RI/FS and IRAM DEVELOPMENTAL PROPOSAL

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

January 21, 2002

Prepared for:
Astoria Area-Wide PRP Group

Photo courtesy Port of Astoria

Prepared by:

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This report has been prepared by *EnviroLogic Resources, Inc*., of Portland, Oregon.

EnviroLogic Resources, Inc. Project No. 10077.001

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1.0 INTRODUCTION

This Remedial Investigation/Feasibility Study (RI/FS) and Interim Remedial Action Measures (IRAM) Development Proposal provides a summary for activities and investigations to be conducted at the Astoria Area-Wide Petroleum Site (Astoria Area Wide) in Astoria, Oregon. The purpose of this document is to provide DEQ with an understanding of the proposed scope for the RI/FS and IRAM Development prior to the formalization of the Astoria Area Wide RI/FS and IRAM Development Work Plan (Work Plan). This proposal is meant to provide an overview of the scope of work contemplated rather than a detailed account of the tasks to be conducted. These details will be fully described in the Work Plan following completion of an Initial Evaluation of the data available for the site. Substantive elements of the U.S. Environmental Protection Agency (EPA) "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA" (EPA 1988) also will be used in the preparation of the RI/FS documents and in performance of the investigations and evaluations.

Chevron Texaco Products Company (Chevron Texaco), Delphia Oil Company (Delphia), McCall Oil and Chemical Company (McCall), Ed Niemi Oil Company (Niemi Oil), Flying Dutchman and Harris Enterprises (Harris), Port of Astoria (the Port), and Shell Oil Company (Shell), collectively potential responsible parties (PRPs), have agreed to develop a coordinated response to DEQ Unilateral Order No. ECSR-NWR-01-11 (Order). While each PRP has retained a consultant to provide technical advice and site-specific proposals, *EnviroLogic Resources, Inc*., will be managing the RI/FS and IRAM development, defining quality assurance procedures, and preparing documentation for submittal to DEQ in response to this Order.

This Proposal is organized to present: 1) relevant background information based on information available at this date; 2) a discussion of the conceptual scope of work for the RI, IRAM, risk assessments, and FS; 3) reporting mechanisms; 4) the approach to project management and

coordination among the PRPs; and 5) a proposed schedule for the work. It is expected that a significant amount of information pertaining to the facilities subject to the Order is available and can be presented in the Initial Evaluation in the Work Plan.

1.1 BACKGROUND

The Astoria Area-Wide site comprises properties located at and near the Port in Astoria, Oregon, as shown on Figure 1. The Study Area is located in Section 7, Township 8 North, Range 9 West, and Section 12, Township 8 North, Range 10 West, Willamette Base and Meridian. A topographic high to the east forms a prominent hill overlooking the Study Area. West Marine Drive (US Highways 26, 30, and 101) is located on a topographic bench approximately 20 feet above the level of the Port facilities. The Columbia River runs to the west on the north side of the Study Area. Young's Bay lies to the south. Threatened or endangered species of anadramous fish use these water bodies for migration to upstream or nearby breeding areas and for juvenile migration to the Pacific Ocean.

Most of the Study Area adjacent to the Columbia River is underlain by dredged materials and fine sediments. To the southeast, marine sedimentary rocks form the bedrock to an alluvial layer. The depth of this alluvial material has not been determined. Ground water flows northwest after infiltration to the alluvial material, except where diverted by storm water management features and other utility lines. The depth to water is variable across the Study Area, ranging from 5 feet in depth below ground surface near the Columbia River, to 19 feet in depth near West Marine Drive.

The area around the Port has been used for petroleum storage and distribution since the 1920s. Aboveground storage tanks (AST), underground storage tanks (UST), and pipelines are present on several of the properties subject to this investigation. Historically, the area was home to at least four bulk petroleum storage facilities and five vehicle fueling or service stations between West Marine Drive and the Columbia River in the Study Area. Pipelines from at least two of the bulk fuel storage facilities extend onto piers at the Port. The area is currently zoned for industrial and commercial uses and is expected to remain so. Figure 2 shows the locations of each of the

properties subject to the Order. Remedial actions have been conducted at several facilities in the Study Area.

1.2 OBJECTIVES

The overall objectives of the RI/FS and IRAM implementation at the Astoria Area-Wide site are to:

- Identify the hazardous substances released to the environment and develop a list of chemicals of interest (COI);
- Define the nature and extent of hazardous substances in affected media on and offsite;
- Evaluate the direction and rate of migration of hazardous substances in affected media;
- Generate or use data of sufficient quality for site characterization, risk assessment, and the selection of remedial alternatives;
- Identify migration pathways and receptors;
- Evaluate the risk posed to human health and the environment;
- Identify hot spots of contamination;
- Implement IRAMs, where appropriate, based on imminent threats; and
- Develop a remedial alternative or alternatives to remedy potential threats to human health or the environment, as appropriate.

These objectives will be met through the RI/FS process. Site-specific objectives include:

- Develop and implement an IRAM to mitigate discharges of petroleum hydrocarbons to the Columbia River;
- Develop and implement an IRAM to mitigate volatile organic compound (VOC) vapor intrusion into buildings at levels exceeding DEQ risk-based concentrations, as appropriate;
- Document the storm water conveyance systems and characterize surface-water quality;
- Locate underground utilities and evaluate their potential to act as potential conduits for the migration of contaminants;
- Determine how tidal and seasonal influences are likely to effect interim or final remedial options for the facilities; and
- Complete a beneficial land and water use survey.

Each PRP will be compiling information about their facilities to meet these objectives. The information developed will be presented in a comprehensive evaluation of these issues for the Astoria Area-Wide site.

2.0 REMEDIAL INVESTIGATION

The basic objective of the RI at the Astoria Area-Wide site is to collect data sufficient to characterize the nature and extent of contamination from releases during former site operations to use in conducting risk assessments and in evaluating remedial alternatives during the FS process. This objective will be addressed for each PRP and the Astoria Area-Wide site as a whole. The RI will be conducted in a phased approach. Each PRP will perform a source/soil characterization for its property under quality assurance protocols approved by the DEQ in the Work Plan. Where possible, one laboratory will be selected to perform soil analyses. Ground water will be addressed as one operable unit for the Astoria Area-Wide site and ground-water quality sampling from monitoring wells will be conducted by one crew over the site. One laboratory will be selected to perform ground-water quality analyses.

2.1 TASKS COMMON TO ALL PRPs

Phase 1 consists of a background investigation; soil, ground water, surface water and sediment quality characterization; determination of ground-water flow directions and gradients; and a screening-level risk assessment, as described in Attachment A, Section III of the Order.

Background information to be collected for each facility includes: 1) site description; 2) ownership and operations history; 3) regulatory history; 4) waste management practices; 5) past sampling data (if available); 6) previous remedial activities; and 7) potential exposure pathways. Historic aerial photographs and the results of local, state, and federal environmental database searches will be included. Background information will be presented in the Initial Evaluation in the Work Plan and will form the basis for defining the scope of Phase 1 RI field investigations.

A boring program will be developed and implemented to characterize source areas and identify suitable locations for the placement of monitoring wells in the shallow water-bearing zone at the Astoria Area-Wide site. Both soil and ground-water samples will be collected from the borings to evaluate the presence of hazardous substances associated with spills and past practices.

Representative soil samples will be analyzed for geotechnical properties and grain-size distribution, as appropriate.

A monitoring-well network will be installed in the shallow water-bearing zone to evaluate the extent of hazardous substances in ground water, and ground-water flow directions and gradients. Previously installed wells will likely be redeveloped and included as part of the network. The monitoring-well network will be developed based on the results of the temporary boring program. Seasonal ground-water fluctuations and tidal influences will be characterized by placing pressure transducers/data logger(s) in selected wells and by manually measuring water levels monthly in the monitoring-well network for one year. Ground water in the monitoring-well network will be sampled for chemical analysis on a quarterly basis for one year.

Soil and ground-water data will be evaluated using DEQ's Risk-Based Decision Making for Petroleum-Contaminated Sites.

Surface water sampling locations will be established on the basis of the comprehensive storm-water conveyance system evaluation and samples collected to evaluate the quality of surface water discharging to the river and/or recharging the shallow water-bearing zone.

2.2 FACILITY-SPECIFIC SOURCE CHARACTERIZATION

This section presents source characterization tasks to be performed by each PRP. The source characterization task is expected to result in an identification of the locations and types of sources of releases of hazardous substances to the environment. Soil chemistry and hydrogeologic information for each site will be collected using a defined set of common protocols approved by DEQ in the Work Plan.

The following sections present the tasks and information pertaining to each PRP. The scopes of work presented were prepared by the consultant for each PRP.

2.2.1 Chevron Texaco Products Company

In addition to assisting in the general source characterization, Chevron Texaco will conduct several tasks at the Young's Bay Texaco at 490 West Marine Drive (Figure 2) as part of the Astoria Area-Wide RI/FS. The purpose of the investigation at Young's Bay Texaco is to identify areas of impacted soil and ground water at the site, identify migration pathways, and to collect sufficient soil data to calculate risk-based concentrations to guide remedial activities. PNG Environmental, Inc., is the consultant for Chevron Texaco.

Soil and ground-water samples will be collected from soil borings drilled using GeoProbe® or equivalent methods at the Young's Bay Texaco site. The collection and analysis of samples will be conducted following the guidelines and protocols developed for the Astoria Area-Wide study and copies of analytical data and hydrogeologic information will be stored in the Study Area database at *EnviroLogic Resources*.

A search for potential sources of future releases of hazardous substances will be conducted. The existing fuel systems will be evaluated. Potential pathways to storm-water conveyance systems and other utilities will be evaluated.

Chevron Texaco will work with neighboring facilities to evaluate ground-water chemistry data with respect to neighboring properties.

2.2.2 Delphia Oil Company

The Delphia bulk petroleum storage facility located at 65 Portway Street and Val's Texaco (currently Chevron Texaco) at 452 West Marine Drive are collectively referred to as the Delphia Property (Figure 2). Maul Foster & Alongi, Inc., is the consultant for Delphia.

The site occupies approximately 0.76 acres and is located approximately 500 feet south of the Columbia River. The site slopes steeply down to the north with a retaining wall separating Val's Texaco from the Delphia bulk facility. Most of the site is paved or covered with structures, except for a graveled area along the northern property boundary (site of a former building). All storm-water drainage is directed to one catch basin, which is equipped with an oil/water separator and subsequently discharged to the municipal storm sewer system.

The Delphia bulk plant consists of a tank cluster of four ASTs with secondary containment adjacent to a loading rack, a second tank cluster of three ASTs with secondary containment, an office/warehouse structure, an empty 3,500-gallon "spill" UST, and a storm-water conveyance system equipped with an oil/water separator. Val's Texaco consists of a service station building, two fuel dispenser islands, and a cluster of two 5,000-gallon and one 10,000-gallon ASTs (in a concrete-floored vault), and one 1,000-gallon diesel UST. Based on a 1996 UST decommissioning report prepared by Neil Shaw Consulting Geologist, Inc. (Shaw, 1996), six USTs were decommissioned at the Val's Texaco site in 1996.

A Phase 1 source area investigation will be completed as part of the overall RI effort. A soil and ground-water investigation using GeoProbe® or equivalent methods will be conducted to characterize source areas and to determine whether ground-water monitoring wells are necessary at the Delphia Property. Appropriate surface water sampling locations will be identified. The collection and analysis of samples will be conducted following the guidelines and protocols developed for the Astoria Area-Wide study and copies of analytical data and hydrogeologic information will be stored in the Study Area database at *EnviroLogic Resources*.

If the GeoProbe® investigation indicates that ground-water contamination is present at concentrations above regulatory standards, one upgradient and two downgradient monitoring wells

will be installed. An addendum to the Work Plan showing the proposed locations of these wells will be submitted to the DEQ for approval.

Site-specific tasks for the source area investigation of the Delphia Property are described in the following sections.

2.2.2.1 Delphia Bulk Facility

- Obtain historical information from the Astoria Fire Department and/or other public sources regarding an alleged 1973 surface release of gasoline.
- Describe the historical development at the bulk facility site including what portions of the site were paved and approximate dates.
- Obtain building plans or as-built drawings (if available) for the bulk facility site storm water drainage system including installation dates of catch basins, historical and current operations and maintenance of catch basins.

2.2.2.2 Val's Texaco

- A geophysical survey (ground-penetrating radar [GPR]) will be conducted at the Val's Texaco site in order to locate the inactive product lines associated with the former USTs.
- A subsurface investigation will be conducted in conjunction with the previously-mentioned GeoProbe® investigation (to characterize source areas) to sample soil and groundwater in the vicinity of the former product lines and the product dispensers to evaluate for potential source areas.

2.2.3 McCall Oil and Chemical Company

McCall (and previously Chevron) operated a bulk petroleum storage facility and associated pipelines at 585 Hamburg Street (Figure 2). The pipelines extend onto Pier 2 at the Port. A release of diesel from the pipelines was discovered in 1993 and remedial actions were implemented. Free-phase petroleum hydrocarbons are present in the subsurface near the Port office building and seeps of free-phase petroleum hydrocarbons occur at Slip 2 in the Columbia River. The IT Group, Inc., is the consultant for McCall.

McCall will provide a report of background information covering McCall's historic investigative and cleanup activities related to the diesel pipeline release to support the Initial Evaluation to be presented in the Work Plan. This information will cover historical:

- soil and groundwater characterization;
- storm water evaluation: catch basin cleanup and replacement;
- soil cleanup;
- groundwater cleanup;
- free product recovery; and
- mitigation of petroleum seep.

McCall will conduct a source investigation for diesel contamination in soil in the location of the diesel pipeline release. McCall will support the PRP group in ground-water characterization near the diesel pipeline release, as set out in Section 2.3. The collection and analysis of samples will be conducted following the guidelines and protocols developed for the Astoria Area-Wide study and

copies of analytical data and hydrogeologic information will be stored in the Study Area database at *EnviroLogic Resources*.

2.2.4 Ed Niemi Oil Company

Niemi Oil operated two facilities in the Study Area, a cardlock fuel dispensing station located at 455 Industry Street, and a bulk petroleum storage facility located at 490 Industry Street (Figure 2). GeoEngineers, Inc., is the consultant for Niemi Oil.

2.2.4.1 Niemi Oil Cardlock – 455 Industry Street

Niemi Oil owns and operates a cardlock facility located at 455 Industry Street. Commercial fuel storage and dispensing began in the 1920s, and the facility is currently operating. Both gasoline- and diesel-range petroleum hydrocarbons have been detected in soil and ground water beneath the property although analysis of gas chromatograms indicates that the primary contaminant at the site is gasoline.

A soil and ground-water sampling program using GeoProbe® or equivalent methods will be implemented to fill data gaps identified in the Initial Evaluation and to determine whether ground-water monitoring wells are necessary at the cardlock facility. Soil and ground-water samples collected from the temporary borings will be analyzed for COIs as defined in the Work Plan. Niemi Oil will collaborate with other PRPs, as appropriate, to establish a monitoring-well network in the shallow water-bearing zone beneath the site. The collection and analysis of samples will be conducted following the guidelines and protocols developed for the Astoria Area-Wide study and copies of analytical data and hydrogeologic information will be stored in the Study Area database at *EnviroLogic Resources*.

Current and historical storm-water management practices employed at the site will be investigated. Niemi Oil will participate as appropriate with all PRPs in the development of a comprehensive

storm-water system analysis and evaluate storm-water quality exiting the site. If necessary, Niemi Oil will develop and implement storm-water controls at the site.

2.2.4.2 Former Niemi Oil Bulk Plant – 490 Industry Street

Niemi Oil operated a bulk plant at 490 Industry Street located on the Port property. The bulk plant was constructed in 1925, and operated until some time in the 1990s, when the ASTs were removed. DEQ records suggest that four USTs may have been abandoned at the Niemi Oil Bulk Plant location from 1987 to 1988. No records of the decommissioning or of any subsequent site assessment(s) are available at the time this proposal was prepared. Gasoline constituents were detected in subsurface soil samples collected at the site during DEQ's 1993 investigation of the McCall Oil pipeline diesel release. The site was placed on the Confirmed Release List in 1997.

A soil and ground-water sampling program using GeoProbe® or equivalent methods will be implemented to fill data gaps identified in the Initial Evaluation and to determine whether ground-water monitoring wells are necessary at the former bulk plant. Soil and ground-water samples collected from the temporary borings will be analyzed for COIs as defined in the Work Plan. Niemi Oil will collaborate with other PRPs, as appropriate, to establish a monitoring-well network in the shallow water-bearing zone beneath the site. The collection and analysis of samples will be conducted following the guidelines and protocols developed for the Astoria Area-Wide study and copies of analytical data and hydrogeologic information will be stored in the Study Area database at *EnviroLogic Resources*.

Niemi Oil will identify the locations of any abandoned USTs and ancillary equipment remaining at the site from historical research and utilization of geophysics, if necessary. If encountered and deemed a source of ongoing contamination, Niemi Oil will oversee the removal of the bulk plant remnants in accordance with OAR 340-122-0205 through 340-122-0360.

Current and historical storm-water management practices employed at the site will be investigated. Niemi Oil will participate as appropriate with all PRPs in the development of a comprehensive storm-water system analysis and evaluate storm-water quality exiting the site.

2.2.5 Port of Astoria

The Port owns much of the property subject to remedial actions under the Order, principally north of Industry Street (Figure 2). The Port has several tasks to complete in support of the Astoria Area-Wide RI effort. In addition to the general source characterization tasks common to all PRPs, the Port will implement investigations related to sediments, IRAMs, air quality, potential sources, and storm water. *EnviroLogic Resources* is the consultant for the Port.

Analytical data generated for characterization of sediments to be dredged will be evaluated. If data gaps are identified, the Port will collect surface and subsurface samples from within Slips 1 and 2. These samples will be analyzed for petroleum-related constituents and other hazardous substances associated with the Port's historical maritime activities. These historical activities will be evaluated to develop an analytical list of potential COIs.

The Port is willing to work with McCall Oil to design an IRAM to stop discharge of petroleum-impacted ground water to the Columbia River. As discussed elsewhere in this Proposal, IRAM development will follow a streamlined FS approach that will help guide RI data collection tasks.

As part of the overall RI effort, soil and ground-water data sufficient to evaluate air quality in buildings potentially impacted by the contaminant plume will be collected. Key constituents will be evaluated in relation to land use and building types existing and proposed in the Port's Central Waterfront Development Plans.

The DEQ has identified other potential sources of hazardous substances on Port property that may not have been previously investigated. These potential sources include the old Columbia Iron and Steel Works facility that occupied an area between the Shell Oil facility and the Niemi Bulk Oil facility from pre-1930s to the 1970s, and Astoria Oil Services, Inc., that operated at 590 Hamburg Street. Historical aerial photographs and other documentation will be evaluated to identify the nature of operations at these facilities and specific areas where releases of hazardous substances

could have occurred. The types of operations at these sites will guide the selection of analytes, which may include PCBs, metals, or semi-volatile organic compounds.

The Port will work with all PRPs to perform a comprehensive graphical analysis of the storm-water and sanitary sewer systems, and other utilities to evaluate the quality of storm-water discharges and potential conduits for the migration of COIs. Four quarters of storm-water outfall sampling will be conducted as a Phase 1 task.

2.2.6 QWEST Corporation

Qwest has not indicated that it is participating in the PRP group RI and IRAM development effort.

2.2.7 Shell Oil Company

Shell reportedly operated a bulk petroleum storage facility at 3 Portway (Figure 2) from approximately 1925 to 1972 that consisted of ASTs and ancillary piping/loading facilities on the Portway site, and a pipeline network that extended from the site to loading and filling stations located at Port of Astoria facilities on the Columbia River. All ASTs and other on-site bulk plant facilities have been removed from the site. The site has been redeveloped and is currently occupied by the Oregon State Police Astoria Patrol Office. The current status of the pipelines is not known. Hart-Crowser, Inc., is the consultant for Shell.

Shell's Phase 1 RI site investigation activities at the former bulk plant will include completing on-site subsurface explorations and collecting soil and ground-water samples from the explorations for chemical analyses. Soil explorations using GeoProbe® or equivalent methods will be completed on the site in accessible areas that were previously occupied by storage tanks and loading facilities and at other accessible locations to provide a range of coverage over the site. Continuous soil samples will be collected from ground surface to the total depth of the each exploration and field screened for the presence of petroleum hydrocarbons. Each exploration will be completed to a depth sufficient to collect a groundwater sample and to assess the vertical extent of contamination if

present (based on field screening). Soil and ground-water samples from each exploration will be analyzed for COIs in accordance with the Work Plan approved by DEQ. Approximately 8 to 12 GeoProbe® explorations on the site will be completed. The collection and analysis of samples will be conducted following the guidelines and protocols developed for the Astoria Area-Wide study and copies of analytical data and hydrogeologic information will be stored in the Study Area database at *EnviroLogic Resources*.

Off-site activities will include locating and tracing the length of the pipelines using geophysical or other utility locating methods, and completing explorations along the pipeline trace to assess soil conditions adjacent to the pipelines and the overall condition of the pipelines. Three pipelines related to the former Shell facility are shown on a 1927 Port of Astoria utility map. No other records of the pipeline locations are available at this time. Shell will attempt to locate the terminus of each pipeline (on the site and at the Port facilities) using geophysical or other appropriate methods. The surface trace of each pipeline will then be marked using utility locating methods. Shell, in conjunction with the other (former and current) pipeline parties, will develop a pipeline investigation plan that will adequately assess pipeline conditions and characterize the adjacent soil without compromising the safe operation of an active pipeline. Test pit explorations will be conducted at identified pipeline junctions and valve locations and at regular intervals along the pipeline trace. The test pits will be completed to depths sufficient to visually inspect the condition of the pipeline and soil immediately adjacent to the pipeline. Soil samples will be collected from test pits based on visual observations and field screening and analyzed for COIs. The collection and analysis of samples will be conducted following the guidelines and protocols developed for the Astoria Area-Wide study and copies of analytical data and hydrogeologic information will be stored in the Study Area database at *EnviroLogic Resources*.

Shell will develop an IRAM plan that will address the fuel pipelines following the Phase 1 RI investigation.

2.2.8 Van West (Flying Dutchman)/Harris Enterprises

A service station was operated on the Flying Dutchman/Harris Enterprises property. A release of petroleum hydrocarbons was discovered in 1990 and a remedial action resulting in soil excavation and ground-water treatment was conducted. Kleinfelder, Inc., is the consultant for Flying Dutchman/Harris. In addition to the general source area characterization tasks common to all PRPs, Flying Dutchman/Harris Enterprises will perform the following site-specific tasks as requested in the Order:

A description of the work performed by others in conducting the on-site cleanup that resulted from the gasoline release discovered in 1990 will be prepared and evaluated to identify data gaps, if any. Samples will be collected to further evaluate extent and magnitude of on-site residual soil and ground-water contamination around the site perimeter and below the base of the previous excavation, if any. The collection and analysis of samples will be conducted following the guidelines and protocols developed for the Astoria Area-Wide study and copies of analytical data and hydrogeologic information will be stored in the Study Area database at *EnviroLogic Resources*.

In coordination with Niemi Oil Company and Qwest, the off-site extent of ground-water contamination will be assessed on the Niemi Oil Cardlock and Qwest properties located adjacent to the site.

2.3 GROUND-WATER CHARACTERIZATION

A monitoring-well network will be established to provide hydrogeologic and ground-water quality data over the Astoria Area-Wide site. Where possible, existing wells will be redeveloped to be included in the network. The analytical results from the temporary boring program will be used to site wells in the monitoring-well network. Addenda to the Work Plan will be prepared to describe well installation and data collection tasks that are not able to be defined at the time the Work Plan is completed. Addenda will include methods and procedures to be used in the field, analytical

protocols, and graphics describing the data collection task. These addenda will be submitted to DEQ for approval prior to implementation.

Pressure transducers connected to data logger(s) will be networked to collect concurrent continuous record water levels in selected wells to evaluate changes in water level in response to tidal influences. Approximately three to four wells in the monitoring-well network will be equipped with pressure transducers/data logger(s). Water levels in the network will be manually measured on a monthly basis for at least a one-year period.

Ground-water quality sampling from the monitoring-well network will be conducted by one sampling crew under quality assurance protocols presented in the Work Plan approved by DEQ to limit data variability resulting from different sampling methods. Wells in the monitoring-well network will be sampled on a quarterly basis for at least four quarters. In addition to COIs, major anions and cations will be analyzed in representative wells. Field measurements of pH, temperature, specific conductance, dissolved oxygen, and oxidation-reduction potential will be made during each sampling round.

Aquifer testing will be conducted to evaluate the hydraulic properties of the shallow water-bearing zone. The scope and methods to be employed for aquifer testing will be defined in an addendum to the Work Plan. Likewise, should modeling of the ground-water system be useful for characterization of chemical migration or to simulate remedial alternatives, the procedures to be used will be presented in an addendum to the Work Plan.

2.4 SUBSEQUENT RI/FS PHASES

Phase 2 of the RI/FS will be implemented to collect data required to fill data gaps in the characterization of environmental media and complete the human health and ecological risk assessments. Phase 3 is intended to address remaining data gaps related to evaluation of remedial alternatives.

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3.0 IRAM DEVELOPMENT

Interim remedial measures, particularly to mitigate the area where hydrocarbons are seeping into the Columbia River at Port of Astoria Slip 2, will be developed once the Initial Evaluation of investigative data has been completed. Potential remedial alternatives will be assembled as part of the Work Plan to identify data collection requirements for further evaluation of alternatives. Where known, data needed to facilitate design of the potential remedial alternatives will be collected as part of the Phase 1 data collection tasks. Addenda to the Work Plan may be required to complete collection of design data or to describe pilot testing of remedial systems. IRAMs are scheduled to be implemented during Phase 2 of the RI/FS.

As the Phase 1 RI task proceeds, it may become apparent that an IRAM needs to be developed for a new-found threat. A process of remedial alternative evaluation will be followed to quickly identify data collection needs for evaluation or design.

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4.0 HUMAN HEALTH EVALUATION

The human health evaluation will be composed of four distinct elements:

- Data evaluation and identification of chemicals of potential concern (COPCs);
- Exposure assessment;
- Toxicity assessment; and
- Risk characterization.

The human health risk assessment portion of the work plan will be developed based on OAR 340-122-084, and 340-122-205 through 360, DEQ risk assessment guidance documents, and US EPA guidance documents. Two different DEQ programs address human health risk at cleanup sites: 1) the Underground Storage Tank program, which oversees releases of petroleum products from USTs, provides risk-based concentrations (RBCs) that are protective of human health under a number of exposure conditions (DEQ, 1999 [RBDM]); and 2) the cleanup program, which oversees the cleanup of hazardous substance releases, has guidance documents which specifically address deterministic human health risk assessment and ecological risk assessment, and utilizes USEPA Region 9 preliminary remediation goal (PRG) concentrations, which are also protective of human health, in the screening step of deterministic human health risk assessments.

The equations and exposure factors used in the RBDM document are generally consistent with those discussed in "Guidance for Conduct of Deterministic Human Health Risk Assessments" (DEQ, 1998b). This document was developed for risk assessments being carried out under the DEQ Hazardous Substance Remedial Action Rules (OAR 340-122-0010 through 340-122-0115) and includes more exposure routes than are typical for sites limited to releases of petroleum-related constituents. The equations in the deterministic risk assessment guidance are written in a format that calculates average daily dose, whereas the equations included in the RBDM guidance document are rearranged to calculate risk-based concentrations (RBCs) that are protective of human health. As long as the COPCs are petroleum-related, the RBDM guidance may be applicable at the Astoria Area-Wide site. However should constituents be identified that are not

petroleum-related, then Oregon's deterministic risk assessment guidance and other related EPA documents would need to be used to evaluate risk.

4.1 DATA EVALUATION AND IDENTIFICATION OF COPCs

A risk-based screening procedure will be conducted to identify COPCs for the site. Maximum concentrations of constituents detected in each medium will be compared to either RBCs or PRGs, depending on which guidance is applicable. Should it be determined that all constituents of interest are petroleum-related, the UST program RBCs (as defined in Oregon's RBDM guidance document) will be utilized for screening purposes. If, however, constituents of possible interest are identified that are not petroleum-related (i.e., outside of the scope of RBDM guidance) the use of Oregon's "Guidance for Conduct of Deterministic Human Health Risk Assessments" (based on EPA Region 9 PRGs) would be warranted.

Screening criteria are based on Oregon Administrative Rule (OAR) 340-122-080(5), which allows for pre-baseline screening of contaminants. In this screening, contaminants detected at the site that have not been screened should be designated as "Chemicals of Interest" (COIs), while those that have been included after screening should be designated as "Contaminants of Potential Concern" (COPCs). Following a deterministic baseline risk assessment, contaminants that did not meet acceptable risk levels should be designated as "Contaminants of Concern" (COCs). COIs are screened on the basis of frequency of detection, background levels of chemicals, and relative toxicity, to determine whether they qualify as COPCs that should be carried forward in the risk assessment.

Constituents with maximum detected concentrations below screening levels will be eliminated from further consideration. The identified COPCs will be further evaluated to calculate risk, from which site-specific risk-based cleanup goals can be derived, similar to USEPA's PRGs.

4.2 EXPOSURE ASSESSMENT

Exposure pathways will be selected based on potential receptors identified both onsite and offsite. Existing and potential reasonable future land use and the physical setting of the site, including climate, soil characteristics, river sediment characteristics, and hydrogeology will be considered in developing the conceptual site exposure model (CSM). Future land-use plans and zoning constraints of the site and surrounding area will be reviewed to identify reasonably likely future uses. Fate and transport of site-related chemicals also will be considered in the evaluation of potential exposure pathways. A preliminary CSM will be presented in the Work Plan.

Exposure parameters will be identified for each potential exposure pathway, with fate-and-transport models used as needed. Site-specific information, along with EPA guidance, will be considered when determining appropriate exposure assumptions for the selected exposure scenarios. Since it has been previously determined that vapor intrusion into indoor air will be a pathway for consideration, methodologies to model this pathway (Oregon RBDM guidance and EPA's Johnson and Ettinger Model) will be used as tools to assist in this evaluation.

Validated data that has undergone a quality assurance-quality control review will be used to calculate exposure point concentrations. For each COPC that is detected at a concentration below an analytical method reporting limit (MRL), one half of the MRL will be used as a representative concentration in calculations, as directed in DEQ and EPA risk assessment guidance.

4.3 TOXICITY ASSESSMENT

If it is determined that the site meets the requirements of risk assessment utilizing DEQ's RBDM guidance, toxicity assessment will be conducted in accordance with that guidance; if, however, the site does not meet the requirements of Oregon RBDM guidance, a toxicity assessment will be conducted by compiling toxicity factors and adverse health effects for each COPC, as required under the deterministic risk assessment guidance. This information, combined with the chronic daily intake amounts calculated in the exposure assessment, will be used calculate carcinogenic and

noncarcinogenic risk related to site chemicals. This information can be used to calculate site-specific risk-based cleanup goals that are protective of human health. Toxicity factors for carcinogens (cancer slope factors) and for noncarcinogens (reference doses) will be obtained from EPA's Integrated Risk Information System (IRIS) or Health Effects Assessment Summary Tables (HEAST, 1997). If toxicity criteria are not available for a constituent from either of these sources, the toxicity factors available in the Region 9 PRG tables will be used. If toxicity factors for a chemical are not available in any source, then that chemical will be discussed qualitatively in the uncertainty section of the risk assessment, since it cannot be carried further through the risk assessment.

4.4 RISK CHARACTERIZATION

The results of the toxicity and exposure assessments will be combined to characterize potential risk to human health from site-related chemicals. If the work is conducted consistent with the RBDM guidance, decisions will be made based on exceedance of RBCs by maximum detected concentrations of contaminants. If the work is conducted consistent with the cleanup program, quantified levels of carcinogenic and noncarcinogenic risk will need to be addressed.

5.0 ECOLOGICAL RISK ASSESSMENT

The ecological risk assessment will be conducted consistent with DEQ's "Guidance for Ecological Risk Assessment: Levels I, II, III, IV (1998-1999-2000-2001). The level I scoping ecological risk assessment (ERA) protocol is a conservative, qualitative determination of whether there is reason to believe that ecological receptors or ecologically important habitat are present at or in the locality of the facility. Scoping is intended to identify sites that are obviously devoid of ecologically important species or habitats and/or where potential exposure pathways are obviously incomplete. The DEQ ERA guidance relies heavily on protocols stipulated in USEPA ecological risk assessment guidance.

The level I scoping ERA will be submitted to the DEQ for review and approval. The results of the level I scoping ERA will be used to determine whether further ecological risk assessment is necessary. Each level of ecological risk assessment entails more detailed work and higher cost than the previous levels. This site may require higher levels of ecological risk assessment due to its proximity to the Pacific Ocean and the Columbia River, which provide habitat for threatened or endangered salmonid species.

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6.0 FEASIBILITY STUDY

The objective of the FS for the Astoria Area-Wide site will be to develop and evaluate remedial action alternatives for contaminated media so that effective response actions may be selected for implementation. The FS will be performed in accordance with OAR 340-122-085. As described in the following sections, the FS process will include:

- Establish Remedial Action Objectives;
- Identify General Response Actions;
- Identify and Screen Remedial Technologies;
- Assemble and Screen Remedial Measures;
- Detailed Analysis of Remedial Alternatives;
- Comparison of Remedial Alternatives;
- Recommend Preferred Alternative; and
- Prepare Feasibility Study report.

The FS will include evaluation of enhancements to the IRAMs, where appropriate.

Remedial action objectives will be established for the media and chemicals of concern. These objectives will be primarily driven by the cleanup standards that establish chemical concentrations and the risk assessment for reducing exposure pathways.

General response actions that will attain the remedial action objectives will be identified. These general response actions will be used to further identify specific remediation technologies. Action-specific ARARs will be used to screen the general response actions.

Once the general response actions have been identified, a broad range of technologies that may be able to attain the remedial action objectives will be evaluated. Process options will be identified for each viable alternative and screened based on effectiveness, implementability, and cost.

Those technologies and associated process options retained will be assembled to form complete remedial measures for further analysis. A detailed analysis will be conducted on the assembled alternatives for the site. The analysis of each alternative will be conducted in accordance with OAR 340-122-085.

A comparative analysis will be conducted to determine the relative performance of each alternative against the selection criteria. In general, the comparison of the alternatives is made on a qualitative basis. An alternative(s) will be recommended based on the detailed and comparative analyses and in accordance with factors presented in OAR 340-122-090.

The report will include sections prepared during the previously conducted tasks in addition to background information summarized from site investigation reports.

7.0 REPORTING

The results of each RI, risk assessments, and FS phase will be submitted to DEQ in separate draft reports for review and comment. Upon receipt of DEQ comments, the Astoria Area-Wide reports will be revised and finalized. Technical Memoranda will be prepared for each data collection task (e.g., soil chemistry, aquifer testing, etc.). In addition to describing the methods and procedures used for data collection, raw data (for example laboratory reports, data validation memoranda, and boring logs) will be reported in these technical memoranda. The RI, risk assessments, and FS reports will include these technical memoranda by reference and will include data management system reports rather than laboratory reports.

Monthly reports will be prepared for submittal to DEQ by the 10th of each month the Order is in effect. These Technical Status Reports will present: 1) actions taken under the Order during the previous month; 2) action scheduled to be taken in the next two months; 3) sampling, test results, and any other data generated or received during the previous month; and 4) a description of any problems experienced during the previous month and actions taken to resolve them. In general, technical data submitted in these reports will be those data that have undergone quality assurance review. It may be more appropriate for these technical data to be submitted in technical memoranda where the quality assurance procedures and reviews can be presented as well.

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8.0 PROJECT MANAGEMENT

Project management and coordination at the Astoria Area-Wide site will be conducted by Thomas J. Calabrese, RG, of *EnviroLogic Resources*. Mr. Calabrese will function as the point of contact between DEQ and the PRP group. Contact information is as follows:

Thomas J. Calabrese, RG, CWRE
Principal/Hydrogeologist
EnviroLogic Resources, Inc.
8948 SW Barbur Boulevard, #56
Portland, Oregon 97219-4047
Ph: 503-768-5121
Fx: 503-768-5121
tomcalabrese@h2ogeo.com

Each PRP has retained a consultant to provide technical advice and perform work on their behalf, where appropriate. This work will be conducted under protocols approved by DEQ in the Work Plan and any addenda prepared by *EnviroLogic Resources* in consultation with other PRPs. The PRPs reserve the right to present additional information to the DEQ. In addition, where ambiguities in terminology or interpretation of tasks in the Work Plan or addenda exist (e.g., descriptions of geologic materials) guidance will be provided by *EnviroLogic Resources* to maintain consistency across the various properties conducting work under the Order. As discussed, ground-water sampling from the monitoring-well network will be performed by one sampling crew to limit sample variability resulting from different personnel and equipment across the site. The results of all work performed in response to the Order will be submitted to the DEQ through *EnviroLogic Resources* and the database of site information will be maintained by *EnviroLogic Resources*.

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9.0 SCHEDULE

Phase 1 RI/FS work activity will begin upon DEQ approval of the final RI/FS work plan. The attached figure illustrates a proposed schedule for the RI/FS. Inherent within this schedule is the expectation that reviews of the progress of the work with DEQ personnel will occur periodically throughout the RI/FS process. The proposed schedule deviates from the schedule in the Order. This project will require coordination among several PRPs, attorneys, and consultants. Document reviews will likely require longer than typical lengths of time in order to accommodate variable personal schedules and to reconcile comments among the parties.

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10.0 REFERENCES

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US EPA, 2000b, Memorandum regarding Region 9 preliminary remediation goals (PRGs) to PRG table mailing list from S. Smucker: U.S. Environmental Protection Agency, November 2000.

FIGURES

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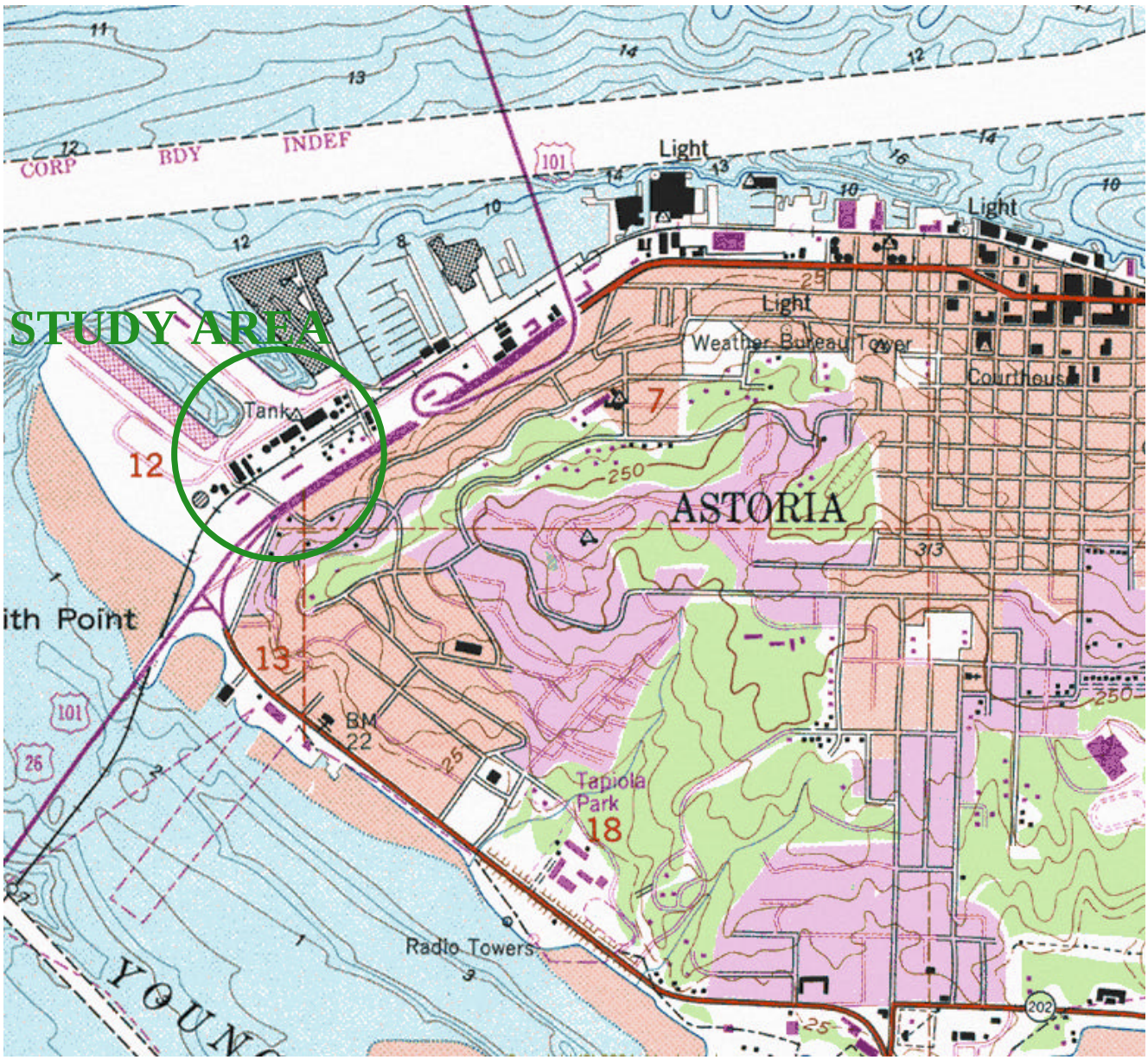


(from USGS, Astoria {1984}, OR 7.5' Quadrangles)

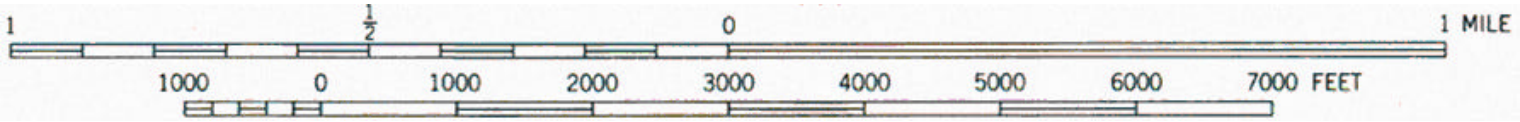


FIGURE 1

STUDY AREA

Remedial Investigation/Feasibilty Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

EnviroLogic Resources, Inc.

Consulting Environmental & Water Resources Scientists

Columbia River

Future Bar Pilot Helicopter Pad

SLIP 2

SLIP 1

PIER 3

PIER 2

PIER 1

Astoria Pacific Seafood

MSRC

100' 200' 300' 400' 500' 600' 700' 800' 900' 1000' 1100' 1200' 1300'

Port Office Bldg

Shop

Shop

Fuel Line

McCall Oil

Pump House

Astoria Oil Services

Niemi Oil

Former Furniture Refinishing

Former Steel Works

OSP

Former Shell Oil

Bergerson Construction

Red Lion Motor Inn

Trolly Barn

Industry Street

Hamburg Street

Portway Street

West Marine Drive

Dairygold

Storage

Storage

Storage

Bayshore Hotel

ILWU

Quest

Former Chevron

Niemi Oil Cardlock Facility

Harris/Van West Shell

Delphia Oil

Portway Texaco

N

0 200 400 800

APPROXIMATE SCALE IN FEET

FIGURE 2

SITE PLAN

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

EnviroLogic Resources, Inc.
Consulting Environmental & Water Resources Scientists

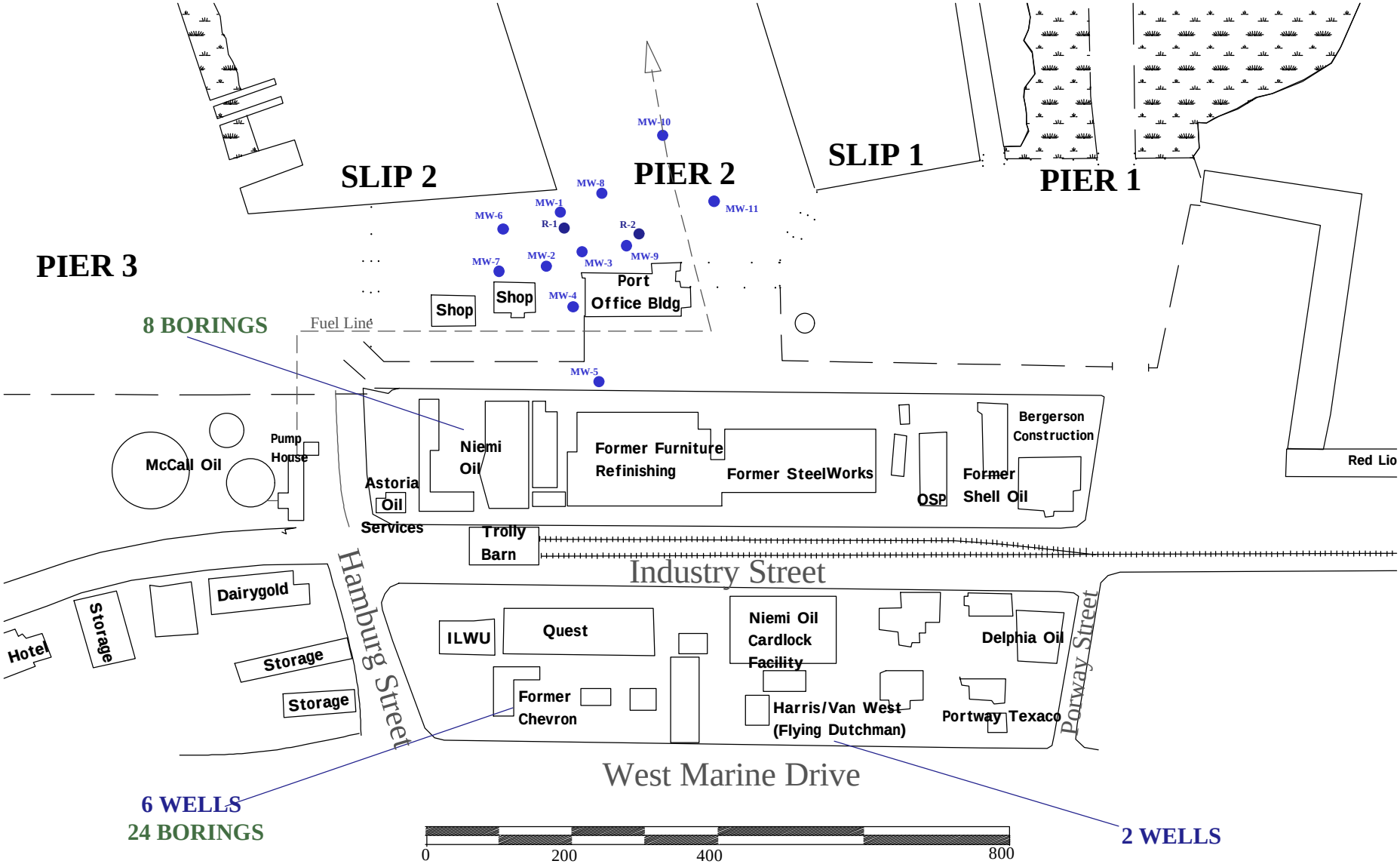


FIGURE 3

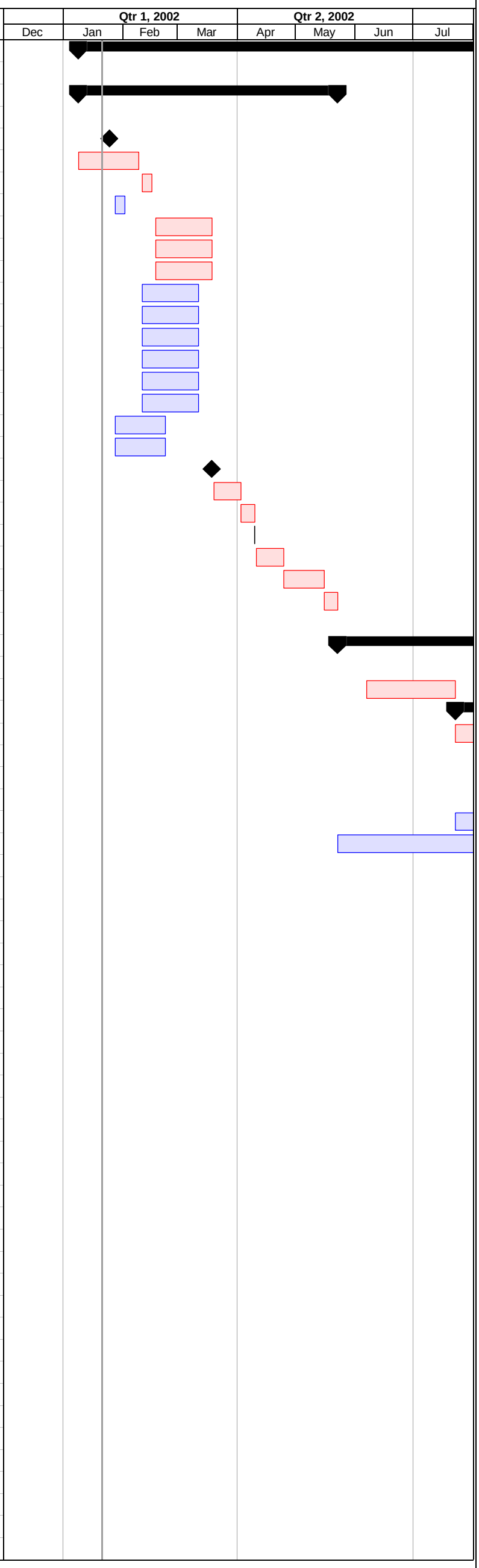
WELL LOCATIONS

Remedial Investigation/Feasibility Study
Astoria Area-Wide Petroleum Site
Astoria, Oregon

EnviroLogic Resources, Inc.
Consulting Environmental & Water Resources Scientists

FIGURE 4
CONCEPTUAL SCHEDULE
RI/FS and IRAM Development
Astoria Area-Wide Petroleum Site
Astoria, Oregon

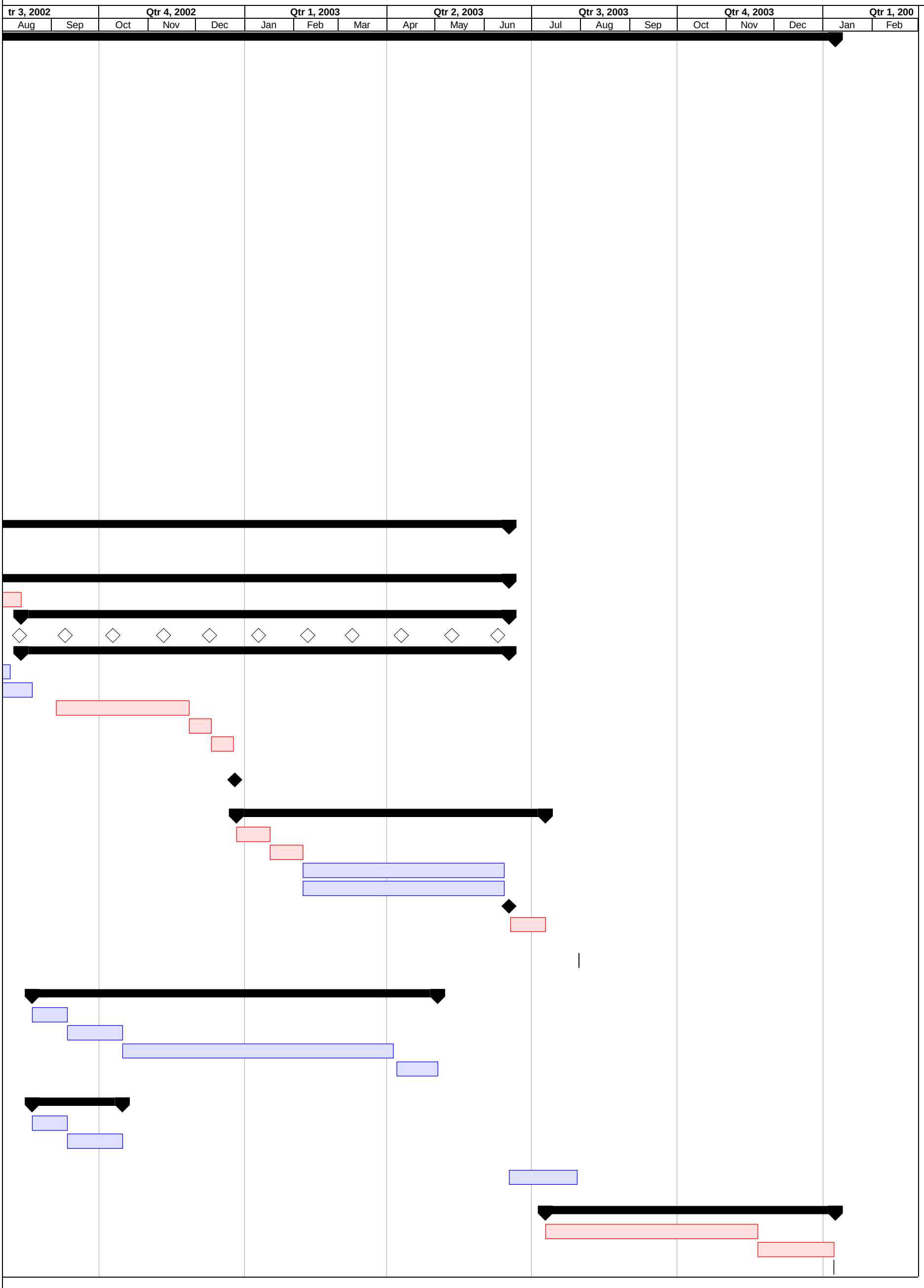
ID	Task Description	Duration	Start	Finish
1	**ASTORIA AREA-WIDE PETROLEUM STUDY**	**509 days**	**1/9/2002**	**1/8/2004**
2				
3	**RI/FS and IRAM DEVELOPMENT WORK PLAN**	**97 days**	**1/9/2002**	**5/22/2002**
4				
5	Scoping Meeting	1 day	1/25/2002	1/25/2002
6	Background/Historical Data Compilation	25 days	1/9/2002	2/8/2002
7	Initial Evaluation	5 days	2/11/2002	2/15/2002
8	Data Quality Objectives Memo	5 days	1/28/2002	2/1/2002
9	Site Characterization Plans	20 days	2/18/2002	3/18/2002
10	Storm/Surface Water Characterization Plan	20 days	2/18/2002	3/18/2002
11	IRAM Development Plan	20 days	2/18/2002	3/18/2002
12	Sampling & Analysis Plan	20 days	2/11/2002	3/11/2002
13	Health & Safety Plan	20 days	2/11/2002	3/11/2002
14	Human Health Evaluation Plan	20 days	2/11/2002	3/11/2002
15	Ecological Risk Assessment Plan	20 days	2/11/2002	3/11/2002
16	Feasibility Study Plan	20 days	2/11/2002	3/11/2002
17	Investigation-Derived Waste Mgmt Plan	20 days	2/11/2002	3/11/2002
18	Community Relations Plan	20 days	1/28/2002	2/22/2002
19	Project Management Plan	20 days	1/28/2002	2/22/2002
20	Compile RI/FS and IRAM Work Plan	1 day	3/19/2002	3/19/2002
21	PRP Group Review	10 days	3/20/2002	4/2/2002
22	Prepare Final Draft RI/FS and IRAM Work Plan	5 days	4/3/2002	4/9/2002
23	Submit Final Draft RI/FS and IRAM Work Plan	1 day	4/10/2002	4/10/2002
24	DEQ Review	10 days	4/11/2002	4/24/2002
25	Final RI/FS Work Plan	15 days	4/25/2002	5/15/2002
26	DEQ Approval	5 days	5/16/2002	5/22/2002
27				
28	**PHASE 1 RI/FS and IRAM TASKS**	**270 days**	**5/23/2002**	**6/16/2003**
29				
30	Souce Characterization	30 days	6/7/2002	7/22/2002
31	Ground-Water Characterization	230 days	7/23/2002	6/16/2003
32	Monitoring-Well Network Installation	15 days	7/23/2002	8/12/2002
33	Ground-Water Sampling	215 days	8/13/2002	6/16/2003
38	Water-Level Measurements	213 days	8/12/2002	6/11/2003
50	Storm/Surface Water Characterization	215 days	8/13/2002	6/16/2003
55	Air Quality Evaluation	10 days	7/23/2002	8/5/2002
56	IRAM Development	60 days	5/23/2002	8/19/2002
57	Draft Phase 1 Report	60 days	9/4/2002	11/26/2002
58	DEQ Review	10 days	11/27/2002	12/10/2002
59	Final Phase 1 Report	10 days	12/11/2002	12/24/2002
60				
61	**MEETING WITH DEQ**	**1 day**	**12/26/2002**	**12/26/2002**
62				
63	**PHASE 2**	**135 days**	**12/27/2002**	**7/9/2003**
64	Draft Phase 2 RI Work Plan	14 days	12/27/2002	1/16/2003
65	Final Phase 2 RI Work Plan	15 days	1/17/2003	2/6/2003
66	Phase 2 Implementation	89 days	2/7/2003	6/13/2003
67	IRAM Implementation	89 days	2/7/2003	6/13/2003
68	Draft Phase 2 Report	1 day	6/17/2003	6/17/2003
69	Final Phase 2 Report	15 days	6/18/2003	7/9/2003
70				
71	**MEETING WITH DEQ**	**1 day**	**7/31/2003**	**7/31/2003**
72				
73	**RISK ASSESSMENT**	**180 days**	**8/20/2002**	**5/2/2003**
74	Draft Risk Assessment Work Plan	15 days	8/20/2002	9/10/2002
75	Final Risk Assessment Work Plan	25 days	9/11/2002	10/15/2002
76	Draft Risk Assessment Report	120 days	10/16/2002	4/4/2003
77	Final Risk Assessment Report	20 days	4/7/2003	5/2/2003
78				
79	**FEASIBILITY STUDY**	**40 days**	**8/20/2002**	**10/15/2002**
80	Draft Feasibility Study Work Plan	15 days	8/20/2002	9/10/2002
81	Final Feasibility Study Work Plan	25 days	9/11/2002	10/15/2002
82				
83	**IRAM REPORTS**	**30 days**	**6/17/2003**	**7/29/2003**
84				
85	**RI/FS REPORT**	**126 days**	**7/10/2003**	**1/8/2004**
86	Draft RI/FS Report	95 days	7/10/2003	11/20/2003
87	Final RI/FS Report	30 days	11/21/2003	1/7/2004
88	Submittal to DEQ	1 day	1/8/2004	1/8/2004



Project: Astoria Area-Wide RI/FS
Date: 1/21/2002

Task	Rolled Up Task	External Tasks
Critical Task	Rolled Up Critical Task	Project Summary
Progress	Rolled Up Milestone	External Milestone
Milestone	Rolled Up Progress	Deadline
Summary	Split	

FIGURE 4
CONCEPTUAL SCHEDULE
RI/FS and IRAM Development
Astoria Area-Wide Petroleum Site
Astoria, Oregon



Project: Astoria Area-Wide RI/FS
Date: 1/21/2002

Task		Rolled Up Task		External Tasks	
Critical Task		Rolled Up Critical Task		Project Summary	
Progress		Rolled Up Milestone		External Milestone	
Milestone		Rolled Up Progress		Deadline	
Summary		Split			