Sunnydell Dryke Shooting Range
Remedial Investigation/Feasibility Study
Work Plan
292 Dryke Road
Sequim, WA

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1 REMEDIAL INVESTIGATION/FEASABILITY STUDY

This Remedial Investigation/Feasibility Study (RI/FS) serves as a mechanism for collecting data at the Sunnydell Dryke Shooting Range located in Sequim, Washington. The collected data will be used for the following purposes: 1) characterize site conditions; 2) determine the nature of the waste; 3) assess the risk to human health and the environment; 4) conduct treatability testing which will evaluate the potential performance and cost of the treatment technologies being considered. The RI/FS will identify the current and potential pathways of exposure, the receptors, and the land and resource uses.

1.1 RI/FS Phases

The RI/FS will be conducted in phases to focus sampling efforts and increase efficiency of the remedial investigation. The initial phases are as follows:

- **Scoping**
- **Site Characterization**
- **Development and Screening of Alternatives**
- **Treatability Investigations**
- **Detail Analysis**

Each of these initial phases may incorporate additional phases within each category. Each phase will be dependent upon the results of the proceeding phase. In this manner, the RI/FS process will remain flexible to avoid the collection and evaluation of unnecessary information so that the subsequent cleanup can proceed in a timely manner.

1.2 Scoping

Scoping is the initial phase of the RI/FS process. ESA Associates, Inc. (ESA Associates) understands that a preliminary assessment (PA) and a site inspection (SI) have been conducted by the Washington State Department of Ecology (Ecology) and the Clallam County Department of Health and Human Services (DOH) at the subject property located at 292 Dryke Road in Sequim, Washington. Please refer to Figure 1 for a site diagram and Figure 2 for sampling locations.

1.2.1 Project Understanding

The following is a summary of the PA and SI:

Mr. Chuck Dryke and Rosemary Knotek are currently the owners and operators of the Sunnydell Dryke Shooting Range. On June 22, 2004, the Washington State Department of Ecology (Ecology) received a complaint from an adjacent property owner (ERTS # 541614) concerning pond water on the Dryke property draining onto their property and impacting the trees on the property owners land. An initial investigation was performed by the Clallam County Department of Health and Human Services on September 8, 2004. A composite soil sample was collected from the upper pond and lower pond of the shooting range and submitted for chemical analysis of lead by EPA Method 6010B. A discrete surface water samples were also collected from the upper and lower ponds on September 8, 2004 and submitted for chemical analysis of lead by EPA Method 7421.

Chemical analytical results indicated that lead was present in the upper pond sediments at a concentration of 77,800 milligrams per kilogram (mg/kg), exceeding the MTCA Method A cleanup level of 250 mg/kg. Chemical analytical results of the surface water sample collected from the upper pond indicated that lead was present in the upper pond water at a concentration of 30 micrograms per liter (µg/L), which exceeded the chronic water quality criteria for lead in surface water. Chemical analytical results of the lower pond sediments indicated lead at concentrations below the Washington State Department of Ecology's (Ecology) Model Toxics Control Act (MTCA) cleanup level. Chemical analytical results of the lower pond water indicated lead concentrations at 10 µg/L, which exceeded the chronic water quality criteria.

Based on the September 8, 2004 chemical analytical results, Ecology mailed an Early Notice Letter to the owners of Sunnydell on November 3, 2004. The Sunnydell Dryke Shooting Range was placed on Ecology's Confirmed and Suspected Contaminated Sites List on November 8, 2004. On June 22, 2005, the Clallam County Department of Health and Human Services performed a Site Hazard Assessment on the subject property. The site was ranked as a priority ranking #1, and was subsequently placed on the Hazardous Sites List on February 3, 2006.

On January 22, 2009, the Clallam County Department of Health and Human Services performed an initial investigation on the adjoining parcel #130050 located to the north of the Sunnydell Dryke Shooting Range. Chemical analytical results indicated that lead was in the surface water at concentrations ranging from 14.6 to 101 µg/L, which exceeded the chronic water quality criteria. The sediment samples from the adjoining parcel contained lead at concentrations below the MTCA method A cleanup levels.

On August 10, 2009, an Agreed Order (N0. DE 6551) was signed by the Sunnydell property owners and a representative from Ecology to provide for remedial action at the facility where there was a release of hazardous substances. The Agreed Order required Chuck Dryke and Rosemary Knotek to undertake a remedial investigation and feasibility study for their property located at 292 Dryke Road. The Agreed Order was issued pursuant to the MTCA RCW 70.105D.050(1).

The agreed order identifies the Site as being defined by the extent of contamination caused by the release of hazardous substances at the Site. The actual extent of the Site will not be fully known until the RI/FS is completed. Ecology understands that certain areas of the subject property are actively used for shooting range activities where lead reclamation is periodically performed. These areas will be identified in writing and shown on a figure after a scoping phase is completed. Lead reclamation in these areas will be noted on the figure. If areas are not going to be included in this RI/FS because they are still active and lead reclamation is ongoing, they will be identified as such.

1.2.2

1.2.2 Scoping Objectives

During the scoping phase of this RI/FS, ESA Associates recommends performing a Phase I Environmental Site Assessment (ESA) for the subject property to better understand and summarize the historical recognized environmental conditions (RECs) as well as the current recognized environmental conditions associated with the subject property. To develop information on the contamination of soil and groundwater on the property, we propose to complete the following five-task assessments. The separation of our scope of services into tasks is for clarity only. All tasks must be completed for a Phase I ESA to be valid.

1.2.2.1 Task 1 Review of Available Site Documented Information

The first task will be to review historical records to obtain information concerning the property and adjacent properties.

1. Review local, state and federal agency database lists pertaining to the storage, handling, discharge, and disposal of hazardous material on the property and adjacent properties.
2. Review available fire insurance maps, reverse telephone directories, property maps, topographic maps, and other public information regarding the property.
3. Review readily-available records concerning contents, construction, maintenance, and monitoring of underground and above-ground storage tanks associated with the property. This would involve a search for possible tax-assessor and building department records for the subject property.

1.2.2.2 Task 2 Title Document and Aerial Photograph Review

Task 2 will include a review of title documents and aerial photographs. This information is typically useful in documenting property development, history and land use.

1. Review readily obtainable aerial photographs to observe discernible physical features which might identify past operations, facilities, and activities.
2. Review readily available chain of title documents, which might aid in identifying previous ownership and activities at the property.

1.2.2.3 Task 3 Property Visit

The third task will be a property visit by an ESA Associates representative. ESA Associates' staff member will perform the following activities:

1. Review and note obvious location(s) of past and present chemical storage, use, and disposal. Photographs will be taken, as appropriate.
2. Look for obvious location(s) of above-ground and underground storage tanks and pipelines.

3. Note terrain characteristics and tour possible “areas of concern,” as noted in the review of the aerial photographs and public information (e.g., chemical storage areas, suspected disposal areas, removed structures).
4. Interview available personnel who have knowledge about environmental conditions and practices at the property.
5. Review readily available hazardous material management plans, spill contingency plans, MSDS sheets, RCRA reports or permits, SARA reports, or NPDES permits for operations at the property.
6. During the site visit, the preliminary boundaries of the study area will be defined.

ESA Associates recommends that this task be performed after completing Tasks 1 and 2. If this is not feasible, a second property visit could be required.

1.2.2.4 Task 4 Evaluation of Findings

Data gathered in Tasks 1, 2, and 3 will be evaluated to provide information about the contamination of soil and groundwater resulting from operations on the property.

1.2.2.5 Task 5 Preparation of Assessment Report

The final task of the assessment will be the preparation of a report for Ecology.

A report of our findings will be provided, based on information obtained in Tasks 1 through 3 and on our evaluation performed in Task 4. This report will describe our assessment procedures, summarize our findings, and present our opinions concerning the contamination of soil and groundwater on the property. The phase I ESA report will identify remedial action objectives and whether interim actions may be necessary or appropriate, and will establish whether the site may be best remediated as one or several operable units.

1.2.3 Scoping Strategy

Once an overall management strategy is agreed upon, the RI/FS scoping activities will include:

- Initiate the identification and discussion of potential Applicable or Relevant and Appropriate Requirements (ARARs) with Ecology.
- Determine the types of decisions to be made and identify the data needed to support these decisions.
- Assemble a technical advisory board to assist in activities, serve as a review board for important deliverables, and monitor the progress during the study.
- Finalize the work plan, sampling and analysis plan, health and safety plan.

1.3 Site Characterization

Field sampling and laboratory analysis are initiated during the site characterization phase of the RI/FS. A subsurface investigation generally involves the collection and analysis of environmental samples (soil, sediment, groundwater, and surface water) to determine the nature, extent, and impact of discovered contaminants on the subject site, and to assess whether contaminants of concern have impacted local waterways or groundwater on or adjacent to the subject property. Data obtained during a subsurface investigation will evaluate the nature and magnitude of contamination at the sites. Sampling activities may be performed in more than one event, depending on sample results. Sampling locations will be based on the results of the Phase I ESA, where historic land use, aerial photographs, county assessors information, state and federal data base information, PA and SI results, and institutional knowledge are collected and evaluated.

The primary goals of a site characterization are to: 1) provide valid data of known and documented quality to characterize sources of contamination; 2) determine off-site migration of contaminants; and 3) document threats or potential threats that the site may pose to human health or the environment.

1.3.1 ASTM Standard for Subsurface investigation

There is an ASTM standard for subsurface investigations as follows: E 1903-97; *Standard Guide for Environmental Site Assessments: Subsurface investigation Environmental Site Assessment Process.* The guide is intended to provide practical procedural guidance for the continuation of an assessment conducted in accordance with the most recent edition of Practice E 1527. The guide fosters an iterative approach to Subsurface investigation assessments and allows the user to terminate the subsurface

investigation at the point where sufficient data have been generated to meet the user's objectives. At the completion of a subsurface investigation, the environmental professional should be able to conclude, at a minimum, that the investigation has provided sufficient information to characterize the site contaminants.

1.3.2 Environmental Consultant

An environmental consultant must be retained to manage and perform the subsurface investigation. Environmental consultants shall develop site-specific Sampling and Analysis Plans (SAPs) in accordance with Ecology's guidelines. The selected consultant shall assemble project teams, implement fieldwork, and coordinate sample analysis. A project manager from the consulting company shall work with regulatory agencies in performing the subsurface investigations. Environmental field staff shall verify the proper functioning of all equipment before beginning field activities, and ensure availability of the proper number, type, and quantity, of sample collection, including preservation requirements for field activities.

1.3.3 Special Training Requirements/Certification

An environmental contractor (ESA Associates) will conduct initial soil and surface water sampling of areas identified in the Agreed Order No. DE 6551 as potentially containing contaminants of concern. All environmental contractor personnel will have a minimum of Occupational Safety and Health Administration 40 hours of hazardous materials training (OSHA 40-hour HAZWOPER) supplemented by annual 8-hour refresher courses. Contractors are responsible for ensuring that their personnel are informed about and trained on relevant OSHA guidelines.

The environmental contractor will prepare and approve a site specific Health and Safety Plan (HASP) before fieldwork begins. All participating staff will be briefed on the risks associated with certain activities conducted during a subsurface investigation. All staff will obtain the proper training to recognize, and protect themselves from, hazardous chemicals known or suspected to be present at contaminated sites. Staff with questions about risks they might be dealing with should use existing resources (e.g., Material Safety Data Sheets {MSDS}, literature, laboratory staff) and contact environmental contractor's Health and Safety Manager. The Health and Safety Manager can recommend and supply the most appropriate personal protective equipment for work at specific sites, and is responsible for managing the respiratory protection program.

1.3.4 Soil, Sediment, and Surface Water Sampling Program

For the purposes of a site characterization (subsurface investigation), several methods of sample collection can be utilized to obtain samples depending on site location, site access, soil type, and volume necessary to adequately identify the targeted contaminants. Subsurface soils can be collected during the installation of soil borings, or wells, during excavation of test pits, or using geoprobe samplers, split spoons, or a hand auger. The sampling method chosen for each area on the subject property is described in the SAP and sampling procedures follow Standard Operating Procedures (SOP) approved by Ecology. In order to address the on site contaminants, ESA Associates recommends separating the areas of concern on the site as follows:

- Area 1: The Upper Pond
- Area 2: The Lower Pond
- Area 3: The Weeping Willow
- Area 4: The Rabbit Run

1.3.4.1 Surface Water and Sediments

The site characterization phase will include the investigation of surface water and sediments to characterize significant hydrologic features such as: surface drainage patterns and quantities, areas of erosion and sediment deposition, surface waters, floodplains, and actual or potential hazardous substance migration routes towards or within these features. Based on the results of the scoping phase, sufficient surface water and sediments samples will be determined to adequately characterize the arial and vertical distribution and concentrations of hazardous substances. Properties of surface and subsurface sediments that are likely to influence the type and rate of hazardous substance migration, or are likely to affect the ability to implement alternative cleanup actions shall be characterized.

1.3.4.2 Soils

The site characterization shall include investigations to adequately characterize the arial and vertical distribution and concentrations of hazardous substances in the soil due to the release. Properties of surface and sub-surface soils that are likely to influence the type

and rate of hazardous substance migration, or which are likely to affect the ability to implement alternative cleanup actions shall be characterized.

1.3.4.3 Geology and Ground Water System Characteristics

Geology and ground water system characteristics shall be conducted upon completion of the scoping phase and as an integral part of the site characterization phase. Investigations of site geology and hydrogeology will be explored by the placement of groundwater monitoring wells which will adequately characterize the arial and vertical distribution and concentrations of hazardous substances in the ground water and those features which affect the fate and transport of these hazardous substances. This shall include, as appropriate, the description, physical properties and distribution of bedrock and unconsolidated materials; ground water flow rate and gradient for affected and potentially affected ground waters; ground water divides; areas of ground water recharge and discharge; location of public and private production wells; and ground water quality data.

1.3.4.4 Natural Resources and Ecological Receptors

Information will be collect during the scoping phase and site characterization phase to determine the impact or potential impact of the hazardous substance from the facility on natural resources and ecological receptors. This information will be used to determine whether a terrestrial ecological evaluation, under WAC 173-340-7492 or 173-340-7493, is needed or will establish that an exclusion under WAC 173-340-7491 is necessary. If it is determined that a simplified or site-specific terrestrial ecological evaluation is not required under WAC 173-340-7491, the basis for this determination shall be included in the remedial investigation report.

1.4 Sampling Strategies

Based on the results of the scoping phase, soil sampling locations will be developed to address the site characterization phase. This section addresses general sampling strategies, which will be incorporated into a final work plan. There are many factors to consider when choosing sediment sampling strategy, including, but not limited to: sample site access, sample volume requirements, sediment texture, and target depth for sediment collection.

Site conditions discovered during the scoping phase will dictate the appropriate sediment sampling equipment to be used within the ponds. In general, piston samplers are best used for soft, fine-grained sediments where sediments at depth are required. Grab/dredge samplers are best for course, shallow sediments and where large volumes of sediment are required.

Grab sampling is the methodology most frequently used for sampling open bodies of water. This procedure is applicable for water sampling from sources such as rivers, streams, lakes, reservoirs, ditches, and pipelines or conduits. Normally, samples collected from open bodies of water are taken without separation of particulate matter. If constituents are present in colloidal or flocculent suspension, the sample is taken so that they are present in representative proportion.

Sampling points may need to be adjusted on site during the site characterization activities. Because of the wide variety of conditions found in streams and bodies of water, it is not possible to prescribe the exact point of sampling. The location of the sampling point will be chosen with respect to the information desired and in conformity to local conditions.

1.4.1 1.4.1 Area 1: Upper Pond

Area 1 is identified as the upper pond. The upper pond was excavated by Mr. Dryke approximately 25 years ago. The pond covers approximately ¾ of an acre and is 14 feet deep. The pond is fed by water that is directed from the state highway 101 via a ditch which runs down gradient to the north along Dryke Road. The Upper pond has been utilized for the past 25 years as a sporting clay target range. The clay targets are reportedly made up of lime and pitch. The ammunition that has been utilized in this area is 12 gage, 1 once, lead No. 8 shot.

The pond shall be divided into four quadrants: the northeast quadrant, the southeast quadrant, the southwest quadrant, and the northwest quadrant. In order to determine the vertical extent of contamination, discrete surface soil samples will be collected from each quadrant at the surface water/soil interface beginning at grade. ESA Associates will utilize a stainless steel auger to collect soil samples around the perimeter of the pond and

in each quadrant. Sampling points will be determined upon completion of the scoping phase. In general, the vertical extent of hazardous materials will be determined by forcing a soil core from the auger and collecting from the depth of interest.
The environmental contractor shall assess whether a lined or stainless steel auger is necessary. Sampling shall begin at grade and proceed in 3 inch increments. Once grade samples have been collected, the auger will be advanced 3 inches and an additional sample will be collected. Once the 3 inch samples have been collected, the auger will be advanced to 6 inches below ground surface to allow for the collection of a soil sample at 6 inches below ground surface at the surface water/soil interface. Therefore, three soil samples will be collected at each sampling location for a total of nine soil samples per quadrant. One sediment sample and one surface water sample will be collected in the center of each quadrant.

Nine soil samples, one sediment, and one surface water sample for a total of 11 samples from each quadrant will be submitted to ESN Northwest, Inc. for the following analyses: EPA Method 8270 will be used to determine the presence of ployaromatic hydrocarbons (PAHs) associated with clay targets; EPA Method 7421 and 6010B will be used to determine the presence of the metal lead associated with shooting clay targets over this area.

1.4.2 Area 2: Lower Pond

Area 2 is identified as the lower pond. Reportedly, the lower pond has always been present as a marshy area. The lower pond was dug out to its current configuration by Mr. Dryke in the last 20 years. The pond covers approximately 1/2 of an acre and is 6 feet deep. The pond is fed by water from the upper pond. Reportedly the water from the lower pond is pumped back up to the upper pond and recycled. The lower pond has been utilized as a dog training facility. Mr. Dryke reports that no ammunition has been utilized in this area.

The pond shall be divided into four quadrants: the northeast quadrant, the southeast quadrant, the southwest quadrant, and the northwest quadrant. In order to determine the vertical extent of contamination, discrete surface soil samples will be collected from each quadrant at the surface water/soil interface beginning at grade. ESA Associates will utilize a stainless steel auger to collect soil samples around the perimeter of the pond and

in each quadrant. Sampling points will be determined upon completion of the scoping phase.

In general, the vertical extent of hazardous materials will be determined by forcing a soil core from the auger and collecting from the depth of interest. The environmental contractor shall assess whether a lined or stainless steel auger is necessary. Sampling shall begin at grade and proceed in 3 inch increments. Once grade samples have been collected, the auger will be advanced 3 inches and an additional sample will be collected. Once the 3 inch samples have been collected, the auger will be advanced to 6 inches below ground surface to allow for the collection of a soil sample at 6 inches below ground surface at the surface water/soil interface. Therefore three soil samples will be collected at each sampling location for a total of nine soil samples per quadrant. One sediment sample and one surface water sample will be collected in the center of each quadrant.

Nine soil samples, one sediment, and one surface water sample for a total of 11 samples from each quadrant will be submitted to ESN Northwest, Inc. for the following analyses: EPA Method 8270 will be used to determine the presence of PAHs associated with clay pigeons; EPA Method 7421 and 6010B will be used to determine the presence of the metal lead in this area.

1.4.3 Area 3: The Rabbit Run

Area 3 is identified as the rabbit run. The rabbit run is located to the southwest of the upper pond in the area identified as the Fur & Feather on the Sunnydell site map (Figure 1). The rabbit run has been utilized as a shooting range in which live rabbits are released and shot. Typically, 28 gage, 20 gage, 12 gage and 4-10 gage lead No. 8 and No. 9 shot has been used in this area. In July of 2005, a representative from DOH sampled the surface soils of the rabbit run shooting range. Chemical analytical results indicated concentrations of lead at 618 mg/kg and benzo(a)pyrene at 8.5 mg/kg, both concentrations exceeding the MTCA Method A cleanup level for those constituents. For that reason, the rabbit run area will be sampled for lead and PAHs.

Hand augers will be utilized to collect soil samples in order to determine extent of contamination. Samples will be collected from grade to one foot below grade. Based on

the results of the scoping phase, sampling locations in the rabbit run area will be ascertained. Soil samples will be collected in areas of obvious ammunition use discovered during the scoping phase. All soil horizons will be screened regardless of visible indications of contamination. Soil samples will be collected using a stainless steel auger to the depth of one foot below ground surface.
Based on field screening results, the soil sample exhibiting the greatest degree of contaminants will be selected from the rabbit run area to be analyzed for the following contaminants: Semi-Volatile Organic Compounds (SVOCs) by EPA Method 8270, Priority Pollutant Metal-lead by EPA Method by 6010B.

Approximately 10 soil samples from this area will be submitted to ESN Northwest, Inc. for the analyses described above for the following reasons: EPA Method 8270 will be used to determine the presence of PAHs associated with clay targets; EPA Method 6010B will be used to determine the presence of the metal lead associated with lead shot.

1.4.4 Area 4: The Weeping Willow

Area 4 is identified as the weeping willow. The weeping willow area is located to the northwest of the upper pond in the lower front field indicated on Figure 1. The weeping willow area has been utilized as a shooting range in which live birds are released and shot. Reportedly, lead shot was not used frequently in this area. In July of 2005, a representative from DOH sampled the surface soils of the weeping willow shooting range. Chemical analytical results indicated concentrations of benzo(a)pyrene at 200 mg/kg and napthalenes at 0.33 mg/kg, both concentrations exceeding the MTCA Method A cleanup level for those constituents. For that reason, the weeping willow area will be sampled for lead and PAHs.

Hand augers will be utilized to collect soil samples in order to determine extent of contamination. Samples will be collected from grade to one foot below grade. Based on the results of the scoping phase, sampling locations in the rabbit run area will be ascertained. Soil samples will be collected in areas of obvious ammunition use discovered in the scoping phase. All soil horizons will be screened regardless of visible indications of contamination. Soil samples will be collected using a stainless steel auger to the depth of one foot below ground surface.

Based on field screening results, the soil sample exhibiting the greatest degree of contaminants will be selected from the rabbit run area to be analyzed for the following contaminants: Semi-Volatile Organic Compounds (SVOCs) by EPA Method 8270 and Priority Pollutant Metal-lead by EPA Method by 6010B.

Approximately 10 soil samples from this area will be submitted to ESN Northwest, Inc. for the analyses described above for the following reasons: EPA Method 8270 will be used to determine the presence of PAHs which were previously discovered in this area. EPA Method 6010B will be used to determine the presence of the metal lead associated with lead shot

1.4.5 Area 5: Adjacent Property

In January of 2009, a representative from DOH collected soil and surface water samples from the adjacent property to the north of the Sunnydell Dryke Shooting range. Chemical analytical data indicated that lead was present in the surface water of the adjacent property at concentrations exceeding MTCA Method A cleanup levels. Chemical analytical data from the soil samples taken from the adjacent property indicated lead concentrations just below the MTCA Method A cleanup level for soil. Based on the results of DOH sampling program, the adjacent property should be sampled to determine the lateral and vertical extent of lead contamination potentially originating from the lower pond of the Sunnydell Dryke Shooting Range.

After authorization is granted from the adjacent property owner, hand augers will be utilized along the property line to collect soil samples in order to determine the extent of contamination. Samples will be collected from grade to one foot below grade. Based on the results of the scoping phase, sampling locations along the property line may be altered. Soil samples will be collected in areas determined during the scoping phase. Soil samples will be collected using a stainless steel auger to the depth of one foot below ground surface.

Based on field screening results, the soil sample exhibiting the greatest degree of contaminants will be selected from the adjacent property to be analyzed for the following contaminants: lead by EPA Method 6010B. If standing water is present on the adjacent property at the time of site characterization, then three water sample will be collected and analyzed for lead by EPA Method 7421. If standing water is not present at the time of site

characterization, then the site will be visited at a time when standing water is present and sampled appropriately.

Approximately six soil samples and three surface water samples from this area will be submitted to ESN Northwest, Inc. for the analyses described above for the following reasons: EPA Method 7421 and 6010B will be used to determine the presence of lead associated with the potential leaching of lead-impacted waters from the lower pond of the subject property.

1.5 Development of Screening Alternatives

In the State of Washington, the Washington State Model Toxics Control Act (MTCA) standards are typically utilized throughout the cleanup process. MTCA has established an administrative process and standards to identify, investigate, and cleanup facilities where hazardous substances have come to be located. The purpose of MTCA is to provide a workable process to accomplish effective and expeditious cleanups in a manner that protects human health and the environment.

The development of alternatives phase of the RI/FS process will begin during the scoping phase when likely response scenarios are first identified. The development of alternatives requires:

- identifying remedial action objectives
- identifying potential treatment, resource recovery, and containment technologies that will satisfy the objectives
- screening the technologies based on their associated containment or disposal requirements into alternatives for the containment media at the site or for the operable unit.

Once potential alternatives have been developed, it may be necessary to screen out certain options to reduce the number of alternatives that will be analyzed. The screening process will involve evaluating alternatives with respect to their effectiveness, implementability, and cost. Any information collected during the RI/FS related to the nature of the release (date, location, material, and quantities if known), identification of the contaminants of concern, aerial and vertical extent of contamination, contaminant concentrations, environmental media affected, description of any known potential threats

to public health, or any known sensitive species or environments damaged or threatened by the release is considered before selecting a remedial screening level.

1.6 Cleanup Levels

MTCA contains policies that state, in part, each person has a fundamental and inalienable right to a healthful environment and it is essential that sites be cleaned up well. Consistent with these policies, cleanup standards and cleanup actions selected shall be established that provide conservative estimates of human health and environmental risks that protect susceptible individuals as well as the general population.

Cleanup standards and cleanup actions selected shall be established that protect human health and the environment for current and potential future site and resource uses. Cleanup actions that achieve cleanup levels at the applicable point of compliance under Methods A, B, or C (as applicable) and comply with applicable state and federal laws shall be presumed to be protective of human health and the environment (WAC 173-340-700). Except as provided for in applicable state and federal laws, cost shall not be a factor determining what cleanup level is protective of human health and the environment.

Prior to site remediation, the environmental consultant must identify the cleanup standards established for the site and the rationale for selecting them. The environmental consultant must select cleanup levels for each media, and document the rationale for selecting them. The cleanup of a particular medium at a site will often affect other media at the site. These cross-media impacts must be considered when establishing cleanup levels and selecting a cleanup action. In general MTCA Method A Cleanup Levels, the most stringent levels, can be used at "points of compliance" for the soil and groundwater at the site. The use of Method A Cleanup Standards, allow an adequate margin for protection of human health and the environment. Cleanup levels must be met throughout the site before the site is considered clean. Cleanup levels for the fresh water sediment will be developed using specific on site biassays.

1.7 Treatability Investigations

The treatability investigation phase of the RI/FS will provide sufficient data to allow treatment alternatives to be fully developed and evaluated during the detailed analysis phase. The treatability investigation phase will support the remedial design of the selected alternatives and reduce cost and performance uncertainties for treatment

alternatives. A remedy will be selected at the conclusion of the treatability investigation phase.

Several remedial options will be considered to achieve site cleanup. Some commonly used on-site and off-site remedial technologies include: Surface water pump and treat, surface water extraction and disposal, soil removal and disposal, biodegradation, and natural attenuation. The technology chosen to remove identified hazardous substances depends on site location, site access, soil type, surface water volumes, and the extent and nature of the contaminant plume.

1.8 Detailed Analysis

Once sufficient data are available, alternatives are evaluated in detail with respect to the following criteria:

- compliance with ARARs
- long term effectiveness and permanence
- reduction of toxicity, mobility, or volume
- short term effectiveness
- implementability
- cost
- state acceptance
- community acceptance

1.9 Remedial Action

Once the appropriate cleanup action has been selected for the site, the actual cleanup can be performed. Remedial actions must be approved by Ecology in accordance with the applicable state regulations. All interim and cleanup actions must be reported to Ecology under WAC 173-340-515.

Environmental consultants must be retained to manage all aspects of the remedial process. The environmental consultant generally subcontracts the personnel and contractors necessary to complete the remedial action plan according to all state and federal regulations. The environmental consultant must appoint a project manager to implement the Sampling and Analysis Plan established for the subject property, and oversee the subcontractors during site remediation activities.

2 SITE GROUND WATER MONITORING

When the results of the site characterization indicate that the subject property has contaminants that have reached the groundwater or surface water, groundwater monitoring is required to ensure that human health and the environment are adequately protected. There are three types of compliance monitoring: Protection, performance, and conformational monitoring.

2.1 Compliance Monitoring

The purposes of three types of compliance monitoring are as follows:

- **Protection Monitoring:** Confirm that human health and the environment are adequately protected during construction and operation and maintenance period of an interim action or cleanup action as described in the safety and health plan.

- **Performance Monitoring:** Confirm that the interim action or cleanup action has attained cleanup standards and, if appropriate, remediation levels or other performance standards such as construction quality control measurements or monitoring necessary to demonstrate compliance with a permit or substantive requirements of other laws.

- **Confirmational Monitoring:** Confirm the long-term effectiveness of the interim action or cleanup action once cleanup standards and, if appropriate, remediation levels or other performance standards have been attained.

Based on the results of the scoping phase, protection monitoring will likely be required to confirm that human health and the environment are adequately protected. At least four monitoring wells as approved by Ecology will be required to assess the on site seasonal variation in groundwater, contaminant levels, and groundwater flow. The location of the groundwater monitoring wells shall be determined after the scoping and site characterization phases and must be approved by Ecology. Once monitoring wells have been installed at the subject property, quarterly monitoring will be conducted to take measurements of the water levels and groundwater flow as well as the collection of groundwater samples to determine contaminant concentrations if present.

2.2 Monitoring Well Installation and Sampling Procedures for Dedicated Monitoring Wells

When drilling in known or potential areas of contamination, the drill rig derrick and all drilling equipment shall be steam cleaned before and after well construction. The casing and screens shall be steam cleaned and rinsed before installation, and stored off the ground on secure clean racks. The filter pack shall be washed with clean water before installation and shall not interfere with the chemical constituents of interest. [Statutory Authority: Chapter 18.104 RCW.88-08-070 (Order 88-58), §173-160-530, filed 4/6/88.]

Wells installed for water quality sampling shall include the following: commercially fabricated screen. The well screen shall be constructed of material that is nonreactive to subsurface conditions. A filter pack is preferred, but not required in coarse or granular formations. When used, it shall be installed from the bottom of the screen to at least three feet above the top of the screen. The well shall be developed to assure continuity between the well, well screen, and formation material. The well seal shall consist of at least two feet of bentonite placed above the filter pack. The annular space shall be grouted with bentonite; or a bentonite-cement sealant, which has a weight in the range of eleven to thirteen pounds per gallon as verified on site, with a mud balance.

Monitoring wells designed to retain the outer casing shall be sealed into the first impermeable layer. The sealant shall be installed with a tremie tube from the bottom up. Only use potable water to hydrate the mixture.

The elevations of all wells will be surveyed to a common datum using a surveyor's level and rod. Well elevations will be recorded to 0.01 foot and accurate to 0.05 foot as determined by closure. Wells will be located on topographic maps (1:24,000) and using a Magellan Global Positioning System (GPS). GPS well locations will be recorded as latitude and longitude. When the study is completed, all wells will be decommissioned in accordance with Chapter 173-160 WAC.

A licensed driller under subcontract to the environmental contractor will install the monitoring wells. The wells will meet or exceed the requirements of Minimum Standards for Construction and Maintenance of Wells (Chapter 173-160 WAC). Wells will be constructed with 2-inch diameter PVC, flush-threaded casing, and commercially fabricated seven-or ten-foot long screens. Clean, inert sand pack materials will be placed over the screened interval to two feet above the top of the screen. Bentonite and

cement/bentonite seals will be placed along the entire length of the annular space (between the boring and the PVC well) from the top of the gravel pack to the surface. Samples can be collected at 5-foot intervals during drilling using a split spoon sampler. Core samples will be placed in labeled plastic zip-lock bags. A portion of the split spoon samples will be analyzed for grain size. Detailed notes will be taken during the drilling process, and photos will be taken of the drilling site and of representative core samples.

After completion, the wells will be developed by the driller until the water removed from the borehole is free of sediment. A state well tag with a unique ID number will be attached to each new well. Monitoring wells will be secured with a lock.

Well caps will be removed and the well allowed to vent for approximately 15 minutes. The depth of water will be measured to the nearest 100^{th} of a foot (.01) using a decontaminated electric water level sounder.

Measurements will be based on standard operating procedures and the preexisting control points on each monitoring well as follows:

- To ensure consistency, prior to measuring any groundwater levels, the top of each well casing to be measured should be marked so that all measurements are collected from the same point.
- Remove the well cap and allow the well to vent for approximately 15 minutes.
- Turn on sounder and check the battery.
- Rinse the sounder probe with deionized water to decontaminate the probe and check the sensitivity of the probe.
- At the survey mark on the top of the well casing, slowly lower the probe into the well until it sounds.
- Record the depth at which the probe first sounds. The measurement should be taken from the top of the well casing. Record the depth measurement to the nearest 0.01 foot.
- Retrieve the probe from the well and rinse with deionized water, dry, and store.
- Repeat this process for each well.

Water resource technicians should take steps necessary to avoid any potential hazards that may be associated with the well or surrounding area. Also the technicians should take steps necessary to ensure that the electric water level sounder is operating correctly to avoid inaccurate measurements. The technician should make sure the battery is fully charged and test the sounder probe for water sensitivity prior to beginning measurement.

After initial measurements have been recorded, the monitoring well will be purged. During purging pH and electrical conductivity will be measured and recorded. Indicator parameters will be considered stabilized when three successive measurements, in 5-gallon increments, vary less than 10 percent. A minimum of three well casing volumes will be removed during purging.

Groundwater samples will be collected using a disposable bailer suspended by a nylon cord or through a peristaltic pump and dedicated tubing. Samples will be collected with Teflon bailers or with Teflon-lined tubing. When using disposable bailers, the bailer will be slowly lowered, retrieved, and emptied to avoid degassing the sample. When using a peristaltic pump to collect samples, the sample line will be first flushed at a rate sufficiently high to remove all sediment and gas pockets. The sample line flow rate will be regulated to not less than 500 milliliters per minute during sample collection. Samples collected from the bailer or peristaltic pump tubing will be transferred directly into the sample bottles.

Groundwater monitoring will evaluate the extent of onsite contaminants within the groundwater table. The groundwater monitoring wells that are installed at locations and depths sufficient to address the limits of potential contaminant plumes will be utilized to perform the monitoring on a quarterly basis for the identified site contaminants for a minimum period of one year. The groundwater will be analyzed for lead and PAHs. Upon completion of the quarterly monitoring, the final RI/FS Report will be written and submitted to Ecology for approval.

3 SCHEDULE OF DELIVERABLES

• Draft RI/FS Work Plan, including effective Sampling and Analysis Plan Agreed Order	180 days flowing the date of the
• Final RI/FS Work Plan	30 days after Ecology's edits
• Commencement of Field Work Ecology, commence days.	Upon receipt of the final RI/FS Work Plan by RI field work will within 60
• Complete RI/FS Field Work	30 days Scoping Phase 30 days soil/sediment/water sampling 30 days monitoring well installation 1 year quarterly sampling of groundwater.
• Draft RI/FS Report	60 days after completion of field work and receipt of final analysis
• Final RI/FS	30 days after receiving Ecology's written comments on the Draft RI/FS Report

4 DOCUMENT REFERENCES

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