Interim Action Work Plan
Bothell Riverside Site
Revision No. 2

City of Bothell™

April 2010

Parametrix

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Interim Action Work Plan
Bothell Riverside Site
Revision No. 2

Prepared for

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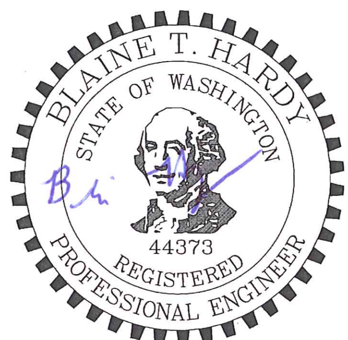
April 2010 | 555-1647-019 (02/0312)

CITATION

Parametrix. 2010. Interim Action Work Plan
Bothell Riverside Site.
Revision No. 2. Prepared by Parametrix,
Bellevue, Washington. April 2010.

CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned, whose seal, as a professional engineer licensed to practice as such, is affixed below.



Prepared by Blaine Hardy, PE

Checked by Scott Elkind, PE

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ACRONYMS AND ABBREVIATIONS

ARAR	applicable or relevant and appropriate requirement
Bgs	below ground surface
CFR	Code of Federal Regulations
City	City of Bothell
COPC	contaminant of potential concern
DCE	dichloroethene
Ecology	Washington State Department of Ecology
HVOC	halogenated volatile organic compound
IAWP	Interim Action Work Plan
mg/kg	milligrams per kilogram
MTCA	Model Toxics Control Act
PCE	tetrachloroethene
RAO	remedial action objective
RI/FS	remedial investigation/feasibility study
Site	Riverside site
SR	State Route
TCE	trichloroethene
TPH	total petroleum hydrocarbons
UST	underground storage tank
WAC	Washington Administrative Code

1. INTRODUCTION

This Interim Action Work Plan (IAWP) is prepared for the Bothell Riverside site (Site) in Bothell, Washington (Figure 1-1). The IAWP is being conducted under Agreed Order DE 6295, as amended in April 2010, between the City of Bothell (City) and the Washington State Department of Ecology (Ecology). The purpose of the Agreed Order is to conduct a remedial investigation/feasibility study (RI/FS), submit a cleanup plan to address known soil contamination related to historical releases of hazardous substances at the Site, and implement interim remedial action(s).

The City currently owns the Site, a portion of which will accommodate the realignment of State Route (SR) 522, which is scheduled for construction in summer 2010. The interim remedial action will be implemented during the construction window of the roadway realignment project. Remnant portions of the property will be redeveloped as part of the City's overall Downtown Revitalization Plan. In general, remedial action approaches discussed in this document will address anticipated future property uses as envisioned in the Downtown Revitalization Plan. Figure 1.1 from the Bothell Downtown Subarea Plan is provided in Appendix A for reference. The figure shows proposed future land uses in the vicinity of the Site.

1.1 PURPOSE

This IAWP was completed per the Agreed Order and Washington Administrative Code (WAC) 173-340-380, Model Toxics Control Act (MTCA) (Ecology 2007). Under WAC 173-340-430, an interim remedial 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, RI/FS, or design of a remedial action.

The purpose of the IAWP is to present a general conceptual-level description of an interim remedial action to remediate petroleum hydrocarbon-contaminated soil at the site. The contaminated media at the site are described in detail in the draft RI/FS submitted by the City (Parametrix 2009). Any additional remedial action that may be required at the Site will be addressed as an additional interim remedial action and/or after the RI/FS is completed (see Section 2.2.3). The IAWP was developed using information obtained during Site investigations that began in 1990 and are ongoing. This IAWP includes the following:

- Applicable state and federal laws for the remedial action.
- Cleanup standards for each hazardous substance and for each medium of concern.
- A brief summary of the other remedial action alternatives evaluated in the draft RI/FS.
- A description of the proposed remedial action and a summary of the rationale used for selecting the proposed alternative.
- A schedule for implementation of the remedial action.

This IAWP also includes the Compliance Monitoring Plan (including a Sampling and Analysis Plan/Quality Assurance Project Plan) (Appendix B), which will be used during completion of interim remedial action at the Site. The Health and Safety Plan (submitted under separate cover) guidelines will also be followed.

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2. SITE CONDITIONS

This section summarizes the Site history and the human health and environmental concerns.

2.1 SITE HISTORY

The Site is located on the south side of SR 522, between downtown Bothell and the Sammamish River (Figure 2-1), and is approximately 2 acres. The property is currently undeveloped and used for parking.

Historical operations on this property included a gasoline service station, known as the “Flying A” station, located at the northwestern portion of the Site (SEACOR 1990). Site investigation work in the early 1990s discovered residual soil and groundwater contamination attributed to the service station operation. Restaurants were located in buildings on either side of the service station and a cabinet shop may have been located near the northeast corner of the property (SEACOR 1990; ECOSS 2008). The service station opened in 1946 (ECOSS 2008) and operated until the early 1960s (SEACOR 1990). The service station building was demolished some time after 1965. The station contained at least two 1,000-gallon underground storage tanks (USTs). The tanks were apparently removed before 1990 (SEACOR 1990). Various Site soil and groundwater investigations have taken place since 1990. For a more detailed discussion of the Site history, physical characteristics, and previous investigations, please see the draft RI/FS (Parametrix 2009).

2.2 HUMAN HEALTH AND ENVIRONMENTAL CONCERNS

The following sections include a discussion of the nature and extent of Site contamination to be addressed by the proposed remedial action, a summary of the Site contaminants of potential concern (COPCs), and an assessment of risk.

2.2.1 Soil

This section summarizes the nature and extent of soil contaminated with COPCs that will be addressed by the proposed remedial action.

2.2.1.1 Petroleum Hydrocarbons

As discussed in Section 2.1, several Site investigations were conducted between 1990 and 1993 to assess petroleum-related contamination associated with a former gas station. In 1991 and 1992, contaminated soil associated with petroleum release(s) was excavated from the Site. Post-excavation sampling results confirmed the removal of petroleum-contaminated soil exceeding MTCA Method A cleanup levels. The excavated material was treated on the Site and used as excavation backfill. Based on the results of sampling during the 2008 Phase II investigation (HWA 2008) and September 2009 RI/FS investigation, lube-oil-range petroleum hydrocarbons above MTCA Method A cleanup levels remain in the soil within the upper 4 feet of material used as backfill. The estimated horizontal extent of petroleum-contaminated soil is shown on Figure 2-1.

2.2.1.2 Metals

Limited sampling for metals was conducted within the former excavation area during the 2009 RI/FS investigation. A total of seven locations were sampled including borings R-12, R-16, R-17, R-19, R-20, R-21, and R-23. Samples were collected between 0 and 4 feet below ground surface (bgs). All samples were analyzed for MTCA metals, which includes arsenic, cadmium, chromium, lead, and mercury. None of the metals concentrations were above MTCA Method A cleanup levels.

Detected metals concentrations in soil were also compared to MTCA Ecological Indicator Soil Concentrations to assess soil quality. Lead, which exceeded the Indicator Concentration of 50 milligrams per kilogram (mg/kg), was detected in R-12 (54 mg/kg) and R-19 (55 mg/kg) within the 2- to 4-foot interval.

2.2.2 Groundwater

This section summarizes the nature and extent of groundwater contaminated with COPCs that will be addressed by the proposed remedial action.

2.2.2.1 Halogenated Volatile Organic Compounds

Historical and current groundwater samples collected from Site wells and borings were analyzed for halogenated volatile organic compounds (HVOCs). Tetrachloroethene (PCE) and breakdown daughter products such as trichloroethene (TCE), cis-1,2-dichloroethene (cis-1,2-DCE), and vinyl chloride were detected in groundwater. PCE, TCE, and vinyl chloride exist in groundwater in both on-Site and upgradient wells at concentrations exceeding MTCA Method A cleanup levels.

During the 2009 RI/FS investigation, eight new monitoring wells were installed to better assess the nature and extent of the HVOC contamination previously identified. The wells were installed at depths ranging from approximately 22 to 42 feet bgs. Monitoring wells RMW-7, RMW-8, and RMW-9 were installed to better assess migration of the HVOC plume (see Figure 2-1). RMW-10 was installed to approximately 42 feet bgs and was completed in the lower portion of the water-bearing zone. During the 2009 RI/FS investigation, monitoring wells BC-3 and RMW-6 were the only wells on the Site showing PCE, TCE, and vinyl chloride at concentrations exceeding their respective MTCA Method A cleanup levels.

Based on the results from the 2008 Phase II and the 2009 RI/FS investigations, it appears that the HVOC groundwater contamination is related to an upgradient source. The presence of PCE daughter products indicates that natural biological degradation and attenuation of PCE are occurring in groundwater.

2.2.3 Summary of Contaminants of Potential Concern

Based on the draft RI/FS (Parametrix 2009), the primary COPC for soil to be addressed by the proposed interim action is:

- Heavy oil-range petroleum hydrocarbons

For groundwater, COPCs include:

- HVOCs

Characterization and remediation of the HVOCs in groundwater will be addressed in the RI/FS.

2.2.4 Assessment of Risk

Complete exposure pathways developed under the draft RI/FS (Parametrix 2009) for the COPCs include the following:

- Current/future industrial worker and future indoor commercial:
  - Inhalation of vapors from the subsurface (groundwater) in outdoor or indoor air
- Current/future construction/utility worker:
  - Incidental soil ingestion and dermal contact
  - Inhalation of vapors from soil in outdoor air
  - Inhalation of vapors or dermal contact with groundwater in a trench or excavation
- Current/future Site visitor and future residents (adult and child):
  - Incidental soil ingestion and dermal contact
  - Inhalation of vapors from the groundwater in outdoor or indoor air
- Ecological receptors:
  - Incidental soil ingestion and dermal contact
  - Inhalation of vapors from the groundwater in air while animals are in a burrow
  - Potential groundwater to surface water (Sammamish River) pathway.

Exposure to contaminants could occur via the complete exposure pathways described above. Based on the nature and the extent of contamination, current risks appear limited. The most likely exposure risk is to construction workers during soil-disturbing activities. Direct contact with soil by visitors or ecological receptors would be limited due to the presence of a gravel cover.

Based on the proposed future development, the human and ecological receptors would have limited risk of direct contact because the portion of the property containing contamination above regulatory standards would be covered by a roadway, buildings, or pavement.

Because of the presence of HVOCs in groundwater, the potential exists for migration of volatile chemicals from groundwater through soil to outdoor air. However, the duration of the potential exposure would be minimal, and actual risk would be low.

Currently, no buildings are located on the property, so vapor intrusion into indoor air is not an issue. However, if future development should include the construction of buildings, vapor intrusion and associated risks should be evaluated.

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3. APPLICABLE STATE AND FEDERAL LAWS

This section discusses the applicable state and federal laws for the interim action including applicable or relevant and appropriate requirements (ARARs), cleanup standards, and remedial action objectives (RAOs).

3.1 APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS

Remedial actions under MTCA (WAC 173-340-710) require the identification of all ARARs. Potential ARARs were identified for each medium of concern in the draft RI/FS (Parametrix 2009). The applicable state and federal laws specific to the proposed remedial action are shown in Table 3-1.

3.2 REMEDIATION LEVELS

Based on the COPCs developed within the draft RI/FS, a list of specific hazardous substances and their associated remediation levels was developed. Applicable remediation levels for the Site were selected from WAC 173-340-720 through 173-340-760. A conservative approach was used to select standards that were most protective of human health and the environment for soil. The following soil remediation levels were selected for the Site:

- MTCA Method A Soil Cleanup Levels for Unrestricted Land Use (WAC 173-340, Table 740-1)

MTCA Method A cleanup standards are appropriate for soil because they are protective of human health and groundwater. Terrestrial ecological receptors will be protected under the future property development scenario, which includes the placement of pavement, buildings, and associated hardscape over the entire interim action footprint (refer to Figure 1-1 in Appendix A). The placement of these types of soil covers qualifies the interim action area for an exclusion from a terrestrial ecological evaluation under WAC 173-340-7491(1) (b). It is acknowledged that an institutional control is required for this exclusion.

For heavy oil-range petroleum hydrocarbons in soil, the MTCA Method A cleanup level of 2,000 mg/kg was selected for the interim action.

3.3 REMEDIAL ACTION OBJECTIVES

The following RAOs have been established for remediation alternatives:

- Achieve the soil cleanup standards for heavy oil-range total petroleum hydrocarbons (TPH) of 2,000 mg/kg.
- Reduce or eliminate human exposure through direct contact (incidental soil ingestion, skin contact with soil, and inhalation of vapors) with contaminated soil or groundwater that exceeds protective regulatory levels.
- Reduce or eliminate risks to ecological receptors from contaminated soil or groundwater.
- Use permanent solutions to the maximum extent practicable (which includes consideration of cost-effectiveness).
- Conduct proper management of contaminated groundwater that may be generated during remediation to ensure that potential exposure to the contaminated on-Site groundwater is reduced or eliminated.

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4. REMEDIAL ALTERNATIVES SUMMARY

This section summarizes remediation alternatives developed under the draft RI/FS (Parametrix 2009) in accordance with MTCA requirements and guidelines. The draft RI/FS is still undergoing Ecology review and comment.

4.1 REMEDIAL ALTERNATIVE DEVELOPMENT

Three remedial alternatives for petroleum-contaminated soil remediation were developed that meet the RAOs and MTCA requirements. Each alternative is summarized below.

4.1.1 Alternative 1 – Natural Attenuation with Cap

Soil Alternative 1 consists of maintaining the planned realignment of SR 522 directly over the existing soil contamination in order to eliminate exposure pathways associated with surface and subsurface soil.

Groundwater monitoring will be conducted for four quarters after realignment of the roadway is complete to verify the contaminated soil has not affected the groundwater in the area. In order to adequately monitor the area, an upgradient well will be installed and a total of 11 wells will be monitored.

The capital costs for Alternative 1 total $21,000 and the operations and maintenance costs total $79,000 for a total alternative cost of $80,000

4.1.2 Alternative 2 – Chemical Oxidation

The chemical oxidation alternative (Soil Alternative 2) will be implemented as an in situ remedial technology prior to the construction of the realignment of SR 522. RegenOx™ by Regenesis is the product proposed as the basis for Soil Alternative 2. A bench-scale treatability test will be conducted to help refine the full-scale treatment approach for Soil Alternative 2. This alternative would consist of mixing the RegenOx™ with the contaminated soil to a depth of 4 feet. The area to be treated is approximately 10,800 square feet. Confirmation soil sampling will be completed on the sidewalls and bottom of the excavation. After in situ treatment, the planned realignment of SR 522 will be constructed over the treated soil.

Groundwater monitoring will be conducted for four quarters after realignment of the roadway is complete to verify the contaminated soil has not affected the groundwater in the area. In order to adequately monitor the area, an upgradient well will be installed and a total of 11 wells will be monitored.

The capital costs for Alternative 2 total $464,000 and the operations and maintenance costs total $48,000 for a total alternative cost of $512,000

4.1.3 Alternative 3 – Excavation and Off-Site Disposal

Approximately 1,600 cubic yards or 2,500 tons of contaminated soil will be excavated with heavy equipment. The contaminated soil will be trucked to a permitted landfill. Confirmation soil sampling will be completed on the sidewalls and bottom of the excavation. The excavated area will then be backfilled with clean material.

The realignment of SR 522 will be constructed over the excavated area. Groundwater monitoring will be conducted for four quarters after realignment of the roadway is complete to verify the contaminated soil has not affected the groundwater in the area. In order to adequately monitor the area, an upgradient well will be installed and a total of 11 wells will be monitored.

The capital costs for Alternative 3 total $422,000 and the operations and maintenance costs total $48,000 for a total alternative cost of $470,000

4.2 REMEDIAL ALTERNATIVES COMPARISON

The three selected soil alternatives were compared in accordance with MTCA regarding the following criteria:

- Each of the alternatives would be protective of human health and the environment through a combination of physical barriers, contaminant destruction or removal, and compliance monitoring.
- Each of the alternatives would be in compliance with cleanup standards in that cleanup levels would be met at the points of compliance for soil.
- Each of the alternatives would be designed and implemented to meet the requirements of the ARARs.
- Each of the alternatives would conduct health and safety protection monitoring during implementation to ensure that the safety of workers, surrounding populations, and the environment are protected. Each of the alternatives would also provide performance and confirmation monitoring to confirm cleanup standards have been attained and to monitor the long-term effectiveness of the cleanup action.

Table 4-1 summarizes the comparison of the alternatives. Effectiveness was evaluated in terms of protectiveness and ability to achieve the RAOs. The implementability of the alternatives depends on their technical feasibility, the availability of required resources, and administrative feasibility. Public concern reflects the anticipated level of adverse public reaction to each alternative. Costs were developed based on Engineer’s estimates and experience from past similar projects. Additional details appear in the draft RI/FS.

5. PROPOSED INTERIM REMEDIAL ACTION

Alternative 3, excavation and off-Site disposal, is the proposed interim remedial action for the Site. Approximately 1,600 cubic yards or 2,500 tons of contaminated soil will be excavated with heavy equipment (see Figure 5-1). The contaminated soil will be transported and disposed of in a Subtitle D landfill for final disposal. Confirmation soil sampling will take place on the sidewalls and bottom of the excavation. A total of 12 confirmation soil samples will be collected. The excavated area will then be backfilled with clean material.

The realignment of SR 522 will be constructed over the excavated area. The roadway construction will consist of a minimum of 4 inches of asphaltic concrete paving on top of a minimum of 12 inches of engineered subbase.

This proposed remedial action is protective of human health and the environment, attains federal and state requirements that are applicable or relevant and appropriate, complies with cleanup standards, meets the threshold criteria, provides a high likelihood of achieving the RAOs within a reasonable restoration time frame, and meets the additional performance criteria. Furthermore, the risks discussed in Section 2.2.4 are mitigated under the proposed remedial action because the action is expected to largely remove the contaminants to levels that are protective to receptors.

Groundwater monitoring will be conducted for four quarters after realignment of the roadway is complete to verify the removed contaminated soil has not affected the groundwater in the area. In order to adequately monitor the area, an upgradient well will be installed and a total of 11 wells will be monitored. It is recommended that the groundwater samples collected be analyzed for HVOCs during each quarterly event to provide an ongoing assessment of concentration trends. These data would aid potential future planning efforts regarding remediation of the upgradient HVOC sources. In addition to monitoring for HVOCs, any future Site development activities should include the proper management and disposal of contaminated groundwater generated by construction activities.

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6. SCHEDULE

The proposed remedial action is planned to be implemented during the construction window of the realignment of SR 522. Construction activities for the realignment of SR 522 are anticipated to begin during the second quarter of 2010including the excavation, removal and disposal of contaminated soil and backfill in the remediation areas. The environmental remediation activities will commence within 90 days of the start of construction.

Groundwater monitoring in the area of the excavation will be conducted for 1 year after the completion of the SR 522 realignment to verify the soil contamination has been removed and remediation levels for Site contamination have been met.

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7. REFERENCES

Ecology (Washington State Department of Ecology). 2007. Model Toxics Control Act Cleanup Regulations. Washington Administrative Code (WAC) 173-340. November 2007.

ECOSS (Environmental Coalition of South Seattle). 2008. City of Bothell Revenue Development Area, Report on Tax Parcel History through 1972. Prepared for King County Solid Waste Division. January 2008.

HWA. 2008. Phase II Environmental Site Assessment, Riverside Property, Bothell, Washington. Prepared for City of Bothell. July 28, 2008.

Parametrix. 2009. Draft Bothell Riverside Remedial Investigation/Feasibility Study Revision No. 0. Prepared by Parametrix, Bellevue, Washington. November 2009.

SEACOR. 1990. Site Investigation, City of Bothell Riverside Property, Bothell, Washington. Prepared for City of Bothell. October 12, 1990.

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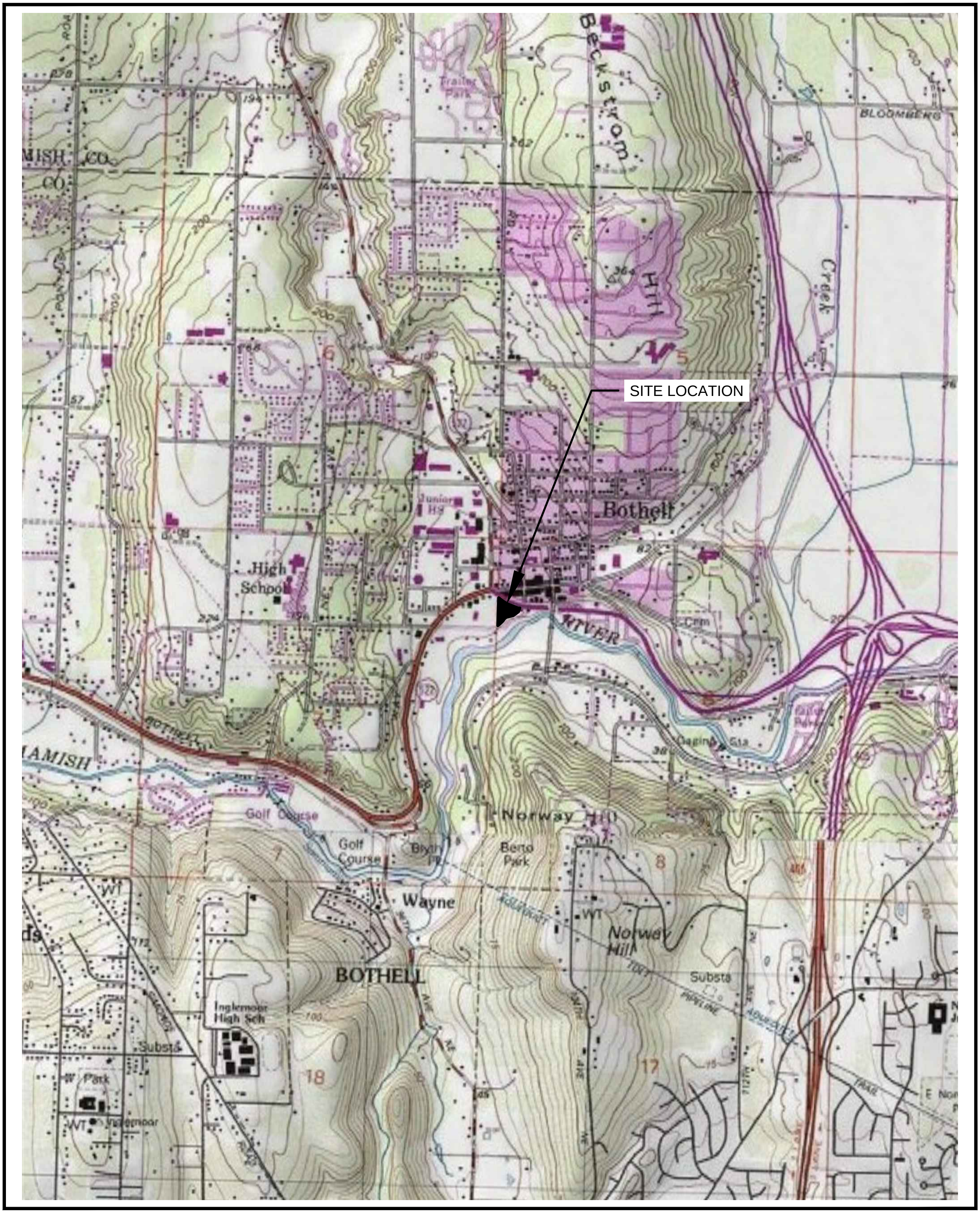
FIGURES



Parametrix DATE: Apr 01, 2010 FILE: BR1647019P02T0312_F-01-1

Image Source: USGS Bothell Quadrangle 1981

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SCALE IN FEET

Figure 1-1
City of Bothell
Bothell Riverside Site
Site Vicinity

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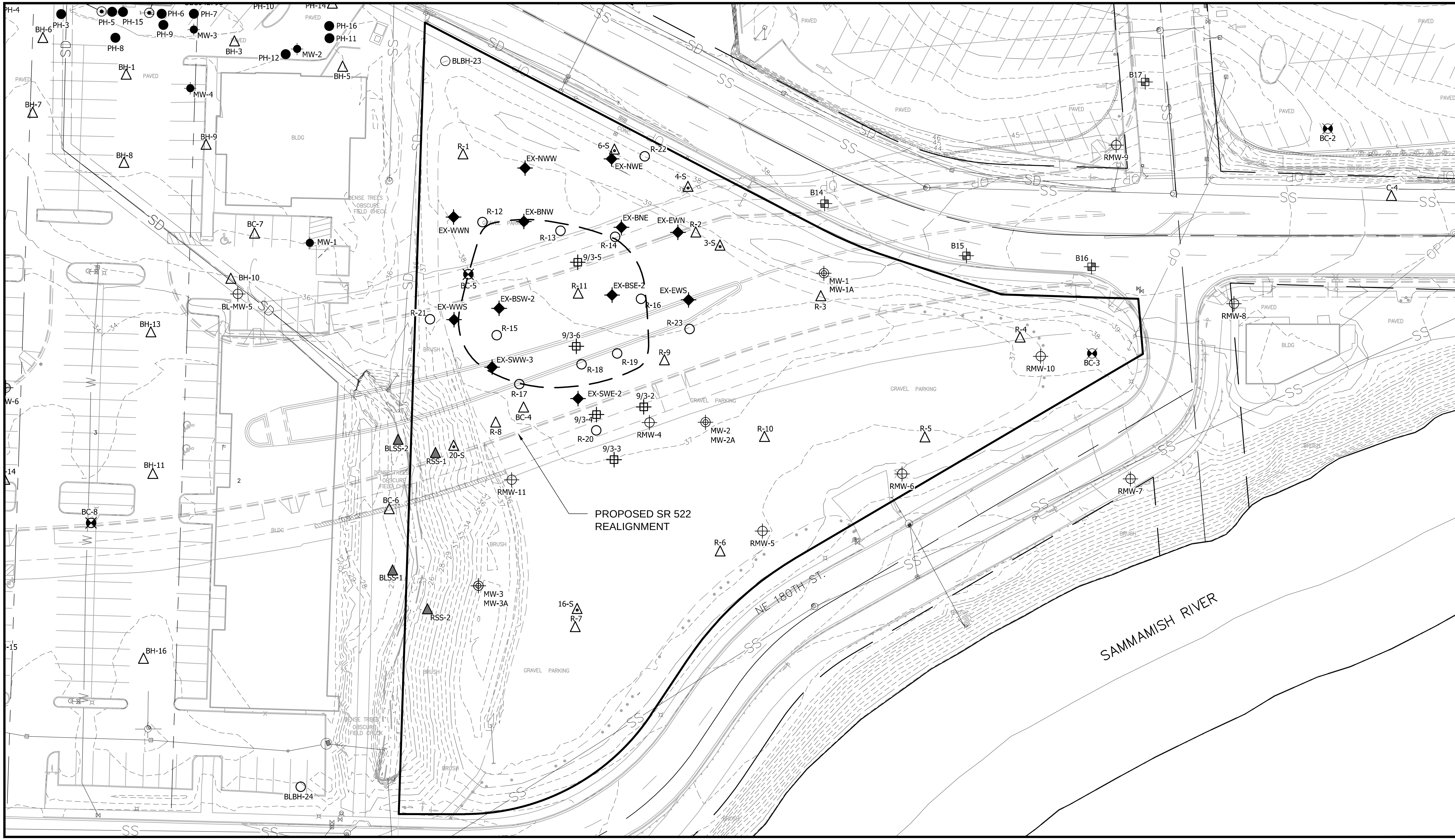

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SCALE IN FEET

LEGEND

- PSI 1998 CLOSURE SAMPLE LOCATIONS
- KLEINFELDER 1999 BORING LOCATIONS
- KLEINFELDER 1999 WELL LOCATIONS
- HWA 2007 PHASE II ESA BORINGS
- HWA 2007 WELL LOCATIONS
- PMX 2009 RI/FS BORING LOCATIONS
- PMX 2009 RI/FS WELL LOCATIONS
- PMX 2009 RI/FS SURFACE SOIL LOCATIONS
- CDM 2009 ROW BORING LOCATIONS
- SEACOR 1990 & 1991 TEST PIT LOCATIONS
- RZA AGRA 1991 EXCAVATION CONFIRMATION SAMPLE LOCATIONS
- GROUNDWATER TECHNOLOGY 1992 EXCAVATION CONFIRMATION SAMPLE LOCATIONS
- GTI 1992 FORMER WELL LOCATIONS
- PROPERTY BOUNDARY
- APPROX LIMITS OF PETROLEUM IMPACTED SOILS

Figure 2-1
City of Bothell
Bothell Riverside Site
Site Plan

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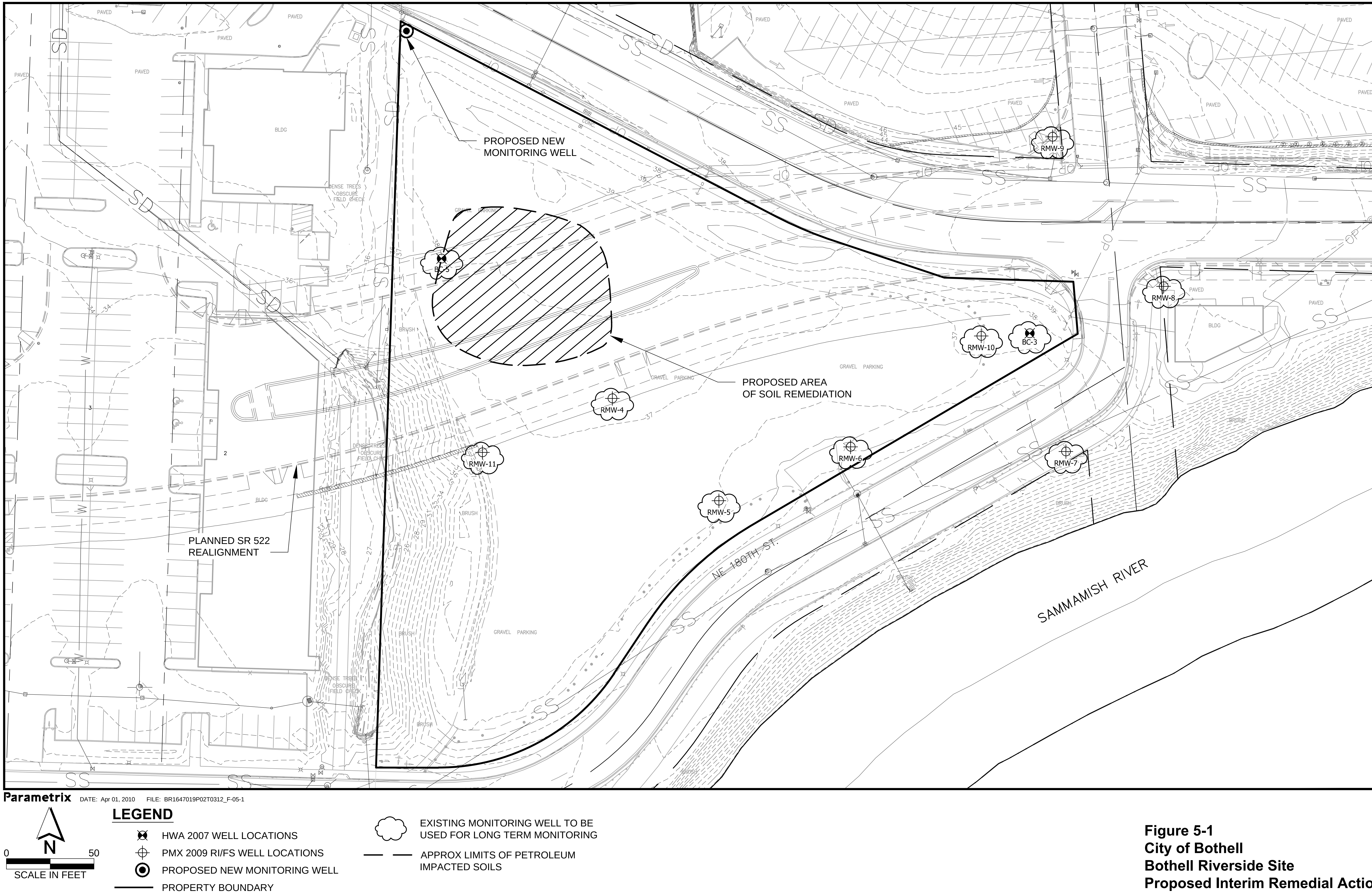

Parametrix DATE: Apr 01, 2010 FILE: BR1647019P02T0312_F-05-1

Figure 5-1
City of Bothell
Bothell Riverside Site
Proposed Interim Remedial Action

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TABLES

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Table 3-1. Potential Applicable or Relevant and Appropriate Requirements (ARARs)

ARAR	Applicability
Soil	
Model Toxics Control Act (WAC 173-340-740, -747)	MTCA cleanup levels are applicable to Site soil.
Groundwater	
Model Toxics Control Act (WAC 173-340-720)	MTCA cleanup levels are applicable to Site groundwater.
Surface Water	
Model Toxics Control Act (WAC 173-340-730)	MTCA cleanup levels are applicable for the Site if remedial activities cause a release to surface water.
Air	
Washington Clean Air Act and Implementing Regulations (WAC 173-400; WAC 173-460; WAC 173-490)	Applicable for excavation activities.
Model Toxics Control Act (WAC 173-340-750)	MTCA cleanup levels are applicable to the Site if remedial activities cause a release to air.
Miscellaneous	
Protection of Wetlands, Executive Order 11990 (40 Code of Federal Regulations [CFR] Part 6, Appendix A)	This Act would be potentially applicable to remedial activities at the Site.
Native American Graves Protection and Repatriation Act (43 CFR Part 10)	This Act is applicable to remedial actions at the Site because it is possible that the disturbance of Native American materials could occur as a result of work in the subsurface excavations at the Site. Such materials are not known to be present at the Site, but could be inadvertently uncovered during soil or sediment removal.
National Historic Preservation Act (36 CFR Parts 60, 63, and 800)	This Act is applicable to subsurface work at the Site. No such sites are known to be present in the area.
Washington Hazardous Waste Management Act (WAC 173-303)	This regulation is applicable to handling of contaminated media on the Site. The contamination policy allows contaminated media to be consolidated within the same area of a site without triggering Resource Conservation and Recovery Act or Washington dangerous waste regulations.
Department of Transportation of Hazardous Wastes (49 CFR 105 – 180)	Applicable to remedial activities that involve the off-site transportation of hazardous waste.
Washington Solid Waste Handling Standards (WAC 173-350)	These regulations are applicable to solid nonhazardous wastes and are relevant and appropriate to on-site remedial actions governing contaminated media management.
Washington Water Well Construction Act Regulations (WAC 173-160)	These regulations are potentially applicable to the installation, operation, or closure of monitoring and treatment wells at the Site.

Table 4-1. Detailed Alternatives Analysis

Alternative	Description	Effectiveness	Implementability	Public Concern	Estimated Cost
1. Natural Attenuation with Cap	Leave contamination in place. Monitor groundwater biannually for a minimum of 10 years.	Medium	High	Medium	$80,000
2. In Situ Chemical Oxidation	Treat contamination in situ using soil mixing, and chemical oxidation. Monitor groundwater quarterly for 1 year.	Medium	Medium	Medium	$512,000
3. Excavation and Off-Site Disposal	Excavate and remove contaminated soils. Monitor groundwater quarterly for 1 year.	High	Medium	Low	$470,000

APPENDIX A

Bothell Downtown Subarea Plan (Figure 1.1)

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C. The Envisioned Future Downtown

This section provides an overview of the desired physical outcomes intended to result from implementing the combined regulations and planned public actions contained in this Plan.

The Downtown Subarea is composed of a multitude of privately held properties and miles of public rights-of-way under public ownership. The overarching purpose of the Downtown Plan is to orchestrate investment in changes made to this multiplicity of properties to produce greater value than any separate development could achieve, by providing a common purpose that all investors can rely upon, contribute to, and derive value from. This section describes the common purpose to which all investments shall be directed: a vision of the future that is sufficiently specific to provide a common purpose, yet broad enough to respond to opportunities and to the changes in the marketplace that will inevitably arise.

Note: The specific outcomes described and illustrated in this section are not part of the formal regulating code, and new development proposals will not be required to mimic the specific designs presented in the illustrations.

Fig. 1.1 A vision of potential future development in Downtown Bothell showing one scenario focusing on redevelopment in the core area

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APPENDIX B

Compliance Monitoring Plan

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TECHNICAL MEMORANDUM

Date:	April 2, 2010
To:	City of Bothell Project File
From:	Scott Elkind
Subject:	Bothell Riverside Interim Action Compliance Monitoring Plan
cc:	Ken Fellow Steve Fuller
Project Number:	555-1647-019 (02/0312)
Project Name:	Bothell Riverside IAWP

INTRODUCTION

In conjunction with the realignment of State Route (SR) 522 and the southward extension of SR 527, the City of Bothell (City) is redeveloping the City's downtown core, which includes the Bothell Riverside Site (Site). The Site is currently under Agreed Order (AO) No. 6295 with the Washington State Department of Ecology (Ecology) to perform a Remedial Investigation/Feasibility Study (RI/FS), implement interim cleanup action(s), and develop a cleanup action plan (CAP) that will address known contamination, related to historical releases of hazardous substances at the site. Excavation of contaminated soils is to take place in compliance with the AO as an Interim Action (IA) for the remediation of petroleum-hydrocarbon-contaminated soils and groundwater at the site. The IA will be implemented during the construction window of the roadway realignment project. Remnant portions of the property will be redeveloped as part of the City's overall Downtown Revitalization Plan. At the current time, the IA for the Site is planned to consist of the following:

- Source removal by excavation of contaminated soils.
- Quarterly groundwater monitoring.

This Compliance Monitoring Plan (CMP) has been prepared in accordance with Washington Administrative Code (WAC) 173-340-410, Compliance Monitoring Requirements. The CMP will be used to:

- Ensure contaminated soil exceeding appropriate cleanup standards is removed during the IA through sampling of the excavation sidewalls and bottom.
- Ensure IA activities are conducted in a safe manner.
- Confirm the effectiveness of the IA through groundwater monitoring following completion of the IA.

There are three types of compliance monitoring: protection, performance, and confirmational monitoring. A description of each is presented in the following sections.

PROTECTION MONITORING

The purpose of protection monitoring is to confirm that human health is adequately protected during construction. Health and safety protocols, including monitoring requirements, are specified in the site-specific health and safety plan (HASP). The HASP has been completed as a separate document.

PERFORMANCE MONITORING

The purpose of performance monitoring is to confirm that the IA has attained appropriate cleanup standards. For the Site, this will include the collection of soil samples from the sidewalls and bottom of the excavation to confirm complete removal of contaminated soil during the IA and collection of soil stockpile samples to help determine proper disposal and/or re-use options. Sample collection procedures, required chemical analyses, and other requirements for performance monitoring are presented in the Compliance Monitoring Quality Assurance Project Plan (CMQAPP) included as Attachment 1 to this technical memorandum. The CMQAPP includes the appropriate cleanup levels necessary to assess soil quality and evaluate the need for continued excavation to achieve the necessary cleanup goals.

CONFIRMATIONAL MONITORING

The purpose of confirmational monitoring is to confirm the effectiveness of the soil IA. This will be accomplished by conducting four quarters of groundwater monitoring following completion of the soil IA. Groundwater purging and sample collection procedures, required chemical analyses, and other requirements for confirmational monitoring are presented in the CMQAPP included as Attachment 1 to this technical memorandum.

ATTACHMENT 1

Compliance Monitoring Quality Assurance Project Plan

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Compliance Monitoring Quality Assurance Project Plan
Bothell Riverside Site
Revision No. 2

Prepared for

City of Bothell
9654 NE 182nd Street
Bothell, WA 98011

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April 2010 | 555-1647-019 (02/0312)

CITATION

Parametrix. 2010. Compliance Monitoring Quality
Assurance Project Plan
Bothell Riverside Site. Revision No. 2.
Prepared by Parametrix, Bellevue, Washington. April 2010.

CERTIFICATION

The technical material and data contained in this document were prepared under the supervision and direction of the undersigned.

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ACRONYMS AND ABBREVIATIONS

AO	Agreed Order
CFR	Code of Federal Regulations
City	City of Bothell
CLP	Contract Laboratory Program
CMQAPP	Compliance Monitoring Quality Assurance Project Plan
COPCs	contaminants of potential concern
cy	cubic yard
DQIs	data quality indicators
DQOs	Data Quality Objectives
Ecology	Washington State Department of Ecology
EDD	electronic data deliverable
EIM	Environmental Information Management
EPA	U.S. Environmental Protection Agency
EPH/VPH	extractible petroleum hydrocarbons/volatile petroleum hydrocarbons
gpm	gallon per minute
GPS	global positioning system
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations and Emergency Response
HVOCs	halogenated volatile organic compounds
IA	interim action
IAWP	Interim Action Work Plan
ID	inside diameter
IDW	investigation derived waste
MS/MSD	matrix spike/matrix spike duplicate
MTCA	Model Toxics Contol Act
NTUs	nephelometric turbidity units
OD	outside diameter
ORP	oxidation-reduction potential
PAH	polycyclic aromatic hydrocabon
PID	photoionization detector
PQL	practical quantitation limit
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control

ACRONYMS AND ABBREVIATIONS (CONTINUED)

RI/FS	Remedial Investigation/Feasibility Study
RPD	relative percent difference
Site	Bothell Riverside Site
SOPs	Standard Operating Procedures
SR	State Route
USTs	underground storage tanks
WAC	Washington Administrative Code

1. INTRODUCTION

In conjunction with the realignment of State Route (SR) 522 and the southward extension of SR 527, the City of Bothell (City) is redeveloping the City's downtown core, which includes the Bothell Riverside Site (Site). The Site, located in Bothell, Washington, (Figure 1-1) is under an Agreed Order (AO) Number DE 6295 between the City and the Washington State Department of Ecology (Ecology) to conduct a remedial investigation/feasibility study (RI/FS), implement interim remedial action(s), and submit a remedial action plan to address known soil contamination related to historical releases of hazardous substances at the Site.

This Compliance Monitoring Quality Assurance Project Plan (CMQAPP) is incorporated within the Interim Action Work Plan (IAWP) for this site, and has been prepared to fulfill the requirements of the Agreed Order per Washington Administrative Code (WAC) 173-340-410(1)(b), Performance Monitoring, and WAC 173-340-410(1)(c), Confirmational Monitoring. This CMQAPP describes the sample collection procedures, analysis, and defines the Data Quality Objectives (DQOs) and criteria for the project. Parametrix prepared this CMQAPP in accordance with the U.S. Environmental Protection Agency (EPA) and Ecology requirements contained in the following:

- EPA QA/R-5, EPA Requirements for Quality Assurance Project Plans, Final, March 2001
- EPA QA/G-5, EPA Guidance for Quality Assurance Project Plans, December 2002
- EPA QA/G-4, EPA Guidance on Systematic Planning Using the Data Quality Objectives Process, February 2006
- Ecology Model Toxics Control Act (MTCA) (Ecology 2007)

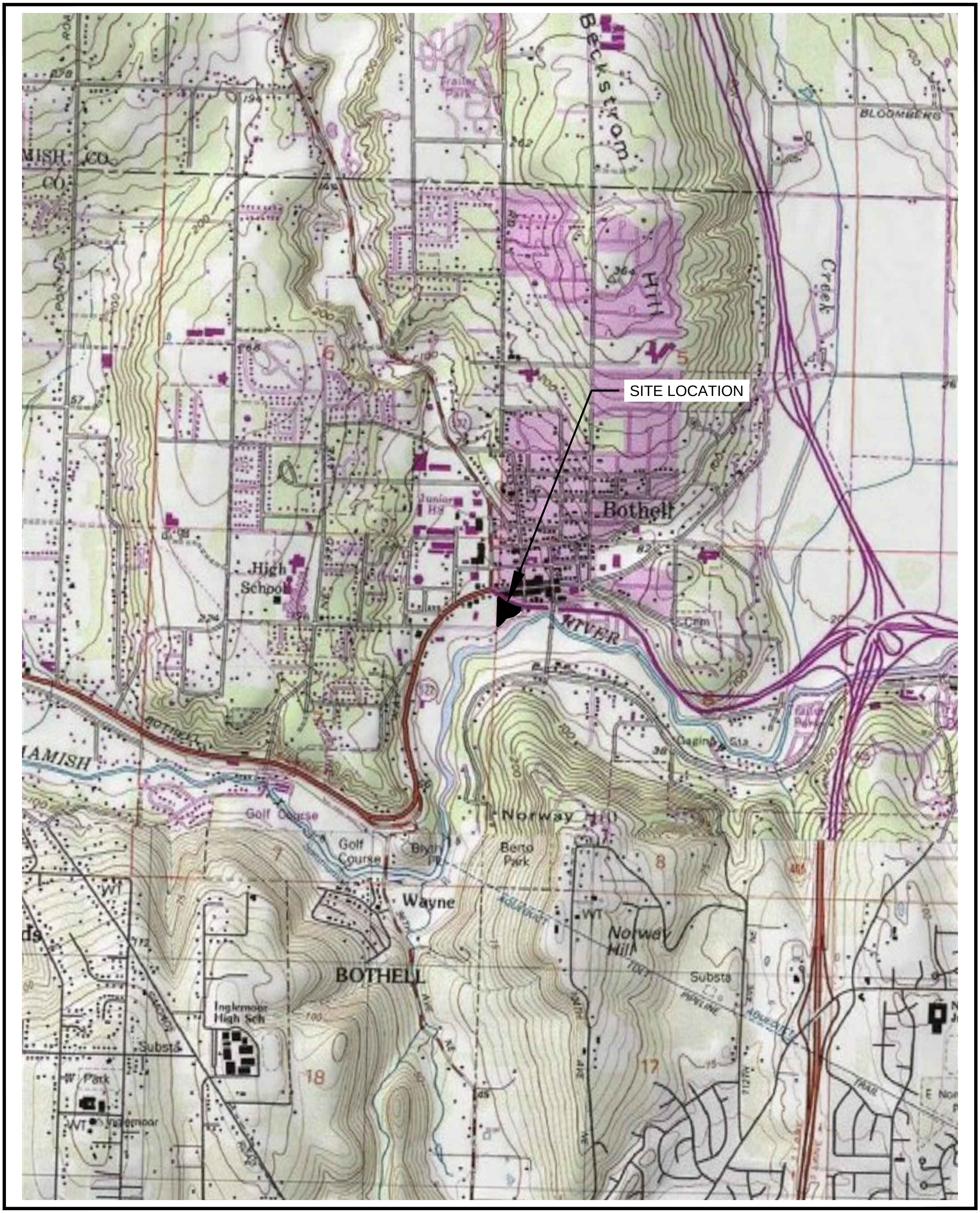

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Image Source: USGS Bothell Quadrangle 1981

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Figure 1-1
City of Bothell
Bothell Riverside Site
Site Vicinity

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2. PROJECT ORGANIZATION AND MANAGEMENT

2.1 PROJECT ORGANIZATION

Specific project roles and responsibilities for oversight and sampling are described in Table 2-1.

Table 2-1. Project Roles and Responsibilities

Personnel	Responsibilities
City of Bothell (Owner) Project Manager	Provides project and construction oversight and performs contract administration.
Contractor	Implements remedial actions and coordinates with environmental consultant for confirmational sampling during construction.
Owner's Representative (Consultant Construction Manager or Environmental Consultant)	Coordinates with Contractor to obtain confirmational sampling during remedial construction; coordinates analytical laboratory testing of samples; prepares interim action reports.

2.2 PROBLEM DEFINITION/BACKGROUND

The Site is located on the south side of SR 522, between downtown Bothell and the Sammamish River, and is approximately 2 acres. The Site is currently undeveloped and used for parking (Figure 2-1).

Historical operations on this site included a gasoline service station, known as the "Flying A" station, located at the northwestern portion of the Site (SEACOR 1990). Site investigation work in the early 1990s discovered residual soil and groundwater contamination attributed to the service station operation. Restaurants were located in buildings on either side of the service station and a cabinet shop may have been located near the northeast corner of the property (SEACOR 1990; ECOSS 2008).

An 1897 topographic map shows a railroad spur line that may have crossed on or near the western edge of the property (HWA 2008). The spur line is not shown on a 1944 topographic map.

The service station opened in 1946 (ECOSS 2008) and operated until the early 1960s (SEACOR 1990). The service station building was demolished some time after 1965. The station contained at least two 1,000-gallon underground storage tanks (USTs). The tanks were apparently removed before 1990 (SEACOR 1990).

The site was the subject of several environmental investigations dating between 1998 and 2009 which included:

- Site Investigation conducted by SEACOR in 1990 (SEACOR 1990).
- A follow-up groundwater investigation by SEACOR in 1991 (SEACOR. 1991).
- Preliminary Environmental Site Assessment in 1991 conducted by Groundwater Technology, Inc. (GTI, 1992).
- Phase I site remediation conducted by RZA AGRA, Inc. in 1992. (RZA AGRA 1992).
- Groundwater monitoring conducted by GTI in 1994 (GTI1994).
- Phase II ESA performed by HWA in 2008 (HWA 2008).
- Remedial Investigation and Feasibility Study (RI/FS) performed by Parametrix in 2009 (Parametrix 2009).

Based on evaluation of analytical data from Site investigations, the primary contaminants of potential concern (COPCs) for soil include:

- Heavy oil-range petroleum hydrocarbons
- Lead (ecological only)

Although polycyclic aromatic hydrocarbons (PAHs) and halogenated volatile organic compounds (HVOCs) have been detected in soil at the Site, no concentration exceeded MTCA Method A cleanup criteria; therefore, they were not included as COPCs as of this writing.

For groundwater, COPCs include:

- Arsenic
- HVOCs

To satisfy the AO requirements, an IAWP was developed for the implementation of an Interim Action (IA) which will be performed to remediate COPCs (except lead) which are present in soil and which are originating form on-site source.

This CMQAPP describes sample collection procedures and quality assurance and control methods to ensure representative data is collected during the IA.

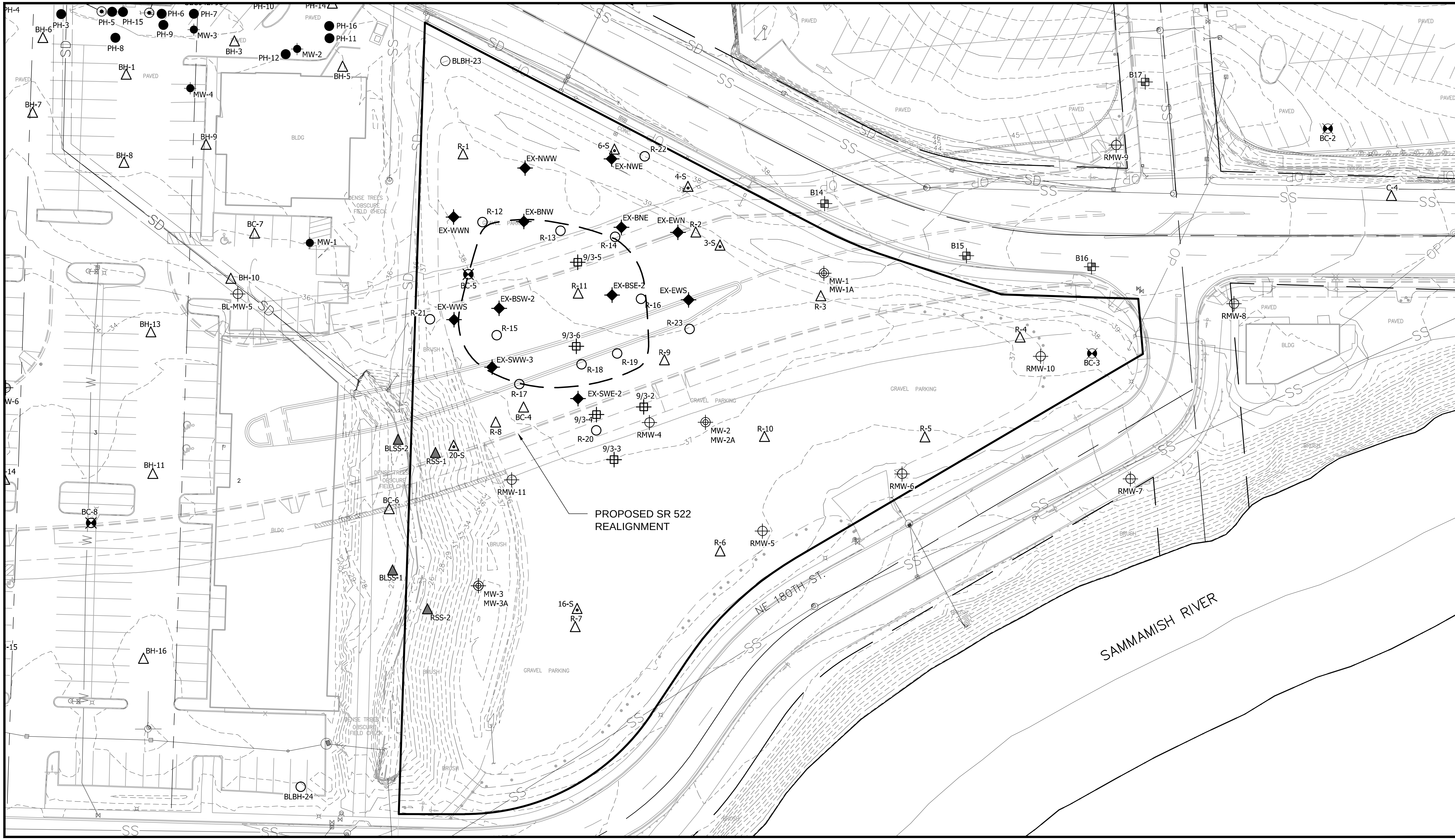
2.3 TASK DESCRIPTION

Based on the results of the RI/FS, the recommended soil remedial action was excavation and off-site disposal. At the current time, the IA is planned to consist of:

- Source removal by excavation in the area outlined in Figure 3-1.
- Quarterly groundwater monitoring to assess groundwater quality following the interim action.

In source excavations, performance monitoring samples will be collected at the bottom and sidewalls of excavations to confirm that target Method A cleanup levels have been met. Stockpiles will also be sampled to confirm and characterize contaminant levels for disposal purposes. Sampling results will be compared to remediation levels provided in Section 3.

Confirmational monitoring will be completed by conducting four quarters of groundwater monitoring following completion of soil removal.



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- PSI 1998 CLOSURE SAMPLE LOCATIONS
- KLEINFELDER 1999 BORING LOCATIONS
- KLEINFELDER 1999 WELL LOCATIONS
- HWA 2007 PHASE II ESA BORINGS
- HWA 2007 WELL LOCATIONS
- PMX 2009 RI/FS BORING LOCATIONS
- PMX 2009 RI/FS WELL LOCATIONS
- PMX 2009 RI/FS SURFACE SOIL LOCATIONS
- CDM 2009 ROW BORING LOCATIONS
- SEACOR 1990 & 1991 TEST PIT LOCATIONS
- RZA AGRA 1991 EXCAVATION CONFIRMATION SAMPLE LOCATIONS
- GROUNDWATER TECHNOLOGY 1992 EXCAVATION CONFIRMATION SAMPLE LOCATIONS
- GTI 1992 FORMER WELL LOCATIONS
- PROPERTY BOUNDARY
- APPROX LIMITS OF PETROLEUM IMPACTED SOILS

Figure 2-1
City of Bothell
Bothell Riverside Site
Site Plan

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2.4 QUALITY OBJECTIVES AND CRITERIA

2.4.1 Data Quality Objectives

DQOs were developed according to EPA's DQOs Process (EPA 2006), to provide data of known and appropriate quality. The DQO process is a seven-step planning approach to develop sampling designs for data collection activities that support decision-making. It provides a systematic procedure for defining the criteria that a data collection design should satisfy. The DQOs for the project are shown in Table 2-2.

Table 2-2. Design Characterization Sampling DQOs

DQO	Description
State the Problem	Was the contaminated soil within the footprint of the remediation area removed?
Identify the Goal of the Study	Does contamination still exist at the selected locations? Are the contaminant levels above applicable cleanup levels? Is the collected chemical data adequate to identify and determine if contamination still exists?
Identify Information Inputs	Analytical results (what are the detected concentrations? are they above cleanup levels? was QA/QC criteria met?). Actual sample locations (correct location and depth?).
Define the Study Boundaries	The Riverside site and adjacent offsite areas containing monitoring wells.
Develop the Analytical Approach	Sampling and analysis strategies will be developed to support the decision making process. Analytical results will be used to determine the presence or absence of contamination. Results will be compared to MTCA Method A (residential) cleanup levels.
Specify Performance or Acceptance Criteria	Ensure through data review and validation that the analytical data for collected samples are within acceptable quality limits as defined by applicable EPA and Ecology data quality protocols.
Develop the Plan for Obtaining Data	Presented in this CMQAPP.

2.4.2 Data Quality Indicators

Data quality and usability are evaluated in terms of performance criteria. Performance and acceptance criteria are expressed in terms of data quality indicators (DQIs). The principal indicators of data quality are precision, accuracy, bias, sensitivity, completeness, comparability, and representativeness. Table 2-3 provides a description of project DQIs.

Table 2-3. General Description of DQIs

DQI	Description
Precision:	A measure of agreement among repeated measurements of the same property under identical conditions. Usually assessed as a relative percent difference (RPD) between duplicate measurements. RPD guidelines for laboratory duplicate analyses are contained in the standard operating procedures (SOPs) for each analytical method and will be obtained from the laboratory for validation purposes.
Accuracy:	A measure of the overall agreement of a measurement to a known value. Analytical accuracy is assessed as percent recovery from matrix spike or reference material measurements. Percent recovery guidelines are contained in laboratory SOPs for each analytical method.
Bias:	The systematic or persistent distortion of a measurement process that causes error in one direction. Usually assessed with reference material or matrix spike measurements. Bias as reported by the laboratory will be used to assess data validity.
Sensitivity:	The capability of a method or instrument to meet prescribed reporting limits. Assessed by comparison with risk-based reporting limits, method reporting limits, instrument reporting limits, or laboratory quantitation limits, as appropriate. In general, reporting limits for the analytical methods used will be at or below applicable criteria.
Completeness:	A measurement of the amount of valid data needed to be obtained for a task. Assessed by comparing the amount of valid results to the total results set. Project requirements for completeness are 90%.
Comparability:	A qualitative term that expresses the measure of confidence that one data set can be compared to another. Assessed by comparing sample collection and handling methods, sample preparation and analytical procedures, holding times, reporting units, and other QA protocols. To ensure comparability of data collected for the Bus Barn to previous data, standard collection and measurement techniques will be used.
Representativeness:	A qualitative term that expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variation at a sample point, or environmental condition. To ensure representativeness, the sampling design will incorporate sufficient samples so that contamination is detected, if present. Additionally, all sampling procedures detailed in this CMQAPP will be followed.

2.5 SPECIAL TRAINING AND CERTIFICATION

All personnel conducting sampling activities on the project site must be 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) trained per 29 Code of Federal Regulations (CFR) 1910.120 and be current with their annual 8-hour refresher course.

All personnel working at the project site will be briefed on potential site hazards, health and safety procedures, and sampling procedures. Following completion of this training, all personnel will be required to sign an acknowledgement form verifying that they have completed the task-specific training.

A Project Health and Safety Plan (HASP) has also been prepared for this site, as required by WAC 296-62-3010. The Contractor and Owner's Representative will prepare their own HASPs to be consistent with the Project HASP.

2.6 SAMPLING DOCUMENTATION AND RECORDS

Sampling documentation will be accomplished according to the procedures provided in Table 2-4.

Table 2-4. Sampling and Sample Handling Records

Record	Use	Responsibility/Requirements
Field Notebook	Record significant events and observations.	Maintained by field sampler/geologist; must be bound; all entries must be factual, detailed, objective; entries must be signed and dated.
Sampling Field Data Sheet	Provide a record of each sample collected (Appendix A).	Completed, dated, and signed by sampler; maintained in project file.
Sample Label	Accompanies sample; contains specific sample identification information.	Completed and attached to sample container by sampler.
Chain-of-Custody Form	Documents chain-of-custody for sample handing (Appendix A).	Documented by sample number. Original accompanies sample. A copy is retained by QA Manager.
Chain-of-Custody Seal	Seals sample shipment container (e.g., cooler) to prevent tampering or sample transference. Individual samples do not require custody seals, unless they are to be archived, before going to the lab for possible analysis at a later date.	Completed, signed, and applied by sampler at time samples are transported.
Sampling and Analysis Request	Provides a record of each sample number, date of collection/transport, sample matrix, analytical parameters for which samples are to be analyzed.	Completed by sampler at time of sampling/transport; copies distributed to laboratory project file.

2.6.1 Field Logs and Forms

A bound field notebook will be maintained to provide daily records of significant events and observations that occur during field investigations. All entries are to be made in waterproof ink, signed, and dated. Pages of the field notebook are not to be removed, destroyed, or thrown away. Corrections will be made by drawing a single line through the original entry (so that the original entry can still be read) and writing the corrected entry alongside. The correction will be initialed and dated. Most corrected errors will require a footnote explaining the correction.

If an error made on a document is assigned to one person, that individual may make corrections simply by crossing out the error and entering the correct information. The erroneous information should not be obliterated. Any error discovered on a document should be corrected by the person who made the entry.

All field logs and forms will be retained in the project files.

2.6.2 Photographs

All photographs taken of field activities will be documented with the following information noted in the field notebook:

- Date, time, and location of photograph taken
- Description of photograph taken

- Reasons photograph was taken
- Viewing direction

Digital photographs will be reviewed in the field to assess quality and need to re-shoot the photograph.

2.7 REPORTING

Following completion of the confirmation sampling and analysis, the results will be included in an interim remedial action report. Reporting will include the following:

- Summary of field activities completed.
- Figures showing sampling locations.
- Summary of laboratory analytical results and a comparison to relevant regulatory criteria.
- Field log forms and sampling forms.
- Laboratory data sheets and the results of data review/validation.
- Recommendations for further sampling, such as groundwater monitoring, if needed.

Preliminary results will be communicated verbally as they become available.

3. SAMPLING PROCESS DESIGN

3.1 SAMPLING PROCESS DESIGN

A Site-specific sampling approach has been developed to provide performance and confirmational monitoring in support of the IA. The IA will target the area of significant petroleum contamination identified during the RI (Figure 3-1). The approach used for the IA will involve source removal by excavation, followed by four quarters of groundwater monitoring to assess short-term groundwater quality following source removal.

A summary of the sampling approach for the IA is provided in Table 3-1. Groundwater monitoring locations and required chemical analyses are presented in Table 3-2.

Table 3-1. Sampling Approach

		COPCs (Soil and Groundwater)	
Area	**No. Locations**	**Soil**	**Groundwater**
Pre-Excavation Sampling	5	EPH/VPH, diesel and heavy oil-range petroleum hydrocarbon	N/A
Interim Action Footprint - Excavation Sidewalls	8[a]	Diesel and heavy oil-range petroleum hydrocarbons	N/A
Interim Action Footprint - Excavation Bottom	4[a]	Diesel and heavy oil-range petroleum hydrocarbons	N/A
Contaminated Soil Stockpile	8[b]	Diesel and heavy oil-range petroleum hydrocarbons[c]	N/A
Groundwater	11	N/A	Diesel and heavy oil-range petroleum hydrocarbons[d], arsenic[d,e], and HVOCs. See Table 3-2.

[a] Additional performance monitoring sampling may be required based on the results for the initial sampling round.

[b] The actual number of stockpile samples required for disposal may change based on the acceptance requirement of the proposed disposal facility.

[c] Additional analyses may be necessary based on disposal facility acceptance requirements.

[d] For selected sampling locations only.

[e] Groundwater will be analyzed for total and dissolved arsenic.

COPCs = contaminants of potential concern.

EPH/VPH = extractible petroleum hydrocarbons/volatile petroleum hydrocarbons.

HVOCs = halogenated volatile organic compounds.

N/A = not applicable.

Table 3-2. Groundwater Monitoring Locations and Analysis

Well	Analytes	Analytical Method
BC-3	HVOCs	EPA Method 8260B
BC-5	Diesel/Heavy Oil-Range Petroleum Hydrocarbons	NWTPH-Dx
	HVOCs	EPA Method 8260B
	Arsenic[a]	EPA Method 200.8
RMW-4	Diesel/Heavy Oil-Range Petroleum Hydrocarbons	NWTPH-Dx
	HVOCs	EPA Method 8260B
RMW-5	Diesel/Heavy Oil-Range Petroleum Hydrocarbons	NWTPH-Dx
	HVOCs	EPA Method 8260B
RMW-6	HVOCs	EPA Method 8260B
	Arsenic[a]	EPA Method 200.8
RMW-7	HVOCs	EPA Method 8260B
	Arsenic[a]	EPA Method 200.8
RMW-8	HVOCs	EPA Method 8260B
RMW-9	HVOCs	EPA Method 8260B
RMW-10	HVOCs	EPA Method 8260B
	Arsenic[a]	EPA Method 200.8
RMW-11	HVOCs	EPA Method 8260B
RMW-12[b]	Diesel/Heavy Oil-Range Petroleum Hydrocarbons	NWTPH-Dx
	HVOCs	EPA Method 8260B
	Arsenic[a]	EPA Method 200.8

[a] Groundwater will be analyzed for total and dissolved arsenic.
[b] New well to be installed.
HVOCs = halogenated volatile organic compounds.

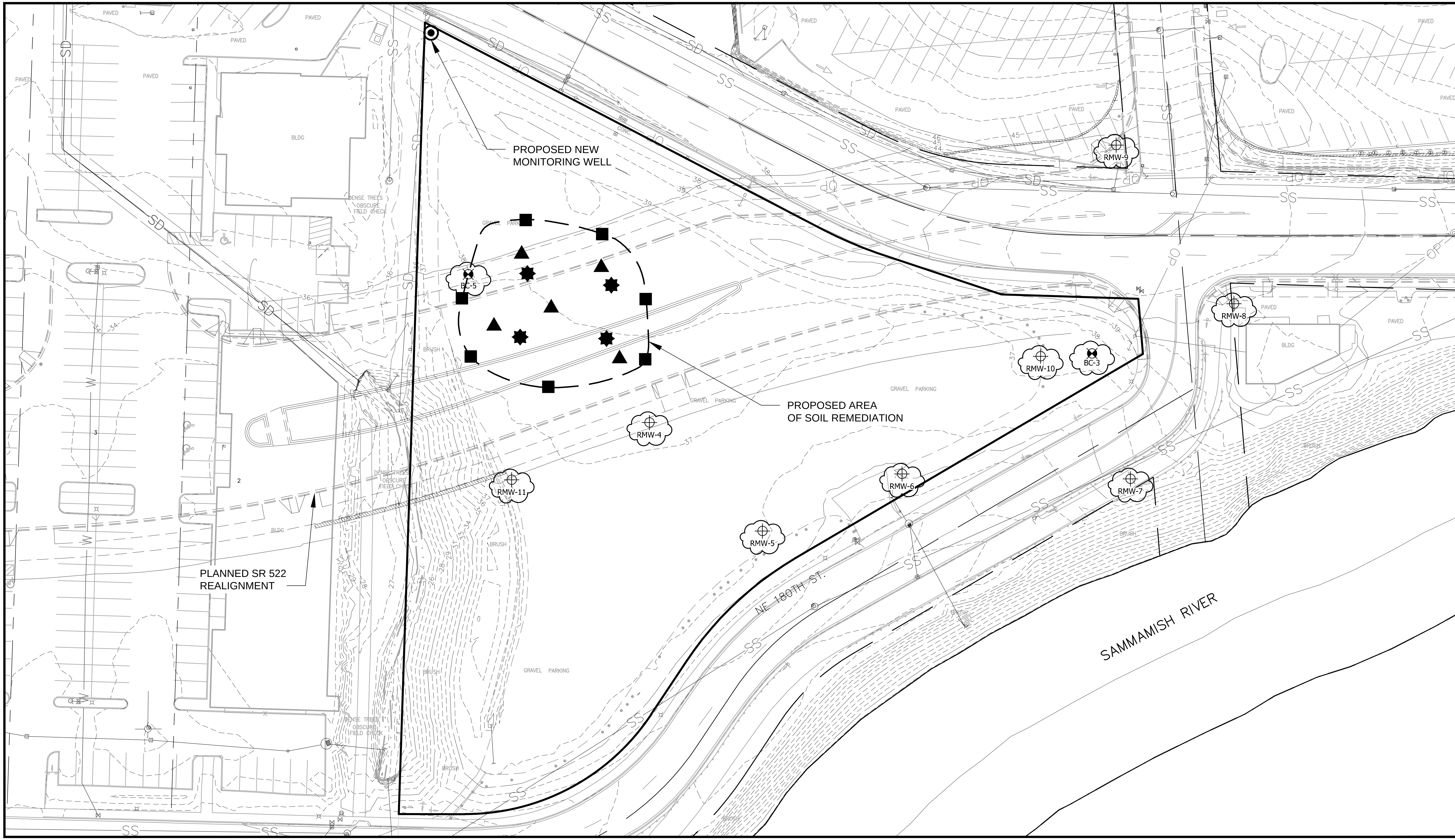
The objectives of the sampling are to confirm that all COPCs have met established cleanup levels in soil, to confirm that all landfill disposal requirements are met for soil disposal, and to monitor groundwater conditions to determine the effectiveness of the remedial action. Details of the remedial action are provided in the following sections.

Flexibility will be incorporated into the field work so that modifications can be made in the field to refine the strategy. An example would be adjusting the location of samples based on field observations.

Descriptions of the specific sampling methods for the above activities are presented in Sections 3.2. In addition, all sampling will be conducted in accordance with standard operating procedures.

3.1.1 Excavation and Soil Removal

The concept for remedial action of source soils within the contaminated area (Figure 3-1) is to remove them by excavation. The extent of the excavation will be determined in the field by real-time observation and field screening. Once the apparent limit of contaminated soil is reached, the bottom and sidewalls of the excavation will be sampled to confirm removal. Both clean and contaminated soils will be stockpiled separately and sampled. Soils that are confirmed clean will be returned to the excavation as backfill. Contaminated soils will be transported to a permitted landfill. The remaining excavation will be backfilled with clean pit run. Removal of all contaminated soils will require excavation dewatering. Contaminated groundwater removed during dewatering will be treated to meet permit effluent standards and will be disposed of into the City’s sanitary sewer system.



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- HWA 2007 WELL LOCATIONS
- PMX 2009 RI/FS WELL LOCATIONS
- PROPOSED NEW MONITORING WELL
- PROPERTY BOUNDARY
- EXISTING MONITORING WELL TO BE USED FOR LONG TERM MONITORING
- APPROX LIMITS OF PETROLEUM IMPACTED SOILS
- PROPOSED EXCAVATION SIDEWALL SAMPLE LOCATION
- PROPOSED EXCAVATION BOTTOM SAMPLE LOCATION
- PROPOSED EPH / VPH SAMPLE LOCATION

Figure 3-1
City of Bothell
Bothell Riverside Site
Proposed Interim Remedial Action
Sampling Locations

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3.1.1.1 Contaminated Soil Removal

The following are the planned steps for contaminated soil removal:

- Prior to beginning excavation, collect soil samples for extractible petroleum hydrocarbons/ volatile petroleum hydrocarbons (EPH/VPH) analysis from pot holes excavated within in the contaminated soil footprint. Five soil samples for EPH/VPH analysis will be collected from the approximate locations shown on Figure 3-1. The samples will be analyzed on a two-day turnaround basis. A range of contaminated soils from moderately to highly contaminated will be targeted for sample collection. Field screening will be used to aid in sample selection. It is anticipated that the samples will be collected from an average of 3 to 4 feet bgs. The results of the EPH/VPH analyses will be input into Ecology's MTCATPH 11.1 spreadsheet model to determine TPH cleanup levels that are protective of direct contact and groundwater. All five samples will also be analyzed for diesel/heavy oil-range petroleum hydrocarbons to provide additional information to be used in the evaluation. Protective concentrations derived using the model will be compared to the remediation levels established for the site. The results of the comparison will be reported in a brief technical memorandum that will be submitted to Ecology. At this time, an evaluation of the appropriateness of the remedial levels will be made in consultation with Ecology. Changes to the remedial levels will be established by agreement between the City and Ecology and will be implemented during the IA. The evaluation will be completed prior to the start of mass soil excavation activities on the Site.
- Excavate contaminated soils from the footprint shown on Figure 3-1. Field screen all excavated soils so that potentially clean and contaminated soils can be segregated and stockpiled separately. Conduct field screening using visual/olfactory methods and headspace measurements using a photoionization detector (PID). Based on historical soil sampling results, it is assumed that no clean soil is present and no clean stock-pile will be generated.
- Excavate contaminated soils to limits defined by on-site field screening. Note that the contaminated soil footprint shown on Figure 3-1 is an estimate; the excavated footprint may change based on actual conditions encountered in the field. Determine the limits of the excavation using field screening and professional judgment. The proposed depth of excavation is 4 feet below ground surface.
- Conduct excavations during the dry summer months (May through September) so that the groundwater table is at the seasonal low. Plan excavations to occur as one of the initial steps in the grading phase of the road realignment.
- Collect performance monitoring soil samples from the base and sidewalls of the excavations. A total of 8 confirmation soil samples will be collected and analyzed for diesel/heavy oil-range petroleum hydrocarbons. Proposed confirmation sample locations are shown on Figure 3-1. Sample results will be compared to the cleanup levels provided in Table 3-3. A second round of performance monitoring sampling may be required if the results of the first round exceed cleanup levels and additional excavation is completed.
- Collect a total of 5 pre-excavation soil samples for analyses of EPH/VPH fractions (Extractable Petroleum Hydrocarbons and Volatile Petroleum Hydrocarbons, respectively) to evaluate Method B cleanup levels vis-à-vis the selected remediation levels and remediation conditions in the field.
- Stockpile "contaminated" soil on plastic sheeting. Cover unworked stockpiles with sheeting at the end of each workday to prevent windblown dust migration and to prevent rainwater infiltration.
- Collect soil samples from contaminated stockpiles. An estimated 1,600 cubic yards (cy) of contaminated soils will be stockpiled. Based on this estimate, a total of four stockpile soil samples will be collected and analyzed for heavy oil. Sample numbers may be reduced based on

Ecology guidelines if stockpile volumes are less than estimated. Dispose of contaminated soil at a permitted landfill. At the current planning level, it is assumed that no soil will require disposal as hazardous waste.

- Restore site by backfilling using imported pit run. Backfill using lifts no greater than 12 inches loose thickness. Compact backfilled soil to a density of at least 90 percent of the maximum value as determined by the Modified Proctor test. Perform a minimum of five density tests for each material type to confirm compaction.

3.1.2 Groundwater Monitoring

At the conclusion of the IA, four quarters of groundwater monitoring will be conducted using the 11 wells shown on Figure 3-1. Following these four events, the appropriateness of additional groundwater sampling events under the IA will be evaluated. Note one new well will be installed following completion of road construction. Groundwater samples collected will be analyzed as shown in Table 3-2. Well installation and sampling shall be performed according to the procedures in Section 3.2.5.

3.1.3 Remediation Levels

As described in the draft RI/FS report (Parametrix 2009), the remediation levels listed in Table 3-3 are applicable under the IA.

Table 3-3. Cleanup Levels

	Medium of Concern	
	Soil	**Groundwater**
Hazardous Substance	**MTCA A [a] (mg/kg)**	**MTCA A [b] (µg/L)**
Diesel	2,000	500
Heavy Oil	2,000	500
Arsenic	-	5

mg/kg = milligrams per kilogram.

µg/L = micrograms per liter.

[a] Model Toxics Control Act Method A Unrestricted Land Uses Table 740-1 (WAC 173-340-900).

[b] Method A Cleanup levels for groundwater Table 720-1 (WAC 173-340-900).

3.2 SAMPLING METHODS AND PROCEDURES

Descriptions of the specific sampling and laboratory methods for the project are presented in this section. The methods described are intended to supplement the SOPs provided in Appendix B. Sampling field forms are provided in Appendix A.

3.2.1 General Sampling Procedures

Excavation sidewall and bottom soil samples will be collected with aid of the excavator or backhoe. Samples will be collected directly from the excavator or backhoe bucket. For excavation less than 4 feet deep, samples may be collected directly from the sidewalls and bottom using hand tools. Samples for non-volatiles analysis will be thoroughly homogenized before being placed in sample containers

For soil stockpiles, one 5-point composite sample will be collected at a rate of approximately one sample per 150 to 200 cy. The actual rate of stockpile sampling may be revised based on the acceptance requirement of the proposed disposal facility. Each of the five sub-samples will be collected with stainless steel or disposable hand tools, placed in a stainless steel mixing bowl and composited. Sub-samples will be collected at least 6-inches below the surface of the stockpile.

All soil samples will be placed into the appropriate sample containers using dedicated, disposable stainless steel or polyethylene spoons. All sample containers will be provided by the analytical laboratory. Bowls used during sample collection will be dedicated, disposable, and constructed of stainless steel, polyethylene, or aluminum. Following sample collection, the location of all samples will be recorded using a handheld global positioning system (GPS) and sketched in the field logbook.

3.2.2 Summary of Sample Media, Numbers, and Analyses

Total numbers of samples to be collected are summarized by medium in Table 3-4. Numbers of samples include four consecutive quarters of groundwater monitoring.

Table 3-4. Summary of Sample Types, Analyses, and Number

Sample Medium	Analysis	No. Field Samples	No. Duplicate Samples	No. Trip Blanks	No. Rinsate Blanks	Total No.
Soil[a]	Diesel/Heavy Oil	25	2	-	-	27
	EPH	5	-	-	-	5
	VPH	5	-	-	-	5
Groundwater	Diesel/Heavy Oil	12	4	-	4	20
	HVOCs	44	4	4	4	56
	Arsenic[b]	20	4	-	4	28

[a] Includes pre-excavation, compliance monitoring, and stockpile samples.
[b] Groundwater will be analyzed for total and dissolved arsenic.
EPH = extractible petroleum hydrocarbons.
HVOCs = halogenated volatile organic compounds.
VPH = volatile petroleum hydrocarbons.

3.2.3 Sample Containers, Preservation, and Holding Times

The following Table 3-5 provides a summary of potential sample analyses and specifications for containers, preservation, and holding times.

Table 3-5. Sample Containers, Preservation, and Holding Times

Analysis	Method	Matrix	Container	Preservation	Holding Time
Diesel/Heavy Oil-Range Petroleum Hydrocarbons	NWTPH-Dx	Soil	1 – 4 oz cwm	Cool to 4°C	14 days
		Groundwater	2 – 500 mL amber	HCL < pH 2 Cool to 4°C	14 days
EPH	EPH	Soil	1 – 4 oz cwm	Cool to 4°C	14 days
VPH	VPH	Soil	2 – pre-weighed vials w/ stir-bar (5 grams of sample per vial)	Cool to 4°C	48 hrs
HVOCs	8260B	Groundwater	3 – 40 mL vials[a], zero headspace	HCL < pH 2 Cool to 4°C	14 days
Arsenic[b]	200.8	Groundwater	1 – 500 mL HDPE Dissolved samples field filtered through 0.45 µm filter	HNO_3 < pH 2 Cool to 4°C	6 months

[a] Teflon-lined silicon septum cap.
[b] Groundwater will be analyzed for total and dissolved arsenic.
cwm = clear, wide-mouth jar.
EPH = extractible petroleum hydrocarbons.
HCl = hydrochloric acid.
HDPE = high-density polyethylene.
HNO_3 = nitric acid.
HVOCs = Volatile organic compounds.
mL = milliliter.
Oz = ounce.
VPH = volatile petroleum hydrocarbons
µm = micron.

3.2.4 Field Screening

During excavation, periodic screening of the excavation sidewalls and will be conducted using a PID and visual/olfactory methods. Each periodic sample will be placed in a re-sealable plastic bag for headspace screening using the PID. The headspace sample will be allowed to heat in the sun for approximately 10 minutes and will then be shaken vigorously. A headspace vapor measurement will be then be collected and recorded on the field sampling form. During sampling, observations will also be made for signs of contamination such as odors, staining, or sheen on saturated samples from below the water table. Such observations will also be recorded on the field sampling form. Field screening information will be used to aid in the determination of the excavation limits.

3.2.5 Monitoring Well Installation, Development, and Sampling

Monitoring wells will be installed by a licensed driller according to applicable Ecology regulations (Chapter 173-160 WAC). The monitoring wells will be constructed using 2-inch inside diameter (ID) polyvinyl chloride (PVC) casings fitted with 10-foot screens (with 0.01-inch or 0.02-inch slots). Well screens will be completed between the depths of 5 and 15 feet bgs. Completed well monuments will be flush-mounted; a 2-foot square concrete pad will be constructed around the monument as a surface seal.

Completed monitoring wells will be allowed to set for at least 24 hours before development to allow grout or bentonite chip seals to set. Development will be achieved by over-pumping at a flow rate of up to 1 gallon per minute (gpm) using a 5/8-inch outside diameter (OD) inertial lift pump fitted with a surge block. New polyethylene tubing shall be used for developing each well.

Water quality parameters (specific conductance, pH, temperature, and turbidity) will be measured during development. Development will be continued until the parameters stabilize as determined by the lack of appreciable change in measurement over several 3-minute monitoring periods or if a turbidity reading of 10 nephelometric turbidity units (NTUs) or less is attained. The 10 NTU criteria are based on EPA sampling guidelines.

Groundwater sampling will be conducted no earlier than 24 hours following development to allow undisturbed water to enter the well column. Groundwater will be collected using a decontaminated, positive-displacement down-hole pump. New, disposable polyethylene tubing will be used at each sample location. For samples collected near the groundwater table, the sample pump will be lowered to 2-feet below the water surface.

Groundwater will be purged and sampled from the wells using low flow techniques. The measured purging and sampling flow rate shall be 0.5 liters per minute or less. Water quality parameters will be measured during sampling; purging shall be considered complete when the criteria shown in Table 3-6 are met over at least three 3-minute monitoring periods.

Table 3-6. Purging Stabilization Criteria

Parameter	Stabilization Criteria
pH	+\- 0.1 unit
Specific conductance	+\- 3%
Oxidation-reduction potential (ORP)	+\- 10 millivolts
Turbidity	+\- 10% (when greater that 10 NTUs)
Dissolved Oxygen	+\- 0.3 milligrams per liter

Filtered samples will be collected using a 0.45 micron filter placed in line with the sample tubing. New well locations will be surveyed with an accuracy of +/- 1 foot horizontally and +/- 0.01 foot vertically.

3.2.6 Decontamination Procedures

Decontamination of all non-disposable tools and equipment will be conducted prior to each sampling event and between each sampling location in accordance with the standard operating procedures. The following steps will be taken during decontamination of sampling equipment used during field investigations:

- Scrub with non-phosphate detergent (i.e., Alconox or similar)
- Rinse with tap water
- Rinse thoroughly with deionized water
- Allow to air dry and place in a new plastic bag for storage

For decontamination of larger tools and equipment, such as push-probe rods, a high-pressure, hot water washer or similar device will be used. Loose soil materials will be removed from equipment using a “dry” decontamination technique consisting of the removal of loose soil using a shovel or brush.

3.2.7 Investigation-Derived Waste

Investigation derived waste (IDW) from sampling activities will be containerized on-site in 55-gallon drums and staged on-site. A single composite sample from both water and soil will be collected for waste characterization. Disposal options for the IDW will be based on the analytical results of the IDW samples. Disposal shall be managed by the Owner’s representative using a licensed waste disposal contractor.

All drums will be labeled indicating date filled, content, location, company, and a unique identification number. All drums and containers will be tracked on a waste-tracking log.

All disposable sampling materials and personal protective equipment, such as disposable coveralls, gloves, and paper towels used in sample processing will be placed inside polyethylene bags or other appropriate containers. Disposable materials will be placed in a normal refuse container and disposed of as normal solid waste in accordance with standard operating procedures for IDW.

3.3 SAMPLE HANDLING AND CUSTODY

The following sections describe sample handling and custody procedures.

3.3.1 Sample Identification and Labeling

Prior to the field investigation, each sample location will be assigned a unique code. Each sample collected at that location will be pre-assigned an identification code using the sampling site followed by other specific information describing the sample. The sample numbering protocol is shown in Table 3-7.

Table 3-7. Sample Numbering Protocol

Site	BR = Bothell Riverside
Matrix	SO = Soil GW = Groundwater TB = Trip blank water
Sampling Station	BRSW01 = Bothell Riverside Sidewall Station 01 BRBT02 = Bothell Riverside Bottom Station 02 BRMW09 = Bothell Riverside Monitoring Well 09 BRSP04 = Bothell Riverside Stockpile Station 04
Sample Type/Sample Depth	0000 = Field sample collected at the surface 0000 = Trip blank water provided by the laboratory 1010 = Field duplicate collected at a depth of 1.0 feet 4115 = Rinsate sample.

Example:
BR-SO-SW01-0120 = Soil sample collected from the excavation sidewall station 01 at a depth of 12.0 feet.

3.3.2 Sample Storage, Packaging, and Transportation

Samples will be placed in a cooler following collection and chilled to approximately 4ºC. Following completion of each days sampling, all samples will be transported and/or shipped to the analytical laboratory, as appropriate. Samples which are routinely delivered to the laboratory on the same day as collection may not have sufficient time to chill to 4ºC.

3.3.3 Sample Custody

The chain-of-custody procedures used for this project provide an accurate written or computerized record that can be used to trace the possession of each sample from the time each is collected until the completion of all required analyses. A sample is in custody if it is in any of the following places:

- In someone’s physical possession
- In someone’s view
- In a secured container
- In a designated secure area

The following information will be provided on the chain-of-custody form:

- Sample identification numbers
- Matrix type for each sample
- Analytical methods to be performed for each sample
- Number of containers for each sample
- Sampling date and time for each sample
- Names of all sampling personnel
- Signature and dates indicating the transfer of sample custody

All samples will be maintained in custody until formally transferred to the laboratory under a written chain-of-custody. Samples will be kept in sight of the sampling crew or in a secure, locked vehicle at all times. Samples that leave the custody of field personnel will be sealed by placing a signed and dated Custody Seal across the seam of the shipping container.

3.4 ANALYTICAL METHODS

All samples will be submitted to a commercial analytical laboratory certified by Ecology to perform the required analyses. Analytical methods are listed in Table 3-5. Laboratory reporting limits will be verified prior to analyses to ensure that, at a minimum, reporting limits for each analyte are equal to or lower than MTCA Method A cleanup levels for soil and groundwater. Matrix interferences may make it impossible to achieve the desired reporting limits and associated quality control (QC) criteria. In such instances, the laboratory shall report the reason for noncompliance with QC criteria or elevated detection limits.

3.5 QUALITY ASSURANCE/QUALITY CONTROL

Quality assurance (QA)/QC checks consist of measurements performed in the field and laboratory. The analytical methods referenced in Section 3.4 specify routine methods required to evaluate data precision and accuracy, and determine whether the data are within acceptable limits.

3.5.1 Field Methods

Guidelines for minimum samples for field QA/QC sampling are summarized in Table 3-8.

Table 3-8. Guidelines for Minimum QA/QC Samples for Field Sampling

	Field		
Media	**Field Duplicate**	**Trip Blank**	**Equipment Blank**
Soil and Groundwater	1 in 20	1 per cooler containing water HVOCs samples	1 in 20 per equipment type, if reusable equipment is utilized

3.5.1.1 Field Duplicates

A minimum of one blind field duplicate will be analyzed per 20 samples. Field duplicates will be collected following field samples. Soil duplicates samples for non-volatiles analysis will be homogenized and split. Duplicate samples will be coded so the laboratory cannot discern which samples are field duplicates.

3.5.1.2 Trip Blanks

A trip blank shall accompany each cooler containing groundwater samples for HVOCs analysis. The trip blank shall be obtained from the laboratory or will be made by filling the appropriate sample containers with certified analyte-free deionized water. Trip blanks will be analyzed for HVOCs with the field samples.

3.5.1.3 Equipment/Rinsate Blanks

One equipment blank will be collected per 20 samples collected with non-disposable sampling equipment. Equipment blanks will be collected by capturing deionized water rinsed over (or through) sampling equipment after decontamination. Equipment blanks will be analyzed for the same constituents as the field samples.

3.5.2 Laboratory Methods and Quality Control

Specific procedures and frequencies for laboratory QA procedures and QC analyses are detailed in the laboratory's QA Plan and SOPs for each method. QC analyses will be performed by the laboratory according to their Ecology-approved SOPs.

Accuracy and precision are determined through QC parameters such as surrogate recoveries, matrix spikes, QC check samples, and blind field duplicates. A blind field duplicate sample will be analyzed as a QC sample for verification of precision and accuracy. If results of the blind field duplicate are outside the control limits, corrective action, and/or data qualification will be determined after review by the Data QA Manager or his/her designee. Blind field duplication can be of poor quality because of sample heterogeneity. Therefore, the Data QA Manager will determine corrective action. Field QC sample requirements are listed in Table 3-8.

All analyses performed for this project must reference QC results to enable reviewers to validate (or determine the quality of) the data. Sample analysis data, when reported by the laboratory, will include QC results. All data will be checked for internal consistency, transmittal errors, laboratory protocols, and for complete adherence to the QC elements.

3.5.3 Laboratory Instruments

All instruments and equipment used during analysis will be operated, calibrated, and maintained according to manufacturer's guidelines and recommendations, and in accordance with procedures in the analytical method cited, as documented in the laboratory QA plan. Properly trained personnel will operate, calibrate, and maintain laboratory instruments. Calibration blanks and check standards will be analyzed daily for each parameter to verify instrument performance and calibration before beginning sample analysis.

Where applicable, all calibration procedures will meet or exceed regulatory guidelines. The Data QA Manager must approve any variations from these procedures before beginning sample analysis.

After the instruments are calibrated and standardized within acceptable limits, precision and accuracy will be evaluated by analyzing a QC check sample for each analysis performed that day. Acceptable performance of the QC check sample verifies the instrument performance on a daily basis. Analysis of a QC check standard is also required. QC check samples containing all analytes of interest will be either purchased commercially or prepared from pure standard materials independently from calibration standards. The QC check samples will be analyzed and evaluated according to the EPA method criteria.

Instrument performance check standards and calibration blank results will be recorded in a laboratory instrument logbook that will also contain evaluation parameters, benchmark criteria, and maintenance information. If the instrument logbook does not provide maintenance information, a separate maintenance logbook will be maintained for the instrument.

3.6 FIELD INSTRUMENT/EQUIPMENT TESTING, INSPECTION, AND MAINTENANCE

The types of field instruments and equipment that are anticipated to be used during sampling include, but are not limited to:

- PIDs
- Personal air monitors, as needed
- GPS

Equipment maintenance will be performed according to manufacturers' specifications by Parametrix or as directed by Parametrix. The frequency of inspection, testing, and maintenance will be established, based on operation procedures and manufacturers' specifications. Field personnel will be responsible for inspection, testing, and maintenance of field equipment. A hard copy of procedures and manufacturer's specifications will be provided to all field personnel working with the equipment. All equipment will be inspected and tested prior to use.

The results of inspection and testing, as well as any problems encountered and corrective actions, will be documented in the activity field notebook. The equipment serial number and date of activity will be included in notebooks so that a complete record is maintained. If problems are encountered, they will be reported to the Manager.

3.7 INSPECTION/ACCEPTANCE OF SUPPLIES AND CONSUMABLES

Field supplies such as sample containers and trip/rinsate blank water shall be obtained from reputable suppliers and shall be certified analyte-free. Records of certification shall be kept by the laboratory (for laboratory-supplied supplies) or by the Owner's representative in the project file. Sampling spoons and bowls shall be food-grade and shall be purchased new.

3.8 NON-DIRECT MEASUREMENTS

The need for non-direct measurements is not anticipated for the Site Investigation. However, if the need does arise during task execution, the previously collected data will be evaluated to assess consistency with project DQOs and DQIs. Data from non-direct sources will be evaluated by the Data QA Manager prior to the data being used in analyses or in data reports.

3.9 DATA MANAGEMENT

The objectives of data management are to assure that large volumes of information and data are technically complete, accessible, and efficiently handled.

3.9.1 Field Data

The original hard (paper) copies of all field notes and laboratory reports will be stored in the project file. Photocopies of these documents should be prepared for working copies as needed.

Field data should be recorded in bound notebooks or individual sampling sheets. The field team members should review the field data for completeness prior to placing it in the files.

3.9.2 Laboratory Data

The laboratory data reports will be archived in the project files. The electronic data will be incorporated into Excel spreadsheets and archived on electronic media and placed in the project file.

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4. ASSESSMENT AND OVERSIGHT

This section describes activities to be conducted to assess the effectiveness of project implementation and associated QA/QC activities. The purpose of the assessment is to ensure that the CMQAPP is properly implemented.

4.1 ASSESSMENTS AND RESPONSE ACTIONS

A performance and system audit may be conducted at anytime. Audits will consist of direct observation of work being performed and inspection of field and laboratory equipment. The performance and system audits will also review the sample custody procedures in the field and laboratory.

If implemented, internal audits of both the field and laboratory activities will be conducted by the Data QA Manager. Audits will be unannounced to assure a true representation of the technical and QA procedures employed.

Checklists for both field and laboratory audits will be based on National Enforcement Investigation Center (EPA 1984) Audit Checklists. The audits will be performed by persons having no direct responsibilities for the activities being performed.

The auditor or designee will prepare an audit report that includes findings, non-conformances, observations, and recommended corrective action, and a schedule for completion of such action.

For each identified nonconformance, a corrective action report will be issued as part of the audit report to notify the individual responsible for implementing the recommended corrective action and its schedule for completion. If a field corrective action is required, the Manager will be notified. If a laboratory corrective action is required, the Data QA Manager will be notified.

The audit will be distributed to the Manager.

Corrective actions may be needed for two categories of nonconformance:

- Deviations from the methods or QA requirements established in the CMQAPP.
- Equipment or analytical malfunctions.

During field operations and sampling procedures, the Field Sampler will be responsible for taking and reporting required corrective action. A description of any such action taken will be entered in the field notebook. If field conditions are such that conformance with the CMQAPP is not possible, the Manager will be consulted immediately. Any corrective action or field condition resulting in a major revision of the CMQAPP will be communicated to the Manager for review and concurrence.

During laboratory analysis, the Laboratory QA Manager will be responsible for taking required corrective actions in response to equipment malfunctions. If an analysis does not meet data quality goals outlined in the CMQAPP, corrective action will follow the guidelines in SW-846 (EPA 1986). If analytical conditions do not conform to this CMQAPP, the Data QA Manager will be notified as soon as possible so that additional corrective actions can be taken.

Corrective Action Reports will document response to any reported non-conformances. These reports may be generated from internal or external audits or from informal reviews of project activities. Corrective Action Reports will be reviewed for appropriateness of recommendations and actions by the Data QA Manager for QA matters, and the Task Manager for matters of technical approach.

4.2 REPORTS TO MANAGEMENT

The Data QA Manager will be responsible for data quality assessments and associated QA Reports. All reports will be submitted to the Manager for review. Final task or investigative reports will contain a separate QA section summarizing data quality information.

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5. DATA VERIFICATION AND VALIDATION

Data verification is confirmation by examination and provision of objective evidence that specified requirements have been fulfilled. Validation is confirmation by examination and provision of objective evidence that the particular requirement for a specific intended use have been fulfilled. Techniques for data verification and validation will be in accordance with the Guidance on Environmental Data Validation and Verification (EPA 2001b).

5.1 DATA REVIEW, VERIFICATION, AND VALIDATION

All data packages provided by the laboratory must provide a summary of quality control results adequate to enable reviewers to validate or determine the quality of the data. The Data QA Manager is responsible for conducting checks for internal consistency, transmittal errors, and for adherence to the quality control elements specified in the CMQAPP.

Field measurements (pH, specific conductance, temperature) will be verified and checked through review of instrument calibration, measurement, and recording procedures.

A verification level validation will be performed on all field documentation and analytical data reports. The data validation process will be used to verify the data quality. The following QC elements will be reviewed, as appropriate:

- Trip blank and rinsate blank results.
- Analytical holding times.
- Preparation blank contamination.
- Check standard precision.
- Analytical accuracy (blank and matrix spike recoveries and laboratory control sample recoveries).
- Analytical precision (comparison of replicate sample results, expressed as relative percent difference [RPD]).
- Each data package will be assessed to determine whether the required documentation is of known and verifiable quality. This includes the following items:
  - Field chain-of-custody record is present, complete, and signed.
  - Certified analytical report.
  - QA/QC sample results.

Data will be qualified using guidance provided in the Contract Laboratory Program (CLP) functional guidelines for assessing data (EPA 1994a, 1994b).

The Data QA Manager will prepare a QA memorandum for each site describing the results of the data validation and describing any qualifiers that are added to the data.

5.2 VERIFICATION AND VALIDATION METHODS

The Data QA Manager will review the following:

- Chain-of-custody documentation
- Holding times

- Equipment/trip blank results
- Field Duplicate results
- Method blank results

A limited review (minimum 10 percent) of the following laboratory QC data results will be conducted:

- Laboratory matrix spike/matrix spike duplicate (MS/MSD) and/or matrix duplicate results
- Laboratory surrogate recoveries
- Laboratory check samples

If, based on this limited review the QC data results indicate potential data quality problems, further evaluations will be conducted.

5.2.1 Precision

Precision measures the mutual agreement among individual measurements of the same property, usually under prescribed similar conditions. QA/QC sample types that measure precision include field duplicates, MSD, and matrix duplicates. The estimate of precision of duplicate measurements is expressed as a RPD (Relative Percent Difference), which is calculated:

$$RPD = \frac{D_1 - D_2}{(D_1 + D_2) \div 2} \; x \; 100$$

Where D1 = First sample value

D2 = Second sample value.

The RPDs will be routinely calculated and compared with DQOs.

5.2.2 Accuracy

Accuracy is assessed using the results of standard reference material, linear check samples, and MS analyses. It is normally expressed as a percent recovery, which is calculated:

$$\text{Percent Recovery} = \frac{\text{(Total Analyte Found - Analyte Originally Present) x 100}}{\text{Analyte Added}}$$

The percent recovery will be routinely calculated and checked against DQOs.

5.2.3 Bias

Bias is the systematic or persistent distortion of a measurement process that causes errors in one direction. Bias will be assessed with field duplicate and laboratory matrix spike samples, similar to that described for accuracy. Bias measurements are usually carried out with a minimum frequency of 1 in 20, or one per batch of samples analyzed, under the same sampling episode.

5.2.4 Sensitivity

Sensitivity expresses the capability of a method or instrument for meeting prescribed measurement reporting limits. Sensitivity will be assessed by comparing data reporting limits with applicable cleanup criteria and analytical or instrument method reporting limits.

5.2.5 Completeness

The amount of valid data produced will be compared with the total analyses performed to assess the percent of completeness. Completeness will be routinely calculated and compared with the DQOs.

5.2.6 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. Sample data will be comparable with other measurement data for similar samples and sample conditions. Comparability of the data will be maintained by using consistent methods and units.

5.2.7 Representativeness

Sample locations and sampling procedures will have been chosen to maximize representativeness. A qualitative assessment (based on professional experience and judgment) will be made of sample data representativeness based on review of sampling records and QA audit of field activities.

5.3 RECONCILIATION AND USER REQUIREMENTS

The Data QA Manager will prepare a technical memorandum for each data package describing the results of the data review and describing any qualifiers that were added to the data. The technical memorandum will also summarize the laboratory's QC criteria and will include recommendations on whether additional actions such as re-sampling are necessary. Technical memoranda will be submitted with the FS report.

5.4 DATA REPORTING

All laboratory data packages will contain the following information:

- Cover letter
- Chain-of-custody forms
- Summary of sample results
- Summary of QC results
- Ecology Environmental Information Management (EIM) electronic data deliverable (EDD)

The minimum information to be presented for each sample for each parameter or parameters group:

Client sample number and laboratory sample number

- Sample matrix
- Date of analysis
- Dilution factors (as reflected by practical quantitation limits (PQL)
- Analytical method
- Detection/quantitation limits
- Definitions of any data qualifiers used

Additionally, sample weights/volumes used in sample preparation/analysis and identification of analytical instrument will not be reported but will be kept in laboratory records for future reference.

The minimum QC summary information to be presented for each sample for each parameters or parameter group will include:

- Surrogate standard recovery results
- Matrix QC results (matrix spike/matrix spike duplicate, duplicate)
- Method blank results

EIM EDDs will be in accordance with the most recent version of the results spreadsheet submittal capable of being quickly uploaded into the Ecology EIM database.

6. SCHEDULE

An estimated project schedule is provided below in Table 6-1. Note that the Contractor's schedule may vary as they will be working on multiple sites within the project vicinity.

Table 6-1. Schedule

Work Element	Commence/Implement By
Interim Remedial Action (Soil Excavation)	August 1, 2010
Install New Monitoring Wells	September 1, 2010
1st Quarter Groundwater Sampling	September 30, 2010
2nd Quarter Groundwater Sampling	December 31, 2010
3rd Quarter Groundwater Sampling	March 30, 2011
4th Quarter Groundwater Sampling	June 30, 2011
Draft Interim Remedial Action Memorandum	August 15, 2011

Note: Groundwater monitoring memoranda will be submitted 6 weeks following completion of each groundwater monitoring event.

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