 soil borings, installing 7 monitoring wells, conducting quarterly groundwater monitoring, and evaluating the direct contact and protection of groundwater risks associated with the petroleum hydrocarbon-impacted soil. The FS consisted of determining alternative soil and groundwater cleanup levels based on the risk evaluation, and developing and evaluating four remediation alternatives. The remediation work consisted of excavating the impacted soil and off-site treatment by bioremediation methods.

- **Remedial Investigations, Sawmill Facility, Snoqualmie, Washington.** Managed remedial investigations at three areas of a sawmill facility in Snoqualmie, Washington. The investigations consisted of drilling and sampling a total of 31 soil borings, installing 13 monitoring wells, and sampling the groundwater in the monitoring wells and in temporary wells in four of the borings. The work also included evaluating the direct contact and protection of groundwater risks associated with the petroleum hydrocarbon-impacted soil. Based on the results of the risk evaluation, an elevated TPH cleanup level was established for the sites.

- **Remedial Investigation/Feasibility Study and Remedial Action, Former Log Handling and Truck Fueling Facility, Chehalis, Washington.** Managed a remedial investigation/feasibility study (RI/FS) and site remediation at a former log handling and truck fueling facility in Chehalis, Washington. The RI consisted of drilling and sampling 14 soil borings, installing 9 monitoring wells, and conducting quarterly groundwater monitoring. The FS consisted of determining soil cleanup levels, establishing alternative groundwater cleanup action levels, and developing and evaluating four remediation alternatives for the gasoline-impacted soil and groundwater (including free product). The site remediation included soil excavation and off-site treatment by physical aeration methods, groundwater and product extraction from the open excavations, and groundwater treatment by ozonation and carbon filtration methods.

Agriculture Chemical Projects

- **Remedial Investigation, Feasibility Study, and Remedial Action, Agriculture Chemical Storage Facility, Pasco, Washington.** Managed a remedial investigation/ feasibility study (RI/FS) at an agriculture chemical storage and distribution facility in Pasco, Washington. The work initially consisted of the preparation of a technical report, in accordance with a MTCA agreed order, that summarized the previous site investigations and remedial actions, identified the contaminants of concern for soil and groundwater, presented a baseline risk evaluation and site conceptual model, and described preliminary site remedial action objectives. Negotiated the scope of work and prepared a work plan for an RI/FS that was approved by the Department of Ecology. The RI consisted of drilling and sampling 11 soil borings, installing 6 shallow and 3 deep monitoring wells, conducting quarterly groundwater sampling, collecting surface water samples from a neighboring stream, re-evaluating the contaminants of concern and the site conceptual model, and preparing a report. The FS included identifying and screening several soil and groundwater remediation technologies, developing and evaluating five cleanup action alternatives, and recommending an alternative. After

completing the FS, negotiated a MTCA agreed order and cleanup action plan (CAP) with the Department of Ecology. The CAP included elevated contaminant cleanup levels, active soil remediation at only one area of the site, and long term groundwater monitoring instead of active groundwater remediation. The first phase of the remedial action was completed and the long-term groundwater monitoring program was started. Since the nitrate concentrations in the shallow groundwater were not actively addressed during the remedial action, a subsequent investigation was conducted to identify the primary sources of the nitrate-impacted groundwater, and an FS was performed to evaluate alternatives to remediate the identified source areas.

- **Remedial Investigation and Remedial Action, Agriculture Chemical Storage Facility, Caldwell, Idaho.** Managed a remedial investigation and remedial action at an agriculture chemical storage and distribution facility in Caldwell, Idaho. The work, which was conducted under a consent order, initially consisted of the development and negotiation of a focused scope of work with the Idaho Department of Environmental Quality. The work included the drilling and sampling of over 40 soil borings, the installation of over 10 groundwater monitoring wells, and groundwater monitoring. After it was discovered that the groundwater contamination extended off of the subject property, an off-site assessment was conducted that included a potential receptor survey, collecting a water sample from a neighboring water supply well, and collecting groundwater samples from over 10 temporary wells. As part of the remedial action, prepared and negotiated a remedial action plan that included cleanup levels for the contaminants of concern (nitrate and organochlorine pesticides). Conducted a remedial action that included sediment excavation from a former storm water evaporation pond, soil excavation, surface capping above inaccessible impacted soil, and groundwater monitoring. The work also included the design, permitting, and construction of a new evaporation pond for the facility storm water.
- **Soil Investigation, Agriculture Chemical Storage Facility, Moses Lake, Washington.** Managed a soil investigation at an agriculture chemical storage and distribution facility in Moses Lake, Washington. The purposes of the work were to assess the potential presence of agriculture chemicals at a previous soil excavation area and at an area of land spreading of the excavated soil. Since the detected pesticide and nitrate concentrations were below the appropriate MTCA cleanup levels and potential impacts to groundwater were unlikely, the potential risks to human health and the environment were acceptable. The Department of Ecology verbally stated that this issue will likely be considered closed.
- **Assist with Establishment of Environmental Reserves, Major Agricultural Chemical Company.** Reviewed previous environmental reports to evaluate environmental conditions and estimate future environmental costs at over 50 agriculture chemical storage and distribution facilities throughout the United States. For each site, prepared a letter that described any environmental concerns, presented a scope of work to address the identified concerns, and detailed the estimated project costs. The client used this information to establish environmental reserves for the facilities. Reviewed the client's corporate policy to estimate and manage environmental remediation liabilities, and provided recommendations.

- **Subsurface Investigation and Beneficial Use Study, Agriculture Chemical Storage Facility, LaGrande, Oregon.** Managed a subsurface investigation at an agriculture chemical storage and distribution facility in LaGrande, Oregon. The purposes of the work were to assess background arsenic concentrations in soil, assess lateral and vertical extents of petroleum-impacted soil, determine lateral extents of nitrate-impacted perched groundwater, and determine the laterals extents of pesticide-impacted soil and perched groundwater. The investigation consisted of drilling and sampling nine soil borings, installing four groundwater monitoring wells, and collecting groundwater samples from the monitoring wells and from temporary wells that were installed in five of the borings. After completing the investigation, conducted a beneficial water and land use survey to evaluate receptors and the appropriate cleanup levels. The results of the investigation and beneficial use survey showed the soil concentrations were below the site cleanup levels and the groundwater concentrations, except for nitrate, were below the site cleanup levels. Based on the results of the work, the Oregon Department of Environmental Quality issued a "no further action" determination for the site and de-listed the site from their Confirmed Release List.
- **Subsurface Investigation, Agriculture Chemical Storage Facility, Roberts, Idaho.** Managed a subsurface investigation at an agriculture chemical storage and distribution facility in Roberts, Idaho. The purposes of the work were to assess the petroleum hydrocarbon concentrations near a former diesel tank and to delineate the vertical extent of dinoseb-impacted soil near a chemical storage warehouse. The work also consisted of cleaning residual material that contained elevated dinoseb concentrations from the concrete floor of the warehouse. The results of the investigation showed that the petroleum concentrations were below risk-based cleanup levels and the vertical extent of the dinoseb-impacted soil was effectively characterized. The vertical extent of the dinoseb-impacted soil was over 20 feet above the groundwater table.
- **Subsurface Investigation, Agriculture Chemical Storage Facility, Bruneau, Idaho.** Managed a subsurface investigation at an agriculture chemical storage and distribution facility in Bruneau, Idaho. The purposes of the work were to assess the petroleum hydrocarbon concentrations in the driveway area, and to delineate the lateral and vertical extents of the pesticide-impacted soil at the former empty pesticide container storage area. The investigations consisted of drilling and sampling 16 soil borings and collecting 3 surface soil samples. The results of the investigation showed that the petroleum hydrocarbon concentrations were below the risk-based cleanup levels, and pesticide (dieldrin, 4,4'-DDT, and 4,4'-DDD) concentrations exceeded the appropriate cleanup levels. The lateral extents of the pesticide-impacted soil were defined in all directions, except the south, and the vertical extent of the contamination was not delineated at all of the sample locations.
- **Subsurface Investigation and Soil Excavation, Agriculture Chemical Storage Facility, Toppenish, Washington.** Managed a subsurface investigation and remedial action at an agriculture chemical storage and distribution facility in Toppenish, Washington. The objectives of the work were to determine the lateral extents of the nitrate-impacted groundwater beneath the site and to remediate the petroleum hydrocarbon-impacted soil [including polycyclic aromatic hydrocarbons (PAHs)] near a former railroad tie treating operations area. The petroleum-impacted soil was excavated and hauled off-site for treatment, and a risk evaluation was conducted to demonstrate

that the remaining soil concentrations were protective of human health and the environment. After completing the investigation, groundwater monitoring was conducted on a quarterly basis to show that the nitrate concentrations were below the MTCA cleanup level.

- **Subsurface Investigation and Soil Excavation, Agriculture Chemical Storage Facility, Rupert, Idaho.** Managed an investigation at an agriculture chemical storage and distribution facility in Rupert, Idaho. The purposes of the work were to delineate the lateral extents of nitrate- and atrazine-impacted groundwater near the former tank farm, and to define the lateral and vertical extents of pesticide-impacted soil near a former pesticide container area. The work consisted on drilling and sampling 11 soil borings, and installing and sampling 4 groundwater monitoring wells. The results of the investigation showed that the laterals extents of the nitrate-impacted groundwater were not delineated, and the pesticide concentrations in the soil decreased with depth to below the cleanup levels. After completing the investigation, the pesticide-impacted soil was excavated and hauled off-site for treatment at a licensed facility.
- **Subsurface Investigation, Agriculture Chemical Storage Facility, Warden, Washington.** Managed a subsurface investigation at an agriculture chemical storage and distribution facility in Warden, Washington. The objective of the work was to delineate the lateral and vertical extents of pesticide-impacted soil at an inactive agriculture chemical storage and distribution facility. The work consisted of drilling and sampling 22 soil borings. The sample results showed that dieldrin, 4,4'-DDT, 4,4'-DDD, and 4,4'-DDE concentrations exceeded the MTCA Method B cleanup levels at several source areas and the concentrations decreased to below cleanup levels at depths of less than 8 feet.
- **Investigation and Risk Evaluation, Agriculture Chemical Storage Facility, Moses Lake, Washington.** Managed an investigation to assess the lateral and vertical extents of pesticide-, fertilizer-, and metals-impacted soil at an agriculture chemical storage and distribution facility in Moses Lake, Washington. Based on the results of the investigation, conducted a baseline risk evaluation to determine appropriate soil cleanup levels and evaluate if remediation was necessary. The risk evaluation included an exposure assessment based on land use scenarios and exposure pathways, a toxicity assessment of the contaminants of concern, and a calculation of risks. The results of the risk evaluation showed that the risks associated with the contamination were below allowable levels and that remediation was not necessary.

EDUCATION

M.B.A., Executive Program, University of Washington, 2005

M.S. Geology, University of Kansas, 1987

B.S. Geology, University of Puget Sound, 1984

REGISTRATIONS/CERTIFICATIONS

Licensed Geologist, Washington, #695

Registered Geologist, Oregon, #G1652

Professional Geologist, Wyoming, #PG-430

PUBLICATIONS AND PRESENTATIONS

"Groundwater vs. Surface Water Influences on Sediment Toxicity and Geochemistry in a Puget Sound Estuary." With L. Williams and L. Jacobs. Proceedings of the Annual Conference of Society of Environmental Toxicology and Chemistry. 2005.

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