LAKE RIVER PREDESIGN SAMPLING PLAN

FORMER PACIFIC WOOD TREATING COMPANY SITE

Prepared for
PORT OF RIDGEFIELD
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The material and data in this plan were prepared
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ACRONYMS AND ABBREVIATIONS

ASTM	American Society for Testing and Materials
bml	below mudline
CFR	Code of Federal Regulations
COC	chain of custody
CUL	cleanup level
DGPS	differential global positioning system
dioxins	polychlorinated dibenzo dioxins and furans
draft RI/FS	former PWT site draft remedial investigation and feasibility study
Ecology	Washington State Department of Ecology
ENR	enhanced natural recovery
IHS	indicator hazardous substance
LRIS	Lake River Industrial Site
MFA	Maul Foster & Alongi, Inc.
MTCA	Model Toxics Control Act
μg/kg	micrograms per kilogram
ng/kg	nanograms per kilogram
PCP	pentachlorophenol
Port	Port of Ridgefield
PSAP	predesign sampling and analysis plan
PSEP	Puget Sound Estuary Program
PWT	Pacific Wood Treating Company
QA/QC	quality assurance and quality control
RNWR	Ridgefield National Wildlife Refuge
SMS	sediment management standards
SWAC	surface-weighted average concentration
TEQ	toxicity equivalent quotient
TPAH	total polycyclic aromatic hydrocarbons
USEPA	U.S. Environmental Protection Agency
WAC	Washington Administrative Code

1 INTRODUCTION

On behalf of the Port of Ridgefield (Port), Maul Foster & Alongi, Inc. (MFA) has prepared this predesign sampling and analysis plan (PSAP) for design of remediation of Lake River offshore of the former Pacific Wood Treating Company (PWT) site in Ridgefield, Washington (see Figure 1-1). PWT operated a wood-treating facility from 1963 to 1993 at the Port's Lake River Industrial Site (LRIS); historical operations resulted in sediment contamination in Lake River. This document has been prepared under the authority of Agreed Order No. 01TCPSR-3119 between the Port and the Washington State Department of Ecology (Ecology) to satisfy the requirements of the Model Toxics Control Act (MTCA) and sediment management standards (SMS), and addresses the substantive requirements of Washington Administrative Code (WAC) 173-340, 350, and 360 (MTCA) and WAC 173-204 (SMS).

The PSAP describes environmental field sampling and laboratory analytical activities necessary to design the remedy of contaminated sediment in Lake River. The selected remedy includes dredging and disposal of contaminated sediment and enhancing natural recovery of remaining low-level and other residual contamination. Lake River sediment characterization, cleanup level (CUL) development, and remedial alternatives evaluation are detailed in the former PWT site draft remedial investigation and feasibility study (draft RI/FS) (MFA, 2012). The PSAP provides information regarding the field sampling objectives, sample location and frequency, equipment and procedures to be used during the sampling, sample handling and analysis, quality assurance protocols, and reporting requirements.

This PSAP is generally consistent with current Puget Sound Estuary Program (PSEP) and U.S. Environmental Protection Agency (USEPA) protocols for sampling and analysis (PSEP, 1986, 1997a,b; USEPA, 1993) and standard USEPA methods based on USEPA test methods for evaluating solid waste, physical/chemical methods (also known as SW-846) requirements, as amended (USEPA, 1986). PSAP contents are consistent with guidance provided in Ecology's Sediment Source Control Standards User Manual, Sediment Sampling and Analysis Plan Appendix (Ecology, 2008).

1.1 Background

The approximately 40-acre LRIS is located within the Ridgefield city limits at 111 West Division Street, Ridgefield, Washington (see Figure 1-2). The LRIS is the former location of the PWT facility; former operations involved pressure-treating wood products with oil-based treatment solutions and water-based mixtures. Constituents released to environmental media included creosote, pentachlorophenol (PCP), copper, chromium, arsenic, zinc, and polychlorinated dibenzo dioxins and furans (collectively referred to as dioxins) (MFA, 2012). The LRIS is bounded on the north by the Ridgefield National Wildlife Refuge (RNWR), which includes Carty Lake; on the west by Lake River; on the east by the Burlington Northern Railroad tracks, which separate the LRIS from residential areas; and on the south by a Port-owned public boat launch. The boat launch property adjoins the privately owned McCuddy's Marina that contains residences, including houseboats. The RNWR is also on the west side of Lake River, across from the LRIS.

The draft RI/FS (MFA, 2012) identifies indicator hazardous substances (IHSs), characterizes IHS nature and extent, identifies potential sources and exposure pathways, develops CULs, and evaluates possible remedial actions in Lake River. IHSs include dioxins, PCP, m&p-cresol, and total polycyclic aromatic hydrocarbons (TPAH). Dioxins occur in Lake River sediment, and elevated dioxin concentrations are collocated with other IHSs exceeding applicable screening criteria. Therefore, cleanup actions directed at dioxins will also remediate other compounds.

The preferred remedy identified in the draft RI/FS (MFA, 2012) involves dredging Lake River sediment and placing clean sand to enhance natural recovery in areas of residual and low-level contamination. Following are components of the preferred remedy:

- Removal of historical infrastructure such as dolphins and pilings
- Removal of Lake River sediment to significantly reduce areawide dioxin concentrations and other IHSs (i.e., PCP, m&p-cresol, TPAH) above screening criteria (see Table 2-1)
- Installation of silt curtains during the removal action to minimize water quality impacts
- Disposal of dredged material as nonhazardous material waste at a Subtitle D landfill facility
- Placement of sand to enhance the natural recovery of sediments in areas of residual contamination
- Stabilization of the lower bank[1]

2 INVESTIGATION OBJECTIVES

This PSAP identifies the chemical and physical sediment characterization required to design the Lake River cleanup action. The primary investigation objectives are:

- Delineation of the dredge (horizontal and vertical extent) prism
- Characterization of sediment physical parameters to evaluate sediment retrieval, handling, and disposal methods
- Collect remedial action confirmation samples.

These objectives are discussed further below.

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[1] The upper portions of the bank are being addressed as part of an upland interim action currently under way.

2.1 Dredge Prism Delineation

The nature and extent of IHSs are generally well understood (MFA, 2012). PCP, m&p-cresol, and TPAH exceedances of CULs are well defined and are collocated with elevated dioxin concentrations. Dioxin concentrations are generally elevated close to shore and near historical outfalls, and decrease substantially within the top 2 to 3 feet of the mudline. However, additional data collection for dioxins is warranted to delineate the extent of dioxins vertically in some locations, and to refine the understanding of the lateral spatial distribution of dioxins. In addition, data collected during the predesign sampling effort will be used to confirm that the remedy will meet remedial action objectives such that confirmation samples will not be required during or upon completion of the remedial action.

To evaluate remedial options, a variety of dredge prism scenarios were presented in the draft RI/FS (MFA, 2012). The dredge prism scenarios were evaluated in terms of technical feasibility, cost, and anticipated postremedial surface-weighted average concentrations (SWACs). The preferred alternative presented in the draft RI/FS involved removing sediment with dioxin toxicity equivalent quotients (TEQs) greater than approximately 60 nanograms per kilogram (ng/kg), with a layer of sand placed in areas with dioxin TEQs over 10 ng/kg. Under this alternative, the areawide concentrations of dioxins would be reduced to below the practical quantitation limit (5 ng/kg), and no point concentrations would be expected to exceed 30 ng/kg after application of enhanced natural recovery (ENR) during site remediation. Ecology has indicated that a scenario in which sediment with dioxin TEQs exceeding approximately 30 ng/kg is removed should also be carried forward in the design process.

Obtaining additional dioxin data during this predesign sampling effort is not anticipated to change the general understanding of the nature and extent of dioxins. However, the additional data are expected to result in slight changes in the dredge prism scenarios and resulting SWACs. The final dredge prism will be developed in consultation with Ecology.

The SWAC evaluation relies on the use of Thiessen polygons to spatially weight concentration data, resulting in an areawide average that is less biased by the spatial distribution of sample locations. Thiessen polygons and preliminary dredge prisms developed in the draft RI/FS (MFA, 2012) for Lake River are shown in Figure 1-3. While the Thiessen polygons were used to anticipate postremedy dioxin SWACs, and for convenience were also used to estimate dredge volumes, the final dredge prism is not expected to adhere to the outline of the polygons. The final dredge prisms will consider dredging logistics, feasibility, and river bottom characteristics. These additional considerations are expected to result in a "smoothing" of the actual prism boundary.

2.2 Sediment Physical Characterization

Sediment physical properties within the anticipated dredge prism will inform the design of the remedy and the remedial cost estimates. These properties will be used to evaluate slope stability, river hydrodynamics, sediment transfer, dredge production rates, volumes, and handling requirements. In addition to geotechnical laboratory analysis, a pilot study will be conducted, using the sediment obtained during this sampling event, to evaluate how the material behaves during the dredging, handling, and disposal processes.

The sediment physical properties not only inform the handling requirements and dredging methods for sediment, but also provide a better understanding of river hydrodynamics and sediment transfer information, given these properties. A full understanding of all of these elements is valuable, as sedimentation or erosion during dredge operations may impact the volume of dredged material, as well as the length of time it takes to reach the design grades. These conditions will affect not only the rate of production and estimated volume to be dredged, but also the final effectiveness of the dredging action, as the assumed low-energy environment would continue to deposit sediment over the ENR layer. Additionally, the hydrodynamic information, when paired with the chemical analysis, will help to inform development of the dredge prism and its extent.

The pilot study will include physical manipulation of the sediment in order to simulate dredging and handling methods. The general behavior of the sediment during each test will be recorded. These pilot study tests are intended to show how the sediment will react to handling, stacking, drying, and amending, among other characteristics that can be observed and recorded.

3 SITE CONDITIONS

The Lake River fluvial environment and environmental conditions are summarized below and are detailed in the draft RI/FS (MFA, 2012).

3.1 Fluvial Environment

Low water velocity, bathymetric analysis, and grain size distribution all indicate that Lake River comprises a predominantly depositional fluvial environment (MFA, 2012). Lake River is essentially a slow, flat slough of the Columbia River, hydraulically connected through a tide gate/flushing structure along the western shoreline of Vancouver Lake. Changes in bathymetry evaluated in the draft RI/FS (MFA, 2012) indicate significant deposition over time, possibly up to 0.3 foot per year in the channel areas. Figure 3-1 shows the estimated difference in Lake River mudline elevations from 1970 and the latest updated bathymetry surveys completed in 2010. Figure 3-2 shows that Lake River surface sediment is dominated by fine-grained sediments, typical in relatively low-energy environments where current velocities are low enough to allow fine particles to settle out of the water column. Lower percent fines were located just offshore of historical outfalls that discharged near the water/sediment interface. In general, the fluvial characteristics suggest that deposition occurs over most of Lake River's length.

Subsurface sediment in Lake River varies based on the sampling location. Generally, in the nearshore slope areas, the sediment is characterized as a fine sandy silt to a depth of approximately 5 feet below mudline (bml) that then transitions to a fine to medium sand. Subsurface sediment in the channel areas of Lake River is generally very fine sandy silt from the length of the core up to 11 feet below the mudline, with the exception of fine to medium sand encountered in two cores (LRIS-LR-02 and LRIS-LR-13) in the Lake River channel area at approximately 6 to 7 feet bml.

Flow direction in Lake River can reverse as a result of tidal influences from the Columbia River. During summer and early fall, flow in Lake River generally reverses daily with the tides. During the winter months, flow is typically toward the Columbia River because of high volume of rain runoff. During the spring, when snowmelt raises water levels in the Columbia River, flow in Lake River is toward Vancouver Lake.

3.2 Environmental Conditions

Dioxins are the most widespread contaminant in Lake River sediment and are collocated with other IHSs. Remedial actions directed at reducing dioxins will eliminate other contaminant concentrations above their respective CULs (CULs are summarized in Table 2-1). Dioxins in Lake River are generally elevated close to shore and particularly near outfalls, and decrease significantly within about 150 feet from shore and from less than 1 to approximately 3 feet bml (see Figure 3-3 and MFA, 2012).

Nature and extent of other IHSs are generally limited and collocated with elevated dioxin concentrations (MFA, 2012). PCP, m&p-cresol, and TPAH exceeded benthic screening criteria (Avocet, 2011) only in the subsurface at LRIS-LR-08 and/or LRIS-LR-09 (see Figure 3-4). The PCP exceedance (3,100 micrograms per kilogram [μg/kg]) at LRIS-LR-08) is limited to the shallow subsurface (1 to 2 feet bml) and is vertically bound at 3 to 4 feet bml (22 μg/kg). Station LRIS-LR-09 exceeded the m&p-cresol criteria (260 μg/kg) in two sample intervals; an exceedance occurred in the 1 to 2 feet bml interval (360 μg/kg) and a marginal exceedance occurred in the 4 to 5 feet bml interval (280 μg/kg), indicating decreasing concentrations with depth. TPAH exceeded screening criteria at one subsurface location, LRIS-LR-08 (1 to 2 feet bml), and is vertically delineated at 3 to 4 feet bml. Subsurface exceedances at LRIS-LR-08 and -09 are consistent with suspected historical stormwater discharge of wood-treating chemicals from Outfall 4 (MFA, 2012).

4 DATA GENERATION AND ACQUISITION

4.1 Sample Program Design

The sample program design for refinement of the extent of dioxins in sediment and evaluation of sediment physical characteristics is described below. A summary of data needs, sampling methods, and analytical program is provided in Table 4-1. Figure 4-1 shows proposed sample stations. Table 4-2 summarizes the sampling method and analytical program by sample station.

4.1.1 Dredge Prism and ENR Boundary Delineation

The final dredge prism design will be informed by the data collected during remedial investigation, additional data collected as part of the predesign sampling effort, and other lines of evidence such as dredging logistics and riverbed characteristics.

The current understanding of the spatial distribution of dioxins is shown on Figure 3-3. The extent of dioxins will be refined by collection of samples at 20 locations. Samples will be collected at 13 new locations and at seven stations from which samples were collected during the RI (i.e., historical stations) (see Figure 4-1 and Table 4-2). Surface sediment will be collected at the new locations to refine the lateral extent of dioxins. In addition, samples will be collected at depth at new stations to evaluate the vertical extent of any elevated dioxins identified at the surface. Samples will be collected at 1-foot intervals to 5 feet bml.

Subsurface samples will be collected at the seven historical sample stations to delineate the vertical extent of dioxin contamination. Locations for subsurface sampling were selected to delineate the extent of impacts where the existing deepest sample exceeded the dioxin TEQ of 30 ng/kg. The exception is station LRIS-LR-109 (known as LRIS-LR-09 in the draft RI/FS [MFA, 2012]), where the subsurface concentration at 1 to 2 feet bml is less than 30 ng/kg at 1.59 ng/kg, but because the dioxin TEQ at the surface is significantly elevated at 578 ng/kg (MFA, 2012), a subsurface sample will be collected at 2 feet bml to confirm low concentrations at this depth.

Samples will be submitted for analysis in tiers, such that the lateral and vertical extent of dioxin TEQs is delineated to approximately 30 ng/kg. Tier 1 samples will be submitted for analysis, Tier 2 samples will be submitted for analysis to further refine the extent of contamination if the Tier 1 dioxin TEQ exceeds 30 ng/kg, and so on. At new sample stations, surface and subsurface (1 to 2 feet bml) are generally designated Tier I samples. However, in three locations anticipated to have low concentrations (i.e., LRIS-LR-126, LRIS-LR-129, LRIS-LR-137), only the surface sample is designated as a Tier 1 sample; at two locations (LRIS-LR-135 and LRIS-LR-136) all samples will be archived and analyzed if Tier I results for nearby stations exceed 30 ng/kg. A total of 26 primary samples from 20 stations and two field duplicates from one station will initially be submitted for analysis. The tier of each sample location is listed in Table 4-2.

4.1.2 Physical Sediment Characterization

Physical data will be collected during predesign sampling to inform design, dredging methodology, and dredge material handling, and to aid in the refinement of the dredge prism. Samples will be collected at six locations within the anticipated dredge prism for physical characterization (see Table 4-2 and Figure 4-1).

Locations were selected to represent a cross section of substrate type within the anticipated dredge area, including soil with low, medium, and high percent fines. The distribution of percent fines is shown in Figure 3-2 and was used to select the proposed sample stations shown in Figure 4-1. As discussed in Section 3.1, the physical characteristics of the river bottom do not change significantly in the top 5 feet of the mudline; therefore, samples collected to a depth of 3 feet bml are considered representative of the anticipated dredge prism.

Samples will be obtained using manually advanced Shelby tubes to preserve in situ conditions to the extent possible. Three-foot samples will be collected and analyzed at six locations, with an allowable minimum recovery of 2 feet. Each sample will be analyzed for bulk density, grain size distribution, permeability, and Atterberg limits.

An additional quantity of sediment will be collected at each location for a series of pilot tests to evaluate how the material behaves during the dredging, handling, and disposal processes. The pilot tests include (but are not limited to) dewatering, settlement time, slump, and general handling. These tests will be performed as a constructability assessment and will consist of analyzing the workability of the sediment to inform construction procedures. Tests will include:

- Drying tests—measuring the time that it takes for the sediment to dry out enough to be transported. Drying time will be assessed with and without coagulants.
- Settling tests—dropping sediment through a water column and monitoring the time that it takes to fall out.
- Workability—assessment of the saturated material's ability to accumulate in stacks on the ground, to evaluate natural compressive dewatering of the sediment, and the apparent slump/spread as it comes out of the water.

Additionally, the behavior of both the saturated and the dried material will be observed and recorded through multiple manual handling processes (i.e., buckets, shovels and mixing).

4.2 Sampling Methods

Sampling methods, including navigation to sample stations and sediment retrieval, are described below.

4.2.1 Positioning

A differential global positioning system (DGPS) on the contractor support vessel will be used to locate the sampling position for each proposed sample station shown on Figure 4-1. Coordinates of new sampling stations are summarized in Table 4-3. Coordinates will be programmed into the navigation system on the contractor vessel. Sample locations will be located to an accuracy of ±3 meters. Horizontal coordinates will be referenced to the Washington South State Plane HARN (NAD83). The DGPS will be used to record the location of each sample station. The vertical elevation of each station will be measured using a fathometer or lead line.

4.2.2 Surface Sediment Grab Sampling

Surface sediment samples collected for dioxin and TOC analysis will be retrieved by a power grab sampler (Van Veen). Use of Van Veen sampling is consistent with historical Lake River remedial investigation surface sampling (Anchor and MFA, 2011; MFA, 2012). The grab sampler, equipped with mesh screens and rubber flaps that minimize the loss of surficial, fine-grained sediments, will be deployed using a winch from a support vessel. The speed of the grab sampler's descent will be controlled to minimize disturbing the sediment. The speed of ascent will also be controlled to minimize loss of sediment from washout. The sediment sample will be inspected upon retrieval to ensure that the grab sampler was completely closed and retained all sediment, including surficial fines.

Retrieving samples in areas where the river bottom includes some gravel or debris may require multiple deployments. This is not expected, given the absence of gravel at previously sampled surface locations (MFA, 2012). However, if after the third deployment of the power grab sampler an adequate sample volume is not retrieved, sampling coordinates of the unsuccessfully sampled location may be field adjusted (i.e., within approximately 20 feet of the original sample location).

Upon retrieval of an acceptable sediment sample, excess water will be decanted from the Van Veen and samples will be collected from the retrieved material. Sediment that is in contact with the sides of the sampler will not be collected.

Two 8-ounce jars will be filled at each sample location. One 8-ounce jar will be submitted for analysis for each Tier 1 designated sample. All other sample containers will be submitted to the laboratory for archiving.

4.2.3 Subsurface Sediment Vibracore Sampling

Subsurface sediment sampling will be conducted using a vibratory core sampler (vibracore) for dioxin and total organic carbon characterization. The vibracore method allows for a continuous profile of subsurface sediments by using a high-frequency vibrating coring device that penetrates into the underlying sediments with minimal distortion. A vibracore works well for collecting long, relatively undisturbed cores from a variety of sediment types. Use of vibracore sampling is consistent with historical Lake River remedial investigation subsurface sampling (Anchor and MFA, 2011; MFA, 2012).

A support vessel with the vibracoring equipment will maneuver to the proposed sample station (see Table 4-2) and anchor if necessary. A decontaminated core tube longer than the depth of the desired penetration of 5 feet will be secured to the vibratory assembly and deployed from the vessel, using a winch. The vibracore assembly will be lowered perpendicular to the water surface and allowed to penetrate into the sediment under the weight of the device, after which the vibrating motor will be engaged. A thin-walled aluminum tube with acetate liner will then be driven by vibration into the sediment. The vibracore unit will be allowed to operate until the maximum depth of the core barrel is achieved or refusal is encountered. The vibracore unit (with core barrel attached) will then be withdrawn from the sediment, using the vessel winch. Once back on the support vessel, the core tube will be separated from the vibracore head unit and maintained in a vertical orientation. The vibracore sample will be accepted if a minimum of 5 feet of material is recovered. If the minimum amount of material has not been recovered, a new acetate liner and core barrel will be affixed to the vibracore head unit and the location will be resampled. If after three attempts inadequate material has been recovered (i.e., less than 75 percent core recovery relative to drive length), the location will be field adjusted by approximately 20 feet and the vibracore unit redeployed until adequate material has been recovered.

Following retrieval of an acceptable core (i.e., minimum of 5 feet length, core surface is intact and core tube appears intact, and recovery is greater than 75 percent of drive length), excess water will be removed from the acetate core liner and the core will be capped and stored in a vertical position for transport to the upland core processing station. Core processing will take place on the LRIS property in a designated area. Acetate core liners will be placed horizontally on a flat work surface and will be cut longitudinally using a saw. The cores will be described, noting features such as sheen, woody debris, and biological features, and then photographed. Each 1-foot increment of the core will be sampled, with care being taken not to sample material in contact with the acetate liner.

Two 8-ounce jars will be filled at each sample location. One 8-ounce jar will be submitted for analysis for each Tier 1 designated sample. All other sample containers will be submitted to the laboratory for archiving.

Remaining material from the top three to five feet of the vibracore sample will be collected in a 5-gallon bucket. The material will be used to perform pilot tests for drying, handling, and other material behaviors.

4.2.4 Shelby Tube Sampling

Sediment sampling for physical parameters will be conducted by manually advancing Shelby tubes through the river substrate. The Shelby tube sampling method allows for retrieval of a relatively undisturbed, i.e., in situ, sample. Shelby tube sampling procedures will be performed in conformance with American Society for Testing and Materials (ASTM) D 1587.

The support vessel will navigate to the proposed subsurface sample location (see Tables 4-2 and 4-3). A 3-inch-by-36-inch Shelby tube will be secured to pole extensions and advanced through the sediment a minimum of 2, but preferably 3, feet. The sample will be retrieved and inspected to ensure that a minimum of 2 feet of sediment is contained in the sampler. Depending on the grain size of the sediment, this process may need to be repeated because of loss of sediment. Additionally, a "keeper" mechanism may be necessary to retain the sample in the Shelby tube.

Once the Shelby tube sample is collected, each end will be wiped clean of loose sediment cuttings (if applicable) and the sample length will be measured. The sample length should be at least 75 percent of the drive depth. The sample will be sealed at each end in a fashion that provides proper confinement and will be stored upright for transportation to the laboratory.

4.3 Decontamination Procedures

Nondisposable sampling equipment that comes in direct contact with the sample (e.g., scoops, bowls) will be decontaminated before use at each sample location, according to the following procedure:

- Rinse with distilled water.
- Wash with scrub brush and Alconox™ soap.
- Rinse with distilled water.
- Rinse with methanol.
- Rinse with distilled water.

4.3.1 Van Veen Grab Sampler

The Van Veen surface grab sampler will be decontaminated before use at each sample location according to the following procedure:

- Rinse with site (river) water.
- Wash with scrub brush and Alconox™ soap.
- Rinse with distilled water.

4.3.2 Vibracore Sampling

Vibracore acetate liners will be decontaminated before deployment, using the following procedure:

- Rinse with potable water.
- Wash with scrub brush and Alconox™ soap.
- Rinse several times with distilled water.
- Seal both ends of each acetate liner with decontaminated plastic caps.

The sealing caps should be removed immediately before placement of the liner into the coring device. Care will be taken during sampling to avoid contact of the sample tube with potentially contaminated surfaces.

4.3.3 Shelby Tube Sampling

New single-use Shelby tubes will be clean and free of all surface irregularities, debris, and/or deleterious soils before sampling. The exterior of each Shelby tube will be rinsed with site water after sampling. If the Shelby tube contacts visibly contaminated sediment, the exterior will be thoroughly washed using Alconox™ soap and then rinsed with site water before the sample is readied for transport to lab.

4.4 Management of Investigation-Derived Waste

Excess sediment following sampling will be collected in new Washington State Department of Transportation–approved, 55-gallon drums labeled with material type and sample location. The drums will be used as a source for any additional sediment needed for handling and dewatering pilot tests. Drummed sediment will be disposed of in a permitted disposal facility pending the completion of pilot testing for dewatering and handling behavior and the receipt of analytical results.

Decontamination fluids will be collected and stored in sealed plastic buckets and disposed of through a permitted service provider. Personal protective equipment will be disposed of in a sanitary landfill.

4.5 Sample Documentation

Accurate recordkeeping will be maintained throughout the course of the field sampling effort. A field notebook will be prepared documenting the weather, field staff, sampling methodology and equipment, sampling procedures, chain-of-custody (COC) data, and observations made during the course of the work. COC forms will be prepared at the time of sampling and will be maintained throughout the sample handling and testing process. Field notes and photographs will be maintained during sampling. The following information will be included:

- Name(s) of the person(s) collecting and logging in the samples
- Sampling vessel and field staff
- A record of site health and safety meetings and updates
- Weather conditions
- The sample location as recorded by the DGPS
- Date and time of collection of each sample
- Sample methodology
- Penetration depth and sample length or percent recovery
- Photographs with sample location ID
- Gross characteristics of the sample, such as organic matter, biota, debris, and sheen
- Physical soil description of each sample consistent with the Unified Soil Classification System (includes soil type, density/consistency of soil, color)
- Description of material selectively removed from the sample before filling of containers for chemical analysis (e.g., gravel, wood debris)
- Any deviation from the Ecology-approved PSAP

4.6 Sample Custody

Samples collected will be traceable from sample collection through laboratory and data analysis. Samples are in custody if they are in the custodian's view, stored in a secure place, or placed in a container secured with custody seals. A COC record will be signed by each person who has custody of the samples and will accompany the samples at all times. Copies of the COC will be included in laboratory reports and data validation memoranda.

The form will include the following information:

- Site name
- Field staff name

- Collection date and time for each sample
- Sampling station identification
- Number of sample containers shipped
- Requested analysis

The original COC form will be transported to the laboratory with the samples. Upon receipt of the samples at the laboratory, the samples will be inventoried and compared with the documentation on the COC. The laboratory will document the samples' progress through the laboratory analytical process.

4.7 Sample Containers, Preservation, and Shipping

Each sample will have an adhesive plastic or waterproof paper label affixed to the container and will be labeled at the time of collection. Samples will be uniquely identified with a sample identification that at a minimum specifies sample number, sample location, sample date/time, and type of sample. Sample container, preservations, and holding-time requirements are summarized in Table 4-4.

4.7.1 Sample Containers for Chemical Analysis

The contract laboratory will supply sample containers, sample coolers, and packing materials for the sampling event. The laboratory will maintain documentation certifying the cleanliness of containers provided. Individual sample containers will be placed in a sealed plastic bag along with COCs. Glass jars will be packed to prevent breakage and will be separated in the shipping container by a shock-absorbent material, such as bubble wrap. Ice in sealed plastic bags will be placed in the cooler to maintain a temperature of approximately 4 degrees Celsius.

When the cooler is full, a temperature blank will be placed in each cooler. Coolers will be taped and then sealed with two COC seals. The temperature blanks are prepared by the laboratory, using analyte-free (reagent) water. Temperature blanks are used by the laboratory to record the temperature of each cooler used to transport samples from the field to the laboratory. The laboratory will verify that the temperature blank measurement is 4 (±2) degrees Celsius. Sample containers identified for archive (e.g., the Tier I sample 8-ounce jar not submitted for analysis and all Tier II through V samples) will be frozen at -18 degrees Celsius to achieve holding times as specified in Table 4-4.

Coolers will be transported to the laboratory by courier or overnight shipping service. Packing and shipping procedures consistent with U.S. Department of Transportation regulations as specified in 49 Code of Federal Regulations (CFR) 173.6 and 49 CFR 173.24 will be followed.

4.7.2 Sample Containers for Physical Analysis

Shelby tubes will be submitted to the geotechnical laboratory for physical properties analysis. The tubes shall conform to the standards in ASTM D 1587. The tubes will be sealed and packed with spacers if necessary to provide acceptable transport. The tubes will be protected to the degree possible against vibration, shock, bumping, rolling, and shock as well as from extreme heat or cold.

Sediment for dewatering and handling behavior pilot testing will be tested at the POR LRIS. Upon completion of testing, the sample sediment will be returned to the site and combined with the investigation-derived waste drums for disposal.

4.8 Field Instrumentation

The subcontractor responsible for navigation will confirm proper operation of the navigation equipment daily. This verification may consist of internal diagnostics or visiting a location with known coordinates to confirm the coordinates indicated by the navigation system. No other field equipment requires calibration. The subcontractor will be responsible for field equipment (i.e., Van Veen and vibracore) maintenance and operation. Any issues will be noted in the field logbook and corrected before sampling operations continue.

5 LABORATORY MEASUREMENTS AND PROCEDURES

5.1 Laboratory Test Methods and Reporting Limits

Chemical and physical testing will be conducted using the proposed analytes, analytical methods, and detection limits presented in Table 5-1. Before analysis, samples will be maintained according to the appropriate holding times and temperatures for each analysis.

5.2 Laboratory Instrumentation

The laboratory shall maintain an inventory of instruments and equipment, and the frequency of maintenance will be based on the manufacturers' recommendations and/or previous experience with the equipment. Laboratory quality assurance and quality control (QA/QC) will be maintained through the use of standard USEPA methods, based on USEPA test methods for evaluating solid waste, physical/chemical methods (also known as SW-846) requirements, as amended (USEPA, 1986).

Laboratory QC procedures, where applicable, include initial and continuing instrument calibrations, standard reference materials, laboratory control samples, laboratory replicates, matrix spikes, surrogate spikes, and method blanks. Table 5-1 presents the data quality objectives of solid phase testing for precision, accuracy, and completeness, while Table 5-2 summarizes general laboratory QA/QC procedures. The laboratory will also meet QA/QC requirements specified in the 2010 Dredged Material Management Program (DMMP) clarification paper (Hoffman, E., and D. Fox 2010). If the laboratory does not meet QA/QC acceptance limits, particularly if estimated maximum potential concentration (EMPC) qualifiers are anticipated, MFA will be contacted and corrective actions consistent with DMMP requirements will be conducted (Hoffman, E., and D. Fox 2010).

5.3 Field Duplicate

One field duplicate (LRIS-LR-130-DUP) will be collected at station LRIS-LR-130. Duplicate samples will be collected for both surface and subsurface sediment locations. The field duplicate will be prepared by dividing aliquots of a homogenized sample into two distinct samples for laboratory analysis. The field duplicate results will be evaluated during data quality review.

5.4 Standard Reference Material

One standard reference material (SRM) sample, SRM 1944, will be analyzed per 20 primary samples analyzed for dioxins. The SRM sample is matrix specific with known concentrations of dioxins that has been certified by the National Institute of Standards and Technology or an equivalent provider. The SRM will be assessed by comparing laboratory results to the certified performance criteria. The results will be evaluated during data quality review.

5.5 Rinsate Blank

One rinsate blank will be collected from reusable equipment coming into direct contact with sediment samples, i.e., bowls and spoons. The equipment rinsate blank will be collected by pouring laboratory-supplied distilled water over or through decontaminated (clean) sampling equipment used in the collection of sediment samples and subsequently collected in prepared sampling containers. The two equipment rinsate blanks will be submitted for analysis of dioxins by USEPA Method 1613B. The rinsate blanks will be shipped with the associated field samples. The rinsate blank results will be evaluated during data quality review.

5.6 Data Reduction, Validation, and Reporting

Data reduction is the process by which original data (analytical measurements) are converted or reduced to a specified format or unit to facilitate analysis of the data. Data reduction requires that all aspects of sample preparation that could affect the test result, such as sample volume analyzed or dilutions required, be taken into account in the final result. It is the laboratory analyst's responsibility to reduce the data, which are subjected to further review by MFA or a third party.

The laboratory data produced will be independently reviewed by MFA for data quality. Dioxin data will be reported consistent with the attached Dioxin and Furan Analysis, Data Validation, and TEQ Calculation Rules memo (see Appendix). The data review will include an assessment of laboratory performance criteria and will be consistent with the USEPA national functional guidelines. Results of the data review will be provided as a memorandum to be included with the data report and lab results sheets. Ecology will be notified prior to development of the data review memorandum if laboratory results indicate any significant data quality issues. Consistent with WAC 173-340-840(5) and Ecology Toxics Cleanup Program Policy 840 (Data Submittal Requirements), data will be submitted simultaneously in both written and electronic formats.

6 REPORTING

A data report will be prepared and submitted to Ecology within 30 days of receipt and review of the validated analytical data, including receipt of any contingent (e.g., Tier II) sampling and analysis data. Ecology will be notified in the event that any Tier I sample results indicate unexpected conditions (e.g. elevated concentrations outside of the preliminary dredge prism [see Figure 1-3]). The data report will include a brief summary of data collection procedures (noting, in particular, deviations from the PSAP); sample locations; summary of field notes; analytical results; a data validation memorandum; and an evaluation of the results. Data will be submitted to Ecology's EIM data system at the same time the final report is submitted. The results of the predesign sampling, including delineation of the extent of the dredge prisms and ENR areas, will be used to support the remedial design effort, in consultation with Ecology.

LIMITATIONS

The services undertaken in completing this plan were performed consistent with generally accepted professional consulting principles and practices. No other warranty, express or implied, is made. These services were performed consistent with our agreement with our client. This plan is solely for the use and information of our client unless otherwise noted. Any reliance on this plan by a third party is at such party's sole risk.

Opinions and recommendations contained in this plan apply to conditions existing when services were performed and are intended only for the client, purposes, locations, time frames, and project parameters indicated. We are not responsible for the impacts of any changes in environmental standards, practices, or regulations subsequent to performance of services. We do not warrant the accuracy of information supplied by others, or the use of segregated portions of this plan.

REFERENCES

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TABLES

Table 2-1
Screening Levels for Indicator Hazardous Substances (µg/kg)
Former PWT Site
Ridgefield, Washington

Chemical	Screening Level[a]
Phenols	
4-Methylphenol (p-cresol)	260
Pentachlorophenol	1,200
PAHs	
Total PAHs	17,000

NOTES:

µg/kg = micrograms per kilogram.

PAH = polycyclic aromatic hydrocarbon.

[a] Avocet, 2011. Development of Benthic SQVs for Freshwater Sediments in Washington, Oregon, and Idaho.

Table 4-1
Summary of Data Needs
Former PWT Site
Ridgefield, Washington

Data Need	Data Collection	Sample Type and Interval	Field Measurements	Laboratory Parameters
Sediment chemical analysis				
Refine lateral extent of dioxins in sediment and the distribution of organic carbon	Van Veen	Discrete interval, 0 to 10 centimeters	Visual observation and GPS	Dioxins and total organic carbon
Refine vertical extent of dioxins in sediment and the organic carbon content at the potential new surface	Vibracore	Discrete intervals, 1-foot intervals in subsurface	Visual observation and GPS	Dioxins and total organic carbon
Sediment physical properties				
Estimate barge loading performance, quantify potential loss of fines through overflow related to loading, and predict the ability to handle and stabilize sediment prior to transport.	Shelby Tube	Composite of top 3 feet and multiple sample stations	Visual observation and GPS	Grain size distribution
Refine production rate prediction by estimating sediment resistance to cutting. Predict amending requirements. Optimize dredging methods. Refine quantity estimates.	Shelby Tube	In situ core of top 3 feet of sediment	Visual observation and GPS	Bulk density, unit weight, and moisture content
Measurement of the fluid flow through sediments or the volumetric flux of fluid through a porous medium. Will inform processes for post dredge handling (e.g., drying, amending) as well as the ability to cut the soil.	Shelby Tube	In situ core of top 3 feet of sediment	Visual observation and GPS	Permeability
Indicates the range of water content over which the portion of fine soil behaves in a plastic manner. The upper limit (liquid limit) gives the water content at which the soil will flow. Will inform drying requirements for transportation and disposal.	Shelby Tube	In situ core of top 3 feet of sediment	Visual observation and GPS	Atterberg Limits
Physical manipulation of soil to estimate drying time, ability to stack and farm, turbidity, appropriate amendments, and other behavioral attributes.	Make visual field observations, collect in bulk quantities using any collection method available.	Disturbed	Visual-Manual Tests for Estimating Soil Properties	None

NOTE:
GPS = global positioning system.

Table 4-2
Sampling Design
Former PWT Site
Ridgefield, Washington

Location			Chemical Parameters						Physical Parameters					
Sample Station	Type of Station	Depth	Dioxins	TOC	Sample Method	Sample Volume	Sample Handling	Unit Weight	Grain Size	Atterberg Limits	Permeability	Sample Method
LRIS-LR-108	Historical	1-2 ft	Archive	Archive	Vibracore	Two 8-oz jars	4 °C					
		2-3 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
LRIS-LR-109	Historical	1-2 ft	Archive	Archive	Vibracore	Two 8-oz jars	4 °C	Tier I	Tier I	Tier I	Tier I	Shelby Tube and 5-gallon bucket
		2-3 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
LRIS-LR-110	Historical	1-2 ft	Archive	Archive	Vibracore	Two 8-oz jars	4 °C					
		2-3 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
LRIS-LR-119	Historical	1-2 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 °C	Tier I	Tier I	Tier I	Tier I	Shelby Tube and 5-gallon bucket
		2-3 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 °C					
LRIS-LR-120	Historical	1-2 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 °C	Tier I	Tier I	Tier I	Tier I	Shelby Tube and 5-gallon bucket
		2-3 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 °C					
LRIS-LR-124	Historical	1-2 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 °C					
		2-3 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 °C					
LRIS-LR-125	Historical	1-2 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 °C					
		2-3 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 °C					
LRIS-LR-105	Historical	0-10 cm	NA	NA	NA	NA	NA	Tier I	Tier I	Tier I	Tier I	Shelby Tube and 5-gallon bucket
		1-2 ft	NA	NA	NA	NA	NA					
		2-3 ft	NA	NA	NA	NA	NA					
		3-4 ft	NA	NA	NA	NA	NA					
		4-5 ft	NA	NA	NA	NA	NA					
LRIS-LR-103	New[a]	0-10 cm	Tier I	Tier I	Van Veen	Two 8-oz jars	4 °C	Tier I	Tier I	Tier I	Tier I	Shelby Tube and 5-gallon bucket
		1-2 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 °C					
		2-3 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 °C					

Table 4-2
Sampling Design
Former PWT Site
Ridgefield, Washington

Location			Chemical Parameters						Physical Parameters				
Sample Station	Type of Station	Depth	Dioxins	TOC	Sample Method	Sample Volume	Sample Handling	Unit Weight	Grain Size	Atterberg Limits	Permeability	Sample Method
LRIS-LR-106	New[a]	0-10 cm	Tier I	Tier I	Van Veen	Two 8-oz jars	4 °C					
		1-2 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 °C					
		2-3 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 °C					
LRIS-LR-122	New[a]	0-10 cm	Tier I	Tier I	Van Veen	Two 8-oz jars	4 °C					
		1-2 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 °C					
		2-3 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 °C					
LRIS-LR-126	New[a]	0-10 cm	Tier I	Tier I	Van Veen	Two 8-oz jars	4 °C	Tier I	Tier I	Tier I	Tier I	Shelby Tube and 5-gallon bucket
		1-2 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		2-3 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier V	Tier V	Vibracore	Two 8-oz jars	4 °C					
LRIS-LR-129	New	0-10 cm	Tier I	Tier I	Van Veen	Two 8-oz jars	4 °C					
		1-2 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		2-3 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier V	Tier V	Vibracore	Two 8-oz jars	4 °C					
LRIS-LR-130	New	0-10 cm	Tier I	Tier I	Van Veen	Two 8-oz jars	4 °C					
		1-2 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 °C					
		2-3 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 °C					
LRIS-LR-130-DUP	New	0-10 cm	Tier I	Tier I	Van Veen	Two 8-oz jars	4 °C					
		1-2 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 °C					
		2-3 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 °C					
LRIS-LR-131	New	0-10 cm	Tier I	Tier I	Van Veen	Two 8-oz jars	4 °C					
		1-2 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 °C					
		2-3 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 °C					
LRIS-LR-132	New	0-10 cm	Tier I	Tier I	Van Veen	Two 8-oz jars	4 °C					
		1-2 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 °C					
		2-3 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 °C					
		3-4 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 °C					
		4-5 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 °C					

Table 4-2
Sampling Design
Former PWT Site
Ridgefield, Washington

Location			Chemical Parameters					Physical Parameters				
Sample Station	Type of Station	Depth	Dioxins	TOC	Sample Method	Sample Volume	Sample Handling	Unit Weight	Grain Size	Atterberg Limits	Permeability	Sample Method
LRIS-LR-133	New	0-10 cm	Tier I	Tier I	Van Veen	Two 8-oz jars	4 ˚C					
		1-2 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 ˚C					
		2-3 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 ˚C					
		3-4 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 ˚C					
		4-5 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 ˚C					
LRIS-LR-134	New	0-10 cm	Tier I	Tier I	Van Veen	Two 8-oz jars	4 ˚C					
		1-2 ft	Tier I	Tier I	Vibracore	Two 8-oz jars	4 ˚C					
		2-3 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 ˚C					
		3-4 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 ˚C					
		4-5 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 ˚C					
LRIS-LR-135	New	0-10 cm	Archive	Archive	Van Veen	Two 8-oz jars	4 ˚C					
		1-2 ft	Archive	Archive	Vibracore	Two 8-oz jars	4 ˚C					
		2-3 ft	Archive	Archive	Vibracore	Two 8-oz jars	4 ˚C					
		3-4 ft	Archive	Archive	Vibracore	Two 8-oz jars	4 ˚C					
		4-5 ft	Archive	Archive	Vibracore	Two 8-oz jars	4 ˚C					
LRIS-LR-136	New	0-10 cm	Archive	Archive	Van Veen	Two 8-oz jars	4 ˚C					
		1-2 ft	Archive	Archive	Vibracore	Two 8-oz jars	4 ˚C					
		2-3 ft	Archive	Archive	Vibracore	Two 8-oz jars	4 ˚C					
		3-4 ft	Archive	Archive	Vibracore	Two 8-oz jars	4 ˚C					
		4-5 ft	Archive	Archive	Vibracore	Two 8-oz jars	4 ˚C					
LRIS-LR-137	New	0-10 cm	Tier I	Tier I	Van Veen	Two 8-oz jars	4 ˚C					
		1-2 ft	Tier II	Tier II	Vibracore	Two 8-oz jars	4 ˚C					
		2-3 ft	Tier III	Tier III	Vibracore	Two 8-oz jars	4 ˚C					
		3-4 ft	Tier IV	Tier IV	Vibracore	Two 8-oz jars	4 ˚C					
		4-5 ft	Tier V	Tier V	Vibracore	Two 8-oz jars	4 ˚C					

NOTES:

˚C = degrees Celsius.

cm = centimeter.

ft = feet.

oz = ounce.

TOC = total organic carbon.

[a] historical station at which dioxins were not previously collected.

Table 4-3
Sample Station Coordinates
Former PWT Site
Ridgefield, Washington

Station ID	Historical Station ID	Surface Sample	Subsurface Sample(s)	X Coordinate	Y Coordinate
LRIS-LR-103	LRIS-LR-03[a]	CP	CP	1066354.68	184998.26
LRIS-LR-105	LRIS-LR-05		P	1066355.33	185146.38
LRIS-LR-106	LRIS-LR-06[a]	C	C	1066257.02	185210.75
LRIS-LR-108	LRIS-LR-08		C	1066161.19	185495.52
LRIS-LR-109	LRIS-LR-09		CP	1066104.28	185421.55
LRIS-LR-110	LRIS-LR-10		C	1066070.68	185702.40
LRIS-LR-119	LRIS-LR-19		CP	1066581.73	184639.93
LRIS-LR-120	LRIS-LR-20		CP	1066456.88	184908.13
LRIS-LR-122	LRIS-LR-22[a]	C	C	1066253.62	185347.21
LRIS-LR-124	LRIS-LR-24		C	1066162.33	185563.89
LRIS-LR-125	LRIS-LR-25		C	1065992.55	185822.31
LRIS-LR-126	LRIS-LR-26[a]	CP	CP	1065901.70	186088.77
LRIS-LR-129	NA	C	C	1065903.66	185788.29
LRIS-LR-130	NA	C	C	1066022.08	185423.91
LRIS-LR-131	NA	C	C	1066113.18	185332.82
LRIS-LR-132	NA	C	C	1066380.39	184871.28
LRIS-LR-133	NA	C	C	1066523.10	184588.89
LRIS-LR-134	NA	C	C	1066592.94	184540.30
LRIS-LR-135	NA	C	C	1066447.19	184534.23
LRIS-LR-136	NA	C	C	1066009.94	185314.60
LRIS-LR-137	NA	C	C	1065791.98	185892.16

NOTES:

Coordinates based on Washington South State Plane HARN (NAD83).

C = chemical data collection.

CP = chemical and physical data collection.

NA = not applicable.

P = physical data collection.

[a] historical station at which dioxins were not previously collected.

Table 4-4
Container Requirements, Holding Times, and Preservation
Former PWT Site
Ridgefield, Washington

Parameter	Sample Size	Container Size and Type	Hold Time for Analysis	Preservation
Dioxins	150 g	8-oz jar	30 days	4°C
			1 year	-18°C
Total organic carbon	50 g	8-oz jar	14 days	4°C
			6 months	-18°C

NOTES:

°C = degrees Celsius.

g = grams.

oz = ounces.

Table 5-1
Sampling Parameters, Analytical Methods, and Data Quality Objectives
Former PWT Site
Ridgefield, Washington

	Analytical Method	Units	Practical Quantitation Limit (PQL)	Level of Detection*	Precision	Laboratory Control Sample Accuracy	Internal Standard Accuracy	Completeness
Dioxins								
2,3,7,8-TCDF	USEPA 1613B	ng/kg	1.0	0.07	NA	75-158% R	24-169% R	100%
2,3,7,8-TCDD	USEPA 1613B	ng/kg	1.0	0.12	NA	67-158% R	25-164% R	100%
1,2,3,7,8-PeCDF	USEPA 1613B	ng/kg	5.0	0.25	NA	80-134% R	24-185% R	100%
2,3,4,7,8-PeCDF	USEPA 1613B	ng/kg	5.0	0.25	NA	68-160% R	21-178% R	100%
1,2,3,7,8-PeCDD	USEPA 1613B	ng/kg	5.0	0.25	NA	70-142% R	25-181% R	100%
1,2,3,4,7,8-HxCDF	USEPA 1613B	ng/kg	5.0	0.29	NA	72-134% R	26-152% R	100%
1,2,3,6,7,8-HxCDF	USEPA 1613B	ng/kg	5.0	2.50	NA	84-130% R	26-123% R	100%
2,3,4,6,7,8-HxCDF	USEPA 1613B	ng/kg	5.0	2.50	NA	70-156% R	28-136% R	100%
1,2,3,7,8,9-HxCDF	USEPA 1613B	ng/kg	5.0	2.50	NA	78-130% R	29-147% R	100%
1,2,3,4,7,8-HxCDD	USEPA 1613B	ng/kg	5.0	0.51	NA	70-164% R	32-141% R	100%
1,2,3,6,7,8-HxCDD	USEPA 1613B	ng/kg	5.0	0.35	NA	76-134% R	28-130% R	100%
1,2,3,7,8,9-HxCDD	USEPA 1613B	ng/kg	5.0	0.34	NA	64-162% R	NA	100%
1,2,3,4,6,7,8-HpCDF	USEPA 1613B	ng/kg	5.0	0.25	NA	82-122% R	28-143% R	100%
1,2,3,4,7,8,9-HpCDF	USEPA 1613B	ng/kg	5.0	0.25	NA	78-138% R	26-138% R	100%
1,2,3,4,6,7,8-HpCDD	USEPA 1613B	ng/kg	5.0	0.25	NA	70-140% R	23-140% R	100%
OCDF	USEPA 1613B	ng/kg	10.0	0.50	NA	63-170% R	NA	100%
OCDD	USEPA 1613B	ng/kg	10.0	0.99	NA	78-144% R	17-157% R	100%

Table 5-1
Sampling Parameters, Analytical Methods, and Data Quality Objectives
Former PWT Site
Ridgefield, Washington

	Analytical Method	Units	Practical Quantitation Limit (PQL)	Level of Detection*	Precision	Laboratory Control Sample Accuracy	Internal Standard Accuracy	Completeness
Physical Parameters								
Atterberg Limits	ASTM D-4318	NA	NA	NA	NA	NA	NA	90%
Grain size	ASTM D-422 with hydrometer	percent	1	0.1	NA	NA	NA	90%
Total solids	PSEP, 1986	percent	0.1	0.1	+/- 20% RPD	NA	NA	90%
Total organic carbon	COE 9060	mg/kg	0.1	0.1	+/- 20% RPD	75-125% R	NA	90%
Permeability	COE EM 1110-2-1906	m^2	0.1	0.1	NA	NA	NA	90%
Unit Weight/Moisture Content	ASTM D-2216	percent	0.1	0.1	+/- 20% RPD	NA	NA	90%

NOTES:

ASTM = American Society for Testing and Materials.

COE = U.S. Army Corps of Engineers.

m^2 = square meter.

mg/kg = milligrams per kilogram (parts per million).

NA = not applicable.

ng/kg = nano grams per kilogram (parts per trillion).

PSEP = Puget Sound Estuary Program.

R = recovery.

RPD = relative percent difference.

USEPA = U.S. Environmental Protection Agency.

*Level of detection is based on Test America, Inc. method detection limits. Estimated detection limits may be reported, depending on matrix conditions and laboratory discretion.

Table 5-2
Analytical Methods and Quality Control Requirements
Former PWT Site
Ridgefield, Washington

Analysis Type	Initial Calibration	Ongoing Calibration	Labeled Analogs	Replicates	Matrix Spikes	LCS/OPR	Method Blanks	Surrogate Spikes
Dioxins	As required by USEPA Method 1613B	Every 12 hours	Every sample	NA	NA	1 per 20 samples	1 per 20 samples	Every sample
Total organic carbon	Daily or each batch	1 per 10 samples	NA	1 per 20 samples	1 per 20 samples	1 per 20 samples	1 per 20 samples	NA

NOTES:

NA = not applicable.

LCS = Laboratory control sample.

OPR = ongoing precision and recovery sample (used for dioxin analysis).

USEPA = U.S. Environmental Protection Agency.

FIGURES

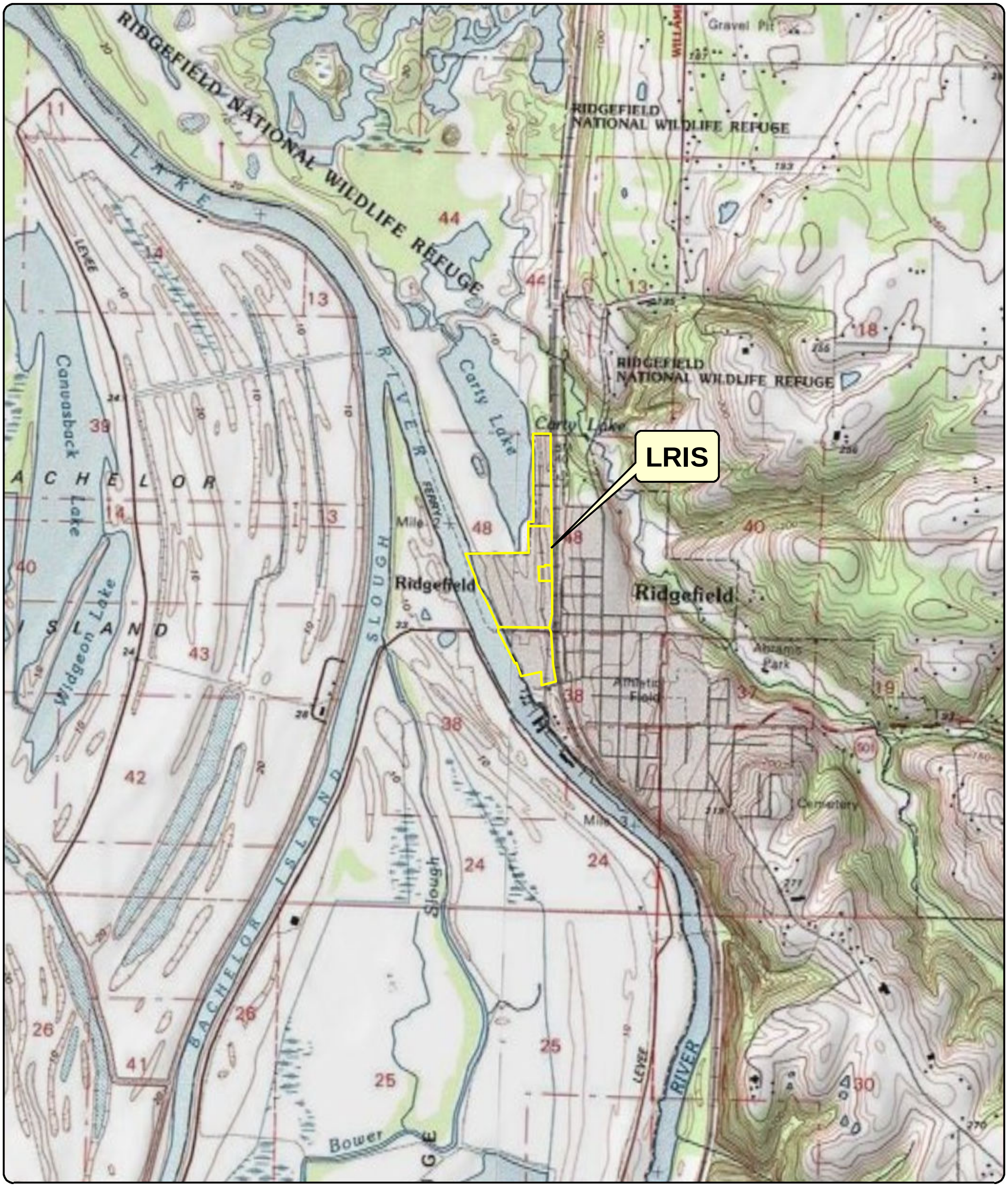
Path: X:\9003.01 Port of Ridgefield\49\Projects\Predesign SAP\Fig1-1_Site Location.mxd

Print Date: 7/23/2012

Approved By: J. King

Produced By: D. Coe/ W. Coffey

Project: 9003.01.20



Source: Topographic Quadrangle obtained from ArcGIS Online
Services/NGS-USGS TOPO! US Geological Survey (1999)
7.5-minute topographic quadrangle: Ridgefield
Address: Lake River Industrial Site
111 W. Division Street, Ridgefield, WA 98642
Section: 24 Township: 4N Range: 1W Of Willamette Meridian

Note: LRIS = Lake River Industrial Site

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Legend

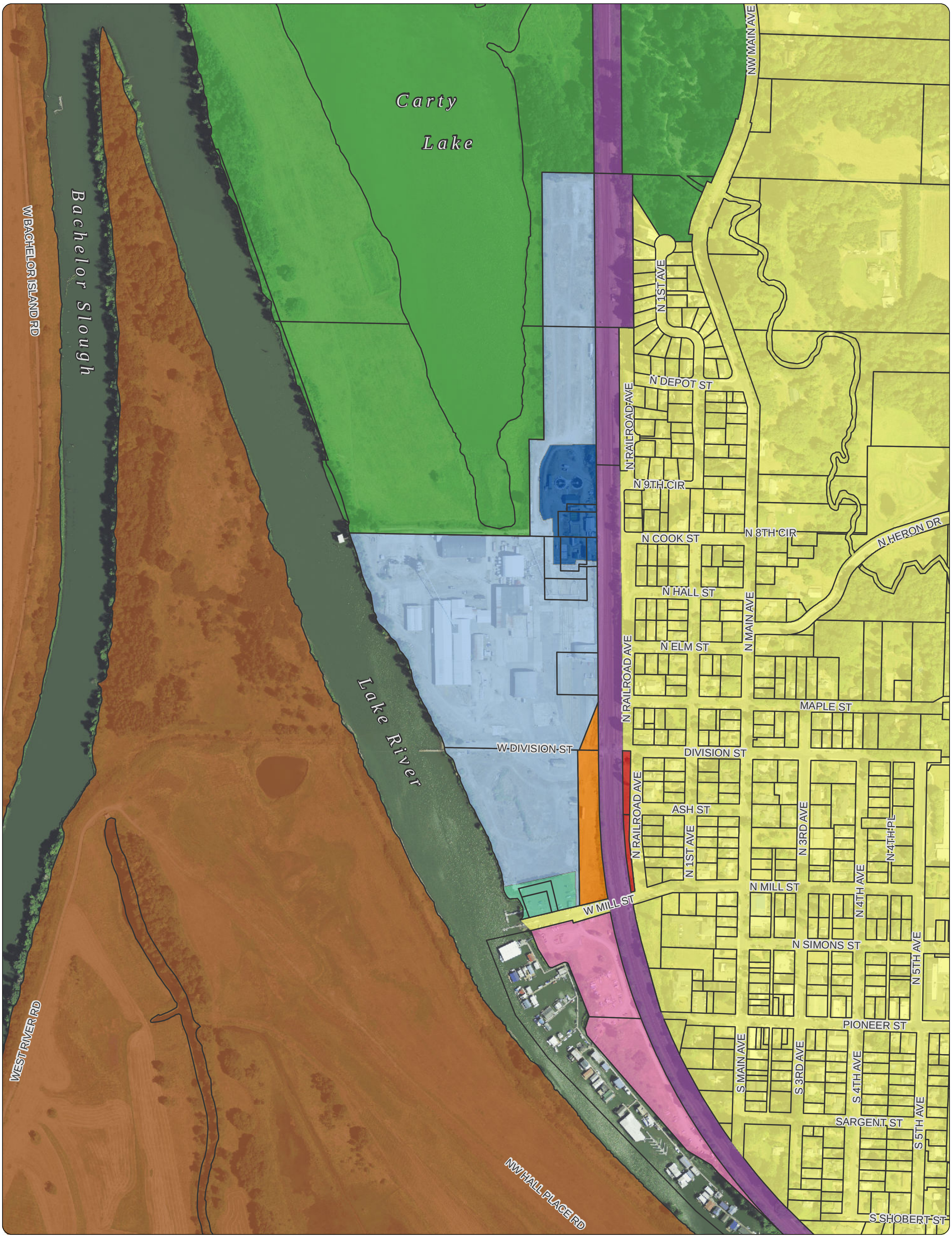
▭ LRIS Cell Boundaries

Figure 1-1
Site Location

Former PWT Site
Ridgefield, Washington

0 1,000 2,000
Feet

Path: X:\9003.01 Port of Ridgefield\49\Projects\Predesign SAP\Fig1-2_Site Vicinity.mxd



Source: Aerial photograph obtained from Clark County (2007).

Notes:
1. LRIS = Lake River Industrial Site
2. RNWR = Ridgefield National Wildlife Refuge.
3. WWTP = Wastewater treatment plant
4. Port = Port of Ridgefield

Legend

▨ LRIS; Port-Owned	▨ McCuddy's Marina Property
▨ LRIS; Union Pacific Railroad-Owned	▨ Off-Property Uplands
▨ Port Railroad Avenue Property	▨ RNWR-Carty Unit
▨ Port Marina Property	▨ RNWR-River S Unit
▨ City of Ridgefield WWTP	▨ BNSF Railroad Property
	☐ Clark County Tax Lots (2010)

Figure 1-2
Site Vicinity

Former PWT Site
Ridgefield, Washington

0 225 450
Feet

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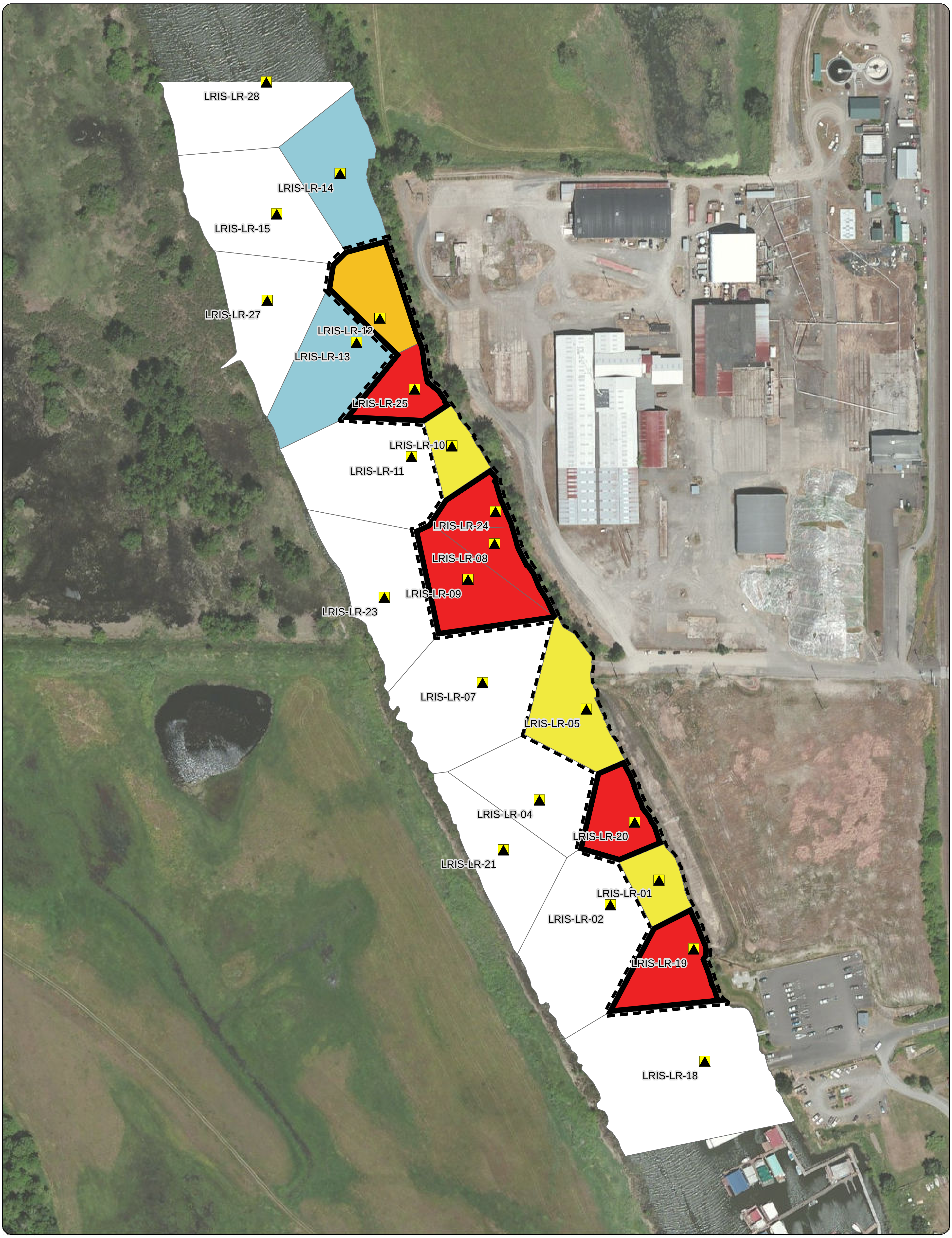
Print Date: 7/23/2012
Approved By: M. Novak
Produced By: J. Schane
Project: 9003.01.49

Path: X:\9003.01 Port of Ridgefield\49\Projects\Predesign SAP\Fig1-3_Thiessen Polygons Used in Surface Weighted Average Calculations.mxd



Source: Aerial photograph obtained from ESRI, Inc. ArcGIS Online/Bing Maps

Notes:
1. TEQ = Toxicity Equivalent calculated using toxicity equivalent factors in Washington Administrative Code 173-340-900 and half of the estimated detection limit for non-detect analytes.
2. ng/kg = nanograms per kilogram

Legend

▲ Surface Sediment Sample

▭ Preliminary Dredge Prism (removal of sediment > 30 ng/kg)

▭ Preliminary Dredge Prism (removal of sediment > 60 ng/kg)

Surface Dioxin TEQ (ng/kg)

⬜ 0 - 5
🟩 5 - 10 ppt
🟦 10 - 30
🟨 30 - 60
🟧 60 - 100
🟥 > 100

0 100 200
Feet

Figure 1-3
Thiessen Polygons Used in Surface Weighted Average Calculations

Former PWT Site
Ridgefield, Washington

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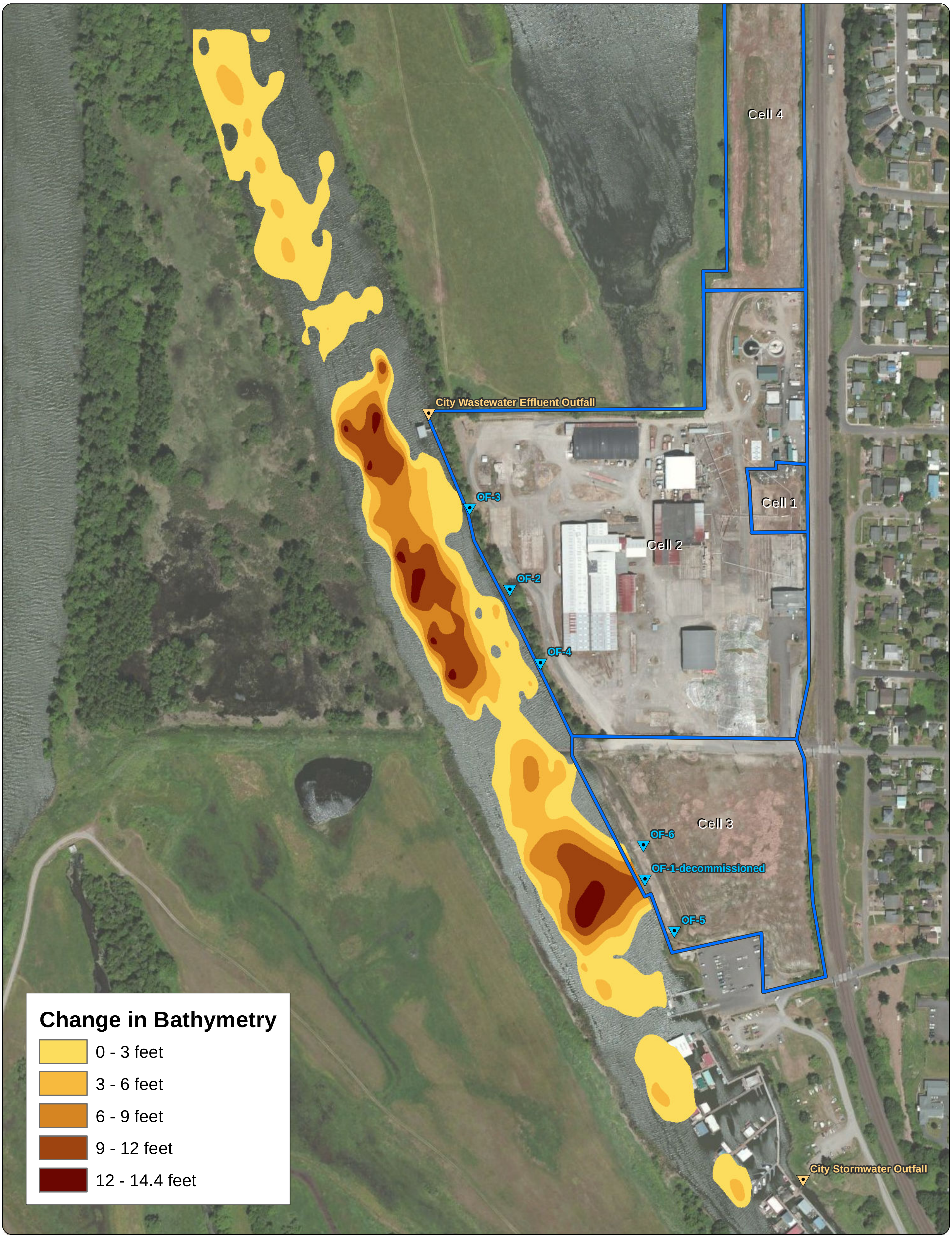
Project: 9003.01.40/05 Produced By: Hines/Schane Approved By: M. Novak Print Date: 8/8/2012

Path: X:\9003.01 Port of Ridgefield\49\Projects\Predesign SAP\Fig3-1_Estimated Sediment Deposition Since 1970_Lake River.mxd



Notes:

1. Sediment deposition estimated by comparing 1970 soundings with 2010 soundings; the representation shown can only be considered as indicating the general conditions existing at the time.
2. Bathymetric surveys from 1970 and 2010 obtained from the COE (Army Corps of Engineers).
3. Bathymetric surfaces created using the ArcGIS 10 Spatial Analyst extension spline method.

Legend

▼ Private Outfalls

▼ City of Ridgefield Outfalls

▭ Cell Boundaries

Figure 3-1
Estimated Sediment Deposition Since 1970 - Lake River

Former PWT Site
Ridgefield, Washington

0 150 300
Feet

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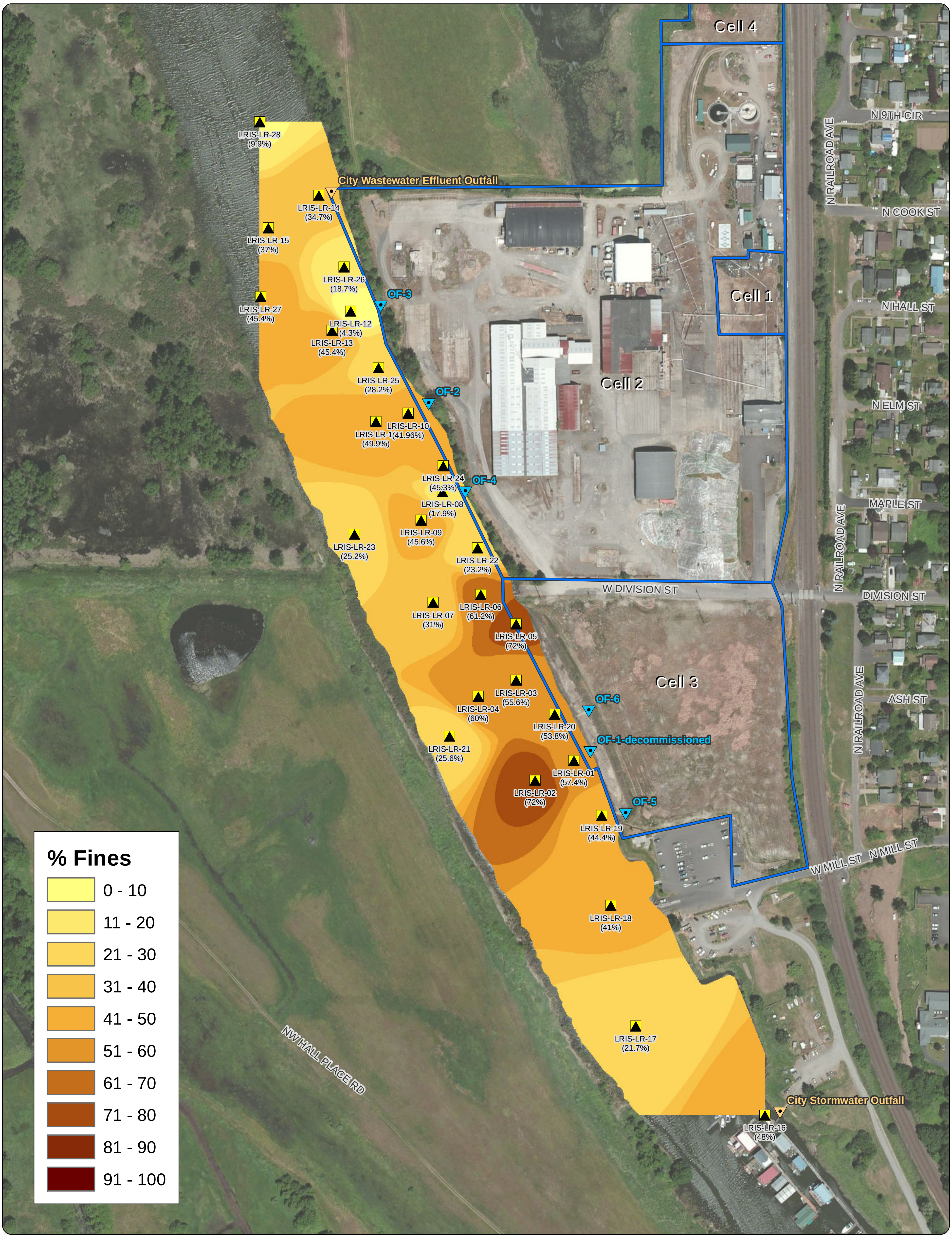
Source: Aerial photograph obtained from ESRI, Inc. ArcGIS Online/Bing Maps

Project: 9003.01.49 Produced By: J. Schane Approved By: M. Novak Print Date: 7/23/2012

Path: X:\9003.01 Port of Ridgefield\49\Projects\Predesign SAP\Fig3-2_Lake River Percent Fines.mxd



Source: Aerial photograph obtained from ESRI, Inc. ArcGIS Online/Bing Maps.

Notes:
1. Percent fines is percent of clay and silt.
2. Contours created using ArcGIS 10 Spatial Analyst inverse distance weighted (IDW) interpolation method.
3. IDW parameters: Power of 6, 12 Points

Figure 3-2
Lake River Percent Fines

Former PWT Site
Ridgefield, Washington

Legend

▲ Sediment Sample Locations
▼ City of Ridgefield Outfalls
▼ Private Outfalls
▭ Cell Boundaries

0 125 250
Feet

Print Date: 7/23/2012 Approved By: M. Novak Produced By: J. Schane Project: 9003.01.49

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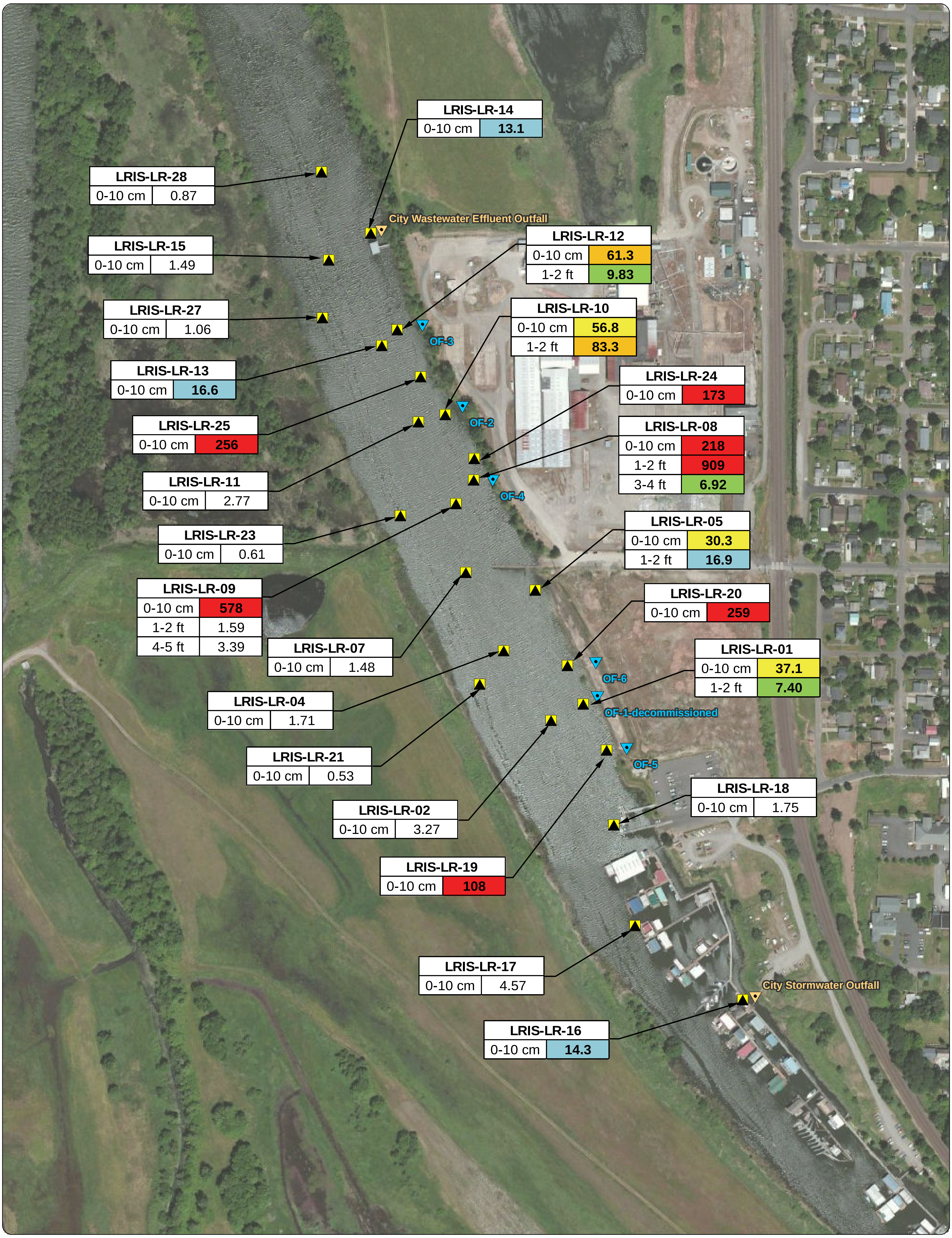
Path: X:\9003.01 Port of Ridgefield\49\Projects\Predesign SAP\Fig3-3_Lake River Dioxin TEQs in Sediment.mxd



Source: Aerial photograph obtained from ESRI, Inc. ArcGIS Online/Bing Maps

Notes:
1. **Bold** value exceeds cleanup level
2. TEQ = Toxicity Equivalent, calculated using toxicity equivalent factors in Washington Administrative Code 173-340-900 and half the estimated detection limit for nondetect congeners
3. ng/kg = nanograms per kilogram

Legend

▽ City of Ridgefield Outfalls
▽ Private Outfalls
▲ Existing Sediment Sample Locations

☐ 0 - 5 ng/kg Dioxin TEQ
🟩 5 - 10 ng/kg Dioxin TEQ
🟦 10 - 30 ng/kg Dioxin TEQ
🟨 30 - 60 ng/kg Dioxin TEQ
🟧 60 - 100 ng/kg Dioxin TEQ
🟥 > 100 ng/kg Dioxin TEQ

Figure 3-3
Lake River Dioxin TEQs in Sediment

Former PWT Site
Ridgefield, Washington

0 150 300
Feet

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Print Date: 7/23/2012
Approved By: M. Novak
Produced By: Hines/Schane
Project: 9003.01.40/05

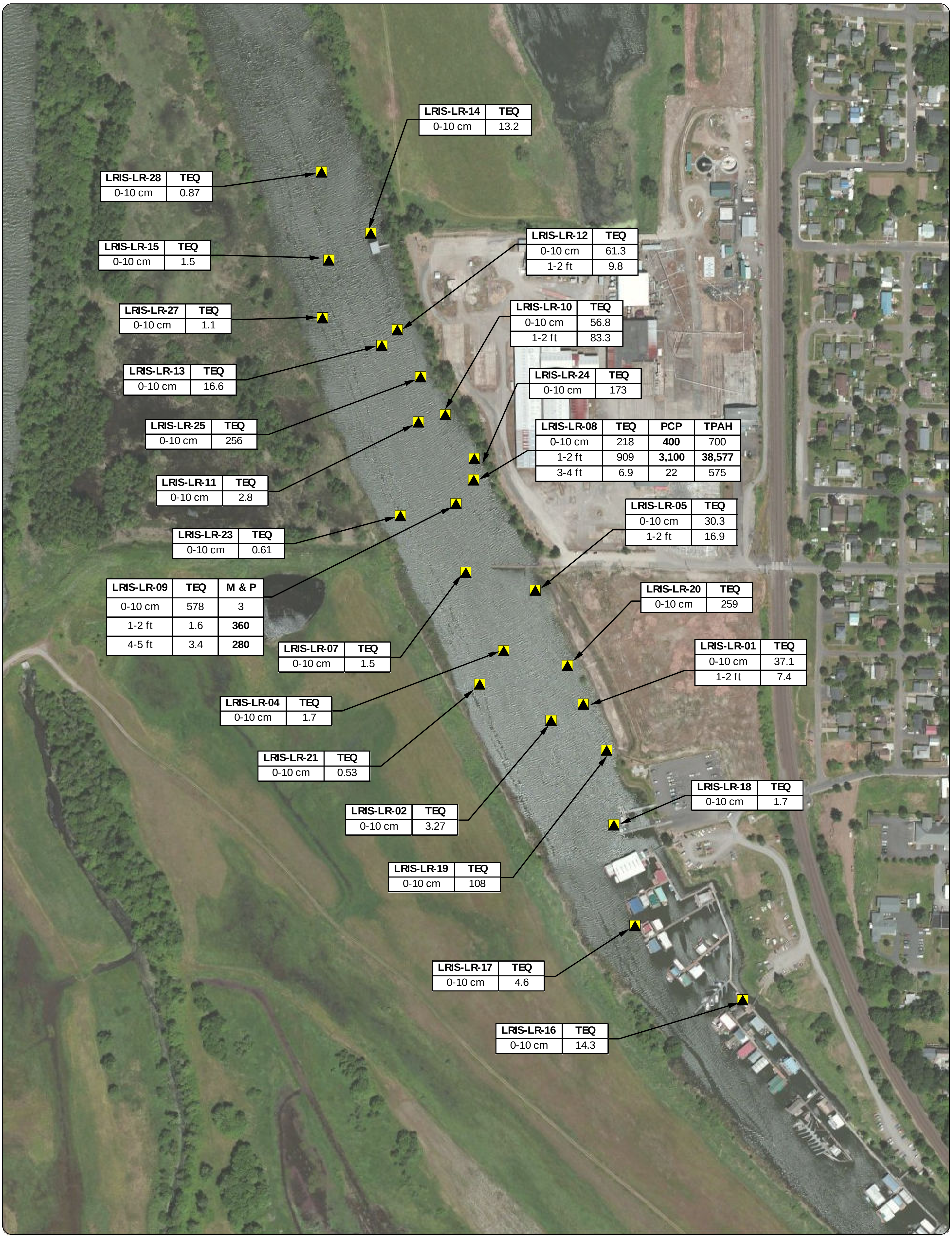
Path: X:\9003.01 Port of Ridgefield\49\Projects\Predesign SAP\Fig3-4 Indicator Hazardous Substances in Surface and Subsurface Sediment.mxd

Print Date: 8/8/2012

Approved By: M. Novak

Produced By: Hines/Schane

Project: 9003.01.40/05



Source: Aerial photograph obtained from ESRI,
Inc. ArcGIS Online/Bing Maps

TEQ = Dioxin Toxicity Equivalent Quotient (ng/kg)
PCP = Pentachlorophenol (µg/kg)
TPAH = Total PAH (µg/kg)
M & P = 3-Methylphenol &
4-Methylphenol / m&p-cresol (µg/kg)*
**Data were compared to 4-methylphenol (p-cresol)*
screening criteria

Legend

▲ Existing Sediment Sample Locations

Figure 3-4
Indicator Hazardous Substances in Surface and Subsurface Sediment

Former PWT Site
Ridgefield, Washington

0 150 300
Feet

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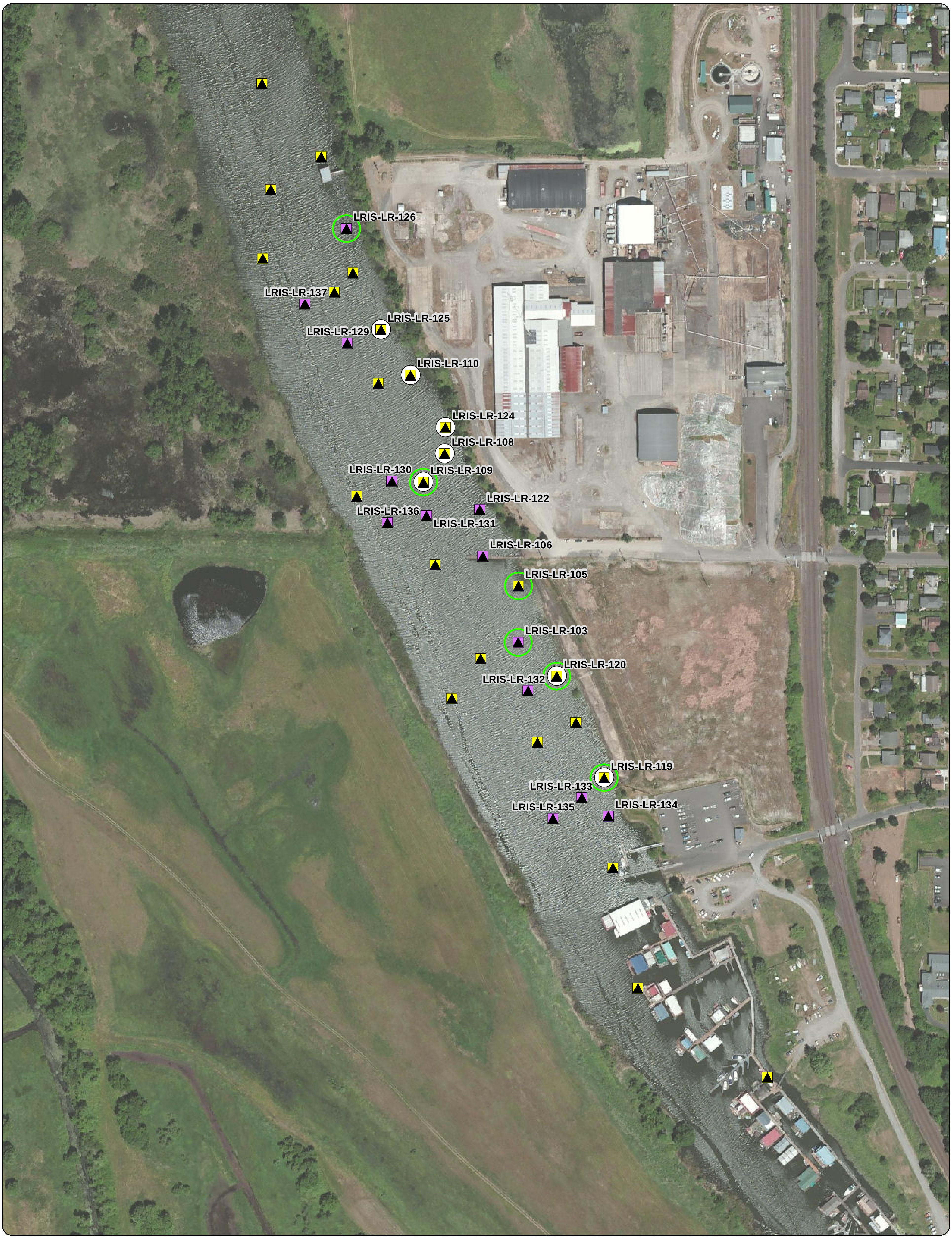
Path: X:\9003.01 Port of Ridgefield\40\Projects\05\Thiessen Polygons\Sept_2012\Fig4-1_Proposed Sediment Sample Locations.mxd



Source: Aerial photograph obtained from ESRI, Inc. ArcGIS Online/Bing Maps

Figure 4-1
Proposed Sediment Sample Locations

Former PWT Site
Ridgefield, Washington

Legend

▲	Historical Sample Stations
▲	Proposed Sample Stations (Chemical Analysis)
○	Proposed Sample Stations for Chemical Analysis (Historical Location)
◯	Proposed Sample Stations for Physical Analysis

0 125 250
Feet

Print Date: 9/17/2012

Approved By: M. Novak

Produced By: Hines/Schane

Project: 9003.01.40/05

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APPENDIX

DIOXIN AND FURAN ANALYSIS, DATA VALIDATION, AND TEQ CALCULATION RULES

MAUL
FOSTER
ALONGI

MEMORANDUM

To: File
Date: September 28, 2012

From: Erik Naylor
Project: 9003.01.40

RE: Dioxin and Furan Analysis, Data Validation, and TEQ Calculation Rules

---

The term dioxin is used to refer to a family of toxic chemicals that share a similar chemical structure and a common mechanism of toxic action. While there are 210 dioxin congeners, typically only the 17 most toxic congeners are reported by laboratories. The reported concentrations of the 17 dioxin congeners typically are validated to assess usability and then a toxicity equivalent concentration (TEQ) is calculated from the reported results to evaluate the toxicity of these compounds as a whole. The purpose of this memo is to provide an approach for dioxin data validation and TEQ calculation for the former Pacific Wood Treating site. Further, analytical method recommendations and requirements for laboratory deliverables are provided to enable consistent data validation and TEQ calculation using data from a variety of laboratories.

Critical to consistent data use is consistent use of terminology. Terms used in this memorandum are defined below.

- Method Detection Limit (MDL)—The minimum concentration of a compound that can be measured and reported with 99 percent confidence that the value is greater than zero according to the Washington State Department of Ecology's (Ecology), Model Toxics Control Act (MTCA) (Ecology, 2007).
- Estimated Detection Limit (EDL)—The sample- and analyte-specific EDL is an estimate made by the laboratory of the concentration of a given analyte that would have to be present to produce a signal with a peak height of at least 2.5 times the background noise signal level (U.S. Environmental Protection Agency [USEPA], 2005).
- Practical Quantitation Limit (PQL)—The lowest concentration that can be reliably measured within specified limits of precision, accuracy, representativeness, completeness, and comparability during routine laboratory operating conditions, using Ecology-approved methods (Ecology, 2007). This value is usually the lowest concentration used to calibrate the instrument after being adjusted for sample volume, sample extract volume, cleanups performed, and injection volume. PQLs should be no greater than 10 times the MDL (Ecology, 2007) and no greater than what is established by the USEPA in 40 Code of Federal Regulations (CFR) 136, 40 CFR 141-143, or 40 CFR 260-270.

- Estimated Maximum Potential Concentration (EMPC)—An EMPC is a value calculated for a reported analyte when the signal-to-noise ratio is at least 2.5:1 for both quantitation ions, but the ion abundance ratio criteria used for analyte confirmation are not met (USEPA, 2005). An EMPC value represents the maximum possible result of an analyte that could not be positively identified. The inability to positively identify the analyte could be a result of matrix interference, a coeluting compound, or low response.
- Toxic Equivalency Factor (TEF)—The factor by which each congener is multiplied in order to calculate its toxicity relative to 2,3,7,8-TCDD (Ecology, 2007). These values are summed to calculate the TEQ. TEFs depend on the endpoint being examined (i.e., birds, fish, mammals).
- TEQs—Concentrations of each congener are adjusted and summed to reflect their potency relative to 2,3,7,8-TCDD, one of the most toxic congeners. The TEQ is the sum of congener results multiplied by their specific TEF (Ecology, 2007).

ANALYTICAL METHODS

Dioxins are analyzed generally by USEPA Method 1613B or 8290, using a high-resolution gas chromatograph paired with a high-resolution mass spectrometer. A laboratory's PQL is usually the same for both methods. While the methods are very similar, Method 1613B is preferred, as it requires more rigorous quality assurance and quality control (QA/QC) through the use of six more internal standards than Method 8290. Because analytical technology and methodology have advanced rapidly since the methods were written, many laboratories combine elements of both methods to obtain the best results possible (Hoffman, E., and D. Fox 2010). Often the preparation and analyses are run using Method 1613B (for the additional QA/QC), while the calculations will be performed by Method 8290 (in order to obtain the sample- and analyte-specific EDLs). Method 1613B with calculated EDLs is the preferred method.

LABORATORY DELIVERABLES

It is important to work closely with the laboratory performing the dioxin analyses because different laboratories report data in different ways. The following items should be requested to ensure that the analytical report and electronic data deliverable (EDD) will contain all of the requisite information to validation the data and calculate TEQs:

- EDLs[1]and PQLs should be included in the final analytical report. EDLs, MDLs, and PQLs should all be included in the EDD.
- Results should be reported to the sample- and analyte-specific EDL. Results below the PQL but above the EDL will be qualified as estimates (J).

---

[1] Note that USEPA Method 1613B does not provide for the calculation of EDLs; therefore, the laboratory must use the calculation approach provided in Method 8290 to report the required limits.

- EMPC results should be reported at the EMPC value (EMPC values will be assigned a "U" qualifier [the analyte was not detected at or above the concentration qualified] at the time of validation).

TEQ concentrations will not be requested from the laboratory. If the laboratory provides TEQ concentrations, they will not be used because the data have not been validated TEQs should be calculated only after the data are validated.

VALIDATION

Dioxin data are validated much like other organic data, but there are a few issues that do not typically arise in other organic data sets. In addition to standard validation procedures (USEPA 2005), the following scenarios should be addressed in the fashion described below, consistent with other Ecology sites (Ecology and Environment and G. L. Glass, 2011):

- EMPC reported values should be assigned a U qualifier at the reported EMPC value.
- EMPC values that appear to be significantly elevated should be investigated further with the laboratory and may be assigned an R qualifier (unusable) when applicable.
- Non-detected results should be assigned a U qualifier and reported at the EDL value.

Further dioxin validation guidelines can be found in the National Functional Guidelines for Chlorinated Dibenzo-p-Dioxins (CDDs) and Chlorinated Dibenzofurans (CDFs) Data Review (USEPA 2005). Data must be validated before TEQs are calculated.

TEQS

To express the overall toxicity of the 17 reported dioxins, the concentration of each congener is adjusted based on its toxicity relative to the most toxic congener, 2,3,7,8-TCDD, and then all 17 are added together. The adjustment factors, the TEFs, are provided by the 2005 World Health Organization. TEQs are commonly calculated by one of the following two methods:

- Non-detected values (U) are set as one half of the EDL. Values that are detected, even as estimates (J), should be used at face value. Multiply congener values by their corresponding TEF and then sum all of the products.
- Non-detected values (U) are set as 0. Values that are detected, even as estimates (J), should be used at face value. Multiply congener values by their corresponding TEF and then sum all of the products.

These methods result in two different TEQ values that can be shown as TEQ (U=1/2) and TEQ (U=0). TEQs should not be calculated to more significant figures than the original data. The table below illustrates these methods:

Dioxin	Result (ng/kg)	TEC[1] (U=1/2) (ng/kg)	TEC[1] (U=0) (ng/kg)	TEF Mammals
1,2,3,4,6,7,8,9-Octachlorodibenzofuran (OCDF)	44	44	44	0.0003
1,2,3,4,6,7,8,9-Octachlorodibenzo-p-dioxin (OCDD)	3000 J	3000	3000	0.0003
1,2,3,4,6,7,8-Heptachlorodibenzofuran (HpCDF)	41	41	41	0.01
1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin (HpCDD)	510	510	510	0.01
1,2,3,4,7,8,9-Heptachlorodibenzofuran (HpCDF)	2.9 U	1.45	0	0.01
1,2,3,4,7,8-Hexachlorodibenzofuran (HxCDF)	6.9 U	3.45	0	0.1
1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	7.4	7.4	7.4	0.1
1,2,3,6,7,8-Hexachlorodibenzofuran (HxCDF)	5.2 U	2.6	0	0.1
1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin (HxCDD)	27	27	27	0.1
1,2,3,7,8,9-Hexachlorodibenzofuran (HxCDF)	0.5 U	0.25	0	0.1
1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin (HxCDD)	22	22	22	0.1
1,2,3,7,8-Pentachlorodibenzofuran (PeCDF)	3.4 U	1.7	0	0.03
1,2,3,7,8-Pentachlorodibenzo-p-dioxin (PeCDD)	3.2 U	1.6	0	1
2,3,4,6,7,8-Hexachlorodibenzofuran (HxCDF)	2.4	2.4	2.4	0.1
2,3,4,7,8-Pentachlorodibenzofuran (PeCDF)	3 U	1.5	0	0.3
2,3,7,8-Tetrachlorodibenzofuran (TCDF)	1.4 U	0.7	0	0.1
2,3,7,8-Tetrachlorodibenzo-p-dioxin (TCDD)	0.23 U	0.115	0	1
Total Heptachlorodibenzofuran (HpCDF)	99	99	99	--
Total Heptachlorodibenzo-p-dioxin (HpCDD)	1,100	1100	1100	--
Total Hexachlorodibenzofuran (HxCDF)	97 J	97	97	--
Total Hexachlorodibenzo-p-dioxin (HxCDD)	250	250	250	--
Total Pentachlorodibenzofuran (PeCDF)	44	44	44	--
Total Pentachlorodibenzo-p-dioxin (PeCDD)	32 J	32	32	--
Total Tetrachlorodibenzofuran (TCDF)	19	19	19	--
Total Tetrachlorodibenzo-p-dioxin (TCDD)	8.2	8.2	8.2	--
TEQ (U=1/2)	**15.2**	--	--	--
TEQ (U=0)	**12.3**	--	--	--

NOTES:
-- = no value.
ng/kg = nanograms per kilogram.
[1] TEC is analyte-specific TEF adjusted concentration.

The difference between TEQ (U=1/2) and TEQ (U=0) values gives data reviewers an idea of how much the EDL substitution affects the TEQ summation (Hoffman, E., and D. Fox 2010). While

MTCA does not specify using the TEQ (U=1/2) method, it is the method that has been historically used at the Port of Ridgefield and will continue to be used.

SUMMARY

- USEPA Method 1613B is recommended for dioxin analysis (with Method 8290 EDL calculations).
- The laboratory must report a PQL and EDL for each sample and each congener, and provide a PQL, EDL, and MDL for each sample and each congener in the EDD.
- Results should be reported to the sample- and analyte-specific EDL. Results below the PQL but above the EDL will be qualified as estimates (J).
- EMPC results should be reported at the EMPC value (EMPC values will be assigned a "U" qualifier at the time of validation). However, if the EMPC is significantly elevated, additional qualification may be appropriate.
- Non-detected results should be assigned a U qualifier and reported at the EDL value.
- Laboratory data must be validated before a TEQ is calculated.
- TEQs should be calculated as follows: non-detected values (U) are set as one half of the EDL. Values that are detected, even as estimates (J), should be used at face value. Multiply congener values by their corresponding TEF and then sum all of the products.

REFERENCES

Ecology. 2007. Model Toxics Control Act statute and regulation. Publication No. 94-06. Washington State Department of Ecology. November.

Ecology and Environment Inc. and Gregory L. Glass. 2011. Rayonier Mill off-property soil dioxin study. June.

Hoffman, E., and D. Fox. 2010. Polychlorinated dioxins and furans (PCDD/F): revisions to the supplemental quality assurance project plan (SQAPP). U.S. Environmental Protection Agency. November.

USEPA. 2005. USEPA contract laboratory program national functional guidelines for chlorinated dibenzo-p-dioxins (CDDs) and chlorinated dibenzofurans (CDFs) data review. EPA 540-R-05-001. U.S. Environmental Protection Agency, Office of Superfund Remediation and Technology Innovation. September.