Region 10
U.S. Environmental Protection Agency

Phase I Sediment Sampling Quality Assurance Project Plan Upper Columbia River Site CERCLA RI/FS

March 24, 2005

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Prepared by

CH2MHILL

ecology and environment, inc.
International Specialists in the Environment

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Title and Approval Sheet

Plan Title:	Phase I Sediment Sampling Quality Assurance Project Plan Upper Columbia River Site CERCLA RI/FS		
Site Name:	Upper Columbia River Site		
Site Location:	North Central Washington State		
City/State/Zip:	Grand Coulee, WA		
Site USEPA ID# :	106X		
Anticipated Sampling Dates:	April to May, 2005		
Prepared By:	Artemis Antipas, Dan Winstanley, Marilyn Gauthier	Date:	March 2005
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QAPP Approval Date:	March 24, 2005		

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[1] Information in parenthesis indicates the applicable QAPP element or group prescribed by Chapter 3 of USEPA (2001) to be addressed in a QAPP.

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Acronyms and Abbreviations

AES	Architect and Engineering Services
amsl	above mean sea level
ASTM	American Society for Testing and Materials
AVS/SEM	acid volatile sulfides/simultaneously extracted metals
bgs	below ground surface
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CDD/CDF	chlorinated dibenzo-p-dioxin/chlorinated dibenzofuran
CLP	Contract Laboratory Program [USEPA]
cm	Centimeter
COI	Contaminant of interest
Colville Tribes	Confederated Tribes of the Colville Indian Reservation
CRDL	contract-required detection level [USEPA CLP]
CRQL	contract-required quantitation limit [USEPA CLP]
DQO	data quality objective
ESI	expanded site inspection
FAR	Federal Acquisition Regulations
FSP	Field Sampling Plan
FTL	field team leader
GC	gas chromatography
GIS	geographic information system
HSP	Health and Safety Plan
ICP/AESICP/MS	inductively coupled plasma/atomic emission spectrophotometry inductively coupled plasma/mass spectroscopy
Lake Roosevelt	Franklin D. Roosevelt Lake
LCS	laboratory control sample
MDL	method detection level
MEL	Manchester Environmental Laboratory
µg/kg	Micrograms per kilogram
µg/L	Micrograms per liter
MS/MSD	matrix spike/matrix spike duplicate
NA	not applicable
ng/kg	nanograms per kilogram
PCB	polychlorinated biphenyl
pg/L	picograms per liter
PM	project manager
ppm	parts per million
PSEP	Puget Sound Estuary Program
QA	quality assurance
QAM	quality assurance manager
QAO	quality assurance officer
QAPP	Quality Assurance Project Plan

QC	quality control
RI/FS	remedial investigation/feasibility study
RL	reporting limit
RSCC	Regional Sample Control Center
RTL	review team leader
SC-HW	safety coordinator—hazardous waste
SIMS	Site Information Management System
SOW	statement of work
STL	sampling team leader
SVOC	semivolatile organic compound
TAL	Target Analyte List [USEPA]
TCL	Target Compound List [USEPA]
TCLP	toxicity characteristic leaching procedure
TOC	total organic carbon
TOPO	Task Order Project Officer
TSU	Technical Support Unit
UCR	Upper Columbia River
USEPA	U.S. Environmental Protection Agency

SECTION 1

Introduction

SECTION 1

Introduction

This Quality Assurance Project Plan (QAPP) presents the policies, organizations, objectives, and functional activities/procedures for the Phase I sediment sampling program being conducted by the U.S. Environmental Protection Agency (USEPA) at the Upper Columbia River (UCR) site in north-central Washington. The QAPP and supporting appendices (Appendix A, Data Quality Objectives, and Appendix B, Field Sampling Plan) have been developed to document the type and quality of data needed for environmental decisions and to describe the methods for collecting and assessing those data during the Phase I sediment sampling program.

This QAPP follows USEPA guidelines contained in *EPA Guidance for Quality Assurance Project Plans* (USEPA 1998, 2002a), and *EPA Requirements for Quality Assurance Project Plans* (USEPA 2001). The development, review, approval, and implementation of the QAPP is part of USEPA's mandatory Quality System, which requires all organizations to develop and operate management structures and processes to ensure that data used in agency decisions are of the type and quality needed for their intended use. The following sections of this document correlate with the subtitles found in the USEPA guidelines (USEPA 2001).

SECTION 2

Project Management (USEPA Group A)

SECTION 2

Project Management (USEPA Group A)

2.1 Project/Task Organization (A4)

The task order for this project was issued pursuant to USEPA Architect and Engineering Services (AES) Contract No. 68-S7-04-01. The task order is managed by CH2M HILL's project manager (PM), who works directly with the USEPA Task Order Project Officer (TOPO) to accomplish the task order. The PM manages the financial, schedule, and technical aspects of the task order. The key people involved in interfacing with the PM are the USEPA TOPO, USEPA Regional Quality Assurance Manager (QAM), review team leader (RTL), and sampling team leader (STL).

The project organization and lines of authority for USEPA and CH2M HILL staff are illustrated in Figure 2-1, and the sediment sampling data flow is shown in Figure 2-2. Figure 2-1 shows both USEPA and CH2M HILL technical personnel and quality assurance personnel. The organizational functions shown are consistent with the overall AES 10 Program Plan (*EPA Management Plans and Standard Operating Procedures For Region 10 Architect Engineering Services*, *Contract Solicitation No. PR-R7-02-10217* [USEPA 2003a]). The AES 10 Program Plan provides additional details for these organizational functions.

The CH2M HILL review team (led by the RTL) and the CH2M HILL quality assurance officer (QAO) will review project planning documents, data evaluation, and deliverables. The primary responsibility for project quality rests with the PM, and independent quality control is provided by the RTL and QAO.

The sampling team will implement the QAPP, Field Sampling Plan (FSP), and Health and Safety Plan (HSP). The safety coordinator—hazardous waste (SC-HW) is responsible for adherence to the HSP and field decontamination procedures. The entire field effort is directed by the STL.

The subcontract administrator is responsible for procuring subcontracts for USEPA's AES projects under Federal Acquisition Regulations (FAR) and provides the interface with subcontractors. Subcontractors may be used on this task order for laboratory analyses depending on USEPA regional laboratory availability.

Where quality assurance problems or deficiencies requiring special action are uncovered, the PM, RTL, and QAO will identify the appropriate corrective action to be initiated by the STL or the laboratory.

USEPA has three TOPOs for the overall UCR project. Kevin Rochlin is the TOPO who will be responsible for sediment sampling. The USEPA Regional Sample Control Coordinator (RSCC) is responsible for both CLP and USEPA Manchester Environmental Laboratory (MEL) coordination. The RSCC works with the USEPA Regional QAM, the region's CLP project officer (PO), and the project's PMs in resolving laboratory and field QA issues and laboratory scheduling. The RSCC provides the regional sample tracking numbers, sample tags, custody seals, and other CLP-required chain-of-custody documentation.

2.2 Problem Definition/Background (A5)

2.2.1 Purpose

This QAPP presents the policies, organizations, objectives, and functional activities/procedures for the Phase I sediment sampling program being conducted by USEPA at the UCR site in north-central Washington. The QAPP was developed to document the type and quality of data needed for environmental decisions and to describe the methods for collecting and assessing those data during the Phase I sediment sampling program.

2.2.2 Problem Statement

In August 1999, the Confederated Tribes of the Colville Indian Reservation (Colville Confederated Tribes) petitioned USEPA to conduct an assessment of hazardous substance contamination at the UCR. The petition expressed concerns about possible risks to people's health and the environment from contamination in the river. In December 2000, USEPA completed a preliminary assessment (USEPA 2000a). Based on a review of available information and existing data, USEPA determined that further data collection was warranted.

In 2001, USEPA conducted an expanded site inspection (ESI) at the UCR and collected sediment samples to assess contaminant concentrations in river sediment and to determine whether further detailed investigation such as a remedial investigation/feasibility study (RI/FS) was warranted (USEPA 2003b). The results of the investigation showed that widespread contamination is present in the lake and river sediment and that an RI/FS was necessary to evaluate possible risks to human health and the environment.

2.2.3 Background

The UCR site is located in north-central Washington and extends from the U.S.-Canadian international border south and west to Grand Coulee Dam, a distance of approximately 147 miles downriver (Figure 2-3). The UCR site includes a free-flowing reach of the Columbia River as well as Franklin D. Roosevelt Lake (Lake Roosevelt), a large reservoir behind Grand Coulee Dam. The transition between the free-flowing river and Lake Roosevelt occurs approximately 15 miles south of the United States-Canadian border and 132 miles upriver from Grand Coulee Dam when the reservoir is full.

Previous investigations by federal and state agencies have identified the presence of contamination within the U.S. portion of the Upper Columbia River and surrounding upland areas from the Grand Coulee Dam to the Canadian border. Other studies have evaluated contaminant source areas and effects north of the Canadian border. Potential sources of contamination include mining and milling operations, smelting operations, pulp and paper production, sewage treatment plants, and other industrial activities. Contaminants found by the studies were documented in the *Draft Phase I Sediment Sampling Approach and Rationale, Upper Columbia River CERCLA RI/FS* (CH2MHILL 2004a) and include heavy metals such as cadmium, copper, lead, mercury, and zinc, as well as organic contaminants such as polychlorinated dibenzo-p-dioxins (dioxins), polychlorinated dibenzofurans (furans), and polychlorinated biphenyls (PCBs).

2.3 Project/Task Description (A6)

2.3.1 Description of Work to be Performed

Activities to be performed as part of the Phase I sediment sampling are as follows:

- Collect surface sediment samples along length of study area
- Collect surface sediment samples at select beaches located along the length of the study area
- Collect sediment cores at intervals along the length of the study area and in focus areas
- Sample analyses
- Data evaluation, including risk assessment
- Report preparation

2.3.2 Schedule of Activities

Field mobilization for the work described in this QAPP and FSP is expected to begin in early March 2005. The sampling and subsequent analytical work is expected to be initiated in early April and conclude by the end of May 2005.

2.4 Quality Objectives and Criteria (A7)

2.4.1 Project Quality Objectives

Project-specific data quality objectives (DQOs) were identified through the DQO process/planning tool (USEPA 1994a, 2000b) to meet the data user's needs for each activity. The specific data needs for the Phase I sampling program focus on conditions in sediment. Appendix A presents the DQO decision-making process findings for the Phase I sediment program. The overall objective of the RI/FS for the UCR site is to identify site contamination, assess potential risk to human or ecological receptors, and develop remedial approaches to mitigate unacceptable risk.

The data needs for the Phase I sediment sampling program are summarized in Table 2-1. This table lists the specific analytes, data uses, data users, and needed detection levels. The listed detection level is the lowest regulatory, risk, or technical criterion identified for the specific analyte. The different criteria that were evaluated are described in Appendix A. The required levels shown in Table 2-1 were taken into consideration during selection of appropriate analytical methodologies. The selected analytical methodologies and associated laboratory analytical detection limits are shown in Tables 2-2a to 2-2e as described in Section 2.4.2.

The project-required limits (Table 2-1) and the analytical detection limits (Tables 2-2a to 2-2e) are compared in Appendix A (Table A-3). These comparisons have been carried out for normal USEPA Contract Laboratory Program (CLP) methods and not the lower detection methods available through the CLP because the lower limits are laboratory specific and cannot be identified until the specific laboratory(s) are identified. This is explained further in Table 2-2a, note (a), and in Tables 2-2b and 2-2d. For some of the analytes, which are in bold font in Table 2-1, the normal analytical reporting limit is higher than the project-required limits. With the lower laboratory-specific CLP methods for SVOCs and metals, the project-required limits are expected to be achievable for most of the marked analytes. The selected methods (Table 2-2a) are state-of-the-art and what is practicable for this study. The CLP laboratory-specific method detection levels (MDLs) are expected to be significantly below the standard CLP detection levels listed in Tables 2-2a to 2-2e. Where reported detection limits received from the CLP laboratory(s) are higher than the project-required limits, the project team may use the lower MDLs as needed for project decisions. (Note: See Table 2-1 note (a) explaining the basis for the comparisons.)

2.4.2 Measurement Performance Criteria

The quality assurance (QA) objective of this plan is to identify procedures and criteria that will provide data of known and appropriate quality for the needs identified in Section 2.4.1. Data quality is assessed by representativeness, comparability, accuracy, precision, and completeness. These parameters, the applicable procedures, and level of effort are described below.

The applicable quality control (QC) procedures, quantitative target limits, and level of effort for assessing data quality are dictated by the intended use of the data as well as the nature of the analytical methods. Analytical parameters, analytical methods, applicable detection levels, analytical precision, accuracy, and completeness in alignment with needs identified in Section 2.4.1 are presented in Tables 2-2a to 2-2e. Analytical methods and quality control procedures are further detailed in Section 3.

Target detection limits listed in Tables 2-2a to 2-2e are method reporting limits, equivalent to USEPA CLP contract-required detection levels (CRDLs). "Target" implies that final sample detection levels may be higher because of sample matrix effects. Detection levels for the individual samples will be reported in the final data. As described in Section 2.4.1, some of the reporting levels may be higher than regulatory limits because no practicable methodology for lower detection is available. Laboratory-specific MDLs are significantly below reporting levels. Where reporting limits are higher than regulatory limits, the project team will use MDLs as needed for project decisions.

Following are definitions and levels of effort for the data assessment parameters:

Representativeness is a measure of how closely the results reflect the actual concentration or distribution of the chemical compounds in the matrix samples. Sampling plan design, sampling techniques, and sample-handing protocols (for example, for storage, preservation, and transportation) have been developed, and are discussed in subsequent sections of this document. The proposed documentation will establish that protocols have been followed and sample identification and integrity ensured.

Comparability expresses the confidence with which one data set can be compared to another. Data comparability will be maintained using defined procedures and the use of consistent methods and consistent units. Actual detection limits will depend on the sample matrix and will be reported as defined for the specific samples.

Accuracy is an assessment of the closeness of the measured value to the true value. For samples, accuracy of chemical test results is assessed by spiking samples with known standards and establishing the average recovery. For a matrix spike, known amounts of a standard compound identical to the compounds being measured are added to the sample. A quantitative definition of average recovery accuracy is given in Section 5.3. Accuracy measurement will be carried out with a minimum frequency of 1 in 20 samples analyzed.

Precision of the data is a measure of the data spread, when more than one measurement has been taken on the same sample. Precision can be expressed as the relative percent difference; a quantitative definition is given in Section 5.3. The level of effort for precision measurements will be a minimum of 1 in 20 samples.

Completeness is a measure of the amount of valid data obtained from the analytical measurement system and the complete implementation of defined field procedures. The quantitative definition of completeness is given in Section 5.3. The target completeness objective will be 90 percent; the actual completeness may vary depending on the intrinsic nature of the samples. The completeness of the data will be assessed during QC reviews.

2.5 Special Training/Certification (A8)

All project staff working on the site will be health and safety trained, and will follow requirements specified in the project's HSP. The HSP describes the specialized training required for personnel on this project, and the documentation and tracking of this training and is included in the FSP (Appendix B).

2.6 Documents and Records (A9)

Field documentation and records will be as described in Section 6.5 of the FSP. Laboratory documentation will be provided in accordance with methods and QA protocols listed in Sections 3.4 and 3.5 of this QAPP and with USEPA Regional Laboratory-specific standard operating procedures. Overall project documentation will be prepared in accordance with USEPA's Region 10 AES Program Plan (USEPA 2003a).

TABLE 2-1
Data Needs and Uses
Upper Columbia River RI/FS

Chemical Group	Analyte[a]	Units	Minimum Potential Regulatory Level[b]	Data Use	Data User
Sediment					
PCBs	**Aroclor-1016**	ug/kg	1.54	Nature and Extent, Fate and Transport, Risk Assessment, Preliminary Remedial Consideration	Regulators, Hydrologists, Risk Assessors, Remedial Technologists
	Aroclor-1221	ug/kg	Not listed		
	Aroclor-1232	ug/kg	Not listed		
	Aroclor-1242	ug/kg	0.533		
	Aroclor-1248	ug/kg	0.533		
	Aroclor-1254	ug/kg	0.533		
	Aroclor-1260	ug/kg	0.533		
Pesticides	4,4'-DDD	ug/kg	96	Nature and Extent, Fate and Transport, Risk Assessment, Preliminary Remedial Consideration	Regulators, Hydrologists, Risk Assessors, Remedial Technologists
	4,4'-DDE	ug/kg	20		
	4,4'-DDT	ug/kg	19		
	2,4'-DDD	ug/kg	1.22		
	2,4'-DDE	ug/kg	2.07		
	2,4'-DDT	ug/kg	1.19		
	Oxychlordane	ug/kg	Not listed		
	trans-nonachlor	ug/kg	Not listed		
	cis-nonachlor	ug/kg	Not listed		
	Aldrin	ug/kg	0.0408		
	alpha-BHC	ug/kg	0.32		
	alpha-Chlordane	ug/kg	2.26		
	beta-BHC	ug/kg	0.32		
	delta-BHC	ug/kg	0.32		
	Dieldrin	ug/kg	0.0439		
	Endosulfan I	ug/kg	290		
	Endosulfan II	ug/kg	1400		
	Endosulfan sulfate	ug/kg	Not listed		
	Endrin	ug/kg	2.22		
	Endrin aldehyde	ug/kg	Not listed		
	Endrin ketone	ug/kg	Not listed		
	gamma-BHC (Lindane)	ug/kg	0.94		
	gamma-Chlordane	ug/kg	2.26		
	Heptachlor	ug/kg	0.408		
	Heptachlor epoxide	ug/kg	0.6		
	Methoxychlor	ug/kg	1900		
	Toxaphene	ug/kg	5.08		
Metals	Aluminum	mg/kg	2600	Nature and Extent, Fate and Transport, Risk Assessment, Preliminary Remedial Consideration	Regulators, Hydrologists, Risk Assessors, Remedial Technologists
	Antimony	mg/kg	0.16		
	Arsenic	mg/kg	0.12		
	Barium	mg/kg	0.7		
	Beryllium	mg/kg	0.46		
	Cadmium	mg/kg	0.1		
	Calcium	mg/kg	Not listed		
	Chromium	mg/kg	7		
	Cobalt	mg/kg	10		
	Copper	mg/kg	10		
	Iron	mg/kg	9900		
	Lead	mg/kg	0.04		
	Magnesium	mg/kg	Not listed		
	Manganese	mg/kg	400		
	Mercury	mg/kg	0.13		
	Nickel	mg/kg	9.9		
	Potassium	mg/kg	Not listed		
	Selenium	mg/kg	0.29		
	Silver	mg/kg	0.5		
	Sodium	mg/kg	Not listed		
	Thallium	mg/kg	Not listed		
	Uranium	mg/kg	8		
	Vanadium	mg/kg	50		
	Zinc	mg/kg	7		

TABLE 2-1
Data Needs and Uses
Upper Columbia River RI/FS

Chemical Group	Analyte[a]	Units	Minimum Potential Regulatory Level[b]	Data Use	Data User
Dioxins/Furans	1,2,3,4,6,7,8-Heptachlorodibenzofuran	ug/kg	3.76	Nature and Extent, Fate and Transport, Risk Assessment, Preliminary Remedial Consideration	Regulators, Hydrologists, Risk Assessors, Remedial Technologists
	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	ug/kg	Not listed		
	1,2,3,4,7,8,9-Heptachlorodibenzofuran	ug/kg	3.76		
	1,2,3,4,7,8-Hexachlorodibenzofuran	ug/kg	0.0144		
	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	ug/kg	Not listed		
	1,2,3,6,7,8-Hexachlorodibenzofuran	ug/kg	0.0144		
	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	ug/kg	Not listed		
	1,2,3,7,8,9-Hexachlorodibenzofuran	ug/kg	0.0144		
	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	ug/kg	Not listed		
	1,2,3,7,8-Pentachlorodibenzofuran	ug/kg	0.00815		
	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	ug/kg	0.00288		
	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	ug/kg	Not listed		
	2,3,4,6,7,8-Hexachlorodibenzofuran	ug/kg	0.0144		
	2,3,4,7,8-Pentachlorodibenzofuran	ug/kg	0.000972		
	2,3,7,8-Tetrachlorodibenzofuran	ug/kg	0.00408		
	2,3,7,8-Tetrachlorodibenzo-p-dioxin	ug/kg	0.000047		
	Octachlorodibenzodioxin	ug/kg	Not listed		
	Octachlorodibenzofuran	ug/kg	Not listed		
SVOCs	1,1'-Biphenyl	ug/kg	110000	Nature and Extent, Fate and Transport, Risk Assessment, Preliminary Remedial Consideration	Regulators, Hydrologists, Risk Assessors, Remedial Technologists
	1,2,4-Trichlorobenzene	ug/kg	400000		
	1,2-DCB	ug/kg	3600000		
	1,3-DCB	ug/kg	1200000		
	1,4-DCB	ug/kg	7290		
	2,2'-oxybis(1-Chloropropane)	ug/kg	2500		
	2,4,5-Trichlorophenol	ug/kg	4000000		
	2,4,6-Trichlorophenol	ug/kg	15900		
	2,4-Dichlorophenol	ug/kg	120000		
	2,4-Dimethylphenol	ug/kg	800000		
	2,4-Dinitrophenol	ug/kg	80000		
	2,4-DNT	ug/kg	80000		
	2,6-DNT	ug/kg	40000		
	2-Chloronapthalene	ug/kg	3200000		
	2-Chlorophenol	ug/kg	200000		
	2-Methylnaphthalene	ug/kg	Not listed		
	2-Methylphenol	ug/kg	2000000		
	2-Nitroaniline	ug/kg	2400		
	2-Nitrophenol	ug/kg	Not listed		
	3,3'-Dichlorobenzidine	ug/kg	389		
	3-Nitroaniline	ug/kg	Not listed		
	4,6-Dinitro-2-methylphenol	ug/kg	Not listed		
	4-Bromophenyl-phenylether	ug/kg	130000		
	4-Chloro-3-methylphenol	ug/kg	Not listed		
	4-Chloroaniline	ug/kg	160000		
	4-Chlorophenyl-phenylether	ug/kg	Not listed		
	4-Methylphenol	ug/kg	760		
	4-Nitroaniline	ug/kg	Not listed		
	4-Nitrophenol	ug/kg	2480000		
	Acenaphthene	ug/kg	6.71		
	Acenaphthylene	ug/kg	5.87		
	Acetaphenone	ug/kg	4000000		
	Anthracene	ug/kg	10		
	Atrazine	ug/kg	788		
	Benzaldehyde	ug/kg	4000000		
	Benzo (a) anthracene	ug/kg	15.72		
	Benzo (a) pyrene	ug/kg	21.6		
	Benzo (b) fluoranthene	ug/kg	21.6		
	Benzo (g,h,i) perylene	ug/kg	300		
	Benzo (k) fluoranthene	ug/kg	21.6		
	Benzoic acid	ug/kg	2910		
	Benzyl alcohol	ug/kg	12000000		

TABLE 2-1
Data Needs and Uses
Upper Columbia River RI/FS

Chemical Group	Analyte[a]	Units	Minimum Potential Regulatory Level[b]	Data Use	Data User
	Bis (2-chloroethoxy) methane	ug/kg	Not listed		
	Bis (2-chloroethyl) ether	ug/kg	159		
	Bis (2-chloroisopropyl) ether	ug/kg	2500		
	Bis (2-ethylhexyl) phthalate	ug/kg	182		
	Butyl benzylphthalate	ug/kg	260		
	Caprolactam	ug/kg	20000000		
	Carbazole	ug/kg	923		
	Chrysene	ug/kg	13.8		
	Dibenzo (a,h) anthracene	ug/kg	6.22		
	Dibenzofuran	ug/kg	540		
	Diethyl phthalate	ug/kg	32000000		
	Dimethyl phthalate	ug/kg	400000000		
	Di-n-butylphthalate	ug/kg	103		
	Di-n-octylphthalate	ug/kg	6200		
	Fluoranthene	ug/kg	31.46		
	Fluorene	ug/kg	10		
	Hexachlorobenzene	ug/kg	22		
	Hexachlorobutadiene	ug/kg	11		
	Hexachlorocyclopentadiene	ug/kg	280000		
	Hexachloroethane	ug/kg	12500		
	Indeno (1,2,3-c,d) pyrene	ug/kg	17.32		
	Isophorone	ug/kg	184000		
	Naphthalene	ug/kg	14.65		
	Nitrobenzene	ug/kg	20000		
	n-Nitrosodi-n-propylamine	ug/kg	Not listed		
	n-Nitrosodiphenylamine	ug/kg	35700		
	Pentachlorophenol	ug/kg	360		
	Phenanthrene	ug/kg	18.73		
	Phenol	ug/kg	420		
	Pyrene	ug/kg	44.27		
Physical and Geochemical Analyses	AVS/SEM TOC Particle Size	NA	NA	Nature and Extent, Fate and Transport, Risk Assessment, Preliminary Remedial Consideration	Regulators, Hydrologists, Risk Assessors, Remedial Technologists
Bioassay Analyses	10-day Sediment Toxicity Test with *Chironomus tentans* 7-Day Sediment Toxicity Test with *Ceriodaphnia dubia* 28-day Sediment Toxicity Test with *Hyalella azteca*	NA	NA	Risk Assessment	Risk Assessors
Pore Water Isolated from Sediment					
Metals	**Aluminum**	ug/L	87	Risk Assessment	Risk Assessors
	Antimony	ug/L	30		
	Arsenic	ug/L	150		
	Barium	ug/L	Not listed		
	Beryllium	ug/L	5.3		
	Cadmium	ug/L	2.2		
	Calcium	ug/L	Not listed		
	Chromium	ug/L	210		
	Cobalt	ug/L	Not listed		
	Copper	ug/L	12		
	Iron	ug/L	1000		
	Lead	ug/L	3.2		
	Magnesium	ug/L	Not listed		
	Manganese	ug/L	Not listed		
	Mercury	ug/L	0.77		
	Nickel	ug/L	160		
	Potassium	ug/L	Not listed		
	Selenium	ug/L	5		

TABLE 2-1
Data Needs and Uses
Upper Columbia River RI/FS

Chemical Group	Analyte[a]	Units	Minimum Potential Regulatory Level[b]	Data Use	Data User
	Silver	ug/L	0.12		
	Sodium	ug/L	Not listed		
	Thallium	ug/L	40		
	Uranium	ug/L	Not listed		
	Vanadium	ug/L	Not listed		
	Zinc	ug/L	120		
Investigation-Derived Waste					
TCLP SVOCs			TCLP[d]	Waste Disposal Evaluation	Project Manager, Waste Disposal Facility Staff
TCLP Pesticides/PCBs			TCLP[d]		
TCLP Metals			TCLP[d]		
TCL SVOCs[c]			Same as sediment		
TCL Pesticides/PCBs[c]			Same as sediment		
TAL Metals (plus Uranium)[c]			Same as sediment		
Dioxins/Furans (tetra through octa)[c]			Same as sediment		

[a] Bold font indicates CLP detection limit for analyte is above lowest potential regulatory limit.
The lowest criterion for these analytes is lower than the CLP detection levels shown for normal procedures in Tables 2-2a to 2-2e.
The current comparison for SVOCs was based on regular CLP methods because the levels attainable by the lower CLP method (selective ion monitoring methodology) are laboratory-specific. This also applies to some of the metals (inductively coupled plasma mass spectroscopy for soil). Thus, for most of the SVOCs and metals, these levels are expected to be achievable. Also see footnote (c) in Table 2-2a.

[b] Different criteria that were evaluated are shown in Appendix A, Table A-4.

[c] TCL and TAL analytes and dioxins/furans are the same as for Sediment analytes, above.

[d] These will be reported for the regulatory list of TCLP analytes.

TAL = Target Analyte List
TCL = Target Compound List
TCLP = Toxic Characteristic Leaching Procedure
TOC = total organic carbon
ug/kg = micrograms per kilogram
mg/kg = milligrams per kilogram
ug/L = micrograms per liter

TABLE 2-2a
Measurement Performance Criteria
Upper Columbia River RI/FS

Parameter	Method [b]	Target Detection Limit	Analytical Accuracy (% Recovery)	Analytical Precision (Relative % Deviation)	Overall Completeness (%)
Site Sediment					
TCL SVOCs[a]	CLP	CLP[c]	CLP	CLP	90
TCL Pesticides/PCBs[a]	CLP	CLP[c]	CLP	CLP	90
TAL Metals (Plus U)[a]	CLP	CLP[c]	CLP	CLP	90
Dioxins/Furans (tetra through octa)[a]	CLP	CLP[c]	CLP	CLP	90
TOC	PSEP	0.05 %	65-135	35	90
AVS/SEM	PSEP		65-135	35	90
Volatiles		0.5 ppm[d]			
Antimony		0.5 ppm[d]			
Cadmium		0.05 ppm[d]			
Chromium		0.1 ppm[d]			
Copper		0.1 ppm[d]			
Lead		1 ppm[d]			
Mercury		0.01 ppm[d]			
Nickel		0.2 ppm[d]			
Zinc		0.1 ppm[d]			
Ammonia and Sulfide	See Note [e]	See Note [e]	See Note [e]	See Note [e]	
Particle size	ASTM D422	NA	NA	NA	90
Bioassay analyses:					
10-day Sediment Toxicity Test with *Chironomus tentans*	ASTM Method E 1706-00 (ASTM 2003) and USEPA Method 100.2 (USEPA 2000)	NA	NA	NA	90
7-Day Sediment Toxicity Test with *Ceriodaphnia dubia*	ASTM Method E 1706-00 (ASTM 2003)	NA	NA	NA	90
28-day Sediment Toxicity Test with *Hyalella azteca*	ASTM Method E 1706-00 (ASTM 2003) and USEPA Method 100.4 (USEPA 2000)	NA	NA	NA	90

Parameter	Method[b]	Reporting Limit/Target Detection Limit	Analytical Accuracy (% Recovery)	Analytical Precision (Relative % Deviation)	Overall Completeness (%)
Investigation-Derived Waste					
TCL SVOCs			As listed for site sediment		
TCL Pesticides/PCBs			As listed for site sediment		
Dioxins/Furans (tetra through octa)			As listed for site sediment		
TAL Metals (plus Uranium)			As listed for site sediment		
TCLP[a] SVOCs	CLP	CLP	CLP	CLP	90
TCLP[a] Pesticides	CLP	CLP	CLP	CLP	90
TCLP[a] Metals	CLP	CLP	CLP	CLP	90
Pore Water Isolated from Sediment					
TAL Metals (Plus U)[a]	CLP	CLP[c]	CLP	CLP	CLP

[a] TCL and TAL analytes and dioxin/furans are listed in Table 2-1. TCLP analytes are per regulatory TCLP list (EPA 1311).

[b] CLP method per USEPA Contract Laboratory Statements of Work: *Multi-Media, Multi-Concentration, Organic Analytical Service for Superfund (OLM04.3;) Multi-Media, Multi-Concentration, Inorganic Analytical Service for Superfund (ILM05.3); Multi-Media, Multi-Concentration Dioxins and Furans Analysis* (DLM01.4).

PSEP method per PSEP, 1986, *Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound*. Other standard methods used by PSEP are as follows:

> USEPA. 1979. *Methods for Chemical Analysis of Water and Wastes*. EPA-600/4-79-020. Revised March 1983.
>
> USEPA. 1989. *Test Methods for Evaluating Solid Waste*. SW846, Standard Methods for the Examination of Water and Wastewater. 17th Edition (1989).

ASTM methods as listed.

[c] CLP detection limits are shown in Tables 2-2b through 2-2e. For organics analyses when the CRQL is below the needed regulatory level shown in Table 2-1, the normal statement of work and CRQL will suffice. For the organic compounds marked with an asterisk in Table 2-1 where the needed detection level is lower than the CRQL, CLP special services for SIM will be requested to attain the needed limit. Because SIM detection limits are laboratory specific, they are not shown here. For inorganic compounds where lower detection is needed as marked in Table 2-1, ICP/MS methods in Table 2-2d will be used. For inorganic detection limits for sediment, ICP/MS will again be laboratory specific; however, the drop is expected to be proportional to what is shown in Table 2-2d for water. For TCL pesticides/PCBs, the project team will use MDLs where the reported level is not below the needed level.

[d] This value also needs to be calculated/reported by the laboratory in μmoles per gram for the ecological risk assessment.

[e] Ammonia is measured in conjunction with the bioassay analyses, and sulfide is part of the AVS/SEM analysis.

TABLE 2-2a
Measurement Performance Criteria
Upper Columbia River RI/FS

Parameter	Method[b]	Reporting Limit/Target Detection Limit	Analytical Accuracy (% Recovery)	Analytical Precision (Relative % Deviation)	Overall Completeness (%)

ASTM = American Society for Testing and Materials
AVS/SEM = acid volatile sulfides/simultaneously extracted metals
CRQL = contract-required quantitation limit
ICP/MS = inductively coupled plasma/mass spectroscopy
NA = not applicable
ppm = parts per million
PSEP = Puget Sound Estuary Program
SIM = selective ion monitoring
TCLP = toxicity characteristic leaching procedure

TABLE 2-2b
SVOC Target Compound List and Corresponding CLP Analytical Limits
Upper Columbia River RI/FS

Compound	Contract-Required Quantitation Limits*			
	OLC03.2	OLM04.2	OLM04.2	OLM04.2
	Water	Water	Low Soil	Medium Soil
	(ug/L)	(ug/L)	(ug/kg)	(ug/kg)
Benzaldehyde	5	10	330	10,000
Phenol	5	10	330	10,000
Bis(2-Chloroethyl) ether	5	10	330	10,000
2-Chlorophenol	5	10	330	10,000
2-Methylphenol	5	10	330	10,000
2,2'-oxybis(1-Chloropropane)	5	10	330	10,000
Acetaphenone	5	10	330	10,000
4-Methylphenol	5	10	330	10,000
N-Nitroso-di-n-propylamine	5	10	330	10,000
Hexachloroethane	5	10	330	10,000
Nitrobenzene	5	10	330	10,000
Isophorone	5	10	330	10,000
2-Nitrophenol	5	10	330	10,000
2,4-Dimethylphenol	5	10	330	10,000
Bis(2-Chloroethoxy) methane	5	10	330	10,000
2,4-Dichlorophenol	5	10	330	10,000
Naphthalene	5	10	330	10,000
4-Chloroaniline	5	10	330	10,000
Hexachlorobutadiene	5	10	330	10,000
Caprolactam	5	10	330	10,000
4-Chloro-3-methylphenol	5	10	330	10,000
2-Methylnaphthalene	5	10	330	10,000
Hexachlorocyclopentadiene	5	10	330	10,000
2,4,6-Trichlorophenol	5	10	330	10,000
2,4,5-Trichlorophenol	20	25	830	25,000
1,1'-Biphenyl	5	10	330	10,000
2-Chloronapthalene	5	10	330	10,000
2-Nitroaniline	20	25	830	25,000
Dimethylphthalate	5	10	330	10,000
Acenaphthylene	5	10	330	10,000
2,6-Dinitrotoluene	5	10	330	10,000
3-Nitroaniline	20	25	830	25,000
Acenaphthene	5	10	330	10,000
2,4-Dinitrophenol	20	25	830	25,000
4-Nitrophenol	20	25	830	25,000
Dibenzofuran	5	10	330	10,000
2,4-Dinitrotoluene	5	10	330	10,000
Diethylphthalate	5	10	330	10,000
4-Chlorophenyl-phenylether	5	10	330	10,000
Fluorene	5	10	330	10,000
4-Nitroaniline	20	25	830	25,000

TABLE 2-2b
SVOC Target Compound List and Corresponding CLP Analytical Limits
Upper Columbia River RI/FS

	Contract-Required Quantitation Limits*			
	OLC03.2	**OLM04.2**	**OLM04.2**	**OLM04.2**
	Water	**Water**	**Low Soil**	**Medium Soil**
Compound	**(ug/L)**	**(ug/L)**	**(ug/kg)**	**(ug/kg)**
4,6-Dinitro-2-methylphenol	20	25	830	25,000
N-Nitrosodiphenylamine	5	10	330	10,000
4-Bromophenyl-phenylether	5	10	330	10,000
Hexachlorobenzene	5	10	330	10,000
Atrazine	5	10	330	10,000
Pentachlorophenol	5	25	830	25,000
Phenanthrene	5	10	330	10,000
Anthracene	5	10	330	10,000
Carbazole	NA	10	330	10,000
Di-n-butylphthalate	5	10	330	10,000
Fluoranthene	5	10	330	10,000
Pyrene	5	10	330	10,000
Butylbenzylphthalate	5	10	330	10,000
3,3'-Dichlorobenzidine	5	10	330	10,000
Benzo(a)anthracene	5	10	330	10,000
Chrysene	5	10	330	10,000
Bis-(2-Ethylhexyl)phthalate	5	10	330	10,000
Di-n-octylphthalate	5	10	330	10,000
Benzo(b)fluoranthene	5	10	330	10,000
Benzo(k)fluoranthene	5	10	330	10,000
Benzo(a)pyrene	5	10	330	10,000
Indeno(1,2,3-cd)pyrene	5	10	330	10,000
Dibenzo(a,h)anthracene	5	10	330	10,000
Benzo(g,h,i)perylene	5	10	330	10,000
1,2,4,5-Tetrachlorobenzene	5	NA	NA	NA

* The analytical detection limits and the terminology used in this table are per CLP statements of work (SOWs) to the laboratories. For SOW OLM 4.2 (or the latest version, OLM 4.3), these limits are the normal methods; the lower SIM methods are not presented here because they are laboratory specific. SOW OLM 4.2 (or OLM 4.3) will be used for both sediments and water. For sediments where the analyte is bolded in Table 2-1, SIM procedures will be used to achieve the lowest criterion. For water, normal SOW OLM 4.2 (or OLM 4.3) procedures will be implemented.

TABLE 2-2c
Pesticides/Aroclors Target Compound List and Corresponding CLP Analytical Limits
Upper Columbia River RI/FS

	Contract-Required Quantitation Limits		
	OLC03.2	**OLM04.2**	**OLM04.2**
	Water	**Water**	**Soil**
Compound	**(ug/L)**	**(ug/L)**	**(ug/kg)**
Alpha-BHC	0.01	0.05	1.7
Beta-BHC	0.01	0.05	1.7
Delta-BHC	0.01	0.05	1.7
Gamma-BHC (Lindane)	0.01	0.05	1.7
Heptachlor	0.01	0.05	1.7
Aldrin	0.01	0.05	1.7
Heptachlor epoxide	0.01	0.05	1.7
Endosulfan I	0.01	0.05	1.7
Dieldrin	0.02	0.1	3.3
4,4'-DDE	0.02	0.1	3.3
Endrin	0.02	0.1	3.3
Endosulfan II	0.02	0.1	3.3
4,4'-DDD	0.02	0.1	3.3
Endosulfan sulfate	0.02	0.1	3.3
4,4'-DDT	0.02	0.1	3.3
Methoxychlor	0.1	0.5	17
Endrin ketone	0.02	0.1	3.3
Endrin aldehyde	0.02	0.1	3.3
Alpha-Chlordane	0.01	0.05	1.7
Gamma-Chlordane	0.01	0.05	1.7
Toxaphene	1	5	170
2,4'-DDD	N/A	N/A	N/A
2,4-DDE	N/A	N/A	N/A
2,4'-DDT	N/A	N/A	N/A
Oxychlordane	N/A	N/A	N/A
Trans-nonachlor	N/A	N/A	N/A
Cis-nonachlor	N/A	N/A	N/A
Aroclor-1016	0.2	1	33
Aroclor-1221	0.4	2	67
Aroclor-1232	0.2	1	33
Aroclor-1242	0.2	1	33
Aroclor-1248	0.2	1	33
Aroclor-1254	0.2	1	33
Aroclor-1260	0.2	1	33

N/A = not applicable; analyte is not a CLP analyte.

TABLE 2-2d
Metals Target Analyte List and Corresponding CLP Analytical Limits
Upper Columbia River RI/FS

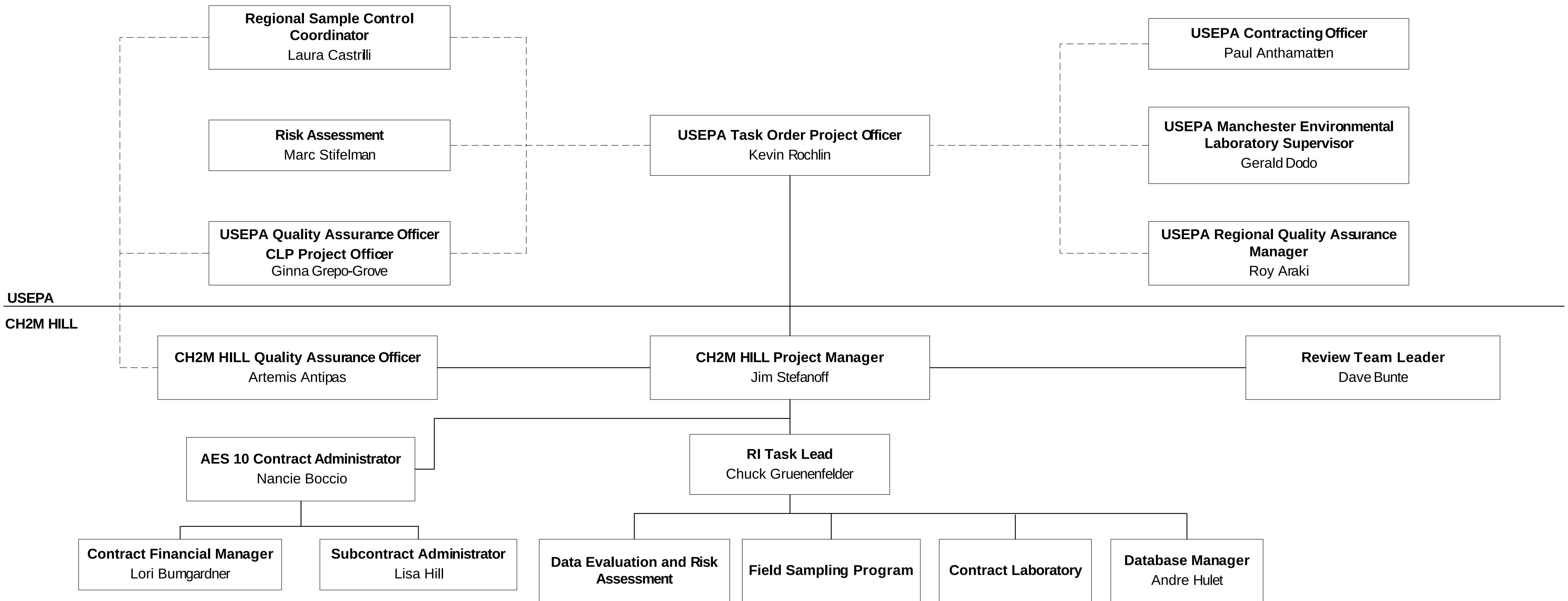
Analyte	Contract-Required Quantitation Limits*		
	ICP/AES	**ICP/AES**	**ICP/MS**
	Water (ug/L)	**Soil (mg/kg)**	**Water (ug/L)**
Aluminum	200	20	- -
Antimony	60	6	2
Arsenic	10	1	1
Barium	200	20	10
Beryllium	5	0.5	1
Cadmium	5	0.5	1
Calcium	5000	500	- -
Chromium	10	1	2
Cobalt	50	5	1
Copper	25	2.5	2
Iron	100	10	- -
Lead	10	1	1
Magnesium	5000	500	- -
Manganese	15	1.5	1
Mercury	0.2	0.1	- -
Nickel	40	4	1
Potassium	5000	500	- -
Selenium	35	3.5	5
Silver	10	1	1
Sodium	5000	500	- -
Thallium	25	2.5	1
Uranium	TBD	TBD	TBD
Vanadium	50	5	1
Zinc	60	6	2

* For sediments where the analyte is bolded in Table 2-1, ICP/MS may be used to achieve the lower criterion.

TABLE 2-2e
Chlorinated Dibenzo-p-dioxins/Chlorinated Dibenzofurans (CDDs/CDFs) and Corresponding CLP Analytical Limits
Upper Columbia River RI/FS

	Contract-Required Quantitation Limits	
	DLM01.4	**DLM01.4**
	Water	**Soil**
Compound	**(pg/L)**	**(ng/kg)**
2,3,7,8-TCDD	10	1
1,2,3,7,8-PeCDD	50	5
1,2,3,6,7,8-HxCDD	50	5
1,2,3,4,7,8-HxCDD	50	5
1,2,3,7,8,9-HxCDD	50	5
1,2,3,4,6,7,8-HpCDD	50	5
OCDD	100	10
2,3,7,8-TCDF	10	1
1,2,3,7,8-PeCDF	50	5
2,3,4,7,8-PeCDF	50	5
1,2,3,6,7,8-HxCDF	50	5
1,2,3,7,8,9-HxCDF	50	5
1,2,3,4,7,8-HxCDF	50	5
2,3,4,6,7,8-HxCDF	50	5
1,2,3,4,6,7,8-HpCDF	50	5
1,2,3,4,7,8,9-HpCDF	50	5
OCDF	100	10

ng/kg = nanograms per kilogram
pg/L = picograms per liter



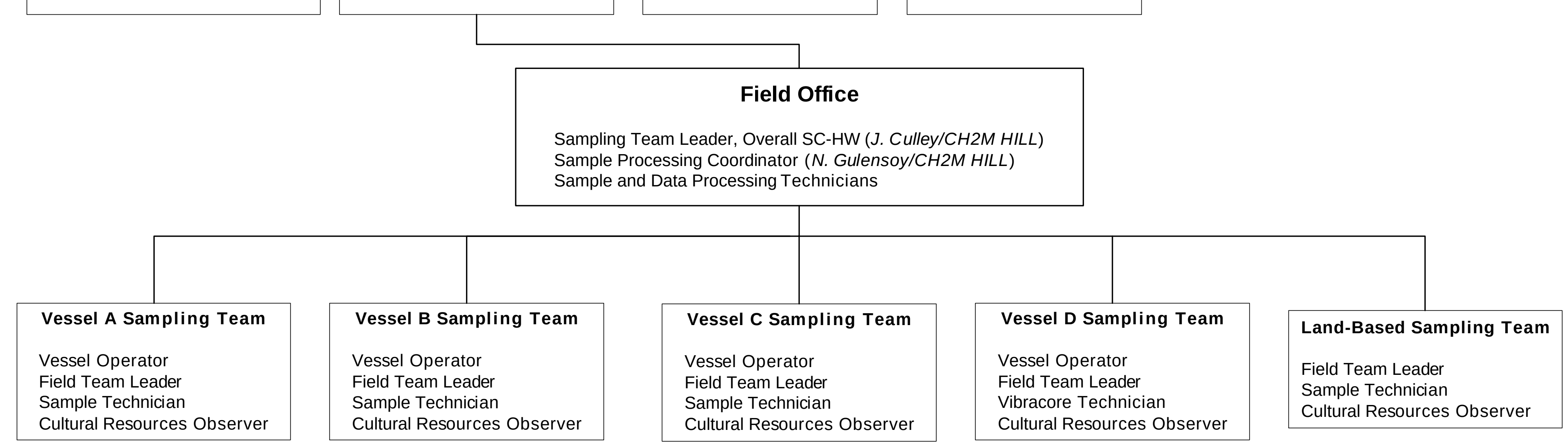


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FIGURE 2-1
Phase 1 Sediment Sampling Project Organization
Upper Columbia River RI/FS

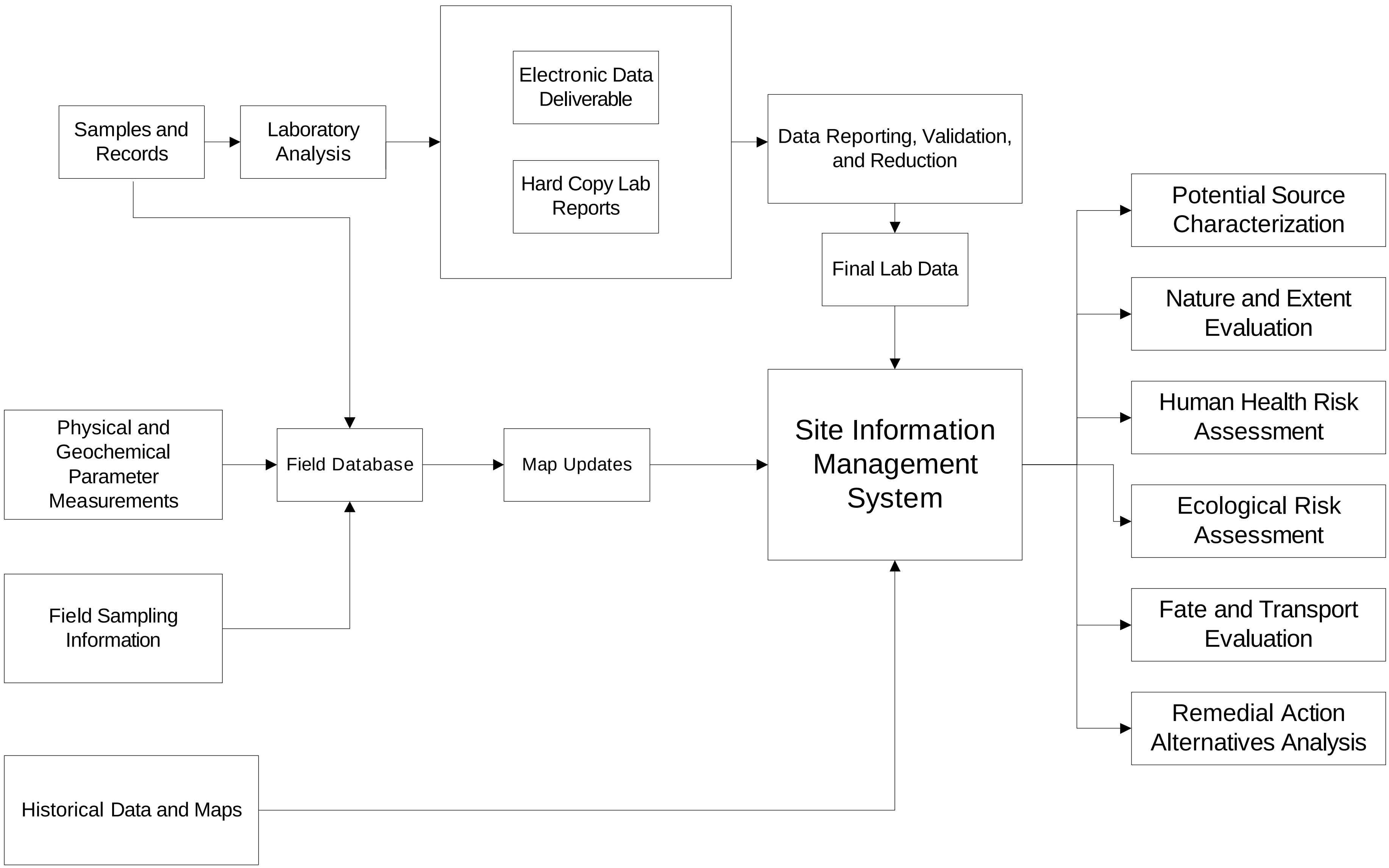

FIGURE 2-2
Sediment Sampling Data Flow
Upper Columbia River RI/FS

FIGURE 2-3
Upper Columbia River and Vicinity
Upper Columbia River RI/FS

SECTION 3

Data Generation and Acquisition (USEPA Group B)

SECTION 3

Data Generation and Acquisition (USEPA Group B)

3.1 Sampling Design (Experimental Design) (B1)

The rationale for the sampling design was described in the *Draft Phase I Sediment Sampling Approach and Rationale – Upper Columbia Rive Site CERCLA RI/FS* (CH2MHILL 2004a) and is detailed in Appendix A.

3.2 Sampling Methods (B2)

The Phase I sediment sampling program includes collection of sediment samples from locations that are below and above water at the time of sampling. Below-water surface sediment samples will be collected using a van Veen sampler. Sediment cores will be obtained using vibracore equipment. Above-water samples will be collected using hand tools. All below-water and most above-water sample locations will be accessed by boat. Certain above-water sample locations may be accessed by land. Sample collection methods are described in detail in Section 6 of the FSP (Appendix B).

3.3 Sample Handling and Custody (B3)

A sample is physical evidence collected from a hazardous waste site, from the immediate environment, or from another source. Because of the potential evidentiary nature of samples, the possession of samples must be traceable from the time the samples are collected until they are introduced as evidence. In addition to field notebooks, there are a number of documents for tracking sample custody.

Field documents including sample custody seals, chain-of-custody records, and packing lists will be obtained from the RSCC in USEPA's Quality Assurance Office. Chain-of-custody procedures will be used to maintain and document sample collection and possession. After sample packaging, one or more of the following chain-of-custody forms will be completed, as necessary, for the appropriate samples:

- Organic traffic report and chain-of-custody record; LITE II forms as applicable
- Inorganic traffic report and chain-of-custody record; LITE II forms as applicable
- USEPA Region 10 Chain-of-Custody Record
- Overnight shipping courier air bill

Copies of the above forms will be filled out and distributed in accordance with the instructions for sample shipping and documentation. Completed field QA/QC summary forms will be sent to the RSCC at USEPA’s Region 10 Quality Assurance Office at the conclusion of the sampling event.

The following subsections summarize each element of sample handling and custody. The sample management and documentation procedures are detailed in Section 6.5 of the FSP.

3.3.1 Chain of Custody

Because samples collected during any investigation could be used as evidence, their possession must be traceable from the time the samples are collected until they are introduced as evidence in legal proceedings. Chain-of-custody procedures are followed to document sample possession as described below.

Definition of Custody

A sample is under custody if one or more of the following criteria are met:

- It is in your possession.
- It is in your view, after being in your possession.
- It was in your possession and then you locked it up to prevent tampering.
- It is in a designated secure area.

Field Custody

In collecting samples for evidence, only enough to provide a good representation of the media being sampled will be collected. To the extent possible, the quantity and types of samples and sample locations are determined before the actual fieldwork. As few people as possible should handle samples.

The field sampler is personally responsible for the care and custody of the samples collected until they are transferred or dispatched properly.

The PM determines whether proper custody procedures were followed during the field work, and decides whether additional samples are required.

Transfer of Custody and Shipment

Samples are accompanied by a chain-of-custody record. When transferring samples, the individuals relinquishing and receiving the samples sign, date, and note the time on the record. This record documents custody transfer from the sampler, often through another person, to the analyst at the laboratory.

Samples are packaged properly for shipment and dispatched to the appropriate laboratory for analysis, with a separate chain-of-custody record accompanying each shipping container (one for each field laboratory, and one for samples driven to the laboratory). Shipping containers will be sealed with custody seals for shipment to the laboratory. Courier names, and other pertinent information, are entered in the "Received by" section of the chain-of-custody record (an example of the chain-of-custody form is provided in the FSP).

Whenever samples are split with a facility owner or agency, it is noted in the remarks section of the chain-of-custody record. The note indicates with whom the samples are being split, and is signed by both the sampler and recipient. If the split is refused, this will be noted and signed by both parties. If a representative is unavailable or refuses to sign, this is noted in the remarks section of the chain-of-custody record. When appropriate, as in the case where the representative is unavailable, the chain-of-custody record should contain a statement that the samples were delivered to the designated location at the designated time.

All shipments are accompanied by the chain-of-custody record identifying its contents. The original record and one copy accompany the shipment to the laboratory, and a second copy is retained by the PM.

Freight bills, postal service receipts, and bills of lading are retained as part of the permanent documentation.

Laboratory Custody Procedures

A designated sample custodian accepts custody of the shipped samples, and verifies that the packing list sample numbers match those on the chain-of-custody records. Pertinent information as to shipment, pickup, and courier is entered in the “Remarks” section. The custodian then enters the sample numbers into a bound notebook, which is arranged by project code and station number.

The laboratory custodian uses the sample identification number or assigns a unique laboratory number to each sample, and is responsible for seeing that all samples are transferred to the proper analyst or stored in the appropriate secure area.

The custodian distributes samples to the appropriate analysts. Laboratory personnel are responsible for the care and custody of samples from the time they are received, until the sample is exhausted or returned to the custodian. The data from sample analyses are recorded on the laboratory report form.

When sample analyses and necessary QA checks have been completed in the laboratory, the unused portion of the sample will be disposed of properly. All identifying stickers, data sheets, and laboratory records are retained as part of the documentation. Sample containers and remaining samples are disposed of by the laboratory in compliance with all federal, state, and local regulatory requirements.

3.3.2 Custody Seals

When samples are shipped to the laboratory, they must be placed in containers sealed with custody seals. One or more custody seals must be placed on each side of the shipping container (cooler).

3.3.3 Field Notebooks

The field information to be entered in the field notebook is described in FSP Section 6.5. In addition to chain-of-custody records, a bound field notebook will be maintained by each sampling field team leader (FTL) to provide a daily record of significant events, observations, and measurements during field investigations. All entries will be signed and dated. The notebook will be kept as a permanent record.

These notebooks are intended to provide sufficient data and observations to enable participants to reconstruct events that occurred during the project, and to refresh the memory of the field personnel if called upon to give testimony during legal proceedings. In a legal proceeding, notes, if referred to, are subject to cross-examination and are admissible as evidence.

3.3.4 Corrections to Documentation

All original data recorded in field notebooks, sample identification tags, chain-of-custody records, and receipts-for-sample forms will be written with waterproof ink, unless prohibited by weather conditions. None of these accountable serialized documents are to be destroyed or thrown away, even if they are illegible or contain inaccuracies that require a replacement document.

If an error is made on an accountable document assigned to one team, the FTL may make corrections simply by drawing a single line through the error and entering the correct information. The erroneous information should not be obliterated. Any subsequent error discovered on an accountable document should be corrected by the person who made the entry. All subsequent corrections must be initialed and dated.

3.4 Analytical Methods (B4)

Project analytes, methods, and required detection levels are listed in Tables 2-2a to 2-2e. The analyses for TAL metals plus uranium, TCL pesticides and PCBs (as aroclors), TCL SVOCs, and dioxins and furans (tetra through octa congeners) will be performed in accordance with CLP methodology and through CLP laboratories. Some project-required detection limits for sediments are lower than the standard CLP limits. For these cases, the analyses will be carried out in accordance with special services provisions currently available under the CLP. For organics analyses when the CRQL is below the needed regulatory level shown in Table 2-1, the normal statement of work and CRQL will suffice. For the organic compounds marked with an asterisk in Table 2-1 where the needed detection level is lower than the CRQL, CLP special services for SIM will be requested to attain the needed limit. Because SIM detection limits are laboratory specific, they are not shown here. For inorganic compounds where lower detection is needed as marked in Table 2-1, ICP-MS methods in Table 2-2d will be used. For inorganic detection limits for sediment, ICP-MS will again be laboratory specific; however, the drop is expected to be proportional to what is shown in Table 2-2d for water. For pore water, sample preparation will be in accordance with a standard operating procedure using centrifugation, and the analysis will be in accordance with the CLP.

The remaining analyses will follow the standard procedures referenced in Table 2-2a and will be subject to QC requirements specified in Section 3.5.

3.5 Quality Control (B5)

QC requirements are detailed in the following subsections.

3.5.1 Field Quality Control Procedures

QC requirements related to the sample collection process (that is, sampling design, sampling methods, sample handling, and sample custody) are described in Sections 3.1 to 3.3 and are detailed in Section 6 of the FSP.

The sampling program includes collection of field QC samples, including field duplicates, field blanks, and laboratory QC samples (for matrix spike and matrix spike duplicates

[MS/MSDs]). The QC samples will be collected immediately following collection of target samples and using the same procedures as the collection of the target sample. The field QC samples are described in Section 6.6 of the FSP.

3.5.2 Laboratory Procedures

Laboratory QC procedures will include the following:

- Analytical methodology and QC according to methods listed in Tables 2-2a to 2-2e
- Instrument calibrations and standards as defined in the methods listed in Tables 2-2a to 2-2e and the CLP SOWs
- Laboratory blank measurements at a minimum 5 percent or 1-per-batch frequency
- Accuracy and precision measurements at a minimum of 1 in 20, 1 per set
- Data reduction and reporting according to the methods listed in Tables 2-2a to 2-2e
- Laboratory documentation equivalent to the CLP SOW

For analyses outside the CLP, the minimum requirements in Table 3-1 apply.

3.6 Instrument/Equipment Testing, Inspection, and Maintenance (B6)

Instrument maintenance logbooks are maintained in laboratories at all times. The logbooks, in general, contain a schedule of maintenance as well as a complete history of past maintenance, both routine and non-routine.

Preventive maintenance is performed according to the procedures described in the manufacturer's instrument manuals, including lubrication, source cleaning, detector cleaning, and the frequency of such maintenance. Chromatographic carrier gas-purification traps, injector liners, and injector septa are cleaned or replaced on a regular basis. Precision and accuracy data are examined for trends and excursions beyond control limits to determine evidence of instrument malfunction. Maintenance will be performed when an instrument begins to degrade as evidenced by the degradation of peak resolution, shift in calibration curves, decrease in sensitivity, or failure to meet one or another of the QC criteria.

Instrument downtime is minimized by keeping adequate supplies of all expendable items, where expendable means an expected lifetime of less than 1 year. These items include gas tanks, gasoline filters, syringes, septa, gas chromatography (GC) columns and packing, ferrules, printer paper and ribbons, pump oil, jet separators, open-split interfaces, and mass spectroscopy filaments.

Preventive maintenance for field equipment (for example, pH meter) will be carried out in accordance with procedures and schedules outlined in the particular model’s operation and maintenance handbook.

3.7 Instrument/Equipment Calibration and Frequency (B7)

3.7.1 Field Calibration Procedures

Field measurements included in the sediment sampling programs are limited to general water quality information such as pH, temperature, and dissolved oxygen. The meters used to obtain these measurements will be calibrated before the start of work and at the end of the sampling day. Any instrument "drift" from prior calibration should be recorded in a field notebook. Calibration will be in accordance with procedures and schedules outlined in the particular instrument's operations and maintenance manual.

Calibrated equipment will be uniquely identified by using either the manufacturer's serial number or other means. A label with the identification number and the date when the next calibration is due will be physically attached to the equipment. If this is not possible, records traceable to the equipment will be readily available for reference. In addition, the results of calibrations and records of repairs will be recorded in a logbook.

Scheduled periodic calibration of testing equipment does not relieve field personnel of the responsibility of employing properly functioning equipment. If an individual suspects an equipment malfunction, the device must be removed from service and tagged so that it is not inadvertently used, and the appropriate personnel notified so that a re-calibration can be performed or a substitute piece of equipment can be obtained.

Equipment that fails calibration or becomes inoperable during use will be removed from service and either segregated to prevent inadvertent use or tagged to indicate it is out of calibration. Such equipment will be repaired and satisfactorily re-calibrated. Equipment that cannot be repaired will be replaced.

Results of activities performed using equipment that has failed re-calibration will be evaluated. If the activity results are adversely affected, the results of the evaluation will be documented and the PM and (data users) will be notified.

3.7.2 Laboratory Calibration Procedures

Laboratory calibration procedures are specified in the methods referenced in Table 2-2a. All calibrations, at a minimum, will be at the following level of effort:

- Initial calibration for all methods, where applicable, will include, at a minimum, three-point calibration before a run.
- Continuing calibration for all methods will include a mid-range calibration standard after every tenth sample or every 12 hours.

3.8 Inspection/Acceptance of Supplies and Consumables (B8)

Supplies and consumables will be acquired in accordance with FAR and inspected in accordance with acquisition specifications upon receipt.

3.9 Nondirect Measurements (B9)

This section describes data that were obtained from non-direct measurement sources such as computer data bases, programs, literature files, and historical data bases and that may be used in making decisions about conditions in UCR sediment. As part of planning for the RI/FS, historical data pertinent to the UCR RI/FS were identified and compiled into a historical database. The data were then reviewed to determine whether they were of sufficient quality for use in certain evaluations. This process is summarized in the following steps:

1. Potential sources of data and reports were identified by interviewing USEPA staff, reviewing existing USEPA Preliminary Assessment/Site Investigation (PA/SI) documents, contacting other governmental agencies and stakeholders, and searching the Internet. A standardized letter requesting information was then sent to identified sources. Effort was made to gather data and reports in electronic format. This process was documented in *Document and Data Gathering Task Summary* (CH2M HILL 2004b)
2. Once gathered, the data were assessed for quality and categorized according to usability, as documented in *Assessment of Quality and Usability of Analytical Electronic Data* (CH2M HILL 2005). This categorization was consistent with DQOs identified within the Puget Sound Estuary Program (PSEP 1986), as described in *Puget Sound Dredged Disposal Analysis (PSDDA) Abbreviated Data Quality Evaluation for Dredged Material Disposal Projects* (PTI 1989, revisions PSDDA 1991).
3. Following assessment or simultaneously with the assessment, the data and reports were entered into a Site Information Management System (SIMS). The SIMS contains an internet accessible database linked to a geographic information system (GIS) to facilitate managing data based on location—an important feature for a site the size of the UCR. It allows access to site data and reports by anyone with Internet connectivity and appropriate authorization. Electronic copies of the various historical reports were entered into the SIMS document database.

3.10 Data Management (B10)

Data obtained during the Phase I sampling program will be managed according to the processes described in the project-specific data management plan prepared for the UCR site (CH2M HILL 2004c). All data for all parameters will undergo two levels of review and validation: 1) at the laboratory and 2) outside the laboratory, as described in Section 5. Following receipt of validated data, they will be input into the SIMS to facilitate database queries and report preparation. The data will be stored in SIMS with all laboratory qualifiers included. Laboratory data from ASCII or equivalent files, provided by the USEPA Region X CLP PO, will be adapted to files compatible with the project database, as described in the project-specific data management plan. The SIMS database will be maintained in a manner that is compatible with, and provided to, USEPA or others at USEPA's request. The data management process is depicted in Figure 2-2.

TABLE 3-1
Minimum Quality Control Requirements for Non-CLP Methods
Upper Columbia River RI/FS

Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
AVS/SEM, TOC	Multipoint calibration for all analytes (minimum 3 standards and one calibration blank) *	Initial calibration prior to sample analysis	Correlation coefficient ≥0.995 for linear regression	Correct problem then repeat initial calibration
	Second-source calibration verification *	Once per multipoint calibration	All analytes within ±10% of expected value	Correct problem then repeat initial calibration
	Retention time window calculated for each analyte *	Each initial calibration and calibration verifications	± 3 times standard deviation for each analyte retention time over 8 hour period	Correct problem then reanalyze all samples analyzed since the last retention time check
	Initial calibration verification *	Daily, before sample analysis or when eluant is changed	All analytes within ±10% of expected value	Correct problem then repeat initial calibration
	Calibration verification *	After every 10 samples and at the end of the analysis sequence	Instrument response within ±10% of expected value	Correct problem then repeat initial calibration verification and reanalyze all samples since last successful calibration verification
	Method blank	One per analytical batch	No analytes detected ≥ reporting limit (RL)	Correct problem, then re-prepare and analyze method blank and all samples processed with the contaminated blank
	Laboratory control sample (LCS) for all analytes	One LCS per analytical batch	QC acceptance criteria, lab specific	Correct problem then reanalyze If still out, re-prepare and reanalyze the LCS and all samples in the affected project batch
	Duplicate	One per every 10 samples	%D (deviation), ≤10%	
	MS/MSD	One MS/MSD per every 20 project samples per matrix	QC acceptance criteria, project specific	none
	MDL study	Once per 12 month period	Detection limits established shall be ≤ the RLs	none

TABLE 3-1
Minimum Quality Control Requirements for Non-CLP Methods
Upper Columbia River RI/FS

Applicable Parameter	QC Check	Minimum Frequency	Acceptance Criteria	Corrective Action
	Results reported between MDL and RL	none	none	none

* May not apply to all methods, such as automated TOC measurements.
RL = reporting limit

SECTION 4

Assessment and Oversight (USEPA Group C)

SECTION 4

Assessment and Oversight (USEPA Group C)

4.1 Assessments and Response Actions (C1)

The QAO, senior reviewers, and PM will monitor the performance of the QA procedures. If problems arise and/or the USEPA TOPO directs the PM accordingly, the QAO will conduct field audits. Field audits may be scheduled to evaluate (1) the execution of sample identification, chain-of-custody procedures, field notebooks, sampling procedures, and field measurements; (2) whether trained personnel staffed the sample event; (3) whether equipment was in proper working order (that is, calibration); (4) availability of proper sampling equipment; (5) whether appropriate sample containers, sample preservatives, and techniques were used; (6) whether sample packaging and shipment were appropriate; and (7) whether QC samples were properly collected.

Sample analyses will be carried out at the USEPA CLPs, the USEPA MEL, and contract laboratories. The distribution of analyses to the laboratories will be determined according to laboratory capability and capacity and the sampling schedule identified in Section 6.2.1 of the FSP. The distribution of analyses may change at the time of analyses depending on capacity and implementation of specific procedures at the Regional Laboratory. The RSCC, residing at USEPA's Technical Support Unit (TSU), will be responsible for coordination and scheduling of analytical services from the CLPs and MEL. The data quality and laboratory performance of CLP laboratories are monitored by the Analytical Services Branch in USEPA Headquarters and the region's CLP PO(s). For MEL, QA oversight is provided by the laboratory's QA Coordinator. Laboratories subcontracted outside the USEPA laboratories will be selected based on prior performance on Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) projects. In addition, onsite audits or performance evaluation samples will be administered by the CH2M HILL QAO and USEPA Regional QAM, as necessary.

Audits will be followed up with an audit report prepared by the reviewer. The auditor will also debrief the laboratory or the field team at the end of the audit and request that the laboratory or field team comply with the corrective action request.

If QC audits result in detection of unacceptable conditions or data, the PM will be responsible for developing and initiating corrective action. The TOPO will be notified if nonconformance is of program significance or requires special expertise not normally available to the project team. In such cases, the PM will decide whether any corrective action should be pursued. Corrective action may include the following:

- Reanalyzing samples if holding time criteria permit
- Re-sampling and analyzing
- Evaluating and amending sampling and analytical procedures
- Accepting data acknowledging a level of uncertainty

4.2 Reports to Management (C2)

The PM or TOPO may request that a QA report be made to the TOPO on the performance of sample collection and data quality. The report will include the following:

- Assessment of measurement data accuracy, precision, and completeness
- Results of performance audits
- Results of systems audits
- Significant QA problems and recommended solutions

Progress reports prepared as needed will summarize overall project activities and any problems encountered. QA reports generated on sample collection and data quality will focus on specific problems encountered and solutions implemented. Alternatively, in lieu of a separate QA report, sampling and field measurement data quality information may be summarized and included in the final reports summarizing Phase I activities. The objectives, activities performed, overall results, sampling, and field measurement data quality information for the project will be summarized and included in the final reports along with any QA reports.

SECTION 5

Data Validation and Usability (USEPA Group D)

SECTION 5

Data Validation and Usability (USEPA Group D)

5.1 Data Review, Verification, and Validation (D1)

All data for all parameters will undergo two levels of review and validation: 1) at the laboratory, and 2) outside the laboratory by the USEPA Regional QAM or their designee. All CLP-generated data will be verified and validated by the chemists at USEPA's TSU. The data generated by the subcontracted commercial laboratories will be validated by CH2M HILL or an independent third-party data reviewer.

5.2 Verification and Validation Methods (D2)

Initial data reduction, validation, and reporting at the laboratory will be performed as described in the laboratory standard operating procedures. Independent data validation by USEPA or their designee will follow USEPA *Contract Laboratory Program National Functional Guidelines for Inorganic/Organic Data Review* (USEPA, 1994b, 1999, 2002b) as described above. All CLP-generated data will be verified and validated by the chemists at the TSU. The data generated by the subcontracted commercial laboratories will be validated by the Contractor or an independent third-party data reviewer.

A full data validation will be performed on all dioxin and furan analyses. For the rest of the organic analyses, the first four sample delivery groups submitted by the CLP laboratory will undergo full data validation. If problems are not encountered with the data, and because of resource and time constraints, only 30 percent of the CLP SVOC, pesticides, and PCB data will undergo full data validation and the remaining 70 will undergo summary forms data review. Validation report memoranda and qualified results will be prepared by the validator and submitted to USEPA and the Contractor's PMs. Unvalidated laboratory data spreadsheets will be sent by TSU to the Contractor.

5.3 Reconciliation with User Requirements (D3)

Results obtained from the project will be reconciled with the requirements specified in Tables 2-2a to 2-2e. Assessment of data for precision, accuracy, and completeness will be performed in accordance with the quantitative definitions in the following subsections.

5.3.1 Precision

If calculated from duplicate measurements, use the following:

$$RPD = \frac{(C_1 - C_2) \text{ x } 100\%}{(C_1 + C_2) / 2}$$

where:

RPD	=	relative percent difference
C_1	=	larger of the two observed values
C_2	=	smaller of the two observed values

If calculated from three or more replicates, use relative standard deviation (RSD) rather than relative percent difference (RPD), as follows:

$$RSD = (s / \bar{y}) \times 100\%$$

where:

RSD	=	relative standard deviation
s	=	standard deviation
$\bar{y}$	=	mean of replicate analyses

Standard deviation, s, is defined as follows:

$$S = \sqrt{\sum_{i=1}^{n} \frac{(y_i / \bar{y})^2}{n-1}}$$

where:

s	=	standard deviation
y_i	=	measured value of the i^{th} replicate
$\bar{y}$	=	mean of replicate analyses
n	=	number of replicates

5.3.2 Accuracy

For measurements where matrix spikes are used, use the following:

$$\%R = 100\% \times \left[\frac{S - U}{C_{sa}}\right]$$

where:

%R	=	percent recovery
S	=	measured concentration in spiked aliquot
U	=	measured concentration in unspiked aliquot
C_{sa}	=	actual concentration of spike added

For situations where a standard reference material (SRM) is used instead of or in addition to matrix spikes, use the following:

$$\%R = 100\% \times \left[\frac{C_m}{C_{sm}}\right]$$

where:

%R	=	percent recovery
C_m	=	measured concentration of SRM
C_{sm}	=	actual concentration of SRM

5.3.3 Completeness (Statistical)

Defined as follows for all measurements:

$$\%C = 100\% \times \left[\frac{V}{T}\right]$$

where:

%C	=	percent completeness
V	=	number of measurements judged valid
T	=	total number of measurements

SECTION 6

References

SECTION 6

References

CH2M HILL. 2004a. *Draft Phase I Sediment Sampling Approach and Rationale – Upper Columbia River Site CERCLA RI/FS.* Prepared for USEPA Region 10, Seattle, WA. December 10, 2004.

–––. 2004b. *Document and Data Gathering Task Summary – Upper Columbia River Site RI/FS.* December 28, 2004.

–––. 2004c. *Data Management Plan/SIMS Overview.* December 28, 2004.

–––. 2005. *Assessment of Quality and Usability of Analytical Electronic Data.* January 14, 2005.

Puget Sound Estuary Program (PSEP). 1986. *Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound*.

U.S. Environmental Protection Agency (USEPA). 1979. *Methods for Chemical Analysis of Water and Wastes*. EPA-600/4-79-020. Revised March 1983.

–––. 1989. *Test Methods for Evaluating Solid Wastes*. SW846, Standard Methods for the Examination of Water and Wastewater. 17th Edition.

–––. 1994b, 1999, and 2002b. *Contract Laboratory Program National Functional Guidelines for Inorganic/ Organic Data Review*.

–––. 1994a and 2000b. *Guidance for the Data Quality Objectives Process*. USEPA Office of Environmental Information, Washington, D.C. EPA QA/G4. September. [UCR177]

–––. 1998 and 2002a. *EPA Guidance for Quality Assurance Project Plans.* EPA QA/G5, EPA/240/R-02/009. December.

–––. 2000a. *Upper Columbia River/Lake Roosevelt River Mile 597 to 745, Preliminary Assessment Report, Washington*. Prepared by Ecology and Environment, Inc.

–––. 2001. *EPA Requirements for Quality Assurance Project Plans* (QA/R-5). EPA/240/B-01/003. March 2001.

–––. 2003a. *EPA Management Plans and Standard Operating Procedures For Region 10 Architect Engineering Services, Contract Solicitation No. PR-R7-02-10217*. Prepared by CH2M HILL, Bellevue, WA.

–––. 2003b. *Upper Columbia River Expanded Site Investigation Report, Northwest Washington.* TDD: 01-02-0028. Region 10 Start – 2, Superfund Technical Assessment and Response Team. May - September 2001 investigation. Prepared by Ecology and Environment, Inc. and Roy F. Weston, Inc. **{USEPA 2001}**[2] [UCR247a]

[2] Note: The style **{bold brackets}** indicates the year of the study itself, rather than the year the study results were published.

APPENDIX A

Data Quality Objectives

APPENDIX A

Data Quality Objectives

The overall objective of the Remedial Investigation/Feasibility Study (RI/FS) for the Upper Columbia (UCR) site is to identify site contamination, assess potential risk to human or ecological receptors, and develop remedial approaches to mitigate unacceptable risk. Meeting this objective for contaminated sediments at the UCR site requires an understanding of the following components of the conceptual site model so that appropriate remedial actions can be assessed:

- Contaminant sources
- Nature and extent of contaminated sediment
- Fate and transport of contaminated sediment and contaminants of concern
- Human and ecological receptors and exposure pathways for contaminated sediment

An important aspect of the Phase I sediment sampling program is to gather data to support the human and ecological risk assessments. The Phase I sediment sampling program will also provide information to support other components of the conceptual site model.

This appendix contains two sections: Section A.1 describes the data quality objectives (DQO) process, and Section A.2 presents the DQOs for the Phase I sediment sampling program.

A.1 Data Quality Objectives Process

The Data Quality Objectives Process of the U.S. Environmental Protection Agency was used to identify specific needs for the project and to establish decision rules for the collection of sediment data to support RI/FS tasks and activities. The DQO process is a seven-step iterative planning approach used to prepare plans for environmental data collection activities and is intended to help site managers plan to collect data of the right type, quality, and quantity to support defensible site decisions. The seven steps are as follows:

1. State the Problem—Summarize the contamination problem that will require new environmental data, and identify the resources available to resolve the problem; develop conceptual site model.

2. Identify the Decision—Identify the decision that requires new environmental data to address the contamination problem.

3. Identify Inputs to the Decision—Identify the information needed to support the decision and specify which inputs require new environmental measurements.

4. Define the Study Boundaries—Specify the spatial and temporal aspects of the environmental media that the data must represent to support the decision.

5. Develop a Decision Rule—Develop a logical "if. . . then. . ." statement that defines the conditions that would cause the decision-maker to choose among alternative actions.

6. Specify Limits on Decision Errors—Specify the decision-maker's acceptable limits on decision errors, which are used to establish performance goals for limiting uncertainty in the data.

7. Optimize the Design for Obtaining Data—Identify the most resource-effective sampling and analysis design for generating data that are expected to satisfy the DQOs.

A.2 Phase I Sediment Data Quality Objectives

This section details the sediment DQOs as they relate to the Phase I sediment sampling program. The section uses the format presented in *Data Quality Objectives Process for Hazardous Waste Site Investigations* (USEPA 2000). For the purposes of this QAPP, a more detailed evaluation of DQOs is provided for the human health risk assessment and ecological risk assessments (benthic and wildlife), whereas a more succinct tabular format is provided for other data uses.

Table A-1 lists the DQO information for contaminant source identification, nature and extent assessments, fate and transport evaluations, and remedial action alternatives development. The overall sampling program for Phase I is summarized in Table A-2, and the target analyte list for each aspect of the sediment sampling program is provided, along with minimum laboratory reporting limits, in Tables A-3a to A-3f. The potential regulatory values used to estimate minimum reporting limits are listed in Table A-4.

A.2.1 Human Health Risk Assessment

Step 1. State the Problem—Human Health Risk Assessment

(1)	Identify members of the planning team	Kevin Rochlin and Sally Thomas—USEPA Marc Stifelman, Burt Shepard, Bruce Duncan—USEPA Risk Staff Jim Stefanoff—CH2M HILL Project Manager Chuck Gruenenfelder—CH2M HILL RI Task Leader Dennis Shelton—CH2M HILL Risk Assessment Task Leader Artemis Antipas—CH2M HILL Quality Assurance Officer/Chemist
(2)	Identify the primary decision-maker	Decisions will be made by consensus between the USEPA and CH2M HILL managers and risk assessment task leader.
(3)	Develop a concise description of the problem	Contaminants may be present in beach sediment and periodically exposed sediment[1] at concentrations that pose unacceptable risk to human receptors.
(4)	Specify available resources and relevant deadlines for the study	Historical sediment data are not of adequate quality or coverage to assess potential risk. Phase I sampling is scheduled to begin in April 2005 and last into May 2005. Project resources are described in the Field Sampling Plan (FSP) (Appendix B). The need for, and schedule of, additional sediment sampling events will be determined following evaluation of Phase I data.

[1] Sediment in nearshore areas that is frequently exposed as a result of seasonal reservoir drawdown.

Step 2. Identify the Decision—Human Health Risk Assessment

(1)	Identify the principal study question	Determine whether measures are needed to prevent exposure of people to contaminants in beach and periodically exposed sediment.
(2)	Define alternative actions that could result from resolution of the principal study question	(a) No action. (b) Additional data are needed. (c) Remedial action alternatives are developed.
(3)	Combine the principal study question and the alternative actions into a decision statement	Compare human health risk (excess cancer risk) and hazard index (adverse noncancer effects) estimates with regulatory risk targets, and determine the appropriate action: no action, additional data collection, or remedial action development.
(4)	Organize multiple decisions	If calculated risk and hazard index (HI) estimates are below regulatory risk targets, with acceptable uncertainty about the result, then no further action may be taken. If calculated risk and HI estimates are below regulatory risk targets, with moderate to high uncertainty about the result, then additional data collection may be necessary. If calculated risk and HI estimates are above regulatory risk targets, with moderate to high uncertainty about the result, then additional data collection may be necessary. If calculated risk and HI estimates are above regulatory risk targets, with acceptable uncertainty about the result, then remedial action alternatives will need to be developed.

Step 3. Identify Inputs to the Decision—Human Health Risk Assessment

(1)	Identify information that will be required to resolve the decision statement	Defined conceptual exposure model, including receptor populations, exposure pathways, and exposure areas. Measured contaminant levels in surface sediment at beaches and periodically exposed sediment. Human health risk and hazard index estimates for each exposure pathway and exposure area. Particle size data. Meteorological data. Air monitoring and/or modeling data.
(2)	Determine the sources for each item of information required	Demographic information. Beach area recommendations from trustees and tribes. Site use information. Toxicological databases and literature. Chemical analysis of Phase I sediment samples. Geotechnical analysis of Phase I sediment samples.
(3)	Identify the information that is needed to establish the action level	Human health risk and hazard index estimates for each exposure pathway.

(4)	Confirm the appropriate measurement methods exist to provide the necessary data	Methods consistent with the above needs are identified in the Quality Assurance Project Plan (QAPP).

Step 4. Define the Boundaries for the Study—Human Health Risk Assessment

(1)	Specify the characteristics that define the population of interest	Surface sediment (approximately the upper 10 to 15 centimeters [cm]) located at beaches and in areas where there is periodically exposed sediment. Potential contaminants include all Contract Laboratory Program (CLP) analytes (volatile organic compounds [VOCs] excepted).
(2)	Define the spatial boundary of the decision statement	Decisions will be made using a variety of spatial boundaries as determined by the conceptual exposure model and the distribution of contaminant concentrations in periodically exposed sediment across the site (note that, for the purposes of Phase I, the study area is bounded by the U.S.-Canadian Border and Grand Coulee Dam).
(3)	Define the temporal boundary of the decision statement	Phase I sampling will be completed in May 2005; decisions regarding risk or need for additional data will be made within 2 years after Phase I data are received.
(4)	Define the scale of decision-making	The scale of the decision will be made based on the conceptual exposure model and the distribution of contaminant concentrations in periodically exposed sediment across the site.
(5)	Identify practical constraints on data collection	The exposure areas may range in size from individual beaches to all periodically exposed sediment in the UCR site. The number of samples and methods of aggregation need to be robust enough to demonstrate the representativeness of concentrations used in assessing risk. Laboratory analytical costs for certain potential contaminants are costly (for example, dioxins and furans).

Step 5. Develop a Decision Rule—Human Health Risk Assessment

(1)	Specify the statistical parameter that characterizes the population of interest	Representative concentrations for each constituent of interest (COI) may be determined through statistical analysis (for example, 95 percent upper confidence limit [UCL]) or may be based on the maximum detected concentration or other suitable method depending on the number of samples and variability in the data set.
(2)	Specify the action level for the study	Potential applicable or relevant and appropriate (ARAR) values for all CLP analytes have been identified for the purpose of defining the laboratory reporting limits (see Table A-3). However, site-specific human health risk and hazard index estimates will also be developed for each exposure pathway and exposure area.
(3)	Develop a decision rule (an “if…then...” statement	If calculated risk and HI estimates are above regulatory risk targets and uncertainties are acceptable, a remedial action alternative may need to be developed or additional data gathered; otherwise, no further evaluation is necessary for human health reasons.

Step 6. Specify Tolerable Limits on Decision Errors—Human Health Risk Assessment

(1)	Determine the range of the parameters of interest	Analytical results for historical sediment samples have been reviewed and compiled in a database from which the potential ranges of certain contaminant concentrations have been derived. However, the quality and coverage of the samples in the historical database are not sufficient to fully define the expected range of contaminants in beach sediment and periodically exposed sediment and are, therefore, not included in this appendix.
(2)	Identify the decision errors and choose a null hypothesis	A key decision error is an understatement of risk (that is, no risk identified when risk is actually present); therefore, sufficient samples need to be collected and health-conservative assumptions (e.g., reasonable maximum exposure, or RME) used to allow for higher confidence in the null hypothesis. The precision, accuracy, representativeness, comparability, and completeness (PARCC) criteria listed in the QAPP and the minimum detection limits listed in Table A-3 will be used to evaluate the usability of analytical data in making decisions about potential risk. Analyte-specific accuracy and precision ranges are shown in the QAPP. The project completeness target is set at 90 percent. Because the error for precision and accuracy is on average about 30 percent, the consequences of decision errors based on sample results less than half the specified detection levels or greater than twice the specified detection levels are expected to be relatively small.
(3)	Specify a range of possible values of the parameter of interest where the consequences of decision error are relatively minor	The risk assessments will provide multiple descriptors of risk, and the uncertainty analyses portion of the risk assessments will address the range of possible values influencing overall decisions regarding risk.
(4)	Assign probability values to points above and below the action level that reflect the tolerable probability for the occurrence of decision errors.	Not applicable to the decision.

Step 7. Optimize the Design—Human Health Risk Assessment

(1)	Review the DQO outputs and existing data	See Steps 1 to 6.
(2)	Develop general data collection design alternatives	The rationale for the sampling design is described in *Draft Phase I Sediment Sampling Approach and Rationale – Upper Columbia River CERCLA RI/FS* (CH2M HILL 2004).
(3)	Formulate the mathematical expressions necessary for each design alternative	The methods to be used in aggregating data and evaluating results for the risk assessment will be determined as part of the data evaluation process.
(4)	For each data collection design alternative, select the optimal sample size that satisfies the DQOs	The data collection design requires collection of a statistically valid number of samples, which can range from 3 to greater than 100 samples, depending on the desired power level for decision. Because the risk decisions will be made using a variety of spatial boundaries that cannot be determined at this time, it is necessary to collect a larger number of samples throughout the overall study area in order to provide sufficient samples for smaller subareas or exposure units.

(5)	Select the most resource-effective data collection design that satisfies the DQOs	The rationale for the sampling design is described in *Draft Phase I Sediment Sampling Approach and Rationale – Upper Columbia River CERCLA RI/FS* (CH2M HILL 2004). This design includes: (a) sampling of periodically exposed sediment at regular intervals (transects) and positions along the length of the UCR, with different distances between transects depending on river reach (closer spacing in upper reaches, farther spacing in lower reaches); (b) sampling of beaches and shorelines distributed along the length of the UCR, with more focused discrete sampling occurring at beaches that are of higher concern to local populations; (c) composite sampling at beaches (composites composed of samples obtained at specified elevations and locations) augmented by discrete samples to gauge the effects of compositing; and (d) separate analysis of size-fractionated samples to gauge contaminant concentrations in the portion of the sediment that may be inhaled. Because of analytical costs, only the beach composite samples will be analyzed for dioxins and furans. The remaining periodically exposed sediment samples will be analyzed for the standard suite of CLP analytes. The sampling program is summarized in Table A-2. Target analytes and geochemical parameters are listed in Table A-3.
(6)	Document the operational details and theoretical assumptions of the selected design in the sampling and analysis plan	The FSP (Appendix B) provides the operational details and assumptions for the sediment sampling design.

A.2.2 Benthic Risk Assessment

Step 1. State the Problem—Benthic Risk Assessment

(1)	Identify members of the planning team	Kevin Rochlin and Sally Thomas—USEPA Marc Stifelman, Burt Shepard, Bruce Duncan—USEPA Risk Staff Jim Stefanoff—CH2M HILL Project Manager Chuck Gruenenfelder—CH2M HILL RI Task Leader Dennis Shelton—CH2M HILL Risk Assessment Task Leader Frank Dillon—- CH2M HILL Lead Biologist Artemis Antipas—CH2M HILL Quality Assurance Officer/Chemist
(2)	Identify the primary decision-maker	Decisions will be made by consensus between USEPA and CH2M HILL managers and risk assessment task leaders.
(3)	Develop a concise description of the problem	Contaminants may be present in surface sediment at concentrations that pose unacceptable risk to benthic/epibenthic resources in the UCR site.
(4)	Specify available resources and relevant deadlines for the study	Historical sediment data are not of adequate quantity, quality, or coverage to assess potential risk. Phase I sampling is scheduled to begin in April 2005 and last into May 2005. Project resources are described in the FSP (Appendix B). The need for and schedule of additional sediment sampling events will be determined following evaluation of Phase I data.

Step 2. Identify the Decision—Benthic Risk Assessment

(1)	Identify the principal study question	Determine whether measures are needed to prevent exposure of benthic/epibenthic resources to contaminants in sediment.
(2)	Define alternative actions that could result from resolution of the principal study question	(a) No action. (b) Additional data are needed. (c) Remedial action alternatives are developed.
(3)	Combine the principal study question and the alternative actions into a decision statement	Compare representative COI concentrations to risk-based concentrations protective of benthic resources and determine the appropriate action: no action, additional data collection, or remedial action development.
(4)	Organize multiple decisions	If the weight of evidence indicates that benthic/epibenthic communities are not potentially at risk, with acceptable uncertainty about the result, then no further action may be taken. If the weight of evidence indicates that benthic/epibenthic communities are not potentially at risk, with moderate to high uncertainty about the result, then additional data collection may be necessary. If the weight of evidence indicates that benthic/epibenthic communities are potentially at risk, with moderate to high uncertainty about the result, then additional data collection may be necessary. If the weight of evidence indicates that benthic/epibenthic communities are potentially at risk, with acceptable uncertainty about the result, then remedial action alternatives will need to be developed.

Step 3. Identify Inputs to the Decision—Benthic Risk Assessment

(1)	Identify information that will be required to resolve the decision statement	Defined conceptual exposure model. Measured contaminant levels in submerged and periodically exposed surface sediment. Measured TAL metals concentrations in pore water. Surface sediment bioassay results (including data for reference locations).
(2)	Determine the sources for each item of information required	Chemical analysis of Phase I sediment samples, including geochemical parameters that govern toxicity and availability of contaminants to biota. Chemical analysis of Phase I pore water samples. Surface sediment bioassay results (including data for reference locations).
(3)	Identify the information that is needed to establish the action level	Ecological hazard quotient estimates for each exposure area. Surface sediment bioassay results (including data for reference locations).
(4)	Confirm the appropriate measurement methods exist to provide the necessary data	Methods consistent with the above needs are identified in the QAPP.

Step 4. Define the Boundaries for the Study—Benthic Risk Assessment

(1)	Specify the characteristics that define the population of interest	Surface sediment (approximately the upper 10 to 15 cm) located in periodically exposed and submerged portions of the UCR site. Potential contaminants include all CLP analytes (VOCs excepted). Pore water in surface sediment located in periodically exposed and submerged portions of the UCR site. Potential contaminants include all TAL metals and uranium.
(2)	Define the spatial boundary of the decision statement	Decisions will be made using a variety of spatial boundaries as determined by the conceptual exposure model and the distribution of contaminant concentrations in periodically exposed and submerged[2] sediment across the site (note that, for the purposes of Phase I, the study area is bounded by the U.S.-Canadian Border and Grand Coulee Dam).
(3)	Define the temporal boundary of the decision statement	Phase I sampling will be completed in May 2005; decisions regarding risk or need for additional data will be made within 2 years after Phase I data are received.
(4)	Define the scale of decision-making	The scale of the decision will be made based on the conceptual exposure model and the distribution of contaminant concentrations in periodically exposed and submerged sediment across the site.

[2] Typically, sediment located near the shoreline. Not expected to include sediment from deeper water mid-channel locations.

(5)	Identify practical constraints on data collection	The exposure units may range in size from individual reaches to the entire UCR site. It is not practical to collect data based on the smallest potential exposure unit size. However, the number of samples and methods of aggregation need to be robust enough to demonstrate the representativeness of concentrations used in assessing risk. Laboratory analytical costs for certain potential contaminants are costly (for example, dioxins and furans).

Step 5. Develop a Decision Rule—Benthic Risk Assessment

(1)	Specify the statistical parameter that characterizes the population of interest	Representative concentrations for each COI may be determined through statistical analysis (for example, 95 percent UCL) or may be based on the maximum detected concentration or other suitable method depending on the number of samples and variability in the data set.
(2)	Specify the action level for the study	Potential ARAR values for all CLP analytes have been identified for the purpose of defining the laboratory reporting limits (see Table A-3). However, receptor-specific protective concentrations will also be developed for use in the benthic risk assessment.
(3)	Develop a decision rule (an "if...then..." statement	If representative COI concentrations are above protective concentrations, a remedial action alternative may need to be developed or additional data gathered; otherwise, no further evaluation is necessary for benthic risk reasons.

Step 6. Specify Tolerable Limits on Decision Errors— Benthic Risk Assessment

(1)	Determine the range of the parameters of interest	Analytical results for historical sediment samples have been reviewed and compiled in a database from which the potential ranges of certain contaminant concentrations have been derived. However, the quality and coverage of the samples in the historical database are not sufficient to fully define the expected range of contaminants in surface sediment at the site. Toxicity tests results could range from no significant effect on survival, growth, and/or reproduction, to complete mortality.
(2)	Identify the decision errors and choose a null hypothesis	The key decision error is an understatement of risk (that is, no risk identified when risk is actually present); therefore, sufficient samples need to be collected to allow for higher confidence in the null hypothesis. The "hit/no hit" designation for the toxicity test results will be based on statistical comparisons with appropriate controls. The PARCC criteria listed in the QAPP and the minimum detection limits listed in Table A-3 will be used to evaluate the usability of analytical data in making decisions about potential risk. Analyte-specific accuracy and precision ranges are shown in the QAPP. The project completeness goal is set at 90 percent. Because the error for precision and accuracy is on average about 30 percent, the consequences of decision errors based on sample results less than half the specified detection levels or greater than twice the specified detection levels are expected to be relatively small.
(3)	Specify a range of possible values of the parameter of interest where the consequences of decision error are relatively minor	The risk assessments will provide multiple descriptors of risk, and the uncertainty analysis portion of the risk assessments will address the range of possible values influencing overall decisions regarding risk.

(4)	Assign probability values to points above and below the action level that reflect the tolerable probability for the occurrence of decision errors.	Not applicable to the decision.

Step 7. Optimize the Design—Benthic Risk Assessment

(1)	Review the DQO outputs and existing data	See Steps 1 to 6.
(2)	Develop general data collection design alternatives	The rationale for the sampling design is described in *Draft Phase I Sediment Sampling Approach and Rationale – Upper Columbia River CERCLA RI/FS* (CH2M HILL 2004).
(3)	Formulate the mathematical expressions necessary for each design alternative	The methods to be used in aggregating data and evaluating results for the benthic risk assessment will be determined as part of the data evaluation process.
(4)	For each data collection design alternative, select the optimal sample size that satisfies the DQOs	All data collection designs require collection of a statistically valid number of samples, which can range from 3 to greater than 100 samples, depending on the desired power level for decision. Because the risk decisions will be made using a variety of spatial boundaries that cannot be determined at this time, it is necessary to collect a larger number of samples throughout the overall study area in order to provide sufficient samples for smaller subareas.
(5)	Select the most resource-effective data collection design that satisfies the DQOs	The rationale for the sampling design is described in *Draft Phase I Sediment Sampling Approach and Rationale – Upper Columbia River CERCLA RI/FS* (CH2M HILL 2004). This design includes: (a) sampling of periodically exposed and submerged surface sediment at regular intervals (transects) and positions along the length of UCR, with different distances between transects depending on river reach (closer spacing in upper reaches, farther spacing in lower reaches); (b) collection of samples for bioassay testing at the same locations where samples are collected for chemical analysis; (c) collection of reference samples for bioassay analysis at locations that appear to be unaffected by UCR contaminants; and (d) collection of pore water samples for possible use in interpretation of biotoxicity results (Note: This procedure is specifically designed to mimic the pore water that the bioassay species are exposed to rather than an attempt to draw conclusions about in situ pore water). The sampling program is summarized on Table A-2. Target analytes and geochemical parameters are listed in Table A-3.
(6)	Document the operational details and theoretical assumptions of the selected design in sampling and analysis plan	The FSP (Appendix B) provides the operational details and assumptions for the sediment sampling design.

A.2.3 Wildlife Risk Assessment

Step 1. State the Problem—Wildlife Risk Assessment

(1)	Identify members of the planning team	Kevin Rochlin and Sally Thomas—USEPA Marc Stifelman, Burt Shepard, Bruce Duncan—USEPA Risk Staff Jim Stefanoff—CH2M HILL Project Manager Chuck Gruenenfelder—CH2M HILL RI Task Leader Dennis Shelton—CH2M HILL Risk Assessment Task Leader Frank Dillon—- CH2M HILL Lead Biologist Artemis Antipas—CH2M HILL Quality Assurance Officer/Chemist
(2)	Identify the primary decision-maker	Decisions will be made by consensus between the USEPA and CH2MHILL managers and risk assessment task leaders.
(3)	Develop a concise description of the problem	Contaminants may be present in surface sediment at concentrations that pose unacceptable risk to wildlife (birds and mammals) in the UCR site.
(4)	Specify available resources and relevant deadlines for the study	Historical sediment data are not of adequate quality or coverage to assess potential risk. Phase I sampling is scheduled to begin in April 2005 and last into May 2005. Project resources are described in the FSP. The need for and schedule of additional sediment sampling events will be determined following evaluation of Phase I data.

Step 2. Identify the Decision—Wildlife Risk Assessment

(1)	Identify the principal study question	Determine whether measures are needed to prevent exposure of wildlife to contaminants in sediment.
(2)	Define alternative actions that could result from resolution of the principal study question	(a) No action. (b) Additional data are needed. (c) Remedial action alternatives are developed.
(3)	Combine the principal study question and the alternative actions into a decision statement	Compare representative COI concentrations to risk-based concentrations protective of wildlife and determine the appropriate action: no action, additional data collection, or remedial action development.
(4)	Organize multiple decisions	If the weight of evidence indicates that wildlife communities are not potentially at risk, with acceptable uncertainty about the result, then no further action may be taken. If the weight of evidence indicates that wildlife communities are not potentially at risk, with moderate to high uncertainty about the result, then additional data collection may be necessary. If the weight of evidence indicates that wildlife communities are potentially at risk, with moderate to high uncertainty about the result, then additional data collection may be necessary. If the weight of evidence indicates that wildlife communities are potentially at risk, with acceptable uncertainty about the result, then remedial action alternatives will need to be developed.

Step 3. Identify Inputs to the Decision—Wildlife Risk Assessment

(1)	Identify information that will be required to resolve the decision statement	Defined conceptual exposure model. Measured contaminant levels in submerged and periodically exposed surface sediment. Food web model hazard quotient results.
(2)	Determine the sources for each item of information required	Wildlife home ranges and migration patterns. Habitat maps. Bathymetry information. Observations regarding wading bird foraging. Chemical analysis of Phase I sediment samples.
(3)	Identify the information that is needed to establish the action level	Food web model hazard quotient results.
(4)	Confirm the appropriate measurement methods exist to provide the necessary data	Methods consistent with the above needs are identified in the QAPP.

Step 4. Define the Boundaries for the Study—Wildlife Risk Assessment

(1)	Specify the characteristics that define the population of interest	Surface sediment (approximately the upper 10 to 15 cm) located in periodically exposed and submerged portions of the UCR site. Potential contaminants include all CLP analytes (VOCs excepted).
(2)	Define the spatial boundary of the decision statement	Decisions will be made using a variety of spatial boundaries as determined by the conceptual exposure model and the distribution of contaminant concentrations in periodically exposed and submerged sediment across the site (note that, for the purposes of Phase I, the study area is bounded by the U.S.-Canadian Border and Grand Coulee Dam).
(3)	Define the temporal boundary of the decision statement	Phase I sampling will be completed in May 2005; decisions regarding risk or need for additional data will be made within 2 years after Phase I data are received.
(4)	Define the scale of decision-making	The scale of the decision will be made based on the conceptual exposure model and the distribution of contaminant concentrations in periodically exposed and submerged sediment across the site.
(5)	Identify practical constraints on data collection	The exposure units may range in size from individual reaches to the entire UCR site. It is not practical to collect data based on the smallest potential exposure area. However, the number of samples and methods of aggregation need to be robust enough to demonstrate the representativeness of concentrations used in assessing risk. Laboratory analytical costs for certain potential contaminants are costly (for example, dioxins and furans).

Step 5. Develop a Decision Rule—Wildlife Risk Assessment

(1)	Specify the statistical parameter that characterizes the population of interest	Representative concentrations for each COI may be determined through statistical analysis (for example, 95 percent UCL) or may be based on the maximum detected concentration or other suitable method depending on the number of samples and variability in the data set.
(2)	Specify the action level for the study	Potential ARAR values for all CLP analytes have been identified for the purpose of defining the laboratory reporting limits (see Table A-3). However, receptor-specific protective concentrations will also be developed for use in the wildlife risk assessment.
(3)	Develop a decision rule (an “if...then...” statement	If representative COI concentrations are above protective concentrations, a remedial action alternative may need to be developed or additional data gathered; otherwise, no further evaluation is necessary for wildlife risk reasons.

Step 6. Specify Tolerable Limits on Decision Errors—Wildlife Risk Assessment

(1)	Determine the range of the parameters of interest	Analytical results for historical sediment samples have been reviewed and compiled in a database from which the potential ranges of certain contaminant concentrations have been derived. However, the quality and coverage of the samples in the historical database are not sufficient to fully define the expected range of contaminants in surface sediment at the site.
(2)	Identify the decision errors and choose a null hypothesis	The key decision error is an understatement of risk (that is, no risk identified when risk is actually present); therefore, sufficient samples need to be collected to allow for higher confidence in the null hypothesis. The PARCC criteria listed in the QAPP and the minimum detection limits listed in Table A-3 will be used to evaluate the usability of analytical data in making decisions about potential risk. Analyte-specific accuracy and precision ranges are shown in the QAPP. The project completeness goal is set at 90 percent. Because the error for precision and accuracy is on average about 30 percent, the consequences of decision errors based on sample results less than half the specified detection levels or greater than twice the specified detection levels are expected to be relatively small.
(3)	Specify a range of possible values of the parameter of interest where the consequences of decision error are relatively minor	The risk assessments will provide multiple descriptors of risk, and the uncertainty analysis portion of the risk assessments will address the range of possible values influencing overall decisions regarding risk.
(4)	Assign probability values to points above and below the action level that reflect the tolerable probability for the occurrence of decision errors.	Not applicable.

Step 7. Optimize the Design—Wildlife Risk Assessment

(1)	Review the DQO outputs and existing data	See Steps 1 to 6.
(2)	Develop general data collection design alternatives	The rationale for the sampling design is described in *Draft Phase I Sediment Sampling Approach and Rationale – Upper Columbia River CERCLA RI/FS* (CH2M HILL 2004).
(3)	Formulate the mathematical expressions necessary for each design alternative	The methods to be used in aggregating data and evaluating results for the wildlife risk assessment will be determined as part of the data evaluation process.
(4)	For each data collection design alternative, select the optimal sample size that satisfies the DQOs	All data collection designs require collection of a statistically valid number of samples, which can range from 3 to greater than 100 samples, depending on the desired power level for decision. Because the risk decisions will be made using a variety of spatial boundaries that cannot be determined at this time, it is necessary to collect a larger number of samples throughout the overall study area in order to provide sufficient samples for smaller subareas.
(5)	Select the most resource-effective data collection design that satisfies the DQOs	The rationale for the sampling design is described in *Draft Phase I Sediment Sampling Approach and Rationale – Upper Columbia River CERCLA RI/FS* (CH2M HILL 2004). This design includes sampling of surface sediment at regular intervals (transects) and positions along the length of UCR, with different distances between transects depending on river reach (closer spacing in upper reaches, farther spacing in lower reaches). The sampling program is summarized on Table A-2. Target analytes and geochemical parameters are listed in Table A-3.
(6)	Document the operational details and theoretical assumptions of the selected design in sampling and analysis plan	The FSP (Appendix B) provides the operational details and assumptions for the sediment sampling design.

A.3 References

CH2M HILL. 2004. *Draft Phase I Sediment Sampling Approach and Rationale – Upper Columbia River CERCLA RI/FS*. Prepared for USEPA Region 10, Seattle, WA. December 10, 2004.

National Oceanic and Atmospheric Administration (NOAA). 1999. *Screening Quick Reference Tables* (SQuiRTs). National Ocean Service, Office of Response and Restoration, Coastal Protection and Restoration Division, Seattle, WA. October 1999. http://response.restoration.noaa.gov/cpr/sediment/squirt/squirt.html

New York State Department of Environmental Conservation (NYSDEC). 1999. *Technical Guidance for Screening Contaminated Sediments*.

U.S. Environmental Protection Agency (USEPA). 2000. *Data Quality Objectives Process for Hazardous Waste Site Investigations*. EPA QA/G-4HW Final.

–––. 2004. *National Sediment Quality Survey*. Appendix D, Screening Values for Chemicals Evaluated. http://www.epa.gov/waterscience/cs/guidelines.htm. Updated December 10, 2004.

Washington State Department of Ecology (Ecology). 1997. *Creation and Analysis of Freshwater Sediment Quality Values in Washington State*. Publication 97-323a.

TABLE A-1
Phase I Remedial Investigation Data Quality Objectives for Other Data Uses
Upper Columbia River RI/FS

Problem Statement	Identify the Decision	Inputs to Decisions	Study Boundaries	Decision Rule	Acceptable Limits on Decision Errors	Optimized Sampling Design
Source Identification						
Potential sources of sediment contaminants in the UCR have not been fully established.	Identify potential primary sources of sediment contaminants.	Release information from upstream UCR industry and operations Available process and historical information from the facilities Review of industry-related chemical literature All Phase I analytical results	Study boundaries are limited to the UCR Site; however, primary sources have been determined to be present north of the international border and may also be present in tributaries. These areas will not be sampled as part of Phase I.	If contaminants found in sediment are similar to chemicals/materials managed or discharged from an upstream UCR operation, that operation is a potential primary source; otherwise the operation is not a potential source.	Decision is to be made using quantitative and qualitative data.	Sample design described for human and ecological risk assessments in Section A.2 and detailed in Sections 4.2 through 4.5 of the FSP (Appendix B of this QAPP).
Nature and Extent of Contaminants in River Sediments						
To adequately characterize impacts to public health and the environment, constituents that are most likely to contribute to risk need to be evaluated during the RI.	Confirm list of COIs for sediment.	Release information from upstream industry and operations Available process and historical information from the facilities Review of industry-related chemical literature Analytical results from prior investigations, including the PSI and ESI All Phase I analytical results Appropriate benchmark or screening levels for sediment, including background concentrations, as developed for risk assessment COI selection process, as developed for risk assessment	UCR site; may be subdivided according to results of risk assessments and Phase I analytical results.	Decision rules for COI identification will be developed as part of risk assessment process.	Decision is to be made using quantitative and qualitative data.	Sample design described for human and ecological risk assessments in Section A.2 and detailed in Sections 4.2 through 4.5 of the FSP (Appendix B of this QAPP).
To adequately characterize impacts on public health and the environment, the longitudinal, transverse, and vertical distributions of COIs need to be evaluated during the RI.	Identify longitudinal and transverse distribution of COIs in sediment along length of UCR. Identify vertical distribution of COIs in sediment at selected locations along length of UCR.	Analytical results of sufficient quality for historical surface and subsurface sediment samples All Phase I surface sediment analytical results Phase I subsurface sediment analytical results Sediment thickness measurements at core locations Longitudinal and transverse variability information Appropriate benchmark or screening levels for sediment, as developed for risk assessment	UCR site; may be subdivided according to results of risk assessment and Phase I analytical results.	If a COI in sediment poses potential unacceptable risk, further evaluation and delineation may be required to determine extent; otherwise, further evaluation and delineation may not be required.	Decision is to be made using quantitative and qualitative data.	Sample design described for human and ecological risk assessments in Section A.2 and detailed in Sections 4.2 through 4.5 of the FSP (Appendix B of this QAPP). The surface sediment results cannot be used to gauge vertical distribution of COIs. To accommodate this DQO, a sampling design that incorporates collection of sediment cores at 13 locations along the former river channel has been developed. Each sediment core will be divided into samples representing the 0- to 6- and 6- to 12-inch intervals, and every 2 feet below 12 inches until the core bottom is reached. An expanded analytical suite (includes dioxins/ furans) will be used for samples collected from seven core locations to evaluate the apparent relationship between dioxins/furans and the elevated total organic carbon (TOC)

TABLE A-1
Phase I Remedial Investigation Data Quality Objectives for Other Data Uses
Upper Columbia River RI/FS

Problem Statement	Identify the Decision	Inputs to Decisions	Study Boundaries	Decision Rule	Acceptable Limits on Decision Errors	Optimized Sampling Design
						concentrations that occur downstream from Marcus Flats. Two of these cores will be taken at locations above Marcus Flats, and five will be taken at locations below Marcus Flats. The sampling program for cores is summarized in Table A-2. Target analytes and geochemical parameters are listed in Table A-3.
Describe Fate and Transport of Contaminants in River Sediment						
Contaminated sediments and slag in the UCR may be eroded and transported to different areas of the site.	Determine which portions of the study area pose potential risk and are susceptible to erosion under the range of hydraulic conditions that are present in the UCR.	Conceptual hydrologic model Historical analytical data, including suspended sediment data (TSS, TOC, particle size, and COI concentrations) Particle size, particle density, and shape analyses Slag weathering information All Phase I surface sediment analytical results Phase I subsurface sediment analytical results Sediment thickness measurements at core locations COI distribution relative to particle size and material type (slag versus mineral) and vertical trend analysis Critical erosion velocities	UCR site; may be subdivided according to results of risk assessment and Phase I analytical results.	If contaminated sediments pose potential risk and are located in areas that can be eroded, remedial action alternatives will need to consider potential for sediment movement; otherwise, remedial action alternatives for the area do not need to consider potential for sediment movement.	Decision is to be made using quantitative and qualitative data.	Sample design described for human and ecological risk assessments in Section A.2 and detailed in Sections 4.2 through 4.5 of the FSP (Appendix B of this QAPP).
Contaminants in sediments and slag may be mobilized and/or transformed in such a way that other media, receptor populations, or downstream areas become contaminated at levels that pose risk.	Determine whether contaminated sediments may act as potential sources of COIs that may be remobilized to affect other media, receptor populations, or downstream areas at levels that pose risk.	All Phase I surface sediment analytical results Phase I subsurface sediment analytical results Slag weathering information COI fate and bioavailability characteristics derived from literature Conceptual hydrologic model Geochemical parameter measurements	UCR site; may be subdivided according to results of risk assessment and Phase I analytical results.	If COIs are potentially mobile under typical UCR conditions and are shown to pose unacceptable risk at the concentrations observed, assess the need to evaluate the presence of COIs in other media and take potential mobility into consideration during subsequent evaluations; otherwise, other media evaluations do not need to consider sediment as a potential source and remedial action alternatives for the area do not need to consider COI mobility.	Decision is to be made using quantitative and qualitative data.	Sample design described for human and ecological risk assessments in Section A.2 and detailed in Sections 4.2 through 4.5 of the FSP (Appendix B of this QAPP), and sampling design for vertical extent described above.

TABLE A-1
Phase I Remedial Investigation Data Quality Objectives for Other Data Uses
Upper Columbia River RI/FS

Problem Statement	Identify the Decision	Inputs to Decisions	Study Boundaries	Decision Rule	Acceptable Limits on Decision Errors	Optimized Sampling Design
Remedial Action Alternatives Development						
For areas demonstrating unacceptable risk during the RI, early information is needed to allow evaluation of potential remedial action alternatives for early action and/or for the feasibility study (FS).	Determine whether the size and physical, chemical, or biological characteristics of the areas demonstrating unacceptable risk lend themselves to particular remedial action alternatives or to early action.	Characteristics of the physical, chemical, and biological setting that would affect chemical conversion and transport processes in the areas posing risk Estimated volumes of contaminated sediment derived from field measurements, bathymetric data, sub-bottom profiling, and COI distribution (longitudinal, transverse and vertical) information for sediment in areas posing risk Particle size distribution and TOC concentrations	Defined areas where risk is determined to be unacceptable.	No decision rules required in this phase for this data collection activity. This information will be used as preliminary input for subsequent phases.	Not applicable.	Sample designs for risk assessment samples area described in Sections 4.2 through 4.5 of the FSP, and sampling design for vertical extent described above.
Investigation-Derived Waste Disposal						
Information is needed to characterize investigation-derived waste for disposal.	Determine whether investigation-derived waste is hazardous for disposal purposes.	Analytical results for samples collected from accumulated investigation-derived wastes Hazardous and dangerous waste threshold values Disposal contractor requirements	Containers used to store investigation-derived waste.	If the investigation-derived waste is characterized as hazardous or dangerous, it will be disposed of in accordance with federal and state laws; otherwise, it will be disposed of as solid waste.	Not applicable.	Representative samples will be collected from each container of investigation-derived waste. Samples from multiple containers of the same waste will be composited together for analysis. Samples will be analyzed for CLP pesticides and aroclors, CLP SVOCs, TAL metals (plus uranium), dioxins and furans, TCLP metals, TCLP SVOCs, and TCLP pesticides.

CLP = Contract Laboratory Program
ESI = expanded site investigation
COI = constituent of interest
PSI = preliminary site investigation
SVOC= semivolatile organic compound
TAL = target analyte list
TOC = total organic carbon
TSS = total suspended solids

TABLE A-2
Summary of Phase I Sediment Sampling Program
Upper Columbia River RI/FS

Sample Type/Interval	Subdivision	Sample Type	Data Uses	Analytical Suite	Quantity
Sediment					
Beach (0 to 10 or 15 cm[a])	Standard Beach Composites	Composites made up of samples taken from three specified elevations on standard beach	Human health risk assessment Wildlife risk assessment Source identification Transverse and longitudinal extent Fate and transport evaluation	Standard Suite—TAL metals (plus U), TCL SVOCs, TCL pesticides/ PCB aroclors, particle size, total organic carbon Dioxins/furans	36 composite samples (12 beaches, 3 composite samples per beach)
	Selected Beach[b] Discrete	Discrete samples from specified elevations on selected beaches	Human health risk assessment Wildlife risk assessment Source identification Transverse and longitudinal extent Fate and transport evaluation	Standard Suite—TAL metals (plus U), TCL SVOCs, TCL pesticides/ PCB aroclors, particle size, total organic carbon	27 discrete samples (3 beaches, 9 discrete samples per beach)
	Selected Beach[b] Composites	Composites made up of samples taken from three specified elevations on selected beach	Human health risk assessment Wildlife risk assessment Source identification Transverse and longitudinal extent Fate and transport evaluation	Dioxins/furans	9 composite samples (3 beaches, 3 composite samples per beach)
	Selected Beach[b] Fractionated Composites	Particle size-based fractions (between 2 and 0.062 μm, and less than 0.062 μm) obtained from single composite made from portions of nine discrete samples taken at each selected beach	Human health risk assessment	Standard Suite—TAL metals (plus U), TCL SVOCs, TCL pesticides/ PCB aroclors, total organic carbon	6 fractionated composite samples (3 beaches, 1 composite per beach divided into 2 particle-size-based fractions)

TABLE A-2
Summary of Phase I Sediment Sampling Program
Upper Columbia River RI/FS

Sample Type/Interval	Subdivision	Sample Type	Data Uses	Analytical Suite	Quantity
Baseline (0 to 10 or 15 cm)[a]	Select and Standard Transects	Discrete samples from periodically exposed and submerged sediment along standard transects and transects in focus areas and fish sampling areas	Benthic risk assessment Wildlife risk assessment Source identification Transverse and longitudinal extent Fate and transport evaluation	Standard Suite—TAL metals (plus U), TCL SVOCs, TCL pesticides/ PCB aroclors, total organic carbon, particle size	205 samples
Bioassay (0 to 10 or 15 cm[a])	Transect	Discrete samples from submerged sediment along transects	Benthic risk assessment Source identification Transverse and longitudinal extent Fate and transport evaluation	Bioassay Suite—TAL metals (plus U), TCL pesticides/ PCB aroclors, TCL SVOCs, particle size, total organic carbon, AVS/SEM, bioassay	49 samples
	Other	Discrete samples from submerged sediment	Benthic risk assessment Source identification Transverse and longitudinal extent Fate and transport evaluation	Bioassay Suite—TAL metals (plus U), TCL pesticides/ PCB aroclors, TCL SVOCs, particle size, total organic carbon, AVS/SEM, bioassay	1 sample
	Reference	Discrete samples from submerged sediment in reference areas	Benthic risk assessment Source identification Transverse and longitudinal extent Fate and transport evaluation	Bioassay Suite—TAL metals (plus U), TCL pesticides/ PCB aroclors, TCL SVOCs, particle size, total organic carbon, AVS/SEM, bioassay	6 samples
Tributary Mouth (0 to 10 or 15 cm)[a]	Tributary Mouth	Discrete samples from submerged sediment in mouths of tributaries	Benthic risk assessment Wildlife risk assessment Source identification Transverse and longitudinal extent Fate and transport evaluation	Standard Suite—TAL metals (plus U), TCL SVOCs, TCL pesticides/ PCB aroclors, total organic carbon, particle size	11 samples

TABLE A-2
Summary of Phase I Sediment Sampling Program
Upper Columbia River RI/FS

Sample Type/Interval	Subdivision	Sample Type	Data Uses	Analytical Suite	Quantity
Core Samples (0 to 6 in, 6 to 12 in, every 2 feet thereafter to bottom of core)	**Standard** Core	Core interval	Vertical distribution Fate and transport evaluation	**Standard Suite**—TAL metals (plus U), TCL SVOCs, TCL pesticides/ PCB aroclors, total organic carbon, particle size	36 samples (6 locations, maximum 6 samples per location)
	Select Core[c]	Core interval	Vertical distribution Fate and transport evaluation	**Standard Suite**—TAL metals (plus U), TCL SVOCs, TCL pesticides/ PCB aroclors, particle size, total organic carbon Dioxins/furans	42 samples (7 locations, maximum 6 samples per location)
Pore Water					
Pore Water Isolated from Whole Sediment	UCR Bioassay	Pore water isolated from whole sediment obtained at all UCR bioassay locations	Benthic risk assessment	Dissolved TAL metals (plus U)	50 samples
	Reference	Pore water isolated from whole sediment obtained at all reference locations	Benthic risk assessment	Dissolved TAL metals (plus U)	6 samples
Investigation-Derived Waste					
Solids		Composites representing all waste containers	Waste characterization	TAL metals (plus U), TCL SVOCs, TCL pesticides/ PCB aroclors, dioxins/furans, TCLP metals, TCLP SVOCs, TCLP pesticides	1 to 3 samples per shipment to waste disposal facility (assume 2 shipments, one from

TABLE A-2
Summary of Phase I Sediment Sampling Program
Upper Columbia River RI/FS

Sample Type/Interval	Subdivision	Sample Type	Data Uses	Analytical Suite	Quantity

[a] Sample should be inclusive of biologically active zone within 15 cm of surface.
[b] Northport City Boat Launch, Kettle Falls Swim Beach, Columbia Campground Beach.
[c] Cores taken at RM 734, 715, 704, 692, 661, 637, and 605.

AVS/SEM = acid volatile sulfides/simultaneously extracted metals
cm = centimeter
ft = foot
SVOC = semivolatile organic compound
TAL = Target Analyte List
TCL = Target Compound List
TCLP = Toxicity Characteristic Leaching Procedure
U = uranium

TABLE A-3a

Sediment Target Analytes and Required Detection Limits – PCBs and Pesticides

Upper Columbia River RI/FS

Chemical Group	Analyte[a]	Units	Minimum Potential Regulatory Level[b]	CLP Detection Limit[c]
PCBs	**Aroclor-1016**	ug/kg	1.54	33
PCBs	Aroclor-1221	ug/kg	Not Listed	67
PCBs	Aroclor-1232	ug/kg	Not Listed	33
PCBs	**Aroclor-1242**	ug/kg	0.533	33
PCBs	**Aroclor-1248**	ug/kg	0.533	33
PCBs	**Aroclor-1254**	ug/kg	0.533	33
PCBs	**Aroclor-1260**	ug/kg	0.533	33
Pesticides	4,4'-DDD	ug/kg	96	3.3
Pesticides	4,4'-DDE	ug/kg	20	3.3
Pesticides	4,4'-DDT	ug/kg	19	3.3
Pesticides	2,4'-DDD	ug/kg	1.22	NA
Pesticides	2,4-DDE	ug/kg	2.07	NA
Pesticides	2,4'-DDT	ug/kg	1.19	NA
Pesticides	Oxychlordane	ug/kg	Not Listed	NA
Pesticides	trans-nonarclor	ug/kg	Not Listed	NA
Pesticides	cis-nonarclor	ug/kg	Not Listed	NA
Pesticides	**Aldrin**	ug/kg	0.0408	1.7
Pesticides	**alpha-BHC**	ug/kg	0.32	1.7
Pesticides	alpha-Chlordane	ug/kg	2.26	1.7
Pesticides	**beta-BHC**	ug/kg	0.32	1.7
Pesticides	**delta-BHC**	ug/kg	0.32	1.7
Pesticides	**Dieldrin**	ug/kg	0.0439	3.3
Pesticides	Endosulfan I	ug/kg	290	1.7
Pesticides	Endosulfan II	ug/kg	1400	3.3
Pesticides	Endosulfan sulfate	ug/kg	Not Listed	3.3
Pesticides	**Endrin**	ug/kg	2.22	3.3
Pesticides	Endrin aldehyde	ug/kg	Not Listed	3.3
Pesticides	Endrin ketone	ug/kg	Not Listed	3.3
Pesticides	**gamma-BHC (Lindane)**	ug/kg	0.94	1.7
Pesticides	gamma-Chlordane	ug/kg	2.26	1.7
Pesticides	**Heptachlor**	ug/kg	0.408	1.7
Pesticides	**Heptachlor epoxide**	ug/kg	0.6	1.7
Pesticides	Methoxychlor	ug/kg	1900	17
Pesticides	**Toxaphene**	ug/kg	5.08	170

[a] Bold font indicates CLP detection limit for analyte is above lowest potential regulatory limit.

[b] Potential regulatory values considered are listed in Table A-4.

[c] Standard detection limits are listed; lower limits are achievable but are laboratory specific.

CLP = Contract Laboratory Program

NA = not applicable (analyte is not typically part of CLP)

PCB = polychlorinated biphenyl

ug/kg = microgram per kilogram

TABLE A-3b
Sediment Target Analytes and Required Detection Limits – Metals
Upper Columbia River RI/FS

Chemical Group	Analyte[a]	Units	Minimum Potential Regulatory Level[b]	CLP Detection Limit[c]
Metals	Aluminum	mg/kg	2600	20
Metals	**Antimony**	mg/kg	0.16	6
Metals	**Arsenic**	mg/kg	0.12	1
Metals	**Barium**	mg/kg	0.7	2
Metals	**Beryllium**	mg/kg	0.46	0.5
Metals	**Cadmium**	mg/kg	0.1	0.5
Metals	Calcium	mg/kg	Not Listed	500
Metals	Chromium	mg/kg	7	1
Metals	Cobalt	mg/kg	10	5
Metals	Copper	mg/kg	10	2.5
Metals	Iron	mg/kg	9900	10
Metals	**Lead**	mg/kg	0.04	1
Metals	Magnesium	mg/kg	Not Listed	500
Metals	Manganese	mg/kg	400	1.5
Metals	Mercury	mg/kg	0.13	0.1
Metals	Nickel	mg/kg	9.9	4
Metals	Potassium	mg/kg	Not Listed	500
Metals	**Selenium**	mg/kg	0.29	3.5
Metals	**Silver**	mg/kg	0.5	1
Metals	Sodium	mg/kg	Not Listed	500
Metals	Thallium	mg/kg	Not Listed	2.5
Metals	**Uranium**	mg/kg	8	5
Metals	Vanadium	mg/kg	50	5
Metals	Zinc	mg/kg	7	6

[a] Bold font indicates CLP detection limit for analyte is above lowest potential regulatory limit.
[b] Potential regulatory values considered are listed in Table A-4.
[c] Standard detection limits are listed; lower limits are achievable but are laboratory specific.

CLP = Contract Laboratory Program
NA = not applicable
mg/kg = milligram per kilogram

TABLE A-3c
Sediment Target Analytes and Required Detection Limits – Dioxins/Furans
Upper Columbia River RI/FS

Chemical Group	Analyte[a]	Units	Minimum Potential Regulatory Level[b]	CLP Detection Limit[c]
Dioxins/Furans	1,2,3,4,6,7,8-Heptachlorodibenzofuran	ug/kg	3.76	0.005
Dioxins/Furans	1,2,3,4,6,7,8-Heptachlorodibenzo-p-dioxin	ug/kg	Not Listed	0.005
Dioxins/Furans	1,2,3,4,7,8,9-Heptachlorodibenzofuran	ug/kg	3.76	0.005
Dioxins/Furans	1,2,3,4,7,8-Hexachlorodibenzofuran	ug/kg	0.0144	0.005
Dioxins/Furans	1,2,3,4,7,8-Hexachlorodibenzo-p-dioxin	ug/kg	Not Listed	0.005
Dioxins/Furans	1,2,3,6,7,8-Hexachlorodibenzofuran	ug/kg	0.0144	0.005
Dioxins/Furans	1,2,3,6,7,8-Hexachlorodibenzo-p-dioxin	ug/kg	Not Listed	0.005
Dioxins/Furans	1,2,3,7,8,9-Hexachlorodibenzofuran	ug/kg	0.0144	0.005
Dioxins/Furans	1,2,3,7,8,9-Hexachlorodibenzo-p-dioxin	ug/kg	Not Listed	0.005
Dioxins/Furans	1,2,3,7,8-Pentachlorodibenzofuran	ug/kg	0.00815	0.005
Dioxins/Furans	**1,2,3,7,8-Pentachlorodibenzo-p-dioxin**	ug/kg	0.00288	0.005
Dioxins/Furans	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	ug/kg	Not Listed	0.005
Dioxins/Furans	2,3,4,6,7,8-Hexachlorodibenzofuran	ug/kg	0.0144	0.005
Dioxins/Furans	**2,3,4,7,8-Pentachlorodibenzofuran**	ug/kg	0.000972	0.005
Dioxins/Furans	2,3,7,8-Tetrachlorodibenzofuran	ug/kg	0.00408	0.001
Dioxins/Furans	**2,3,7,8-Tetrachlorodibenzo-p-dioxin**	ug/kg	0.000047	0.001
Dioxins/Furans	Octachlorodibenzodioxin	ug/kg	Not Listed	0.01
Dioxins/Furans	Octachlorodibenzofuran	ug/kg	Not Listed	0.011

[a] Bold font indicates CLP detection limit for analyte is above lowest potential regulatory limit.
[b] Potential regulatory values considered are listed in Table A-4.
[c] Standard detection limits are listed; lower limits are achievable but are laboratory specific.

CLP = Contract Laboratory Program
NA = not applicable
ug/kg = microgram per kilogram

TABLE A-3d
Sediment Target Analytes and Required Detection Limits – SVOCs
Upper Columbia River RI/FS

Chemical Group	Analyte[a]	Units	Minimum Potential Regulatory Level[b]	CLP Detection Limit[c]
SVOCs	1,1'-Biphenyl	ug/kg	110000	330
SVOCs	2,2'-oxybis(1-Chloropropane)	ug/kg	2500	330
SVOCs	2,4,5-Trichlorophenol	ug/kg	4000000	830
SVOCs	2,4,6-Trichlorophenol	ug/kg	15900	330
SVOCs	2,4-Dichlorophenol	ug/kg	120000	330
SVOCs	2,4-Dimethylphenol	ug/kg	800000	330
SVOCs	2,4-Dinitrophenol	ug/kg	80000	830
SVOCs	2,4-DNT	ug/kg	80000	330
SVOCs	2,6-DNT	ug/kg	40000	330
SVOCs	2-Chloronapthalene	ug/kg	3200000	330
SVOCs	2-Chlorophenol	ug/kg	200000	330
SVOCs	2-Methylnaphthalene	ug/kg	Not Listed	330
SVOCs	2-Methylphenol	ug/kg	2000000	330
SVOCs	2-Nitroaniline	ug/kg	2400	830
SVOCs	2-Nitrophenol	ug/kg	Not Listed	330
SVOCs	3,3'-Dichlorobenzidine	ug/kg	389	330
SVOCs	3-Nitroaniline	ug/kg	Not Listed	830
SVOCs	4,6-Dinitro-2-methylphenol	ug/kg	Not Listed	830
SVOCs	4-Bromophenyl-phenylether	ug/kg	130000	330
SVOCs	4-Chloro-3-methylphenol	ug/kg	Not Listed	330
SVOCs	4-Chloroaniline	ug/kg	160000	330
SVOCs	4-Chlorophenyl-phenylether	ug/kg	Not Listed	330
SVOCs	4-Methylphenol	ug/kg	760	330
SVOCs	4-Nitroaniline	ug/kg	Not Listed	830
SVOCs	4-Nitrophenol	ug/kg	2480000	830
SVOCs	**Acenaphthene**	ug/kg	6.71	330
SVOCs	**Acenaphthylene**	ug/kg	5.87	330
SVOCs	Acetaphenone	ug/kg	4000000	330
SVOCs	**Anthracene**	ug/kg	10	330
SVOCs	Atrazine	ug/kg	788	330
SVOCs	Benzaldehyde	ug/kg	4000000	330
SVOCs	**Benzo (a) anthracene**	ug/kg	15.72	330
SVOCs	**Benzo (a) pyrene**	ug/kg	21.6	330
SVOCs	**Benzo (b) fluoranthene**	ug/kg	21.6	330
SVOCs	**Benzo (g,h,i) perylene**	ug/kg	300	330
SVOCs	**Benzo (k) fluoranthene**	ug/kg	21.6	330
SVOCs	Bis (2-chloroethoxy) methane	ug/kg	Not Listed	330
SVOCs	**Bis (2-chloroethyl) ether**	ug/kg	159	330
SVOCs	**Bis (2-ethylhexyl) phthalate**	ug/kg	182	330
SVOCs	**Butyl benzylphthalate**	ug/kg	260	330
SVOCs	Caprolactam	ug/kg	20000000	330
SVOCs	Carbazole	ug/kg	923	330
SVOCs	**Chrysene**	ug/kg	13.8	330
SVOCs	**Dibenzo (a,h) anthracene**	ug/kg	6.22	330
SVOCs	Dibenzofuran	ug/kg	540	330

TABLE A-3d
Sediment Target Analytes and Required Detection Limits – SVOCs
Upper Columbia River RI/FS

Chemical Group	Analyte[a]	Units	Minimum Potential Regulatory Level[b]	CLP Detection Limit[c]
SVOCs	Diethyl phthalate	ug/kg	32000000	330
SVOCs	Dimethyl phthalate	ug/kg	400000000	330
SVOCs	**Di-n-butylphthalate**	ug/kg	103	330
SVOCs	Di-n-octylphthalate	ug/kg	6200	330
SVOCs	**Fluoranthene**	ug/kg	31.46	330
SVOCs	**Fluorene**	ug/kg	10	330
SVOCs	**Hexachlorobenzene**	ug/kg	22	330
SVOCs	**Hexachlorobutadiene**	ug/kg	11	330
SVOCs	Hexachlorocyclopentadiene	ug/kg	280000	330
SVOCs	Hexachloroethane	ug/kg	12500	330
SVOCs	**Indeno (1,2,3-c,d) pyrene**	ug/kg	17.32	330
SVOCs	Isophorone	ug/kg	184000	330
SVOCs	**Naphthalene**	ug/kg	14.65	330
SVOCs	Nitrobenzene	ug/kg	20000	330
SVOCs	n-Nitrosodi-n-propylamine	ug/kg	Not Listed	330
SVOCs	n-Nitrosodiphenylamine	ug/kg	35700	330
SVOCs	**Pentachlorophenol**	ug/kg	360	830
SVOCs	**Phenanthrene**	ug/kg	18.73	330
SVOCs	Phenol	ug/kg	420	330
SVOCs	**Pyrene**	ug/kg	44.27	330

[a] Bold font indicates CLP detection limit for analyte is above lowest potential regulatory limit.
[b] Potential regulatory values considered are listed in Table A-4.
[c] Standard detection limits are listed; lower limits are achievable but are laboratory specific.

CLP = Contract Laboratory Program
NA = not applicable
ug/kg = microgram per kilogram

TABLE A-3e

Sediment Target Analytes and Required Detection Limits – Bioassay and Other Parameters

Upper Columbia River RI/FS

Chemical Group	Analyte	CLP Detection Limit	Lowest Potential Regulatory Value
Geochemical and Other Parameters	Acid volatile sulfides/simultaneously extracted metals	NA	NA
	Total organic carbon	NA	NA
	Particle size	NA	NA
Bioassay	10-Day sediment toxicity test with chironomus tentans	NA	NA
	7-Day sediment toxicity test with ceriodaphnia dubia	NA	NA
	28-Day sediment toxicity test with hyalella azteca		

CLP = Contract Laboratory Program

NA = not applicable

TABLE A-3f

Pore Water Target Analytes and Required Detection Limits

Upper Columbia River RI/FS

Chemical Group	Analyte[a]	Units	Chronic Freshwater AWQC	CLP Detection Limit[b]	CLP Detection Limit[c]
Metals	**Aluminum**	ug/L	87		200
Metals	Antimony	ug/L	30	2	60
Metals	Arsenic	ug/L	150	1	10
Metals	Barium	ug/L	Not Listed	10	200
Metals	Beryllium	ug/L	5.3	1	5
Metals	Cadmium	ug/L	2.2	1	5
Metals	Calcium	ug/L	Not Listed		5000
Metals	Chromium	ug/L	210	2	10
Metals	Cobalt	ug/L	Not Listed	1	50
Metals	Copper	ug/L	12	2	25
Metals	Iron	ug/L	1000		100
Metals	Lead	ug/L	3.2	1	10
Metals	Magnesium	ug/L	Not Listed		5000
Metals	Manganese	ug/L	Not Listed	1	15
Metals	Mercury	ug/L	0.77		0.2
Metals	Nickel	ug/L	160	1	40
Metals	Potassium	ug/L	Not Listed		5000
Metals	Selenium	ug/L	5	5	35
Metals	**Silver**	ug/L	0.12	1	10
Metals	Sodium	ug/L	Not Listed		5000
Metals	Thallium	ug/L	40	1	25
Metals	Uranium	ug/L	Not Listed	NA	NA
Metals	Vanadium	ug/L	Not Listed	1	5
Metals	Zinc	ug/L	120	2	6

[a] Bold font indicates CLP detection limit for analyte is above lowest potential regulatory limit.

[b] ICP/MS detection limits are listed; lower limits are achievable but are laboratory specific.

[c] ICP/AES detection limits are listed; lower limits are achievable but are laboratory specific.

AWQC = Ambient Water Quality Criteria

CLP = Contract Laboratory Program

ICP/AES = Inductively coupled plasma/atomic emission spectrophotometry

ICP/MS = inductively coupled plasma/mass spectrometry

NA = not applicable (analyte is not typically part of CLP)

ug/L = microgram per liter

TABLE A-4
Potential Regulatory Values for UCR Sediment
Upper Columbia River RI/FS

CAS Number	Chemical Group	Analyte	Units	Minimum Potential Regulatory Level	Colville Confederated Tribes Sediment Cleanup Levels CTLOC Chapter 4-16, Appendix C Protection of Sediment-Dwelling Organisms[a]	Colville Confederated Tribes Sediment Cleanup Levels CTLOC Chapter 4-16, Appendix C Protection of Human Health[a]	USEPA National Sediment Quality Survey Screening Values[c] SQCoc	USEPA National Sediment Quality Survey Screening Values[c] ER-L	USEPA National Sediment Quality Survey Screening Values[c] ER-M	USEPA National Sediment Quality Survey Screening Values[c] AET-L	USEPA National Sediment Quality Survey Screening Values[c] AET-H	USEPA National Sediment Quality Survey Screening Values[c] SQALoc	USEPA National Sediment Quality Survey Screening Values[c] TEL	USEPA National Sediment Quality Survey Screening Values[c] PEL	Spokane Tribe of Indians Hazardous Substance Control Act, Sediment Cleanup Levels SLOC Resolution 2004-85, Appendix C Protective of Bottom-Dwelling Organisms
67562-39-4	Dioxins/Furans	1,2,3,4,6,7,8-Heptachlorodibenzofuran	ug/kg	3.76		3.76									
55673-89-7	Dioxins/Furans	1,2,3,4,7,8,9-Heptachlorodibenzofuran	ug/kg	3.76		3.76									
70648-26-9	Dioxins/Furans	1,2,3,4,7,8-Hexachlorodibenzofuran	ug/kg	0.0144		0.0144									
57117-44-9	Dioxins/Furans	1,2,3,6,7,8-Hexachlorodibenzofuran	ug/kg	0.0144		0.0144									
57117-41-6	Dioxins/Furans	1,2,3,7,8-Pentachlorodibenzofuran	ug/kg	0.00815		0.00815									
72918-21-9	Dioxins/Furans	1,2,3,7,8,9-Hexachlorodibenzofuran	ug/kg	0.0144		0.0144									
40321-76-4	Dioxins/Furans	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	ug/kg	0.00288		0.00288									
60851-34-5	Dioxins/Furans	2,3,4,6,7,8-Hexachlorodibenzofuran	ug/kg	0.0144		0.0144									
57117-31-4	Dioxins/Furans	2,3,4,7,8-Pentachlorodibenzofuran	ug/kg	0.000972		0.000972									
51207-31-9	Dioxins/Furans	2,3,7,8-Tetrachlorodibenzofuran	ug/kg	0.00408		0.00408									
1746-01-6	Dioxins/Furans	2,3,7,8-Tetrachlorodibenzo-p-dioxin	ug/kg	0.000047		0.000047									
7429-90-5	Metals	Aluminum	mg/kg	2600											
7440-36-0	Metals	Antimony	mg/kg	0.16						150	200				
7440-38-2	Metals	Arsenic	mg/kg	0.12	9.79			8.2	70	57	700		7.24	41.6	9.79
7440-39-3	Metals	Barium	mg/kg	0.7											
7440-41-7	Metals	Beryllium	mg/kg	0.46											
7440-43-9	Metals	Cadmium	mg/kg	0.10	0.99			1.2	9.6	5.1	9.6		0.68	4.21	0.99
7440-47-3	Metals	Chromium	mg/kg	7	43.4			81	370	260	270		52.3	160	43.4
7440-48-4	Metals	Cobalt	mg/kg	10											
7440-50-8	Metals	Copper	mg/kg	10	31.6			34	270	390	1300		18.7	108	31.6
7439-89-6	Metals	Iron	mg/kg	9900											
7439-92-1	Metals	Lead	mg/kg	0.04	35.8			46.7	218	450	660		30.2	112	35.8
7439-96-5	Metals	Manganese	mg/kg	400											
7439-97-6	Metals	Mercury	mg/kg	0.13000	0.18			0.15	0.71	0.59	2.1		0.13	0.7	0.18
7440-02-0	Metals	Nickel	mg/kg	9.9	22.7			20.9	51.6				15.9	42.8	22.7
7782-49-2	Metals	Selenium	mg/kg	0.29											
7440-22-4	Metals	Silver	mg/kg	0.5				1	3.7	6.1	6.1		0.73	1.77	
7440-61-1	Metals	Uranium	mg/kg	8											
7440-62-2	Metals	Vanadium	mg/kg	50											
7440-66-6	Metals	Zinc	mg/kg	7	121			150	410	410	1600		124	271	121
12674-11-2	PCBs	Aroclor-1016	ug/kg	1.54		1.54									
53469-21-9	PCBs	Aroclor-1242	ug/kg	0.533		0.533									
12672-29-6	PCBs	Aroclor-1248	ug/kg	0.533		0.533									
11097-69-1	PCBs	Aroclor-1254	ug/kg	0.533		0.533									
11096-82-5	PCBs	Aroclor-1260	ug/kg	0.533		0.533									
72-54-8	Pesticides	4,4'-DDD	ug/kg	96											
72-55-9	Pesticides	4,4'-DDE	ug/kg	20											
50-29-3	Pesticides	4,4'-DDT	ug/kg	19											
53-19-0	Pesticides	2,4'-DDD	ug/kg	1.22				1.58	27	16	43		1.22	7.8	
3424-82-6	Pesticides	2,4-DDE	ug/kg	2.07				2.2	27	9	15		2.07	374	
789-02-6	Pesticides	2,4'-DDT	ug/kg	1.19				1.58	27	34	34		1.19	4.7	
27304-13-8	Pesticides	Oxychlordane	ug/kg	Not listed											
39765-80-5	Pesticides	trans-nonachlor	ug/kg	Not listed											
5103-73-1	Pesticides	cis-nonachlor	ug/kg	Not listed											
309-00-2	Pesticides	Aldrin	ug/kg	0.0408		0.0408									
319-84-6	Pesticides	alpha-BHC	ug/kg	0.32									0.32	0.99	
319-85-7	Pesticides	beta-BHC	ug/kg	0.32									0.32	0.99	
319-86-8	Pesticides	delta-BHC	ug/kg	0.32								13000	0.32	0.99	
5103-71-9	Pesticides	alpha-Chlordane	ug/kg	2.26									2.26	4.79	
5103-74-2	Pesticides	gamma-Chlordane	ug/kg	2.26									2.26	4.79	
60-57-1	Pesticides	Dieldrin	ug/kg	0.0439	1.9	0.0439	11000					11000	0.72	4.3	1.9
959-98-8	Pesticides	Endosulfan I	ug/kg	290								290			
33213-65-9	Pesticides	Endosulfan II	ug/kg	1400								1400			
72-20-8	Pesticides	Endrin	ug/kg	2.22	2.22	172	4200					4200			2.22
76-44-8	Pesticides	Heptachlor	ug/kg	0.408		0.408									
1024-57-3	Pesticides	Heptachlor epoxide	ug/kg	0.6	2.47										2.47
58-89-9	Pesticides	gamma-BHC (Lindane)	ug/kg	0.94											2.37
72-43-5	Pesticides	Methoxychlor	ug/kg	1900								1900			
8001-35-2	Pesticides	Toxaphene	ug/kg	5.08		5.08						10000			

TABLE A-4
Potential Regulatory Values for UCR Sediment
Upper Columbia River RI/FS

CAS Number	Chemical Group	Analyte	Units	Minimum Potential Regulatory Level	Colville Confederated Tribes Sediment Cleanup Levels CTLOC Chapter 4-16, Appendix C Protection of Sediment-Dwelling Organisms[a]	Colville Confederated Tribes Sediment Cleanup Levels CTLOC Chapter 4-16, Appendix C Protection of Human Health[a]	USEPA National Sediment Quality Survey Screening Values[c] SQCoc	USEPA National Sediment Quality Survey Screening Values[c] ER-L	USEPA National Sediment Quality Survey Screening Values[c] ER-M	USEPA National Sediment Quality Survey Screening Values[c] AET-L	USEPA National Sediment Quality Survey Screening Values[c] AET-H	USEPA National Sediment Quality Survey Screening Values[c] SQALoc	USEPA National Sediment Quality Survey Screening Values[c] TEL	USEPA National Sediment Quality Survey Screening Values[c] PEL	Spokane Tribe of Indians Hazardous Substance Control Act, Sediment Cleanup Levels SLOC Resolution 2004-85, Appendix C Protective of Bottom-Dwelling Organisms
92-52-4	SVOCs	1,1'-Biphenyl	ug/kg	110000								110000			
108-60-1	SVOCs	2,2'-oxybis(1-Chloropropane)	ug/kg	2500											
95-95-4	SVOCs	2,4,5-Trichlorophenol	ug/kg	4000000											
88-06-2	SVOCs	2,4,6-Trichlorophenol	ug/kg	15900											
120-83-2	SVOCs	2,4-Dichlorophenol	ug/kg	120000											
105-67-9	SVOCs	2,4-Dimethylphenol	ug/kg	800000											
51-28-5	SVOCs	2,4-Dinitrophenol	ug/kg	80000											
121-14-2	SVOCs	2,4-DNT	ug/kg	80000											
606-20-2	SVOCs	2,6-DNT	ug/kg	40000											
91-58-7	SVOCs	2-Chloronapthalene	ug/kg	3200000											
95-57-8	SVOCs	2-Chlorophenol	ug/kg	200000											
95-48-7	SVOCs	2-Methylphenol	ug/kg	2000000											
88-74-4	SVOCs	2-Nitroaniline	ug/kg	2400											
91-94-1	SVOCs	3,3'-Dichlorobenzidine	ug/kg	389											
101-55-3	SVOCs	4-Bromophenyl-phenylether	ug/kg	130000								130000			
106-47-8	SVOCs	4-Chloroaniline	ug/kg	160000											
106-44-5	SVOCs	4-Methylphenol	ug/kg	760											
100-02-7	SVOCs	4-Nitrophenol	ug/kg	2480000											
83-32-9	SVOCs	Acenaphthene	ug/kg	6.71			130000	16	500	500	2000	130000	6.71	88.9	
208-96-8	SVOCs	Acenaphthylene	ug/kg	5.87				44	640	1300	1300		5.87	128	
98-86-2	SVOCs	Acetaphenone	ug/kg	4000000											
120-12-7	SVOCs	Anthracene	ug/kg	10	57.2			85.3	1100	960	13000		46.9	245	57.2
1912-24-9	SVOCs	Atrazine	ug/kg	788											
100-52-7	SVOCs	Benzaldehyde	ug/kg	4000000											
56-55-3	SVOCs	Benzo (a) anthracene	ug/kg	15.72				261	1600	1600	5100		74.8	693	108
50-32-8	SVOCs	Benzo (a) pyrene	ug/kg	21.6	150	21.6		430	1600	1600	3600		88.8	763	150
205-99-2	SVOCs	Benzo (b) fluoranthene	ug/kg	21.6		21.6				3600	9900				
191-24-2	SVOCs	Benzo (g,h,i) perylene	ug/kg	300											
207-08-9	SVOCs	Benzo (k) fluoranthene	ug/kg	21.6		21.6				3600	9900				
65-85-0	SVOCs	Benzoic acid	ug/kg	2910											
100-51-6	SVOCs	Benzyl alcohol	ug/kg	12000000											
111-91-1	SVOCs	Bis (2-chloroethoxy) methane	ug/kg	Not listed											
111-44-4	SVOCs	Bis (2-chloroethyl) ether	ug/kg	159											
39638-32-9	SVOCs	Bis (2-chloroisopropyl) ether	ug/kg	2500											
117-81-7	SVOCs	Bis (2-ethylhexyl) phthalate	ug/kg	182						1300	1900		182	2650	
85-68-7	SVOCs	Butyl benzylphthalate	ug/kg	260											
105-60-2	SVOCs	Caprolactam	ug/kg	20000000											
86-74-8	SVOCs	Carbazole	ug/kg	923											
218-01-9	SVOCs	Chrysene	ug/kg	13.8	166	13.8		384	2800	2800	9200		108	846	166
53-70-3	SVOCs	Dibenzo (a,h) anthracene	ug/kg	6.22				63.4	260	230	970		6.22	135	
132-64-9	SVOCs	Dibenzofuran	ug/kg	540						540	1700	200000			
84-66-2	SVOCs	Diethyl phthalate	ug/kg	32000000											
131-11-3	SVOCs	Dimethyl phthalate	ug/kg	400000000											
84-74-2	SVOCs	Di-n-butylphthalate	ug/kg	103						1400	1400	1100000			
117-84-0	SVOCs	Di-n-octylphthalate	ug/kg	6200						6200	6200				
206-44-0	SVOCs	Fluoranthene	ug/kg	31.46	423		620000	600	5100	2500	30000	620000	113	1494	423
86-73-7	SVOCs	Fluorene	ug/kg	10	77.4			19	540	540	3600	54000	21.2	144	77.4
118-74-1	SVOCs	Hexachlorobenzene	ug/kg	22						22	230				
87-68-3	SVOCs	Hexachlorobutadiene	ug/kg	11						11	270				
77-47-4	SVOCs	Hexachlorocyclopentadiene	ug/kg	280000											
67-72-1	SVOCs	Hexachloroethane	ug/kg	12500								100000			
193-39-5	SVOCs	Indeno (1,2,3-c,d) pyrene	ug/kg	17.32		21.6				690	2600				
78-59-1	SVOCs	Isophorone	ug/kg	184000											
91-57-6	SVOCs	2-Methylnaphthalene	ug/kg	Not listed											
91-20-3	SVOCs	Naphthalene	ug/kg	14.65	176			160	2100	2100	2700	47000	34.6	391	176
98-95-3	SVOCs	Nitrobenzene	ug/kg	20000											
621-64-7	SVOCs	n-Nitrosodi-n-propylamine	ug/kg	Not listed											
86-30-6	SVOCs	n-Nitrosodiphenylamine	ug/kg	35700											
87-86-5	SVOCs	Pentachlorophenol	ug/kg	360						360	690				

TABLE A-4
Potential Regulatory Values for UCR Sediment
Upper Columbia River RI/FS

CAS Number	Chemical Group	Analyte	Units	Minimum Potential Regulatory Level	Colville Confederated Tribes Sediment Cleanup Levels CTLOC Chapter 4-16, Appendix C Protection of Sediment-Dwelling Organisms[a]	Colville Confederated Tribes Sediment Cleanup Levels CTLOC Chapter 4-16, Appendix C Protection of Human Health[a]	USEPA National Sediment Quality Survey Screening Values[c] SQCoc	USEPA National Sediment Quality Survey Screening Values[c] ER-L	USEPA National Sediment Quality Survey Screening Values[c] ER-M	USEPA National Sediment Quality Survey Screening Values[c] AET-L	USEPA National Sediment Quality Survey Screening Values[c] AET-H	USEPA National Sediment Quality Survey Screening Values[c] SQALoc	USEPA National Sediment Quality Survey Screening Values[c] TEL	USEPA National Sediment Quality Survey Screening Values[c] PEL	Spokane Tribe of Indians Hazardous Substance Control Act, Sediment Cleanup Levels SLOC Resolution 2004-85, Appendix C Protective of Bottom-Dwelling Organisms
85-01-8	SVOCs	Phenanthrene	ug/kg	18.73	204		180000	240	1500	1500	6900	180000	86.7	544	204
108-95-2	SVOCs	Phenol	ug/kg	420						420	1200				
129-00-0	SVOCs	Pyrene	ug/kg	44.27	195			665	2600	3300	16000		153	1398	195

Note: Gray shading indicates value in terms of organic carbon (not dry weight).

[a] Values for DDT and toxaphene derived from guidelines available from the New York State Department of Environmental Conservation (NYSDEC), *Technical Guidance for Screening Contaminated Sediments*, 1999.

[b] NOAA SQuiRTs = NOAA Screening Quick Reference Tables (NOAA 1999).

[c] USEPA. 2004. National Sediment Quality Survey, Appendix D (http://www.epa.gov/waterscience/cs/guidelines.htm).

[d] Washington State Department of Ecology (Ecology). 1997. *Creation and Analysis of Freshwater Sediment Quality Values in Washington State.* Publication 97-323a.

[e] Washington State Department of Ecology (Ecology). http://www.ecy.wa.gov/biblio/0309088.html

2LAET = second lowest apparent effects threshold
AET = apparent effects threshold
AET-L = apparent effects threshold-low
AET-H = apparent effects threshold-high
ER-L = effects range-low
ER-M = effects range-median
LAET = lowest apparent effects threshold
PEL = probable effects level
SQALoc = sediment quality advisory level
SQCoc = USEPA draft sediment quality criteria
TEL = threshold effects level

mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram
DW = dry weight
PCB = polychlorinated biphenyl
OC = organic carbon
CAS = Chemical Abstracts Service

Ecology = Washington State Department of Ecology
CTLOC = Colville Tribes Law and Order Code
NOAA = National Oceanic and Atmospheric Administration
SLOC = Spokane Law and Order Code

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Potential Regulatory Values for UCR Sediment
Upper Columbia River RI/FS

CAS Number	Chemical Group	Analyte	Units	Spokane Tribe of Indians Hazardous Substance Control Act, Sediment Cleanup Levels SLOC Resolution 2004-85, Appendix B Protective of Human Health	NOAA SQuiRTs[b] Freshwater Sediment Background	NOAA SQuiRTs[b] Freshwater Sediment Lowest ARCs *H. azteca* TEL	NOAA SQuiRTs[b] Freshwater Sediment TEL	NOAA SQuiRTs[b] Freshwater Sediment PEL	NOAA SQuiRTs[b] Freshwater Sediment UET	Ecology[d] 2003 AETs *Hyalella* Mortality	Ecology[d] 2003 AETs *Chironomus* Growth	Ecology[d] 2003 AETs *Chironomus* Mortality	Ecology[d] 2003 AETs Microtox ® Lumin.	Ecology[e] 2003 LAET	Ecology[e] 2003 2LAET
67562-39-4	Dioxins/Furans	1,2,3,4,6,7,8-Heptachlorodibenzofuran	ug/kg												
55673-89-7	Dioxins/Furans	1,2,3,4,7,8,9-Heptachlorodibenzofuran	ug/kg												
70648-26-9	Dioxins/Furans	1,2,3,4,7,8-Hexachlorodibenzofuran	ug/kg												
57117-44-9	Dioxins/Furans	1,2,3,6,7,8-Hexachlorodibenzofuran	ug/kg												
57117-41-6	Dioxins/Furans	1,2,3,7,8-Pentachlorodibenzofuran	ug/kg												
72918-21-9	Dioxins/Furans	1,2,3,7,8,9-Hexachlorodibenzofuran	ug/kg												
40321-76-4	Dioxins/Furans	1,2,3,7,8-Pentachlorodibenzo-p-dioxin	ug/kg												
60851-34-5	Dioxins/Furans	2,3,4,6,7,8-Hexachlorodibenzofuran	ug/kg												
57117-31-4	Dioxins/Furans	2,3,4,7,8-Pentachlorodibenzofuran	ug/kg												
51207-31-9	Dioxins/Furans	2,3,7,8-Tetrachlorodibenzofuran	ug/kg												
1746-01-6	Dioxins/Furans	2,3,7,8-Tetrachlorodibenzo-p-dioxin	ug/kg												
7429-90-5	Metals	Aluminum	mg/kg	40000	2600	25500									
7440-36-0	Metals	Antimony	mg/kg	16	0.16				3	4.4	0.6	1.9	5.1	0.6	1.9
7440-38-2	Metals	Arsenic	mg/kg	0.12	1.1	10.8	5.9	17	17	200	31.4	50.9	123	31.4	50.9
7440-39-3	Metals	Barium	mg/kg	2800	0.7										
7440-41-7	Metals	Beryllium	mg/kg	80						2		0.46		0.46	
7440-43-9	Metals	Cadmium	mg/kg	20	0.1	0.58	0.6	3.53	3	9.1	5.6	2.39	2.9	2.39	2.9
7440-47-3	Metals	Chromium	mg/kg	200	7	36.29	37.3	90	95	348	133	133	95	95	133
7440-48-4	Metals	Cobalt	mg/kg	2400	10										
7440-50-8	Metals	Copper	mg/kg	1490	10	28.01	35.7	197	86	2010	829	619	1460	619	829
7439-89-6	Metals	Iron	mg/kg		9900	188400			40000						
7439-92-1	Metals	Lead	mg/kg	0.04	4	37	35	91.3	127	1310	1160	335	431	335	431
7439-96-5	Metals	Manganese	mg/kg	1870	400	630			1100						
7439-97-6	Metals	Mercury	mg/kg	12000	4		0.17	0.49	0.56	3.74	3.04	0.8	3.04	0.8	3.04
7440-02-0	Metals	Nickel	mg/kg	800	9.9	19.51	18	35.9	43	113	113	113	53.1	53.1	113
7782-49-2	Metals	Selenium	mg/kg	200000	0.29										
7440-22-4	Metals	Silver	mg/kg	200	0.5				4.5	3.5	3.3	3.3	0.545	0.545	3.5
7440-61-1	Metals	Uranium	mg/kg	8											
7440-62-2	Metals	Vanadium	mg/kg	280	50										
7440-66-6	Metals	Zinc	mg/kg	12000	7	98	123.1	315	520	4150	1080	683	1130	683	1080
12674-11-2	PCBs	Aroclor-1016	ug/kg	2800											
53469-21-9	PCBs	Aroclor-1242	ug/kg												
12672-29-6	PCBs	Aroclor-1248	ug/kg												
11097-69-1	PCBs	Aroclor-1254	ug/kg	800						1060	294	340	230	230	294
11096-82-5	PCBs	Aroclor-1260	ug/kg							500	138	184	140	138	140
72-54-8	Pesticides	4,4'-DDD	ug/kg							96		96		96	
72-55-9	Pesticides	4,4'-DDE	ug/kg							21		20		21	
50-29-3	Pesticides	4,4'-DDT	ug/kg							19				19	
53-19-0	Pesticides	2,4'-DDD	ug/kg												
3424-82-6	Pesticides	2,4-DDE	ug/kg												
789-02-6	Pesticides	2,4'-DDT	ug/kg												
27304-13-8	Pesticides	Oxychlordane	ug/kg												
39765-80-5	Pesticides	trans-nonachlor	ug/kg												
5103-73-1	Pesticides	cis-nonachlor	ug/kg												
309-00-2	Pesticides	Aldrin	ug/kg	10.3					40						
319-84-6	Pesticides	alpha-BHC	ug/kg												
319-85-7	Pesticides	beta-BHC	ug/kg												
319-86-8	Pesticides	delta-BHC	ug/kg												
5103-71-9	Pesticides	alpha-Chlordane	ug/kg												
5103-74-2	Pesticides	gamma-Chlordane	ug/kg												
60-57-1	Pesticides	Dieldrin	ug/kg	10.9			2.85	6.67	300						
959-98-8	Pesticides	Endosulfan I	ug/kg												
33213-65-9	Pesticides	Endosulfan II	ug/kg												
72-20-8	Pesticides	Endrin	ug/kg	12000			2.67	62.4	500						
76-44-8	Pesticides	Heptachlor	ug/kg	38.9					10						
1024-57-3	Pesticides	Heptachlor epoxide	ug/kg				0.6	2.74	30						
58-89-9	Pesticides	gamma-BHC (Lindane)	ug/kg				0.94	1.38	9						
72-43-5	Pesticides	Methoxychlor	ug/kg	200000											
8001-35-2	Pesticides	Toxaphene	ug/kg												

TABLE A-4
Potential Regulatory Values for UCR Sediment
Upper Columbia River RI/FS

CAS Number	Chemical Group	Analyte	Units	Spokane Tribe of Indians Hazardous Substance Control Act, Sediment Cleanup Levels SLOC Resolution 2004-85, Appendix B Protective of Human Health	NOAA SQuiRTs[b] Freshwater Sediment Background	NOAA SQuiRTs[b] Freshwater Sediment Lowest ARCs *H. azteca* TEL	NOAA SQuiRTs[b] Freshwater Sediment TEL	NOAA SQuiRTs[b] Freshwater Sediment PEL	NOAA SQuiRTs[b] Freshwater Sediment UET	Ecology[d] 2003 AETs *Hyalella* Mortality	Ecology[d] 2003 AETs *Chironomus* Growth	Ecology[d] 2003 AETs *Chironomus* Mortality	Ecology[d] 2003 AETs Microtox ® Lumin.	Ecology[e] 2003 LAET	Ecology[e] 2003 2LAET
92-52-4	SVOCs	1,1'-Biphenyl	ug/kg	2000000											
108-60-1	SVOCs	2,2'-oxybis(1-Chloropropane)	ug/kg	2500											
95-95-4	SVOCs	2,4,5-Trichlorophenol	ug/kg	4000000											
88-06-2	SVOCs	2,4,6-Trichlorophenol	ug/kg	15900											
120-83-2	SVOCs	2,4-Dichlorophenol	ug/kg	120000											
105-67-9	SVOCs	2,4-Dimethylphenol	ug/kg	800000											
51-28-5	SVOCs	2,4-Dinitrophenol	ug/kg	80000											
121-14-2	SVOCs	2,4-DNT	ug/kg	80000											
606-20-2	SVOCs	2,6-DNT	ug/kg	40000											
91-58-7	SVOCs	2-Chloronapthalene	ug/kg	3200000											
95-57-8	SVOCs	2-Chlorophenol	ug/kg	200000											
95-48-7	SVOCs	2-Methylphenol	ug/kg	2000000											
88-74-4	SVOCs	2-Nitroaniline	ug/kg	2400											
91-94-1	SVOCs	3,3'-Dichlorobenzidine	ug/kg	389											
101-55-3	SVOCs	4-Bromophenyl-phenylether	ug/kg												
106-47-8	SVOCs	4-Chloroaniline	ug/kg	160000											
106-44-5	SVOCs	4-Methylphenol	ug/kg							2360		760		760	2360
100-02-7	SVOCs	4-Nitrophenol	ug/kg	2480000											
83-32-9	SVOCs	Acenaphthene	ug/kg	2400000					290	7420	1320	6290	1060	1060	1320
208-96-8	SVOCs	Acenaphthylene	ug/kg						160						
98-86-2	SVOCs	Acetaphenone	ug/kg	4000000											
120-12-7	SVOCs	Anthracene	ug/kg	12000000		10			260	16200	1580	1900	1230	1230	1580
1912-24-9	SVOCs	Atrazine	ug/kg	788											
100-52-7	SVOCs	Benzaldehyde	ug/kg	4000000											
56-55-3	SVOCs	Benzo (a) anthracene	ug/kg	240		15.72	31.7	385	500	44000	11000	5800	4260	4260	5800
50-32-8	SVOCs	Benzo (a) pyrene	ug/kg	24		32.4	31.9	782	700	55000	14000	3300	4810	3300	4810
205-99-2	SVOCs	Benzo (b) fluoranthene	ug/kg	240											
191-24-2	SVOCs	Benzo (g,h,i) perylene	ug/kg						300	12100	11000	5200	4020	4020	5200
207-08-9	SVOCs	Benzo (k) fluoranthene	ug/kg	2400		27.2			13400						
65-85-0	SVOCs	Benzoic acid	ug/kg							3790		2910		2910	3790
100-51-6	SVOCs	Benzyl alcohol	ug/kg	12000000											
111-91-1	SVOCs	Bis (2-chloroethoxy) methane	ug/kg												
111-44-4	SVOCs	Bis (2-chloroethyl) ether	ug/kg	159											
39638-32-9	SVOCs	Bis (2-chloroisopropyl) ether	ug/kg	2500											
117-81-7	SVOCs	Bis (2-ethylhexyl) phthalate	ug/kg												
85-68-7	SVOCs	Butyl benzylphthalate	ug/kg	8000000						1520	366	980	260	260	366
105-60-2	SVOCs	Caprolactam	ug/kg	20000000											
86-74-8	SVOCs	Carbazole	ug/kg	8750						923				923	
218-01-9	SVOCs	Chrysene	ug/kg	24000		26.83	57.1	862	800	46000	11000	6400	5940	5940	6400
53-70-3	SVOCs	Dibenzo (a,h) anthracene	ug/kg	24		10			100	3070	2600	800	839	800	839
132-64-9	SVOCs	Dibenzofuran	ug/kg	160000					5100						
84-66-2	SVOCs	Diethyl phthalate	ug/kg	32000000											
131-11-3	SVOCs	Dimethyl phthalate	ug/kg	400000000											
84-74-2	SVOCs	Di-n-butylphthalate	ug/kg	4000000						1740	1740	103	1740	103	
117-84-0	SVOCs	Di-n-octylphthalate	ug/kg	800000											
206-44-0	SVOCs	Fluoranthene	ug/kg	1600000		31.46	111	2355	1500	46100	15000	16700	11100	11100	15000
86-73-7	SVOCs	Fluorene	ug/kg	1600000		10			300	6970	3850	3890	1070	1070	3850
118-74-1	SVOCs	Hexachlorobenzene	ug/kg	109					100						
87-68-3	SVOCs	Hexachlorobutadiene	ug/kg	2240											
77-47-4	SVOCs	Hexachlorocyclopentadiene	ug/kg	280000											
67-72-1	SVOCs	Hexachloroethane	ug/kg	12500											
193-39-5	SVOCs	Indeno (1,2,3-c,d) pyrene	ug/kg	240		17.32			330	18000	18000	5300	4120	4120	5300
78-59-1	SVOCs	Isophorone	ug/kg	184000											
91-57-6	SVOCs	2-Methylnaphthalene	ug/kg												
91-20-3	SVOCs	Naphthalene	ug/kg	800000		14.65			600	5630	4970	529	1310	529	1310
98-95-3	SVOCs	Nitrobenzene	ug/kg	20000											
621-64-7	SVOCs	n-Nitrosodi-n-propylamine	ug/kg												
86-30-6	SVOCs	n-Nitrosodiphenylamine	ug/kg	35700											
87-86-5	SVOCs	Pentachlorophenol	ug/kg	1460											

TABLE A-4
Potential Regulatory Values for UCR Sediment
Upper Columbia River RI/FS

CAS Number	Chemical Group	Analyte	Units	Spokane Tribe of Indians Hazardous Substance Control Act, Sediment Cleanup Levels SLOC Resolution 2004-85, Appendix B Protective of Human Health	NOAA SQuiRTs[b] Freshwater Sediment Background	NOAA SQuiRTs[b] Freshwater Sediment Lowest ARCs *H. azteca* TEL	NOAA SQuiRTs[b] Freshwater Sediment TEL	NOAA SQuiRTs[b] Freshwater Sediment PEL	NOAA SQuiRTs[b] Freshwater Sediment UET	Ecology[d] 2003 AETs *Hyalella* Mortality	Ecology[d] 2003 AETs *Chironomus* Growth	Ecology[d] 2003 AETs *Chironomus* Mortality	Ecology[d] 2003 AETs Microtox ® Lumin.	Ecology[e] 2003 LAET	Ecology[e] 2003 2LAET
85-01-8	SVOCs	Phenanthrene	ug/kg			18.73	41.9	515	800	41100	7570	8950	6100	6100	7570
108-95-2	SVOCs	Phenol	ug/kg	24000000											
129-00-0	SVOCs	Pyrene	ug/kg	1200000		44.27	53	875	1000	68000	16000	18000	8790	8790	16000

Note: Gray shading indicates value in terms of organic carbon (not dry weight).

[a] Values for DDT and toxaphene derived from guidelines available from the New York State Department of Environmental Conservation (NYSDEC), *Technical Guidance for Screening Contaminated Sediments*, 1999.

[b] NOAA SQuiRTs = NOAA Screening Quick Reference Tables (NOAA 1999).

[c] USEPA. 2004. National Sediment Quality Survey, Appendix D (http://www.epa.gov/waterscience/cs/guidelines.htm).

[d] Washington State Department of Ecology (Ecology). 1997. *Creation and Analysis of Freshwater Sediment Quality Values in Washington State.* Publication 97-323a.

[e] Washington State Department of Ecology (Ecology). http://www.ecy.wa.gov/biblio/0309088.html

2LAET = second lowest apparent effects threshold
AET = apparent effects threshold
AET-L = apparent effects threshold-low
AET-H = apparent effects threshold-high
ER-L = effects range-low
ER-M = effects range-median
LAET = lowest apparent effects threshold
PEL = probable effects level
SQALoc = sediment quality advisory level
SQCoc = USEPA draft sediment quality criteria
TEL = threshold effects level

mg/kg = milligrams per kilogram
ug/kg = micrograms per kilogram
DW = dry weight
PCB = polychlorinated biphenyl
OC = organic carbon
CAS = Chemical Abstracts Service

Ecology = Washington State Department of Ecology
CTLOC = Colville Tribes Law and Order Code
NOAA = National Oceanic and Atmospheric Administration
SLOC = Spokane Law and Order Code

APPENDIX B

Field Sampling Plan

Region 10
U.S. Environmental Protection Agency

Phase I Sediment Sampling Field Sampling Plan Upper Columbia River Site CERCLA RI/FS

March 24, 2005

SPK\050280001

Region 10
U.S. Environmental Protection Agency

Phase I Sediment Sampling Field Sampling Plan Upper Columbia River Site CERCLA RI/FS

March 24, 2005

Prepared by

CH2MHILL

ecology and environment, inc.
International Specialists in the Environment

CONTRACT NO 68-S7-04-01

SPK\050280001

NONDISCLOSURE STATEMENT

Title and Approval Sheet

Plan Title:	Phase I Sediment Sampling Field Sampling Plan Upper Columbia River Site CERCLA RI/FS
Site Name:	Upper Columbia River Site
Site Location:	North Central Washington State
City/State/Zip:	Grand Coulee, WA
Site USEPA ID# :	106X
Anticipated Sampling Dates:	April to May, 2005
Prepared By:	Dan Winstanley Date: March 2005
Agency or Firm:	CH2M HILL, Inc.
Address:	1100 112th Avenue NE
City/State/Zip:	Bellevue, WA 98004-4505
Telephone:	425-453-5000
USEPA Remedial Site Manager:	Kevin Rochlin Phone: 206-553-2106
FSP Approval Date:	March 24, 2005

****

Approved: James Stefanoff, P.E. [signature] Date: March 24, 2005
CH2M HILL Site Manager

Approved: Artemis Antipas, Ph.D. Artemis Antipas Date: March 24, 2005
CH2M HILL Quality Assurance Officer

Approved: Kevin Rochlin [signature] Date: March 24, 2005
USEPA Remedial Site Manager

Approved: Ginna Grepo-Grove [signature] Date: March 24, 2005
USEPA Quality Assurance Officer

Approved: Roy Araki Roy Araki Date: March 24, 2005
USEPA Region X Quality Assurance Reviewer

Contents

Tables

Figures

Figures (continued)

Attachments

Acronyms and Abbreviations

amsl	above mean sea level
AVS/SEM	acid volatile sulfides/simultaneously extracted metals
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
cfs	cubic feet per second
CLP	Contract Laboratory Program
cm	centimeter
COI	contaminant of interest
DGPS	differential global positioning system
DMS	data management system
DQO	data quality objective
ESI	expanded site inspection
FSP	Field Sampling Plan
ft/sec	feet per second
FTL	field team leader
GIS	geographic information system
HPLC	high-performance liquid chromatography
HSM	health and safety manager
HSP	Health and Safety Plan
IDW	investigation-derived waste
m/sec	meters per second
m^2	square meter
MS	matrix spike
MSD	matrix spike duplicate
NOAA Fisheries	National Oceanic and Atmospheric Administration Fisheries
PCB	polychlorinated biphenyl
PPE	personal protective equipment
QC	quality control
RI/FS	remedial investigation/feasibility study
SC-HW	safety coordinator—hazardous waste
Sediment A&R Document:	*Draft Phase I Sediment Sampling Approach and Rationale – Upper Columbia River Site CERCLA RI/FS*(CH2M HILL 2004a)
SIMS	Site Information Management System
SOP	Standard of Practice
SPC	sample processing coordinator
STL	sampling team leader
SVOC	semivolatile organic compound
TAL	Target Analyte List
TOC	total organic carbon
UCR	Upper Columbia River
USBR	U.S. Bureau of Reclamation
USCS	Unified Soil Classification System

USCGS	U.S. Coastal and Geodetic Survey
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound
WSDOT	Washington State Department of Transportation

SECTION 1

Objectives

SECTION 1

Objectives

This Field Sampling Plan (FSP) describes the methods and procedures for performing the initial phase of sediment sampling to be conducted on the Columbia River (in Lake Roosevelt and upstream) by the U.S. Environmental Protection Agency (USEPA) in April and May 2005. These samples will be collected along a stretch of the Columbia River between the U.S.-Canadian border and Grand Coulee Dam, an area referred to as the Upper Columbia River (UCR).

The activities described in this FSP will comprise Phase I of the sediment sampling program associated with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigation/Feasibility Study (RI/FS) for the UCR. CH2M HILL and its subcontractors will perform the RI/FS activities at the UCR site pursuant to USEPA Architect and Engineering Services Contract Number 68-S7-04-01.

1.1 Background

The UCR site is located in north central Washington and extends from the U.S.-Canadian international border south and west to Grand Coulee Dam, a distance of approximately 147 miles downriver (see the location map, Figure 3-1 in Section 3). The UCR site includes a free-flowing reach of the Columbia River as well as Franklin D. Roosevelt Lake (Lake Roosevelt), a large reservoir behind Grand Coulee Dam. The transition between the free-flowing river and Lake Roosevelt occurs approximately 15 miles south of the U.S.-Canadian border and 132 miles upriver from Grand Coulee Dam when the reservoir is full.

Previous investigations by federal and state agencies have identified the presence of contamination within the U.S. portion of the UCR and surrounding upland areas from Grand Coulee Dam to the Canadian border. Other studies have evaluated contaminant source areas and effects north of the Canadian border. Potential sources of contamination include mining and milling operations, smelting operations, pulp and paper production, sewage treatment plants, and other industrial activities. Contaminants found by the studies include heavy metals such as cadmium, copper, lead, mercury, and zinc, as well as organic contaminants such as polychlorinated dibenzo-p-dioxins (dioxins), polychlorinated dibenzofurans (furans), and polychlorinated biphenyls (PCBs).

In August 1999, the Confederated Tribes of the Colville Indian Reservation (Colville Tribes) petitioned USEPA to conduct an assessment of hazardous substance contamination at the UCR. The petition expressed concerns about possible risks to people's health and the environment from contamination in the river. In December 2000, USEPA completed a preliminary assessment (USEPA 2000). Based on a review of available information and existing data, USEPA determined that further data collection was warranted.

In 2001, USEPA conducted an expanded site inspection (ESI) at the UCR and collected sediment samples to assess contaminant concentrations in river sediment and to determine whether further detailed investigation such as an RI/FS was warranted (USEPA 2003). The results of the investigation showed that widespread contamination is present in the lake and river sediment and that an RI/FS is necessary to evaluate possible risks to human health and the environment.

1.2 Objectives

The purpose of the FSP is to describe the methods and procedures for collecting Phase I sediment samples at the UCR site. The samples will be analyzed during the RI, and the data obtained will be used to characterize the nature and extent of sediment contamination at the site, perform human health and ecological risk assessments, and evaluate potential remedies that are protective of human and ecological receptors.

Activities to be performed as part of the Phase I sediment sampling are as follows:

- Collect baseline surface sediment samples at regularly spaced transects and focus areas (see Section 4 for a definition of sample types and groups) over the length of the study area. The upper 10 to 15 centimeters [cm] of sediment will be sampled at both above- and below-water locations. Baseline samples will be analyzed for the standard analytical suite developed for the site, which includes Target Analyte List (TAL) metals (plus uranium), Target Compound List (TCL) semivolatile organic compounds (SVOCs), TCL pesticides/PCB aroclors, total organic carbon (TOC), and grain size distribution.
- Collect bioassay samples at 50 locations within the UCR and at 6 reference locations in selected UCR tributaries. The upper 10 to 15 cm of sediment will be sampled at near-shore transect locations. These samples will be analyzed for the standard analytical suite listed above and for acid volatile sulfides/simultaneously extracted metals (AVS/SEM). The sediment will also be used for conduct of 7-day, 10-day, and 28-day sediment toxicity tests.
- Collect surface sediment samples for pore water isolation at the 50 bioassay sample locations within the UCR and at the 6 reference locations in UCR tributaries. The pore water will be isolated in the laboratory using centrifugation, and the resulting liquid will be analyzed for dissolved TAL metals plus uranium.
- Collect surface sediment at six locations where tributaries discharge into the UCR. Two samples will be obtained from each tributary mouth. The upper 10 to 15 cm of sediment will be sampled at approximate mid-channel locations. The tributary mouth samples will be analyzed for the standard analytical suite.
- Collect beach samples at 15 locations along the length of the study area. The upper 10 to 15 cm of sediment will be sampled, as follows:
  - Discrete sampling will be conducted at three of the beaches (Northport City Boat Launch, Kettle Falls Swim Beach, and Columbia Campground Beach). The discrete samples will be analyzed for the standard analytical suite. Composite samples will also be taken at the three beaches for dioxin and furan analysis.
  - Composite samples will also be taken at the three beaches for fractionation into particle-size-based samples. The two fractions (particles greater than 0.062 micron

and particles less than 0.062 micron) will be analyzed for the standard analytical suite.

  – Composite sampling will be conducted at the remaining 12 beaches. The composite samples taken from the 12 beaches will be analyzed for the standard analytical suite and dioxin and furan analysis.

- Collect sediment cores at 13 locations along the length of the study area. The cores will be divided into multiple samples representing the full thickness of sediment recovered at each location, with the upper 1 foot of sediment divided into two 6-inch-long sample intervals and the remainder of the core being divided into 24-inch-long sample intervals. Samples from cores obtained at seven selected locations will be analyzed for the standard analytical suite and dioxin and furan analysis; the samples from the remaining cores will be analyzed for the standard analytical suite.

Additional details on the objectives and rationale for the sediment sampling program are provided in *Draft Phase I Sediment Sampling Approach and Rationale – Upper Columbia River Site CERCLA RI/FS* (Sediment A&R Document) (CH2M HILL 2004a) and in Appendix A.

SECTION 2

Site Background

SECTION 2

Site Background

This section describes the physical features of the UCR site that are relevant to the field sampling program. Further information on the UCR site background is provided in the Sediment A&R Document (CH2M HILL 2004a).

2.1 Site Location

The UCR project area is situated in north central Washington along the Columbia River (see Figure 3-1). This project area extends 147 miles from the U.S.-Canadian border south and west along the Columbia River to Grand Coulee Dam area. Behind Grand Coulee Dam, the impounded river forms the Lake Roosevelt reservoir, which extends 132 miles upriver to within approximately 15 miles of the Canadian border when the reservoir is full. The interval between the U.S.-Canadian border and Grand Coulee Dam (including Lake Roosevelt and the upper reaches of the Columbia River) is collectively referred to in this document as the UCR.

2.2 Regional and Local Geology

The UCR is situated within two geologic provinces: the Okanagan Highlands, and the Columbia Plateau. The Okanagan Highlands, which are typified by rounded mountains and deep, narrow valleys, include both shores of the Columbia River above the confluence with the Spokane River. Along the south shore of the reservoir in some places, sheer basalt cliffs of the Columbia Basin rise nearly 1,000 feet above the lake.

Erosion and slumping of bank deposits are probably responsible for much of the present-day bed sediment found in the mid- and lower reaches of Lake Roosevelt. With the filling of Grand Coulee Dam, areas that were previously dry and stable became saturated and less stable, resulting in bank slumping. Variations in lake elevation, resulting from reservoir management, continue to cause bank slumping, making this an ongoing process for deposition of bed sediments in these areas.

2.3 Hydrology

The Columbia River begins at the base of the Canadian Rockies in southeastern British Columbia, Canada, and flows approximately 1,200 miles before discharging to the Pacific Ocean near Astoria, Oregon. The drainage area of the Columbia River above Lake Roosevelt is approximately 59,700 square miles, or about the size of the State of Georgia. North of the Canadian border, flow in the Columbia River is controlled by many large reservoirs and numerous smaller reservoirs and power plants on its tributaries.

The average river flow since 1938 has been about 100,000 cubic feet per second (cfs). Annual peak river flows typically occur in June; low flows typically occur between late fall and early spring.

Grand Coulee Dam was completed in 1941 to provide power generation, irrigation, and flood control. Before completion of the dam, the UCR channel width was much narrower. The present-day channel width includes the old river channel, the former floodplains, and higher elevation portions of the river valley.

The UCR is characterized by four main reaches: the Northport Reach, the Upper Reservoir Reach, the Middle Reservoir Reach, and the Lower Reservoir Reach (see Section 3, Figure 3-1). The Northport Reach is more of a free-run river, with the transition between the river and the reservoir occurring near the southern extent when water levels in the reservoir are above elevation approximately 1,270 feet above mean sea level (amsl). This 15-mile-long reach of the river is consistently narrow, and has an approximate depth of 14 feet near the U.S.-Canadian border. The Upper Reservoir Reach is a relatively narrow channel approximately 22 miles long. This reach has few shoreline embayments and irregularities. The reservoir depth is generally increasing over this reach, ranging from approximately 50 to 100 feet at full pool (elevation 1,290 feet amsl).[1] The Middle Reservoir Reach is the longest reach of the reservoir, extending approximately 68 miles. This reach has an irregular shoreline with channel widths varying between 0.25 and 1.75 miles. Channel depths within this reach vary from 100 to 300 feet at full pool. The Lower Reservoir Reach extends approximately 43 miles from the Spokane River confluence to Grand Coulee Dam. This reach is influenced by the Spokane River and has a deep channel. Water depths near the dam can be up to 400 feet at full pool.

The main source of inflow to Lake Roosevelt is the Columbia River. On average, the Columbia River contributes about 89 percent of inflow to the lake, with the remainder coming from the Spokane River (7 percent), the Kettle River (3 percent), and numerous other streams, including the Colville and Sanpoil Rivers, which together contribute about 1 percent. Outflow from the lake is either by flow through the dam to the Columbia River or by pumped discharge to Banks Lake for irrigation storage.

The elevation of water maintained within Lake Roosevelt is managed by the U.S. Bureau of Reclamation (USBR). The maximum elevation of water maintained in Lake Roosevelt (or full pool elevation) is 1,290 feet amsl. During the annual operating cycle, water levels in the lake are drawn down between January and March to accommodate increased spring flows. The level of drawdown is determined based on estimates for the spring flow volumes, and can be as low as 1,208 feet amsl. In a given year, the level of drawdown may be reduced because of lesser snowpack in the mountains.

2.4 Bathymetry

A U.S. Coastal and Geodetic Survey (USCGS) bathymetric survey from 1947-1949 provides the most detailed information on variations in river depth and river channel characteristics

[1] All depths presented in this section are based on the 1947-1949 U.S. Coastal and Geodetic Survey (USCGS) bathymetry survey digitized by the National Oceanic and Atmospheric Administration, National Geophysics Data Center (http://www.ngdc.noaa.gov/).

from Grand Coulee Dam to the Canadian border. Depth soundings from this survey were digitized by the National Oceanic and Atmospheric Administration Fisheries (NOAA Fisheries) in 1974, making them amenable to geographic information system (GIS) applications.

The bathymetric configuration of Lake Roosevelt and the upper reaches of the Columbia River largely reflect the major geomorphologic features that existed in the floodplain prior to dam construction. These included:

- The original main stem channel of the Columbia River
- Floodplain area benches and terraces
- Point bar features (exposed and submerged)
- Steep side bank areas

In localized reaches, bank slumps that occurred between 1941 and the completion of the bathymetric survey work in 1949 also could have influenced the bathymetry recorded at that time. Ongoing sedimentation from the Columbia River and tributaries, bed scour and redeposition during high flow events, bank slumpage, and human-related effects (for example, localized filling or dredging) likely account for any variations between the current bathymetry and the conditions depicted by the 1947-1949 USCGS bathymetric survey.

SECTION 3

Maps

SECTION 3

Maps

The following maps are provided in this FSP:

FIGURE 3-1
Upper Columbia River and Vicinity
Upper Columbia River RI/FS

FIGURE 3-2
Project Area Highway Map
Upper Columbia River RI/FS

SPK31010224, FIELD SAMPLING PLAN PROJECT AREA HIGHWAY MAP (FIGURE 3-2).MXD

CH2MHILL

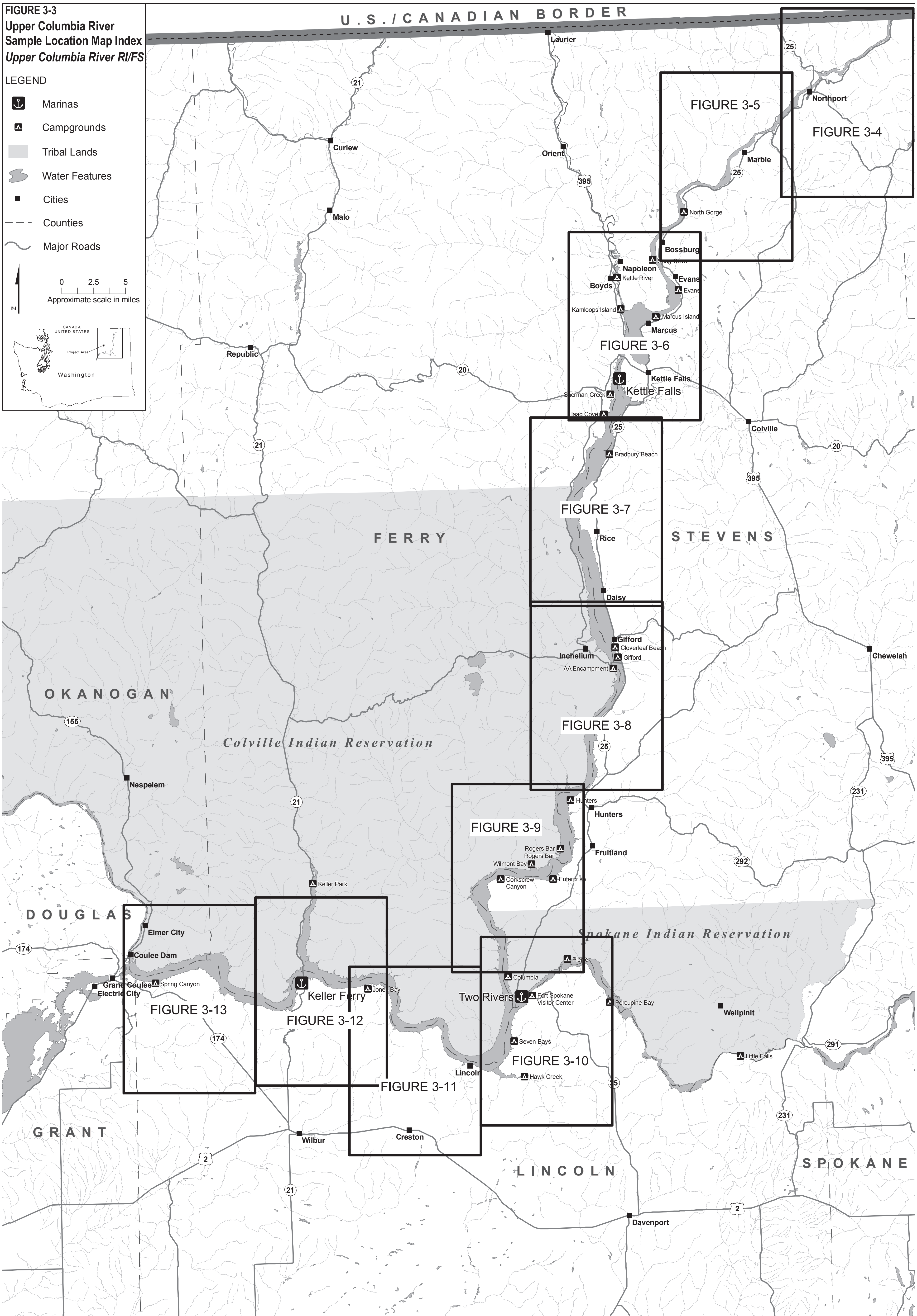


FIGURE 3-3
Upper Columbia River Sample Location Map Index
Upper Columbia River RI/FS

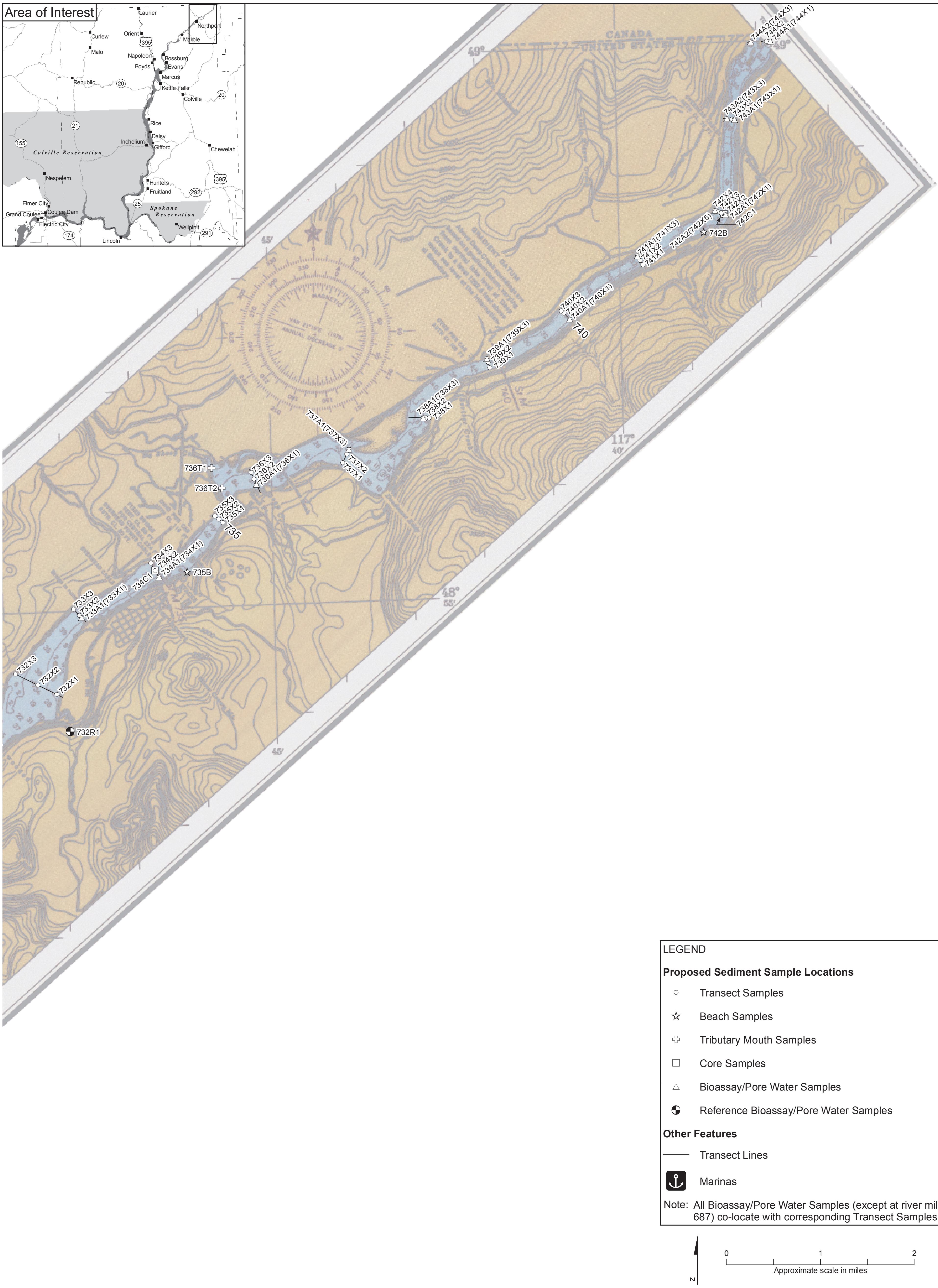
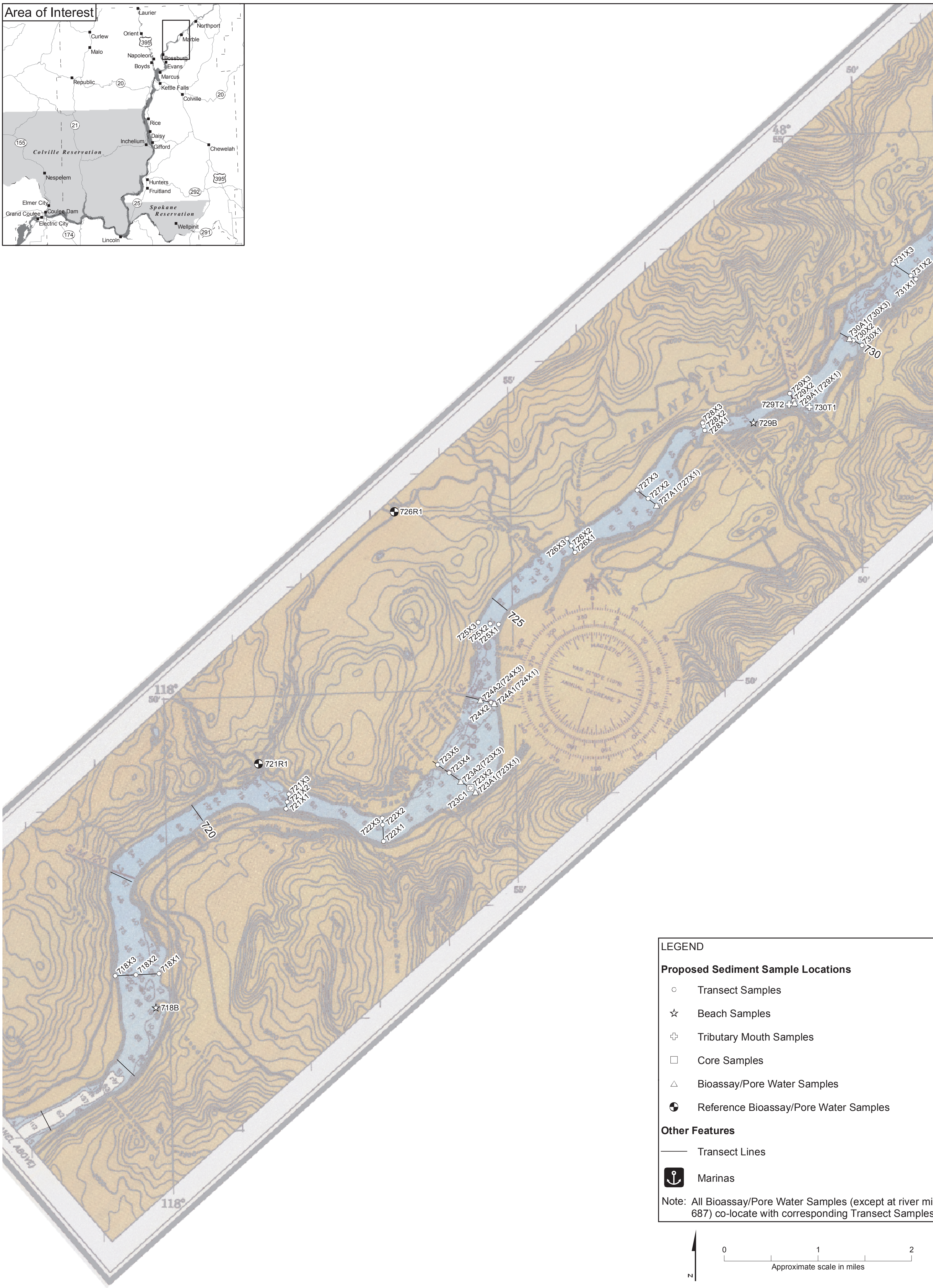


FIGURE 3-4
Proposed Sediment Sample Locations and Types
River Miles 732 to 744
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, FIELD SAMPLING PLAN SAMPLE LOCATIONS ON NOAA CHARTS (1TO63360).MXD
BASEMAP MODIFIED FROM NOAA CHART #18553 (1979)



LEGEND

Proposed Sediment Sample Locations

- ○ Transect Samples
- ☆ Beach Samples
- ✚ Tributary Mouth Samples
- □ Core Samples
- △ Bioassay/Pore Water Samples
- Reference Bioassay/Pore Water Samples

Other Features

- Transect Lines
- Marinas

Note: All Bioassay/Pore Water Samples (except at river mile 687) co-locate with corresponding Transect Samples

FIGURE 3-5
Proposed Sediment Sample Locations and Types
River Miles 716 to 731
Upper Columbia River RI/FS

SPK31010224, FIELD SAMPLING PLAN SAMPLE LOCATIONS ON NOAA CHARTS (1TO63360).MXD
BASEMAP MODIFIED FROM NOAA CHART #18553 (1979)

CH2MHILL

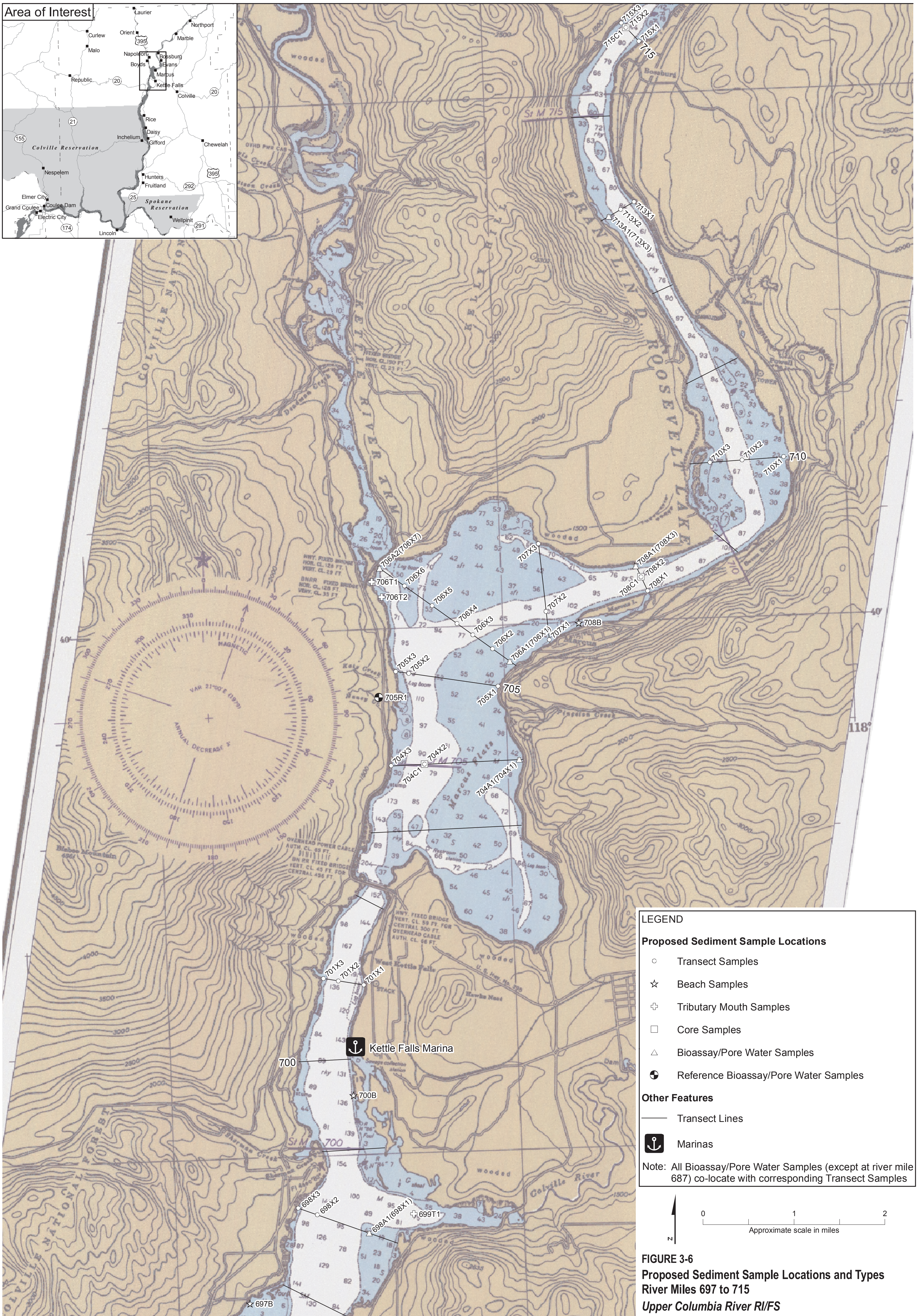


FIGURE 3-6
Proposed Sediment Sample Locations and Types
River Miles 697 to 715
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, FIELD SAMPLING PLAN SAMPLE LOCATIONS ON NOAA CHARTS (1TO63360).MXD
BASEMAP MODIFIED FROM NOAA CHART #18553 (1979)

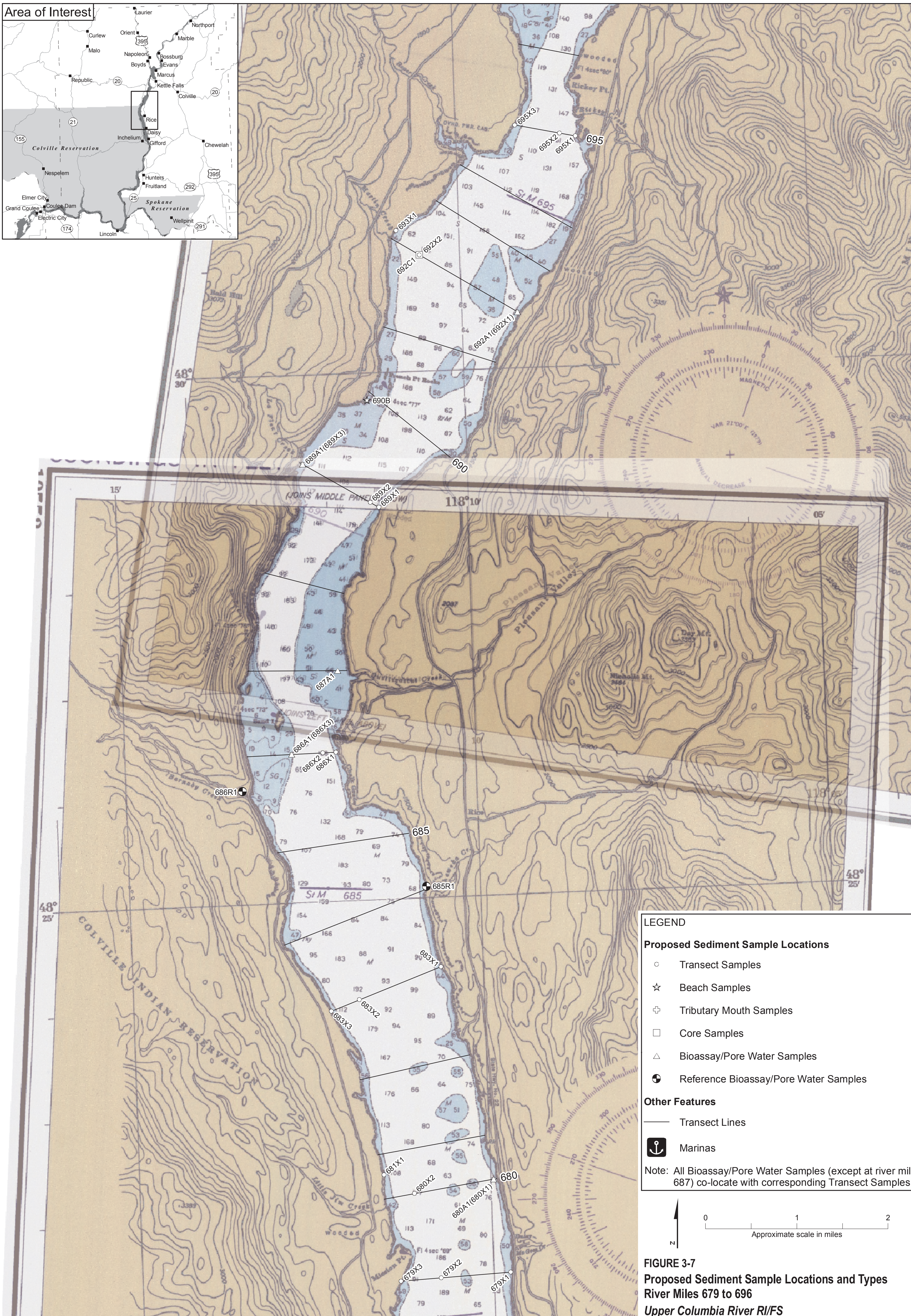


FIGURE 3-7
Proposed Sediment Sample Locations and Types
River Miles 679 to 696
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, FIELD SAMPLING PLAN SAMPLE LOCATIONS ON NOAA CHARTS (1TO63360).MXD
BASEMAP MODIFIED FROM NOAA CHART #18553 (1979)

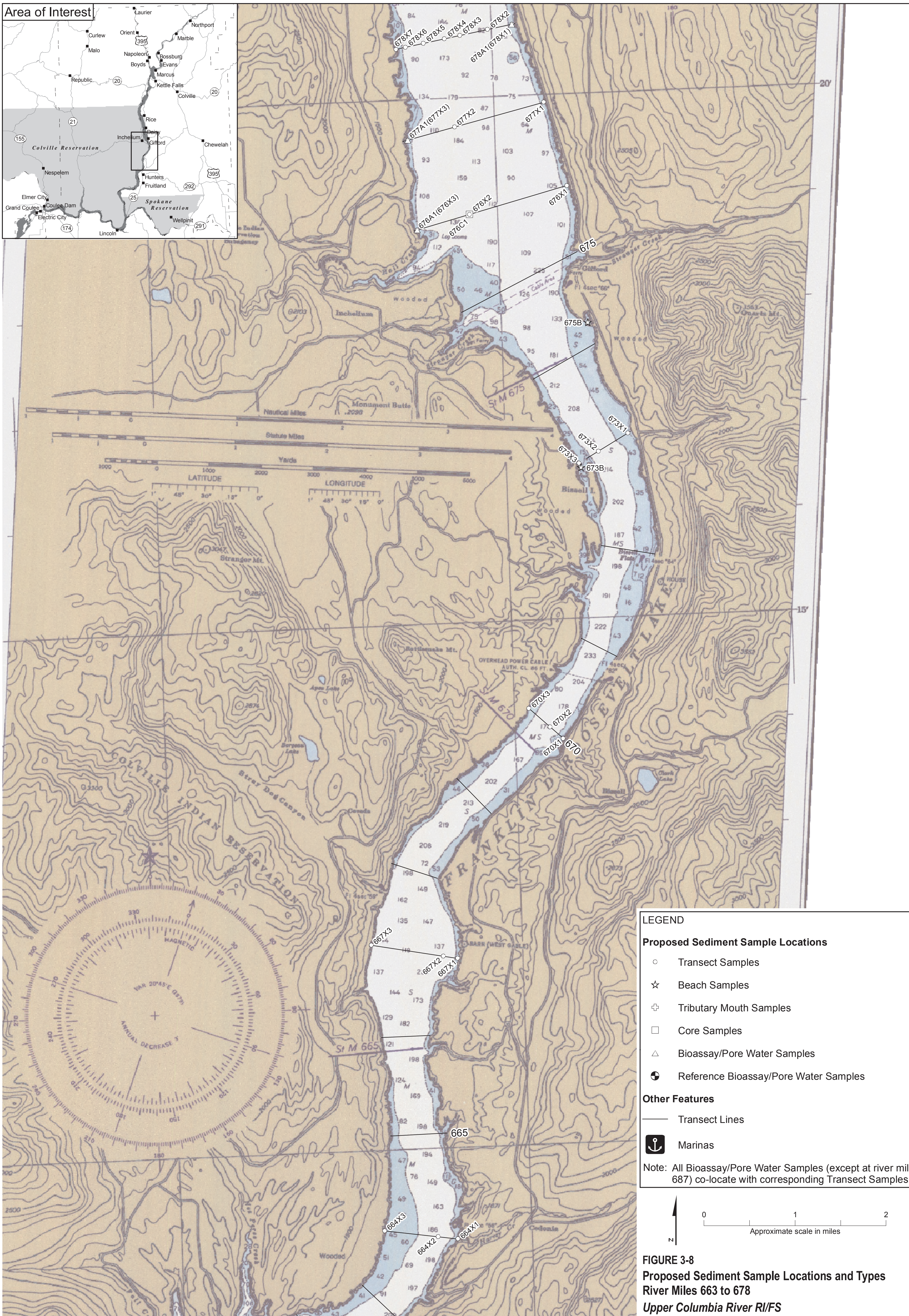


FIGURE 3-8
Proposed Sediment Sample Locations and Types
River Miles 663 to 678
Upper Columbia River RI/FS

CH2MHILL

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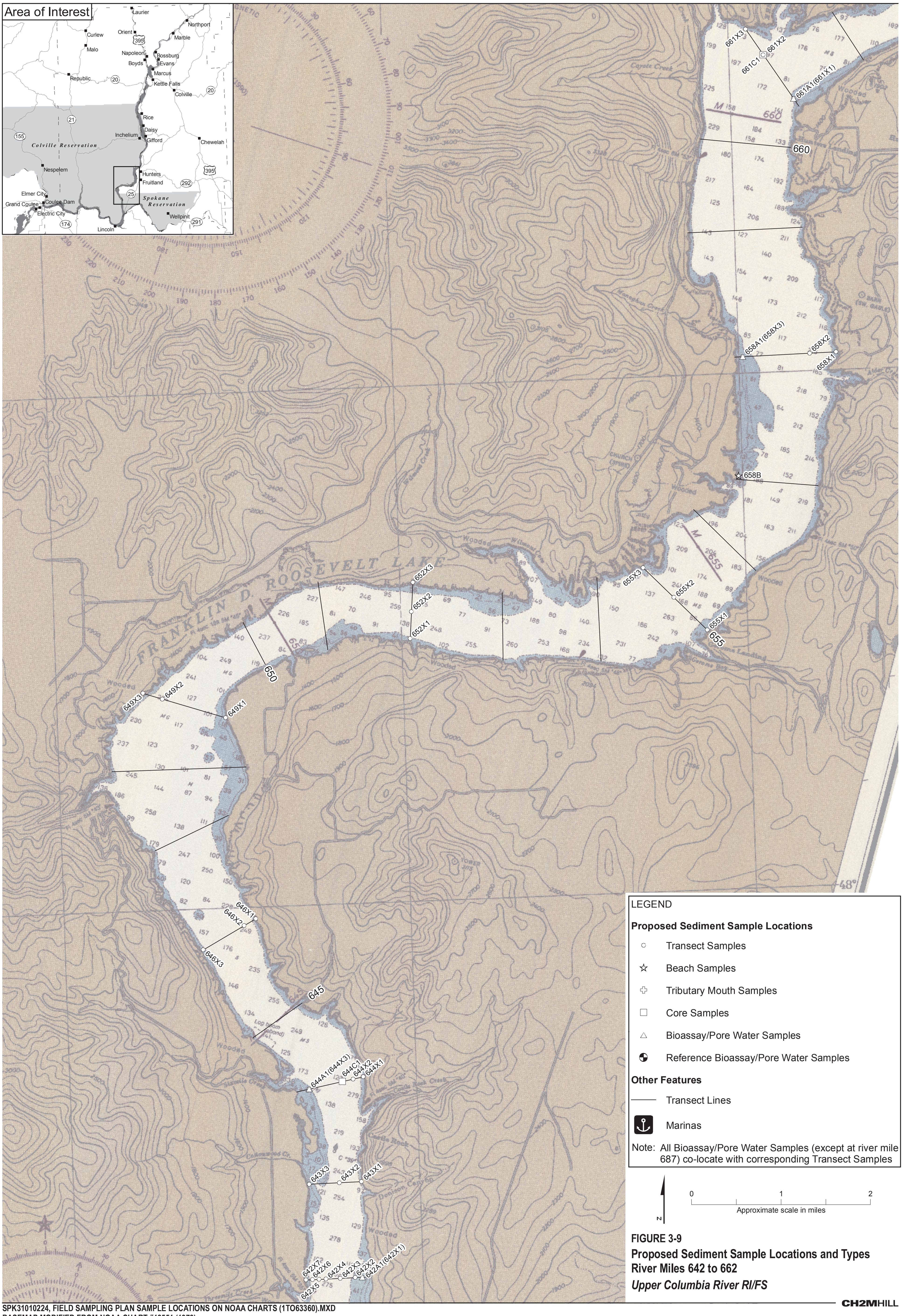


FIGURE 3-9

Proposed Sediment Sample Locations and Types
River Miles 642 to 662
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, FIELD SAMPLING PLAN SAMPLE LOCATIONS ON NOAA CHARTS (1TO63360).MXD
BASEMAP MODIFIED FROM NOAA CHART #18551 (1979)

LEGEND

Proposed Sediment Sample Locations

○ Transect Samples

☆ Beach Samples

✙ Tributary Mouth Samples

□ Core Samples

△ Bioassay/Pore Water Samples

Reference Bioassay/Pore Water Samples

Other Features

Transect Lines

Marinas

Note: All Bioassay/Pore Water Samples (except at river mile 687) co-locate with corresponding Transect Samples

N

0 1 2

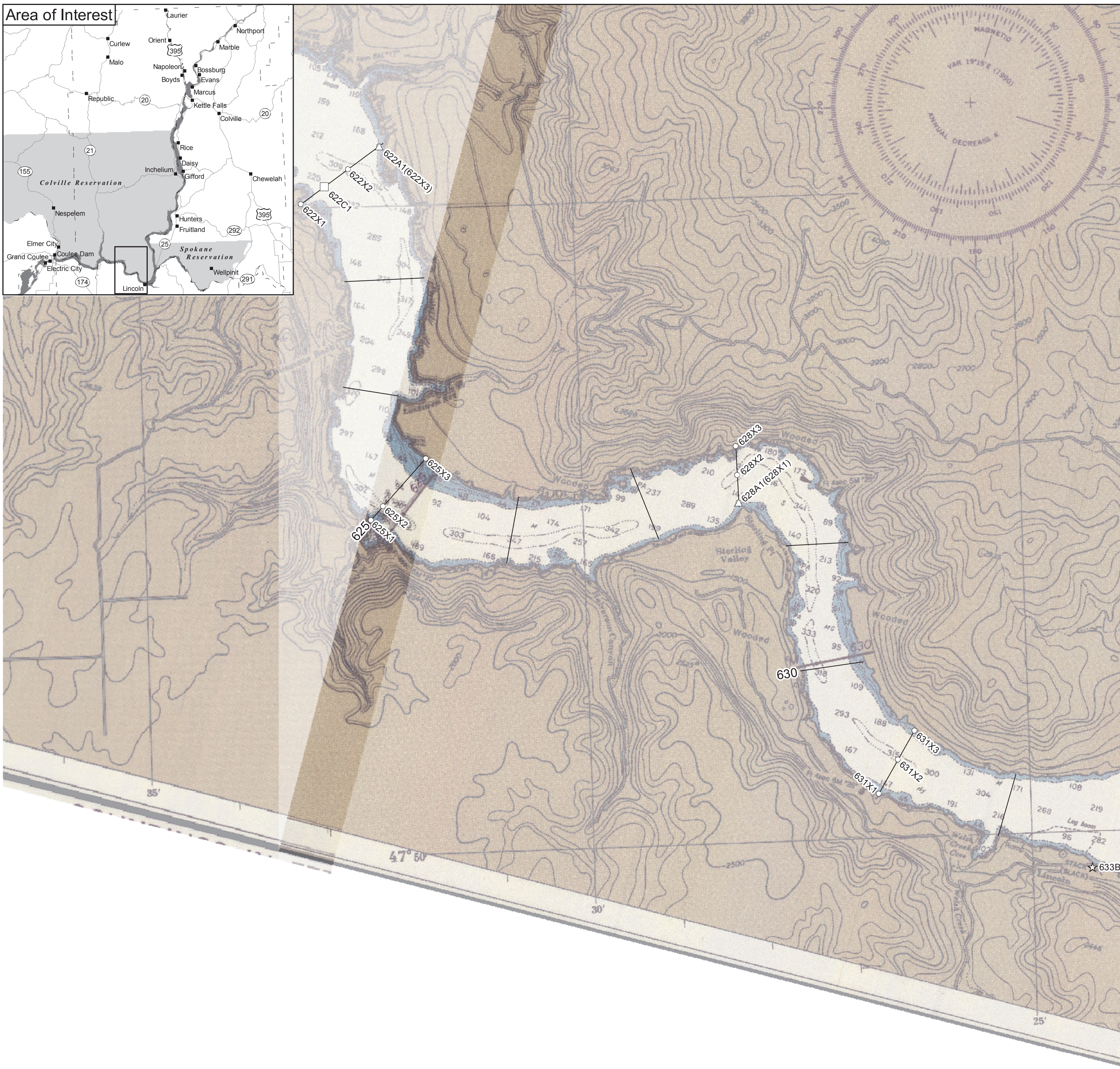
Approximate scale in miles

FIGURE 3-10

Proposed Sediment Sample Locations and Types
River Miles 634 to 641

Upper Columbia River RI/FS

CH2MHILL



LEGEND

Proposed Sediment Sample Locations

○ Transect Samples

☆ Beach Samples

✣ Tributary Mouth Samples

□ Core Samples

△ Bioassay/Pore Water Samples

● Reference Bioassay/Pore Water Samples

Other Features

—— Transect Lines

⚓ Marinas

Note: All Bioassay/Pore Water Samples (except at river mile 687) co-locate with corresponding Transect Samples

N

0 1 2

Approximate scale in miles

FIGURE 3-11

Proposed Sediment Sample Locations and Types
River Miles 622 to 633

Upper Columbia River RI/FS

CH2MHILL

LEGEND

Proposed Sediment Sample Locations

- ○ Transect Samples
- ☆ Beach Samples
- ✣ Tributary Mouth Samples
- □ Core Samples
- △ Bioassay/Pore Water Samples
- Reference Bioassay/Pore Water Samples

Other Features

- Transect Lines
- Marinas

Note: All Bioassay/Pore Water Samples (except at river mile 687) co-locate with corresponding Transect Samples

N

0 1 2

Approximate scale in miles

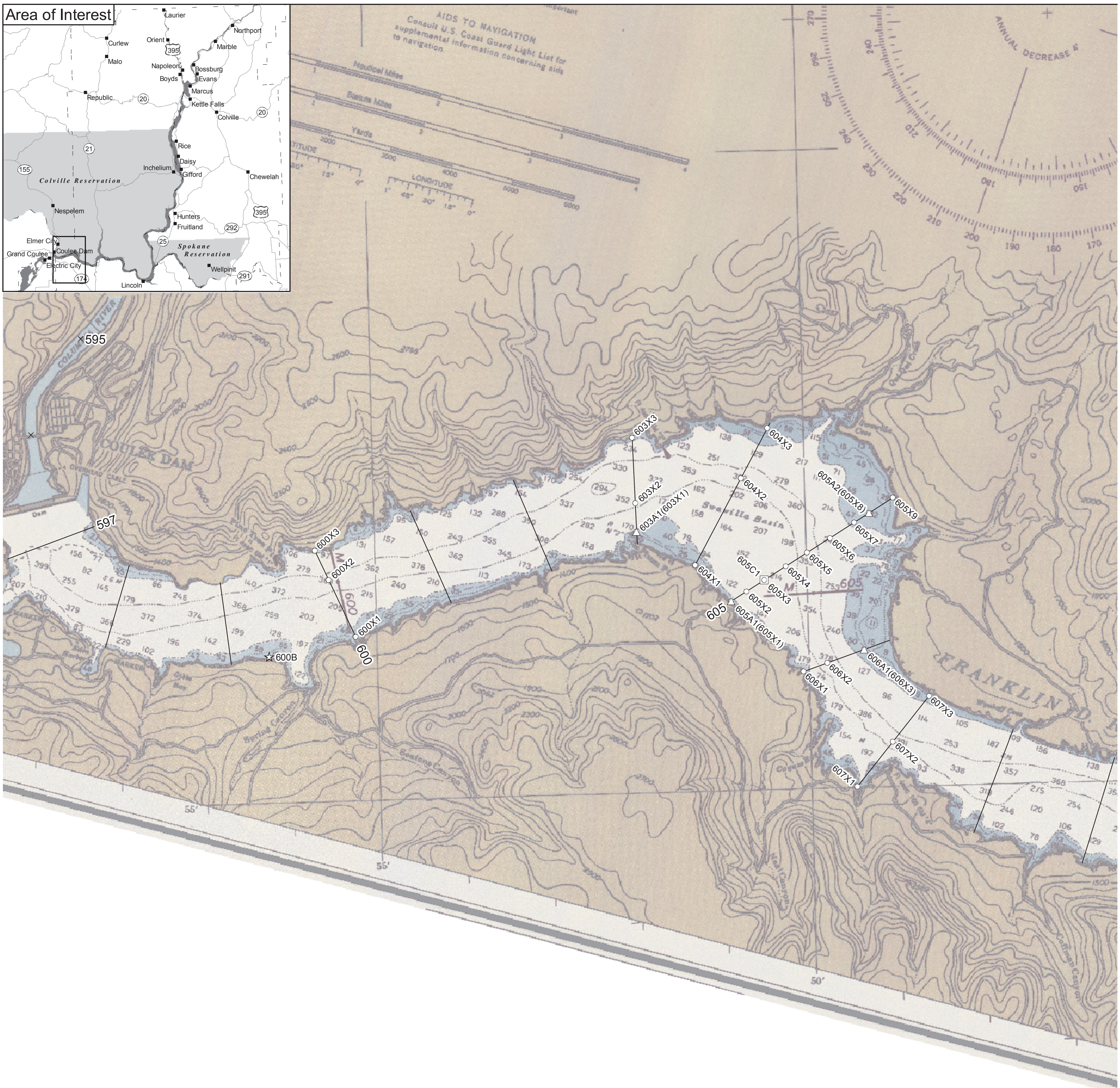
FIGURE 3-12

Proposed Sediment Sample Locations and Types
River Miles 610 to 621

Upper Columbia River RI/FS

CH2MHILL

SPK31010224, FIELD SAMPLING PLAN SAMPLE LOCATIONS ON NOAA CHARTS (1TO63360).MXD
BASEMAP MODIFIED FROM NOAA CHART #18551 (1979)



LEGEND

Proposed Sediment Sample Locations

- ○ Transect Samples
- ☆ Beach Samples
- ✣ Tributary Mouth Samples
- ☐ Core Samples
- △ Bioassay/Pore Water Samples
- ◐ Reference Bioassay/Pore Water Samples

Other Features

- —— Transect Lines
- ⚓ Marinas

Note: All Bioassay/Pore Water Samples (except at river mile 687) co-locate with corresponding Transect Samples

N

0 1 2
Approximate scale in miles

FIGURE 3-13
Proposed Sediment Sample Locations and Types
River Miles 595 to 609
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, FIELD SAMPLING PLAN SAMPLE LOCATIONS ON NOAA CHARTS (1TO63360).MXD
BASEMAP MODIFIED FROM NOAA CHART #18551 (1979)

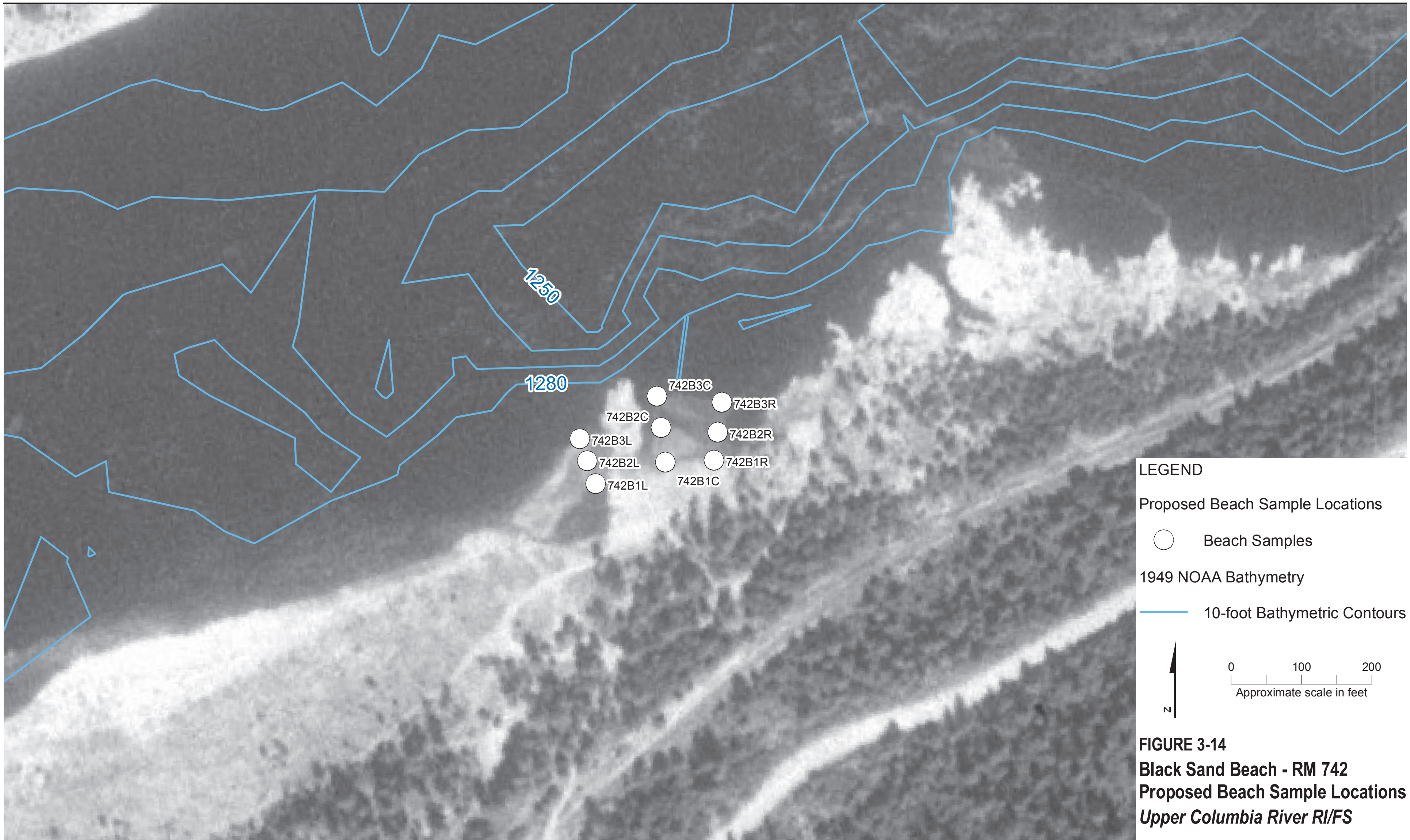


FIGURE 3-14
Black Sand Beach - RM 742
Proposed Beach Sample Locations
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, PROPOSED BEACH SAMPLE LOCATIONS (1TO2400).MXD

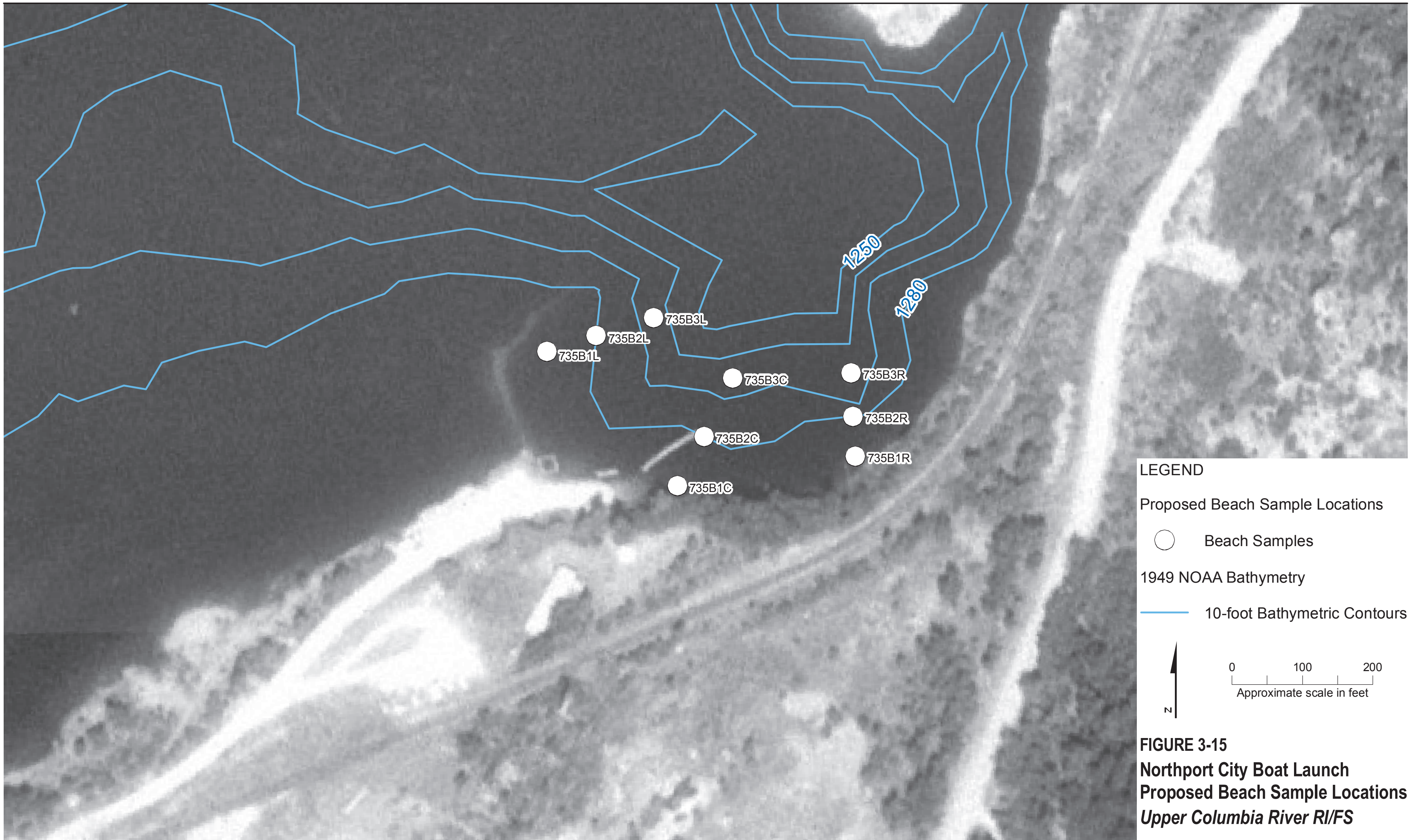


FIGURE 3-15
Northport City Boat Launch
Proposed Beach Sample Locations
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, PROPOSED BEACH SAMPLE LOCATIONS (1TO2400).MXD

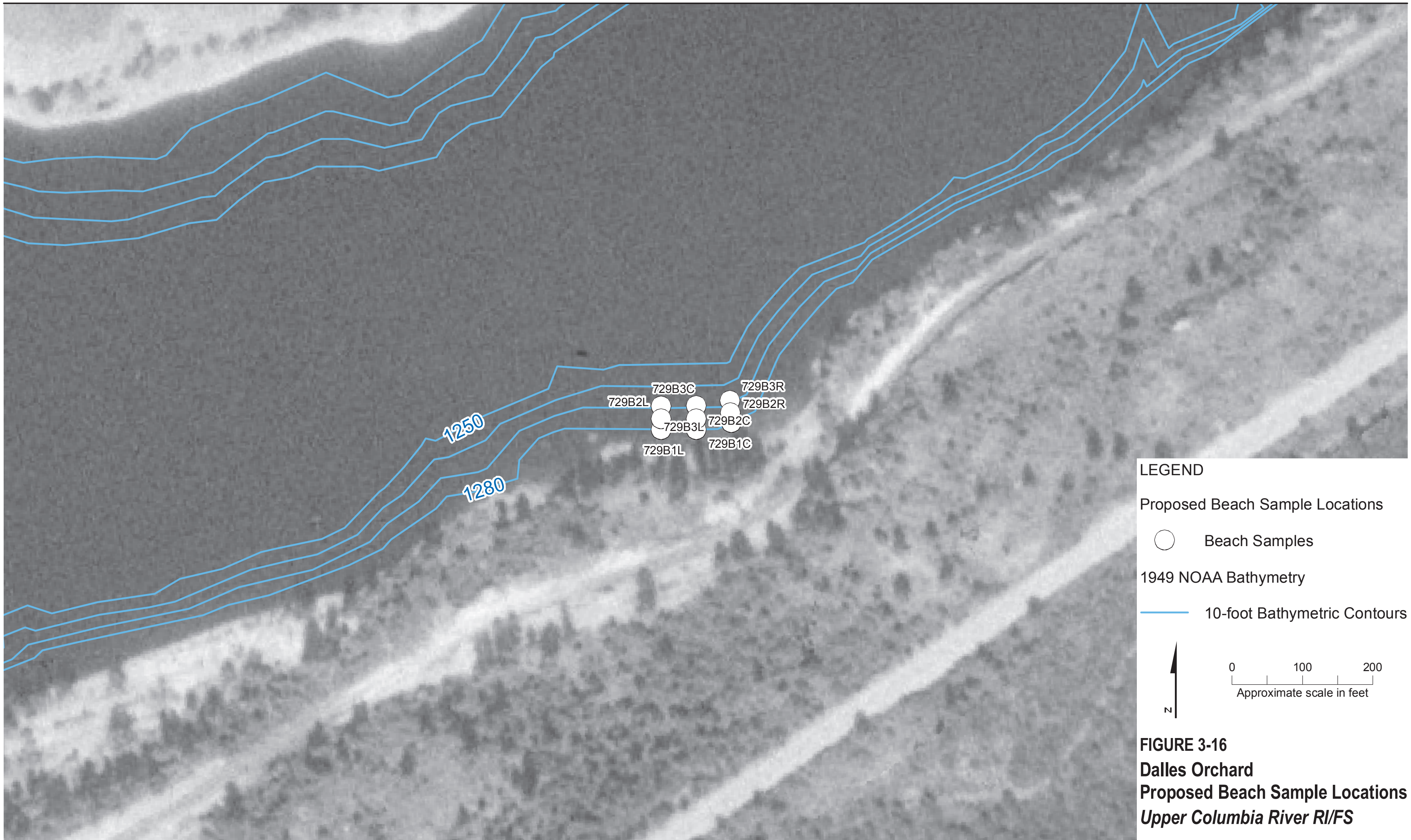


FIGURE 3-16
Dalles Orchard
Proposed Beach Sample Locations
Upper Columbia River RI/FS

SPK31010224, PROPOSED BEACH SAMPLE LOCATIONS (1TO2400).MXD

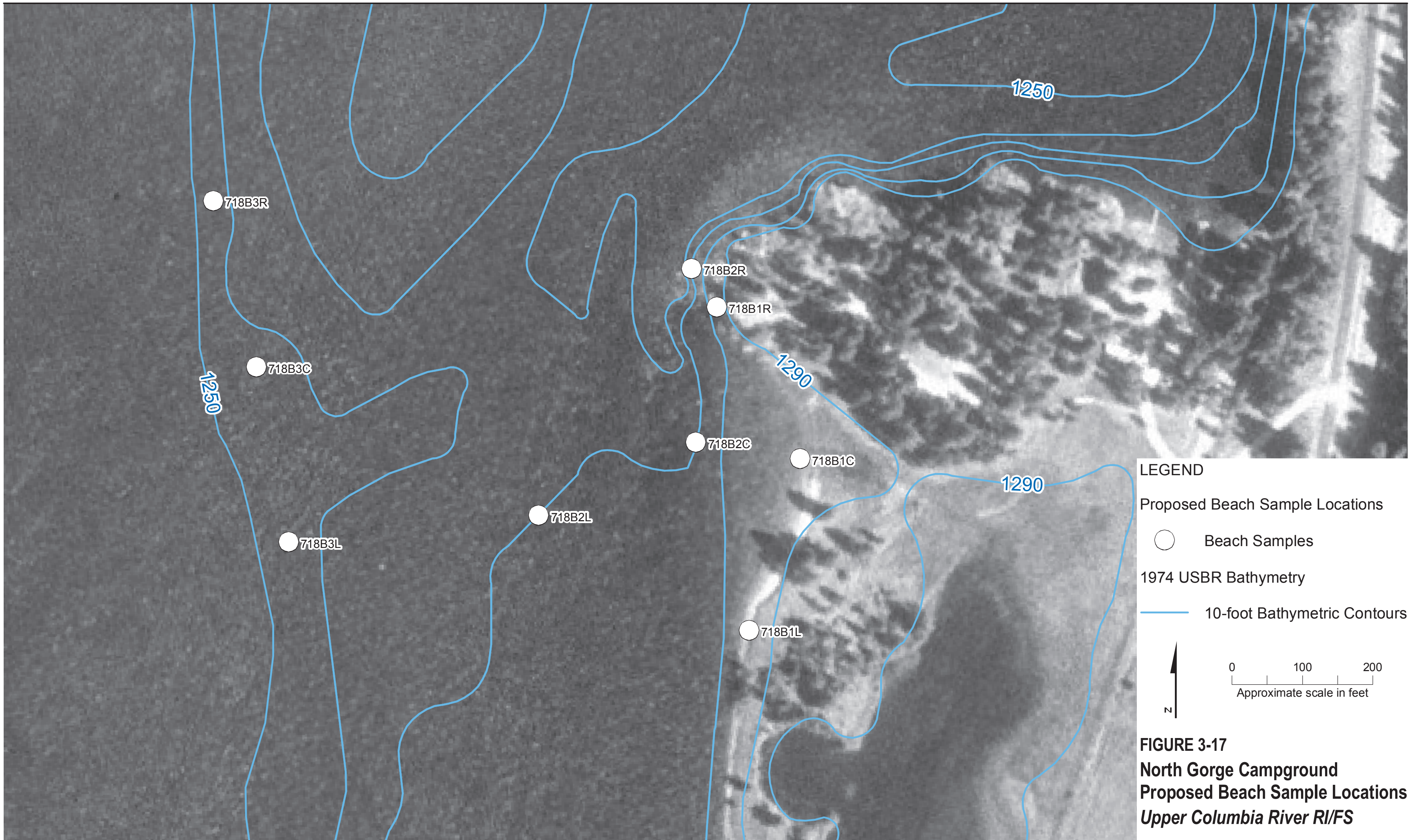


FIGURE 3-17
North Gorge Campground
Proposed Beach Sample Locations
Upper Columbia River RI/FS

SPK31010224, PROPOSED BEACH SAMPLE LOCATIONS (1TO2400).MXD

CH2MHILL

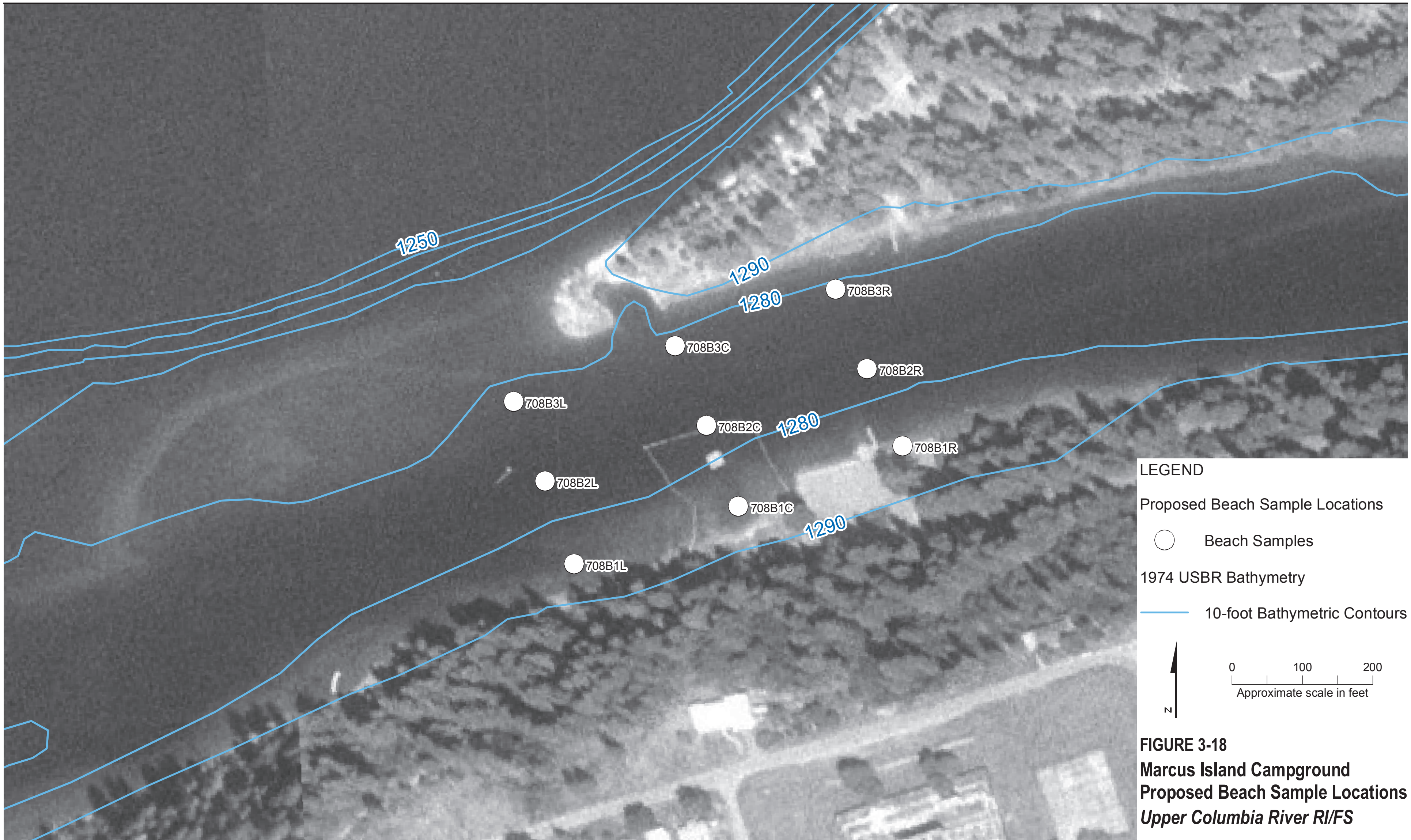


FIGURE 3-18
Marcus Island Campground
Proposed Beach Sample Locations
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, PROPOSED BEACH SAMPLE LOCATIONS (1TO2400).MXD

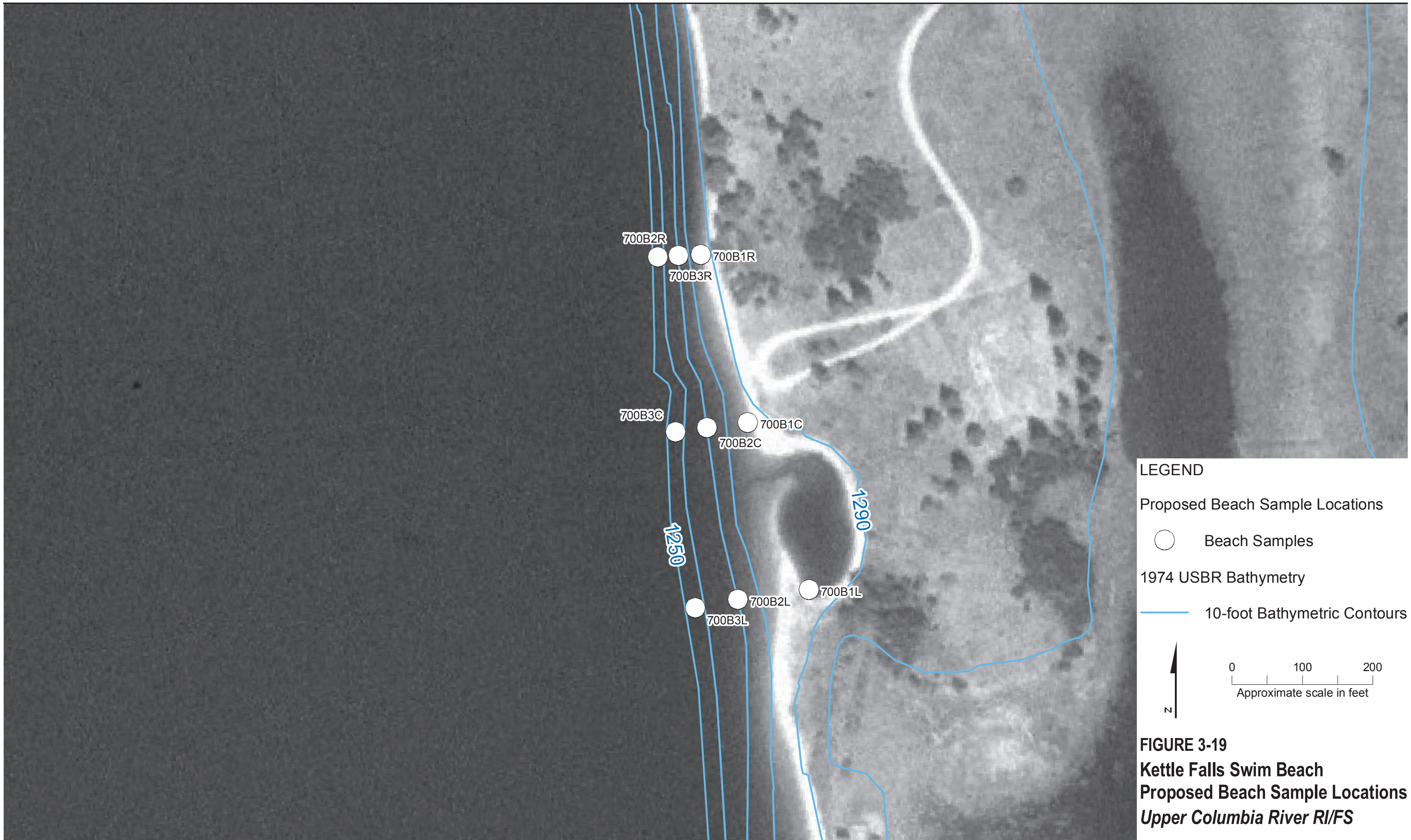


FIGURE 3-19
Kettle Falls Swim Beach
Proposed Beach Sample Locations
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, PROPOSED BEACH SAMPLE LOCATIONS (1TO2400).MXD

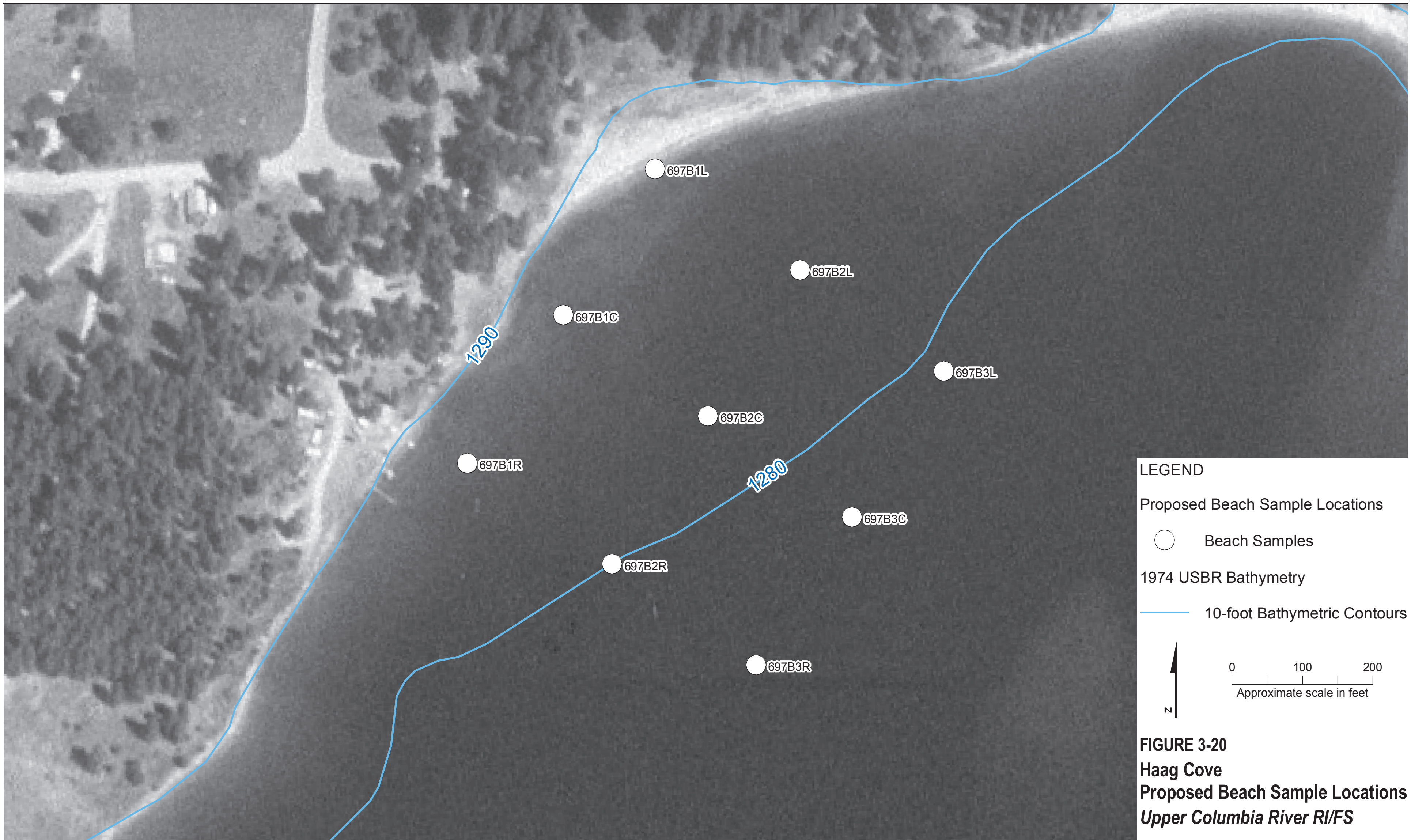


FIGURE 3-20
Haag Cove
Proposed Beach Sample Locations
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, PROPOSED BEACH SAMPLE LOCATIONS (1TO2400).MXD

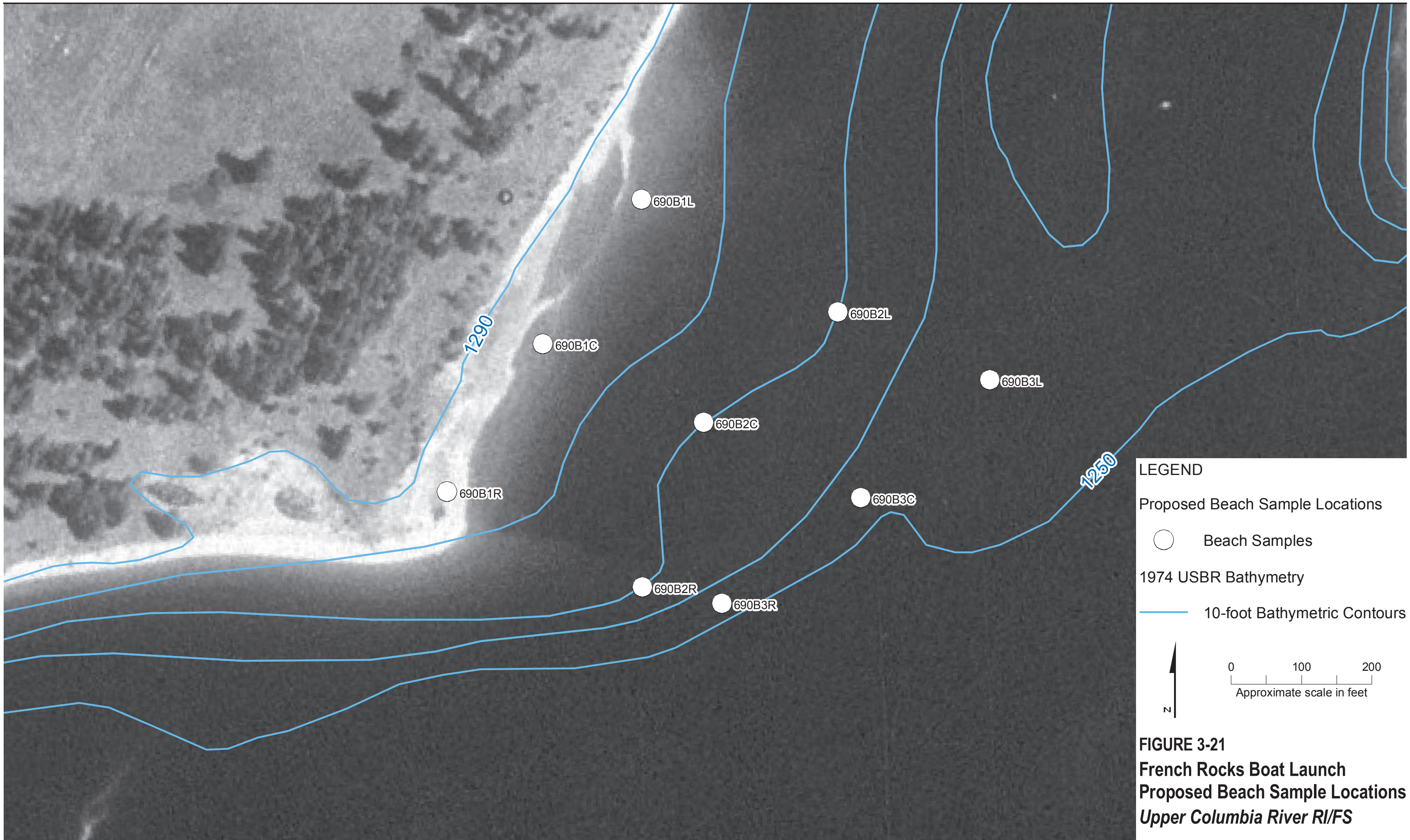


FIGURE 3-21
French Rocks Boat Launch
Proposed Beach Sample Locations
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, PROPOSED BEACH SAMPLE LOCATIONS (1TO2400).MXD

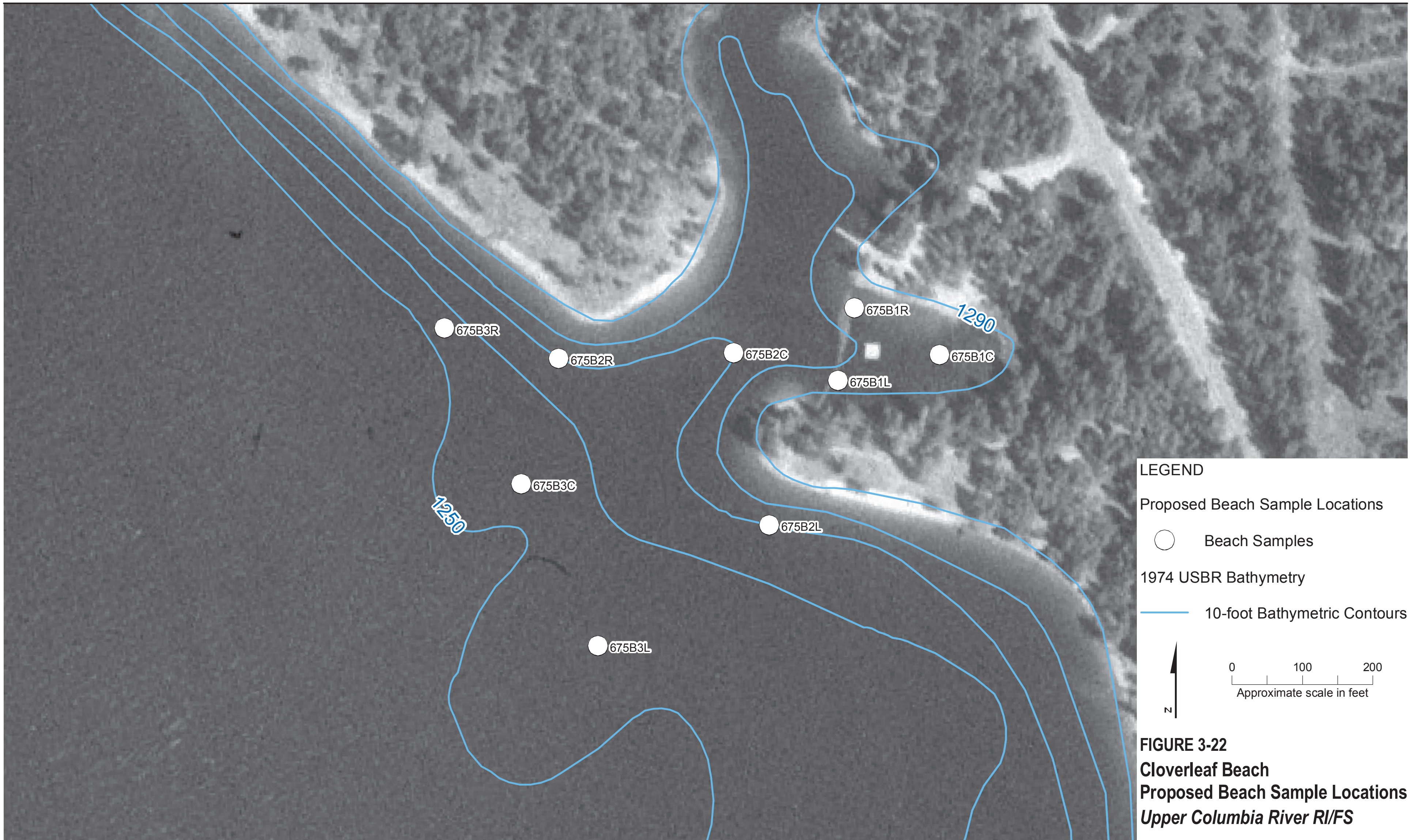
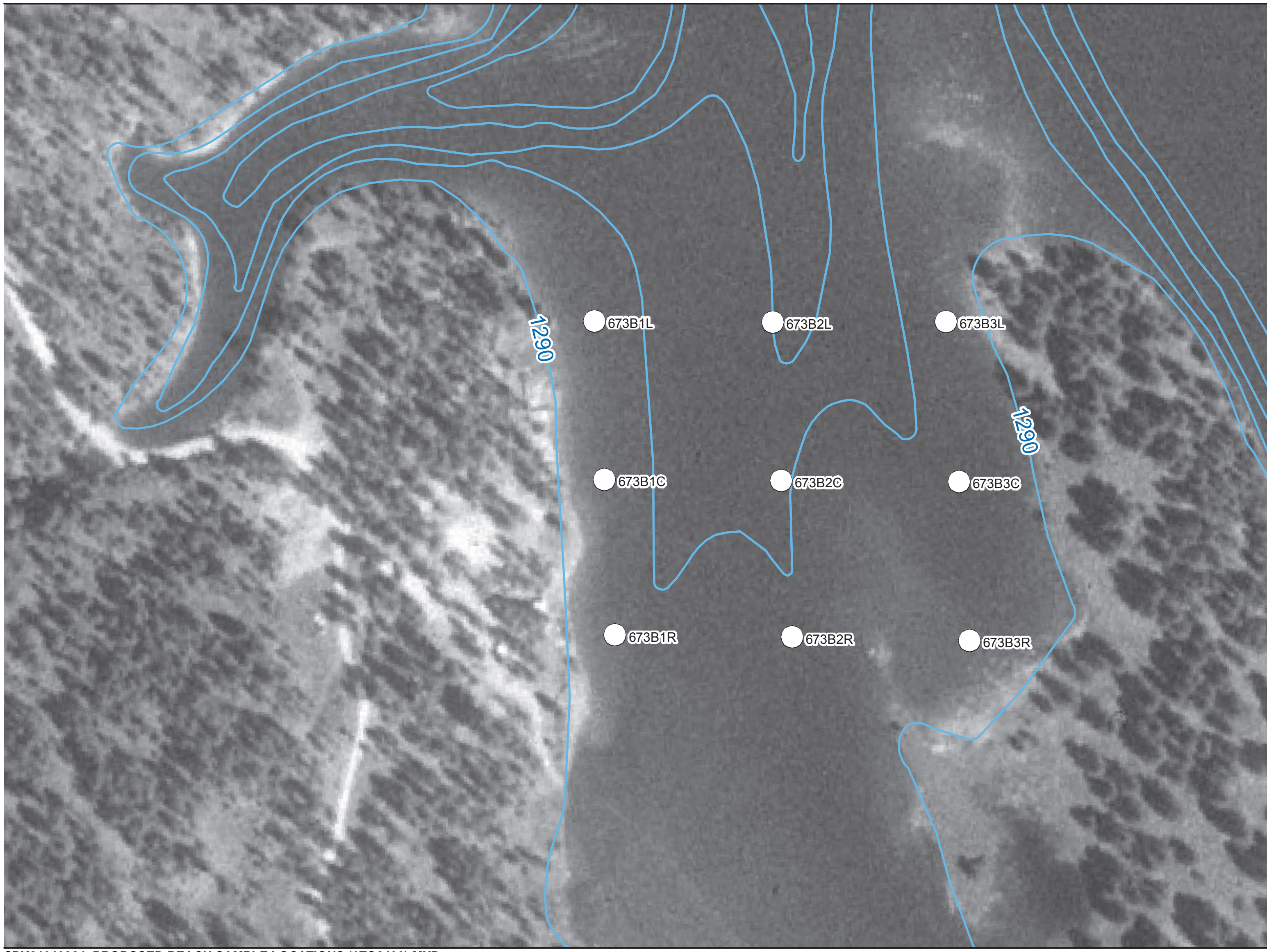


FIGURE 3-22
Cloverleaf Beach
Proposed Beach Sample Locations
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, PROPOSED BEACH SAMPLE LOCATIONS (1TO2400).MXD



LEGEND

Proposed Beach Sample Locations

Beach Samples

1974 USBR Bathymetry

10-foot Bathymetric Contours

N

0 100 200

Approximate scale in feet

FIGURE 3-23
AA Campground
Proposed Beach Sample Locations
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, PROPOSED BEACH SAMPLE LOCATIONS (1TO2400).MXD

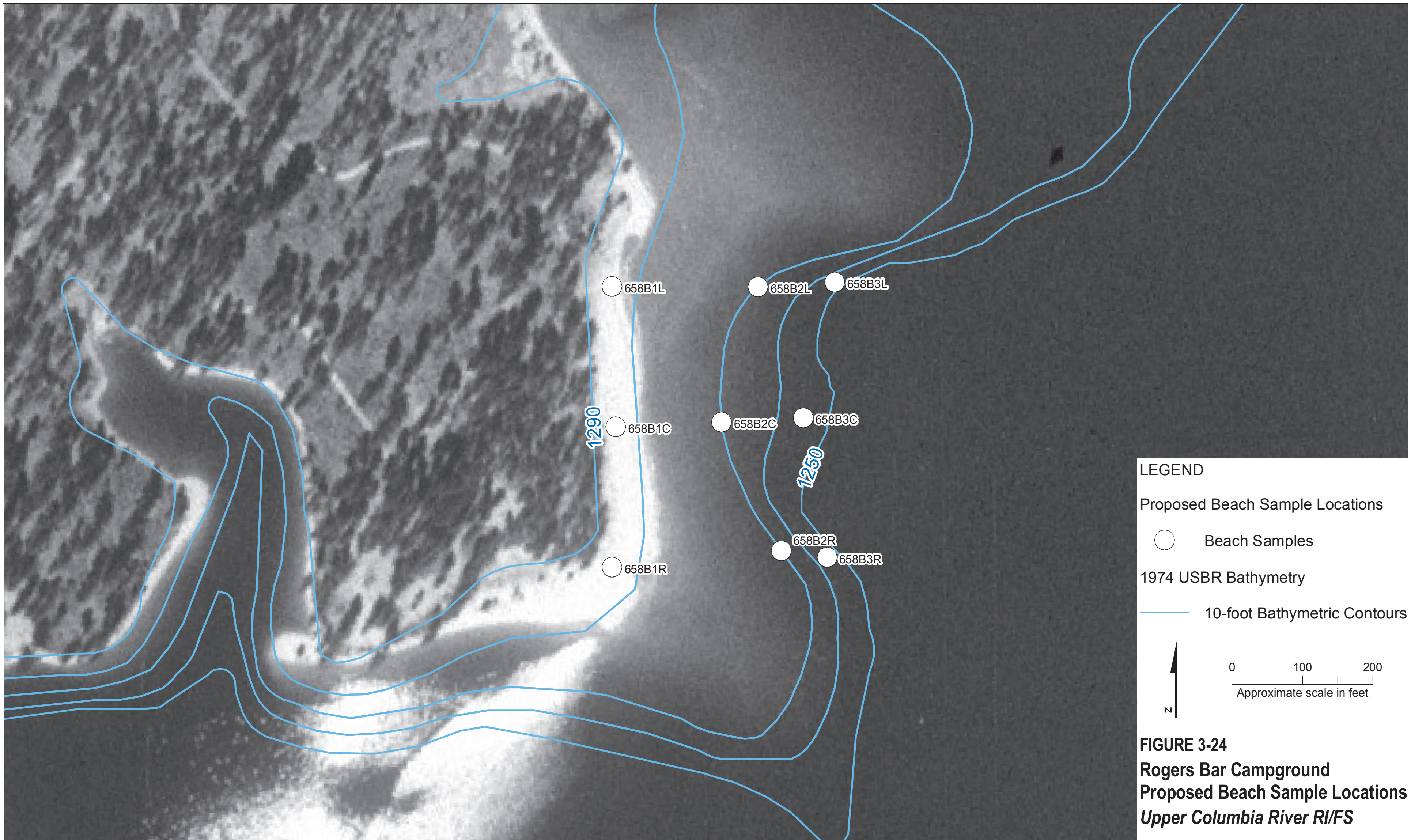


FIGURE 3-24
Rogers Bar Campground
Proposed Beach Sample Locations
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, PROPOSED BEACH SAMPLE LOCATIONS (1TO2400).MXD

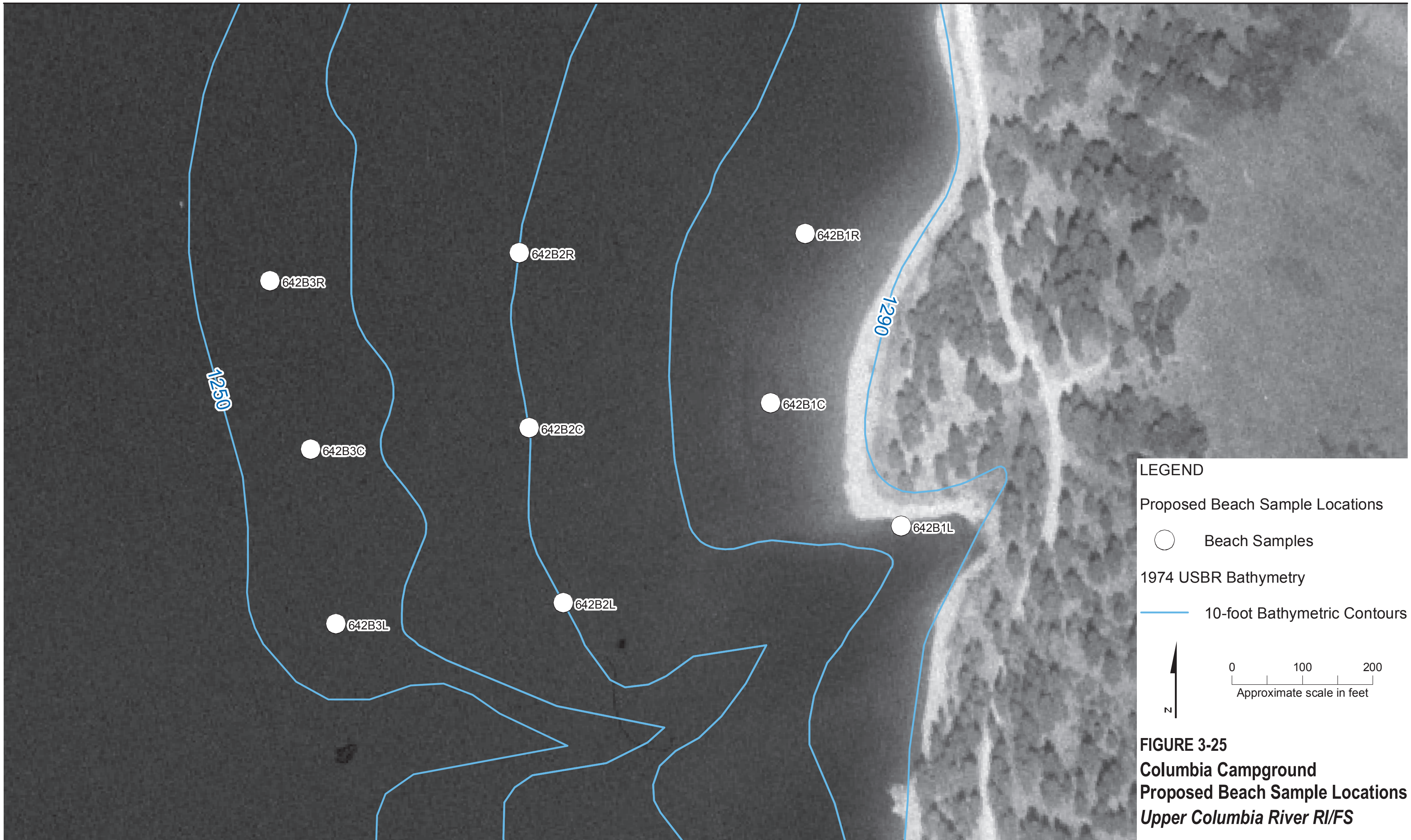
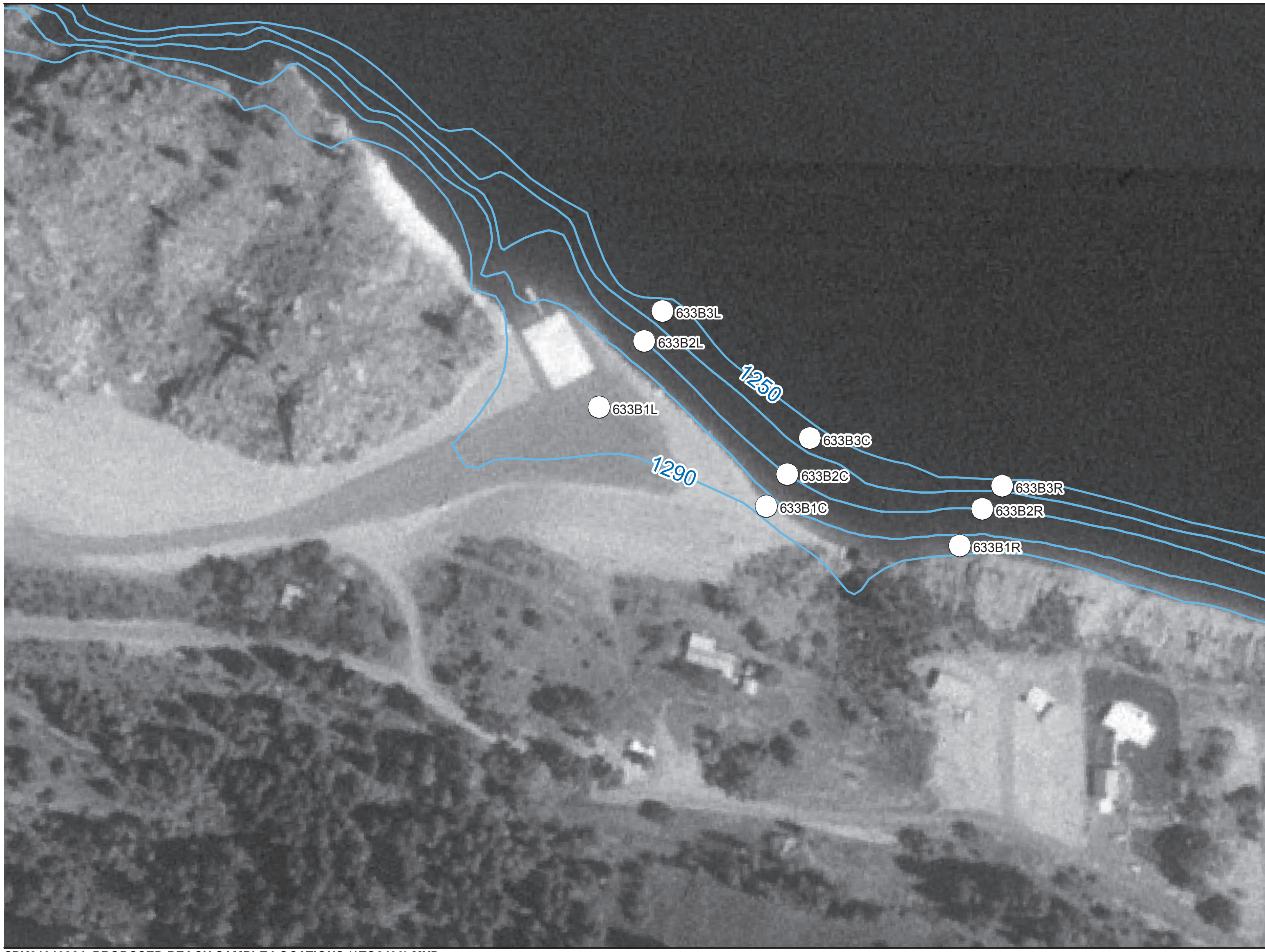


FIGURE 3-25
Columbia Campground
Proposed Beach Sample Locations
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, PROPOSED BEACH SAMPLE LOCATIONS (1TO2400).MXD



LEGEND

Proposed Beach Sample Locations

Beach Samples

1974 USBR Bathymetry

10-foot Bathymetric Contours

N

0 100 200

Approximate scale in feet

FIGURE 3-26
Lincoln Mill Boat Ramp
Proposed Beach Sample Locations
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, PROPOSED BEACH SAMPLE LOCATIONS (1TO2400).MXD

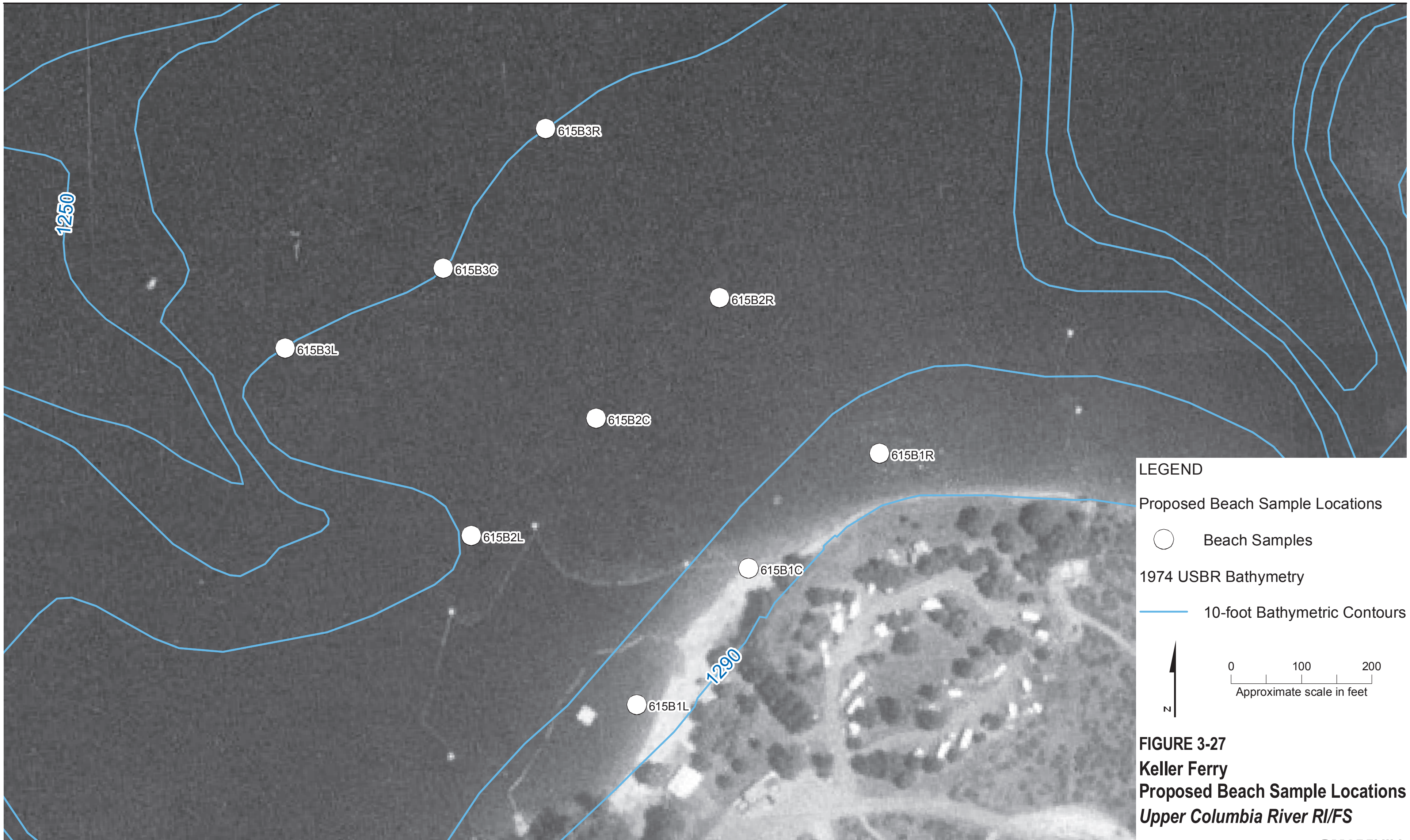


FIGURE 3-27
Keller Ferry
Proposed Beach Sample Locations
Upper Columbia River RI/FS

SPK31010224, PROPOSED BEACH SAMPLE LOCATIONS (1TO2400).MXD

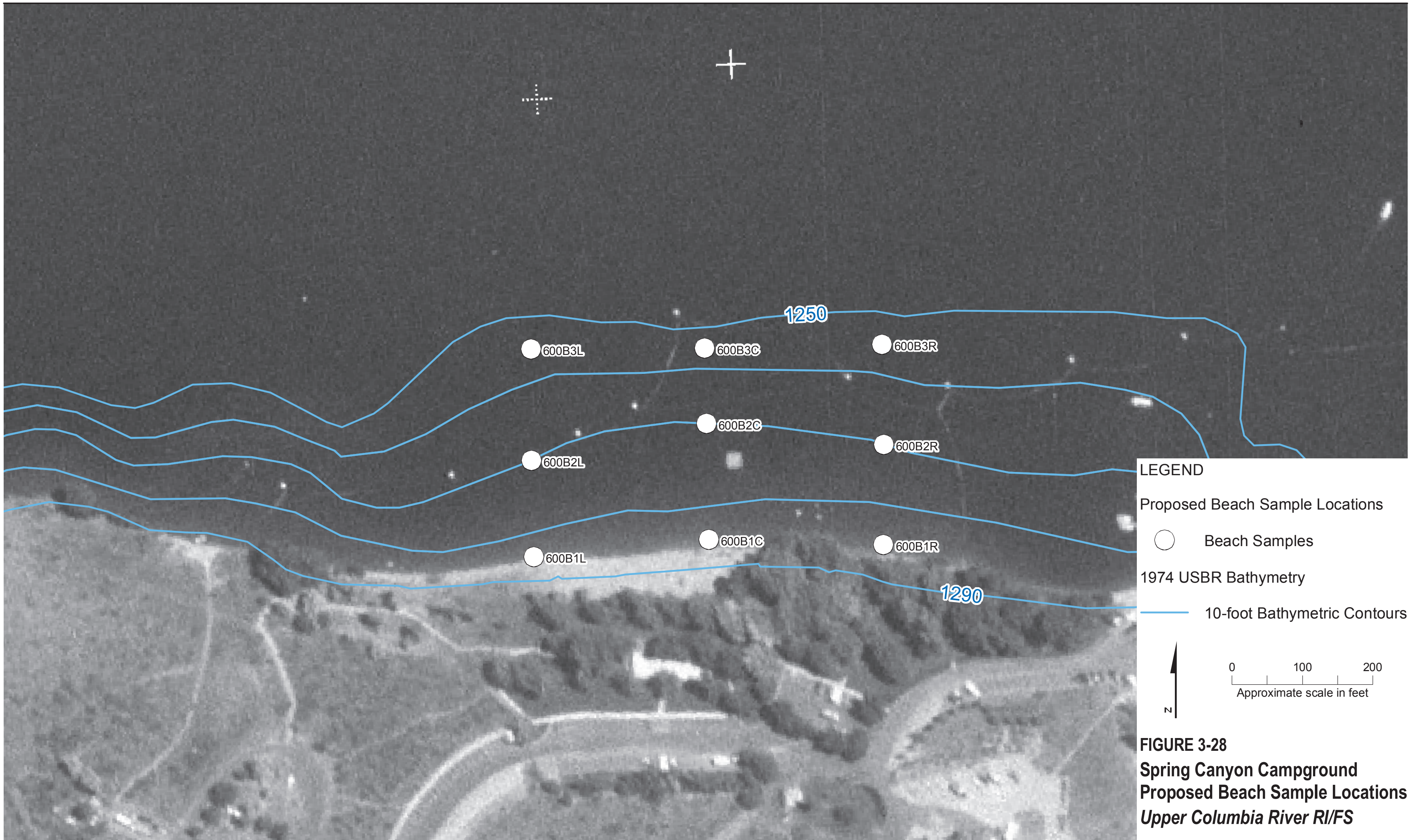


FIGURE 3-28
Spring Canyon Campground
Proposed Beach Sample Locations
Upper Columbia River RI/FS

CH2MHILL

SPK31010224, PROPOSED BEACH SAMPLE LOCATIONS (1TO2400).MXD

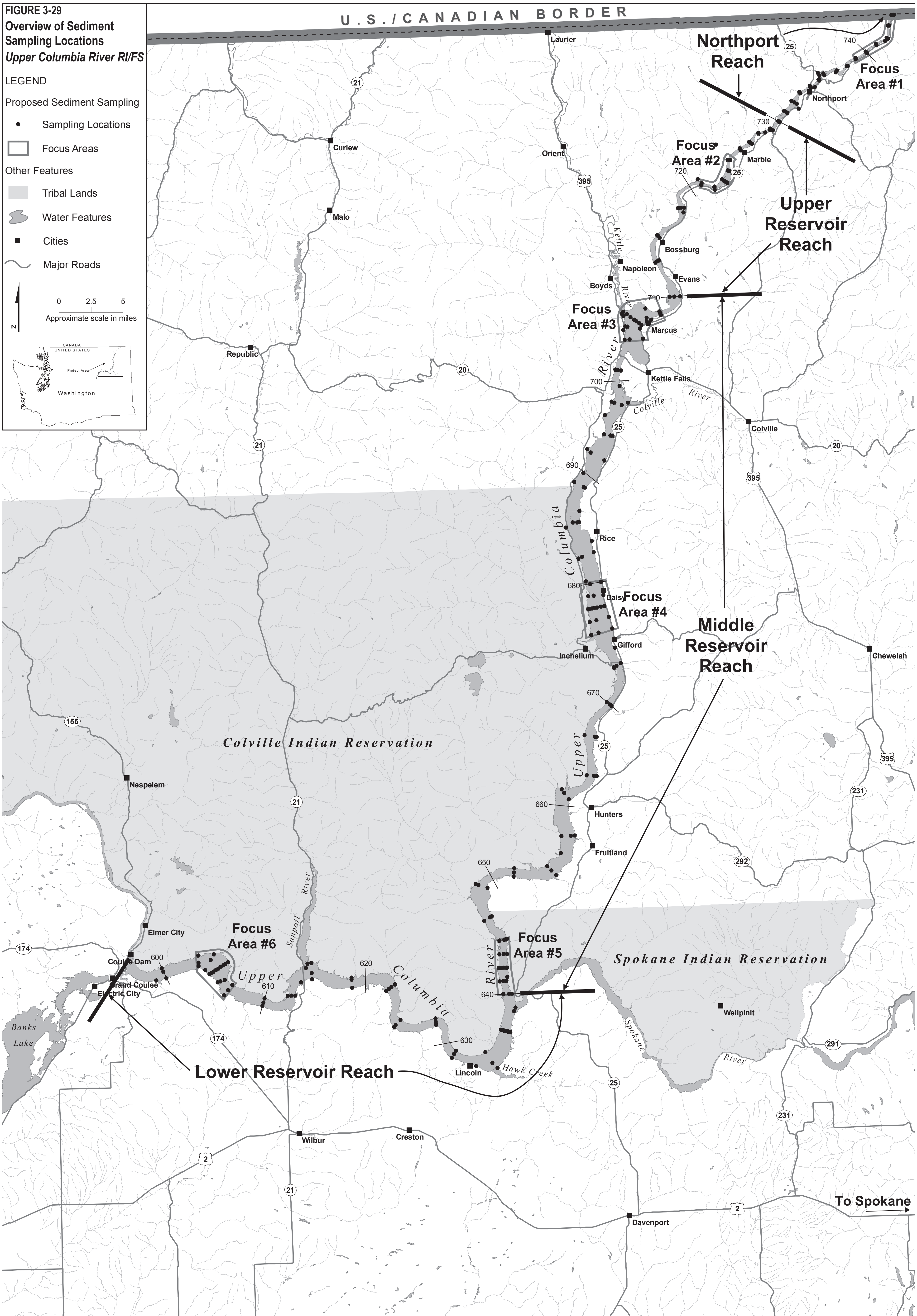


FIGURE 3-29
Overview of Sediment Sampling Locations
Upper Columbia River RI/FS
LEGEND
Proposed Sediment Sampling
Sampling Locations
Focus Areas
Other Features
Tribal Lands
Water Features
Cities
Major Roads
0 2.5 5
Approximate scale in miles
CANADA
UNITED STATES
Project Area
Washington
U.S./CANADIAN BORDER
Northport Reach
Upper Reservoir Reach
Middle Reservoir Reach
Lower Reservoir Reach
Focus Area #1
Focus Area #2
Focus Area #3
Focus Area #4
Focus Area #5
Focus Area #6
Colville Indian Reservation
Spokane Indian Reservation
Upper Columbia River
Kettle River
Colville River
Sanpoil River
Spokane River
Hawk Creek
Banks Lake
Laurier
Northport
Marble
Curlew
Orient
Malo
Bossburg
Napoleon
Evans
Boyds
Marcus
Republic
Kettle Falls
Colville
Rice
Daisy
Gifford
Inchelium
Chewelah
Nespelem
Hunters
Fruitland
Elmer City
Coulee Dam
Grand Coulee
Electric City
Lincoln
Wellpinit
Wilbur
Creston
Davenport
To Spokane
740
730
720
710
700
690
680
670
660
650
640
630
620
610
600
SPK31010224, FIELD SAMPLING PLAN SAMPLING OVERVIEW MAP (FIGURE 3-29).MXD
CH2MHILL

SECTION 4

Rationale for Sample Locations, Number of Samples, and Laboratory Analyses

SECTION 4

Rationale for Sample Locations, Number of Samples, and Laboratory Analyses

The Phase I sampling program is summarized by sample location and type in Table 4-1. The table includes several sample subgroups that were developed as part of planning for the field sampling program and that may be used for specific data evaluation purposes. These include baseline samples, focus area samples, beach samples, tributary mouth samples, bioassay samples (including pore water), and core samples.

The sampling and analysis programs for these sediment sample groups are described in Sections 4.1 through 4.5. Section 4.6 describes the analytical suite for each subgroup. The individual sample locations are listed in Section 5.

4.1 Baseline Samples

Baseline samples include transect and focus area samples. The primary purpose of the baseline sediment samples is to characterize human and/or ecological risk and better define the current nature and extent of contaminants of interest (COIs) over the length and width of the UCR. Baseline samples include both above- and below-water samples. The baseline samples will be analyzed for the standard analytical suite (see Section 4.6).

A subset of the below-water transect samples is the UCR bioassay samples. The sampling program for the bioassay samples is described separately in Section 4.2.

4.1.1 Transect Samples

Baseline transect samples consist of surface sediment samples collected along regularly spaced interval lines (i.e., transects) laid out perpendicular to a line drawn upstream-to-downstream through the middle of the river. Between the U.S.-Canadian border and RM 720, baseline samples will be collected along transects (lines) spaced at 1-mile intervals. Between RM 720 and Grand Coulee Dam, baseline samples will be collected along transects spaced at 3-mile intervals. The 1-mile interval spacing in the upper reaches of the river will allow better refinement of where the bulk of the larger grained slag appears to have been deposited. The 3-mile spacing is appropriate in the lower reaches of the study area, where more homogeneous fine-grained sediments appear to have been deposited.

A minimum of three samples will be collected along each transect: a sample near each opposing river bank, and a sample near the center of the original pre-dam river channel. The mid-channel samples will be collected near the center of the original river channel, where historical sampling has been sparse. At selected transects (RM 605, RM 633, RM 637, RM 642, RM 661, RM 678, RM 692, RM 706, RM 715, RM 723, RM 732, and RM 742), up to six additional samples will be collected in different positions across the channel.

4.1.2 Focus Area Samples

Six focus areas have been identified to assess current and future conditions within selected reaches of the river/reservoir system (see Section 3, Figure 3-29). Given the large size of the site, the focus areas are intended also to serve as smaller, representative sub-areas within the study area that can be used as a gauge of anticipated sediment conditions for the larger areas that lie between focus areas. The focus areas include an increased density of sediment samples (i.e., selected transects, described above) within a discrete area. This greater density of samples will enhance the ability to assess transverse, longitudinal, and vertical changes in COI concentrations, and will provide a baseline for evaluating changes that may result from any potential future remedial actions.

4.2 Bioassay Sediment Samples

Sediment from 50 transect locations along the length of the UCR and from 6 reference locations along UCR tributaries will be used in bioassay tests to evaluate potential toxicity of the COIs to aquatic organisms and to allow correlation of contaminant concentrations and sediment toxicity. The UCR bioassay samples will be colocated with a near-shore baseline transect sample.

Reference bioassay samples will be collected from the following tributaries at elevations greater than the maximum water level in the reservoir:

- Fivemile Creek (RM732)
- Crown Creek (RM725)
- Flat Creek (RM721)
- Nancy Creek (RM705)
- Barnaby Creek (RM686)
- Cheweka Creek (RM685)

The bioassay samples from the UCR and the reference locations will be analyzed for the bioassay analytical suite (see Section 4.6).

In addition to whole sediment (i.e., solids and associated liquid), pore water samples will also be obtained from each of the bioassay and reference area locations. The pore water will be isolated from the whole sediment in the laboratory using centrifugation, as described in Attachment 2, SOP SEDFSP-11, Sediment Pore Water Isolation and Handling Procedures, and the resulting liquid will be analyzed for dissolved TAL metals, plus uranium. The intent of pore water sampling is to provide supporting data for interpretation of biotoxicity in surface sediment.

This procedure is specifically designed to mimic the pore water that the bioassay species are exposed to rather than an attempt to draw conclusions about in situ pore water. It is possible that whole sediment chemistry results from the Phase 1 RI will not correlate with sediment toxicity results well enough to identify a risk-based concentration for sediment. It has been reported at other sites that sediment pore water could provide a better correlation. If whole sediment concentrations correlate poorly with sediment toxicity results and pore water concentrations correlate adequately, the pore water results, along with other supporting information, may be used to estimate risk-based concentrations for sediment.

4.3 Tributary Mouth Samples

Tributary sediment samples will be collected within the UCR near the mouths of six major tributaries. The data from these samples will be used to better understand the role of tributaries from larger watersheds in the study area as potential sources of COIs and to assess potential COI dilution or enrichment effects on main UCR river channel sediments immediately downstream from the tributary mouths.

The Phase I sediment sampling program will include collection of two sediment samples from each tributary mouth area. One sample will be collected approximately mid-mouth at the tributary's confluence with the UCR. The other sample will be collected along the near bank of the UCR approximately 0.1 to 0.2 mile downstream from the mouth of the tributary. At the Colville River (RM 699), only one tributary mouth sample is planned: a transect sample at RM 698 will serve as the downstream tributary mouth sample. Tributary mouth samples will be analyzed for the standard analytical suite (see Section 4.6)

4.4 Beach Sediment Samples

A total of 15 beach areas were selected for sampling in order to provide a sufficient number of representative samples to assess potential risk to human and ecological receptors. These beaches include the following:

- Black Sand Beach—RM 742, East Side
- Northport City Boat Launch—RM 735, East Side
- Dalles Orchard—RM 730, East Side
- North Gorge Campground—RM 718, East Side
- Marcus Island Campground—RM 708, East Side
- Kettle Falls Swim Beach—RM 700, East Side
- Haag Cove—RM 697, West Side
- French Rocks Boat Launch—RM 690, West Side
- Cloverleaf Beach—RM 675, East Side
- AA Campground—RM 673, East Side
- Rogers Bar Campground—RM 658, West Side
- Columbia Campground—RM 642, East Side
- Lincoln Mill Boat Ramp—RM 633, East Side
- Keller Ferry No. 2—RM 615, East Side
- Spring Canyon Campground—RM 600, South Side

Three of the beaches—Northport City Boat Launch, Kettle Falls Swim Beach, and Columbia Campground Beach—have been identified as areas of interest, where more detailed discrete and composite sampling will occur. The sampling and analysis program for the selected beaches is described in Section 4.4.1. Conditions at the other 12 beaches will be represented by composite samples. The sampling and analysis program for these beaches is described in Section 4.4.2. The layouts of the sampling configurations at these beaches are shown in Section 3, Figures 3-14 to 3-28.

4.4.1 Selected Beach Samples

The sampling program for Northport City Boat Launch, Kettle Falls Swim Beach, and Columbia Campground Beach consists of collecting discrete samples from nine locations at each beach. The nine samples will be laid out along three specified elevation contours (to be determined based on beach topography; see Figures 3-15, 3-19, and 3-25) so that three samples spaced 200 to 300 feet apart are obtained from each contour. The upper 10 to 15 cm of sediment at the beach will be sampled. The area to be sampled at each beach was selected based on human use patterns and takes reservoir water levels and topography into account. Beach sampling is scheduled for a period when the reservoir level will be at or below 1255 feet. Therefore, most beach sample locations will not be submerged at the time of sampling. The samples will be analyzed for the standard analytical suite.

In addition to the discrete samples, three elevation-specific composite samples will be made by combining samples taken from the three locations along each elevation contour line. These composite samples will be analyzed for dioxins and furans.

Also, a large composite sample will also be created from the nine sample locations at a beach. The composite sample will be submitted to a laboratory for particle-size fractionation by sieving, as described in SOP SEDFSP-10, Preparation of Particle-Size-Fractionated Samples For Chemical Analysis. Two samples will be fractionated from the composite, one made up of sediment between 2 mm and 75 microns and one made up of sediment less than 75 microns. The fractionated samples will be analyzed for the standard analytical suite. The results for the size-fractionated samples will be used in the human health risk assessment to gauge contaminant concentrations in the fraction of the beach sediment that may be inhaled.

4.4.2 Standard Beach Samples

The sampling program for the other 12 beaches consists of collecting 3 composite samples from 9 locations at each beach. As with the selected beach sampling program, the nine samples will be laid out along three specified elevation contours (to be determined based on beach topography; see maps in Section 3) so that three samples spaced 200 to 300 feet apart are obtained from each contour. Composite samples will be created from the three samples taken along each elevation contour. The upper 10 to 15 cm of sediment at the beach will be sampled. The area to be sampled at each beach was selected based on human use patterns and takes reservoir water levels and topography into account. Beach sampling is scheduled for a period when the reservoir level will be at or below 1255 feet. Therefore, most beach sample locations will not be submerged at the time of sampling. The composite samples from each beach will be analyzed for the standard analytical suite and dioxins and furans (see Section 4.6).

4.5 Sediment Core Samples

Sediment core samples will be collected to characterize vertical variations in COI concentrations within the upper sediment column and to establish the apparent thickness of the contaminated sediment layer at selected locations. Sediment cores will be obtained at 13 locations along the length of the study area.

The cores will be divided into multiple samples representing the full thickness of sediment recovered at each location, with the upper 1 foot of sediment divided into two 6-inch-long sample intervals and the remainder of the core being divided into 24-inch-long sample intervals. Samples from cores obtained at two locations above Marcus Flats (RM 734 and RM 715), and five locations below Marcus Flats (RM 704, RM 692, RM 661, RM 637, and RM 605) where TOC concentrations increase will be analyzed for the standard analytical suite and dioxins and furans. Samples from the remaining cores will be analyzed for the standard analytical suite.

4.6 Laboratory Analyses

The analytical suites included in the Phase I sediment sampling program consist of the following:

- **Standard Analytical Suite**: TAL metals (plus uranium), TCL SVOCs, TCL pesticides/PCB aroclors, TOC, and particle size
- **Dioxins and Furans :** Tetra through octa chlorinated dibenzo-p-dioxins and chlorinated dibenzofurans
- **Bioassay Analytical Suite:** TAL metals (plus uranium), TCL SVOCs, TCL pesticides/PCB aroclors, TOC, AVS/SEM, and toxicity tests
- **Dissolved Metals:** Dissolved TAL metals (plus uranium) in pore water isolated from sediment

The laboratory analytical suite required for each sample group is listed in Table 4-1. Individual analytes and parameters associated with the listed analytical suites are provided in Table 2-1 in the main body of the Quality Assurance Project Plan (QAPP).

TABLE 4-1
Summary of Phase I Sediment Sampling Program
Upper Columbia River RI/FS

Sample Type/Group	Standard Analytical Suite: TAL Metals (plus uranium), TCL SVOCs, TCL Pesticides/PCB Aroclors, Particle Size, TOC	Bioassay Analytical Suite: Standard Analytical Suite plus AVS/SEM, and Bioassay	Dissolved TAL Metals	Dioxins and Furans
Baseline Samples [a]	205			
Bioassay and Reference Samples [b]		56		
Pore Water Isolated from Bioassay and Reference Samples[b]			56	
Tributary Mouth Samples[c]	11			
Selected Beach Discrete Samples[d]	27			
Selected Beach Composite Samples[e]				9
Selected Beach Fractionated Composite Samples[f]				
As-Received, Wet Composite Samples	3			3
Air-Dried, Particle-Size-Fractionated Samples	6			6
Standard Beach Composite Samples[e]	36			36
Core Samples[g]	78			42
Total	**366**	**56**	**56**	**96**

[a] Includes standard and selected transects. Selected transects are located at RM 605, RM 633, RM 637, RM 642, RM 661, RM 678, RM 692, RM 706, RM 715, RM 723, RM 732, and RM 742. These transects correlate with the 11 designated river/reservoir areas where Phase I fish sampling activities will be conducted, 6 of which overlap with the sediment focus areas.

[b] The UCR bioassay samples will be colocated with a nearshore baseline transect sample.

[c] Two samples per tributary (except at RM 699, where transect sample serves as downstream tributary sample).

[d] Northport City Boat Launch, Kettle Falls Swim Beach, Columbia Campground Beach; nine discrete samples per beach.

[e] Three composite samples per beach area. Each will be made from three grab samples taken over a lateral area of 200 to 300 feet along a specific elevation line

[f] One composite per beach, two particle size fractions per composite.

[g] Up to 10 feet of core, six samples per core (0 to 6 inches, 6 to 12 inches, every 2 feet thereafter).

Note: The sample counts listed here do not include quality control samples (field duplicates and matrix spike/matrix spike duplicates). The locations of quality control samples are identified in Attachment 1, Sampling and Analysis Matrix.

SECTION 5

Samples and Analyses

SECTION 5

Samples and Analyses

A full listing of sample locations, sample intervals, and analytical suites for the Phase I sampling program is provided in Attachment 1. Maps showing the sample locations are provided in Section 3, Figures 3-4 to 3-28.

The detailed sampling matrix will be used by the field teams to establish the day's objectives by providing a detailed reference guide for estimating specific samples types and sample container requirements to be collected on that day. The detailed sampling and analysis matrix has been designed to work in conjunction with the detailed operations schedule provided in Attachment 3. Together they will assist the field team leaders (FTLs) and sampling team leader (STL) in managing the day-to-day fluctuations in progress being made by sampling teams.

Note that sampling locations are currently being assessed for potential conflicts with historical or cultural resources. Some sampling locations may be relocated as a result of this assessment. In addition, conditions encountered during sample collection may require either relocation or abandonment of some sample locations.

SECTION 6

Field Methods and Procedures

SECTION 6

Field Methods and Procedures

This section describes field methods and procedures to be used for Phase I sediment sampling, organized in accordance with USEPA guidelines. Section 6.1 catalogs the required sample containers and preservatives. Section 6.2 describes procedures to be used for the sampling and includes information about the field operations schedule, sample station positioning and elevation control, coordination with cultural resource observers, field equipment requirements, and specific procedures for below- and above-water sample collection. Section 6.2 is supported by detailed Standards of Practice (SOPs) in Attachment 2. Section 6.3 describes decontamination of sampling equipment, and Section 6.4 discusses handling of investigation-derived waste (IDW). Section 6.5 describes sample management procedures and documentation, including procedures for sample packaging and shipment, sample labeling, and sample documentation. Section 6.6 identifies sampling to be performed for quality control purposes.

6.1 Sample Containers and Preservatives

Summary listings of the sample containers and preservatives required for all samples to be collected in the Phase I sampling are provided in Table 6-1 for sediment samples and Table 6-2 for samples of pore water isolated in the laboratory.

6.2 Sample Collection and Field Measurements

This section describes the methods to be used to access and gather sediment samples at the UCR Site. The methods presented are intended to provide standardized, reliable, and repeatable results in an economical manner and were derived from the following guidance and technical practice documents:

- *Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual* (EPA 823-B-01-002) (USEPA 2001).
- *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, Sediment Sampling and Analysis Plan Appendix (USEPA 1988)
- *Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards* (Washington Department of Ecology [Ecology] 2003)
- *Contract Laboratory Guidance for Field Samplers* (EPA 540-R00-003) (USEPA 2004)

The general approach to sample collection consists of the following activities:

1. Transport sample equipment and samplers by boat or vehicle to sediment sample locations.

2. Deploy sediment sampling equipment appropriate to substrate type, sample type, and other location-specific factors.
3. Visually examine recovered sediment and record physical and cultural resource observations.
4. Homogenize sample and remove coarser grained particles and debris
5. Transfer sediment samples to appropriate holding containers and/or laboratory bottles.
6. Prepare field sampling records.
7. Decontaminate sampling equipment.
8. Manage IDW.
9. Transfer samples to the onshore sediment sample processing facility.
10. Ship samples to the laboratory.

6.2.1 Field Operations Schedule and Personnel

Operations Schedule

Field mobilization for the work described in this FSP is expected to begin in early March 2005. The sampling will be initiated in early April and conclude by the end of May 2005. The anticipated field schedule is provided in Figure 6-1.

Work activities will be staged out of the marinas at Kettle Falls and Two Rivers (see Section 3, Figure 3-3). At each marina a sheltered sediment processing station configured with work benches, equipment storage space, electricity, lighting, and water will be established.

The sampling will be performed by the following six field teams:

- Four water-based sampling teams (associated with Vessels A, B, C, and D)
- One ground-based sampling team
- One sample processing team

The water-based sampling teams will use specially configured vessels to facilitate rapid travel between sometimes remote sampling stations. If relatively easy access to a sufficient number of above-water or shallow water sampling stations is possible, consideration will be given to mobilizing a ground-based sampling team to ensure delivery of the work to meet the target schedule. A sample processing team will staff the processing stations located at each marina on a daily basis to handle processing and paperwork associated with the multitude of samples delivered each evening from the sampling teams.

The summary field schedule shown in Figure 6-1 lists significant attributes associated with the four water-based sampling teams. These attributes include staging locations, nonwork days, and specific vessels assigned to complete coring operations along selected river miles. A detailed operations schedule showing the basis and assumptions for preparation of the summary schedule is provided as Attachment 3. The detailed operations schedule will be used by the field team assigned to each vessel to establish the day’s objectives, provide a detailed reference guide for estimating vessel transit time to and from the sample stations, provide horizontal coordinates and vertical elevations, and describe the basis for collection of each sample. The detailed operations schedule serves as a general guide and will be updated by the STL on a daily basis in order to manage the day-to-day variations in progress being made by the sampling teams and to manage the workload distribution.

The proposed detailed operations schedule in Attachment 3 will be used as a guide. Adjustments to specific dates may be necessary to account for variable conditions such as inclement weather, difficulties in accessing sampling locations, or time needed to collect samples. Modifications to the field operations schedule are expected and will be monitored by the CH2M HILL project manager on a regular basis.

Sampling Team Roles and Responsibilities

The sampling team organization for the Phase I sediment sampling is shown in Figure 6-2. The following paragraphs describe the roles and responsibilities of the personnel directly responsible for field sampling management and implementation. Roles and responsibilities for the other personnel are described in the main body of the QAPP.

CH2M HILL Project Manager. The CH2M HILL project manager is Jim Stefanoff. Mr. Stefanoff has the responsibility for the overall performance of the field team in performing the Phase I sediment sampling program. He is responsible for the ultimate decisions regarding the implementation of this project and for ensuring that the procedures and processes are followed in accordance with the contractual requirements. He also has responsibility for maintaining the project budget and schedule.

CH2M HILL Remedial Investigation Task Lead. The CH2M HILL RI task lead is Chuck Gruenenfelder. Mr. Gruenenfelder provides direct support to Mr. Stefanoff on all aspects of the project as it relates to execution of the remedial investigation.

CH2M HILL Sampling Team Leader. John Culley is assigned the role of STL and also will serve as the overall safety coordinator—hazardous waste (SC-HW). Mr. Culley will have day-to-day working knowledge of all aspects of establishing and maintaining the onsite field operations, including staffing and on-the-scene decision-making.

CH2M HILL Field Team Leaders. The CH2M HILL FTLs will direct daily field operations, act as the SC-HW for each team, and coordinate closely with the STL and vessel operators concerning operational procedures.

Vessel Operators. The vessel operators are at all times responsible for the prudent and safe operation of the vessel and are responsible for approving or disapproving any particular operation or maneuvering of the vessel.

Field Technicians. The field technicians will provide as-needed sampling support to the FTL as necessary.

Cultural Resources Observer. The cultural resources observer will be responsible for observing the samples as they are obtained. The observer is responsible for notifying the CH2M HILL FTL if cultural remains or artifacts are present or suspected in the sample material and for implementing USEPA-approved Section 106 protocols for protecting the sampling locations from further impact.

CH2M HILL Sample Processing Coordinator. Nahide Gulensoy will serve as CH2M HILL's Sample Processing Coordinator and will direct all sample processing, shipping, and logistics in the field. Ms. Gulensoy will serve as the main point of contact with USEPA's designated sample coordinator.

Sample Preparation Technician. The Sample Processing Support Technician will report directly to the Sample Processing Coordinator and will support all aspects of sample processing, shipment, and transport.

Coring Subcontractor. The coring subcontractor will be responsible for collecting the core samples and providing them to the FTL for processing by the land-based sample processing team.

The complexity and duration of the project requires that staff from several organizations be used to fill a number of the above-listed roles. To support the scheduling of these staff, a detailed personnel schedule has been prepared and is provided in Attachment 4. This schedule will be used by the project team to obtain staffing commitments and to assist in managing the week-to-week changes in staffing needs as the work progresses.

6.2.2 Station Positioning and Elevation Control

The horizontal and vertical locations of the sampling stations will be established using methods that depend on whether the samples are below or above water. For below-water sampling sites, horizontal positioning will be accomplished using a differential global positioning system (DGPS) (or GPS if the U.S. Coast Guard differential signal cannot be received). Water depths will be determined using a fathometer, lead line, or surveyor rod. For above-water sampling sites, DGPS/GPS measurements will be used initially to locate the pre-planned location of the sampling point. This position will then be adjusted, as needed, to achieve the desired elevation specified in Attachment 1. Elevations of above-water samples will be determined using a laser rangefinder with an integrated inclinometer.

SOPs are provided in Attachment 2 for station positioning at below- and above-water stations and for elevation control at beach sampling locations, as follows:

- SOP SEDFSP-1: Positioning at Below-Water Stations
- SOP SEDFSP-2: Positioning and Elevation Control at Above-Water Stations

6.2.3 Cultural Resource Coordination

The UCR corridor is highly sensitive in terms of cultural and historical resources. As a result, USEPA will involve cultural resource observers (assigned by others) as part of each field sampling team. These observers will provide direct guidance to the teams if any cultural or historical resources are discovered during sampling. The planned sample locations are being screened based on review of known or recorded archeological and/or historical sites. Where spatial conflicts between a desired sampling location and a cultural resource are identified during sample planning, the sampling location may be moved to an alternative location that does not conflict with known or recorded cultural resource sites.

A qualified cultural resource specialist will be present during sample retrieval and processing to account for the possible presence of unknown or unrecorded archeological or historical sites. The cultural resource specialist will observe the samples as they are obtained and notify the FTL if cultural or historical resources are present in the sample material. If cultural or historical resources are observed, sampling will immediately cease in that location and the cultural resource observer will implement USEPA-approved Section 106 protocols for protecting the site from further impact. If a sample location is abandoned under these circumstances, the FTL will confer with the cultural resource observer to identify an alternative sample location. If a suitable location cannot be established in the area, the area will be vacated and the situation reported to the STL at the end of the day's activities. The STL will then confer with the RI task lead to establish the need for any further activities.

6.2.4 Field Equipment

Required Supplies and Equipment

SOPs SEDFSP-3, 4, and 5 list the minimum requirements for supplies and equipment to be available to the field teams each field day based on the type of operations being performed. SOP SEDFSP-3 shows the requirements for below-water sediment sampling, SOP SEDFSP-4 lists the requirements for coring operations, and SOP SEDFSP-5 gives the requirements for above-water sediment sampling.

Equipment Calibration and Procedures

The DGPS/GPS navigation equipment will be checked each morning at the dock by comparing it against a known (i.e., surveyed), previously established monument. If the position fix exceeds 10 meters from the actual position, the USCG Maritime Differential GPS Service will be checked to determine whether it is operating correctly. USCG notifies users of any outages via the RTCM SC-104 (Maritime Services Special Committee 104) Type 16 message, which will be available on the DGPS/GPS unit. If there is an outage, the vessel will not get underway. The CH2M HILL STL will be notified so that a decision can be made regarding further field operations. If the DGPS/GPS system is operating properly and the position fix is more than 10 meters from the actual position, the troubleshooting procedures in the DGPS/GPS operating manual will be followed to try to determine the cause. If the problem cannot be resolved, the STL will be notified.

Before getting underway in the morning, the fathometer will be checked by taking a sounding at the dock and comparing the reading with a lead line measurement of the depth. The fathometer water depth should be within ±0.15-meter (0.5-foot) of the lead line sounding for depths 10 meters or less. The fathometer setting will be adjusted as needed until the soundings agree with each other.

6.2.5 Sample Collection Procedures

As noted in Section 4, the sample groups are categorized into subsets based on whether the sampling locations lie above or below the waterline at the time of sampling. The location above or below water is important because different sampling equipment and procedures may be required for sample collection.

The following subsections describe the sampling procedures to be used for above- or below-water sampling. To assist the field teams in preparing to take samples at different locations,

Figure 6-3 was developed showing the various types of below- and above-water sampling situations that can occur among the sampling groups.

Below-Water Sediment Sample Collection Procedures

Two primary types of below-water sediment samples will be collected: surface sediment grab samples for chemical and/or bioassay/pore water analysis, and core samples for chemical analysis. In addition, reconnaissance sampling will be conducted in the free-flowing segment of the river above the reservoir (reconnaissance samples will not be submitted for chemical analysis and are therefore not identified in Sections 4 or 5). The methods of sample retrieval (preparation and procedures) and sample processing for each sample type are discussed in the following subsections. If cultural or historical resources are discovered at any time during the sampling process, the sampling at that location will cease and the protocol summarized in Section 6.2.3 will be followed.

Grab Samples

Below-water surface sediment samples will typically be collected using a 0.11-square-meter (m^2) stainless steel (modified) van Veen grab sampler. This type and size of sampler is capable of collecting up to 20 liters (5.3 gallons) of sample. At shallow water locations that cannot be accessed by boat, smaller devices such as a petite ponar (2.5-liter capacity) or hand tools may be required to obtain samples. In such areas, multiple grabs may be needed to collect adequate sample volume to fill sample containers.

Detailed sample collection and sample processing procedures for collecting grab samples with the van Veen sampler and other equipment are described in Attachment 2 in SOP SEDFSP-3, Below-Water Grab Sampling Procedures.

Core Samples

Sediment core samples will be collected using a vibratory corer (hereafter referred to as a vibracorer). Vibracorers have an electric-powered, mechanical vibrator located at the head end of the corer that applies thousands of vertical vibrations per minute to help penetrate the sediment. A core tube and rigid liner of varying diameter, depending on the specific vibrator head used, is inserted into the head and the entire assembly is lowered into the water. Use of a vibracorer requires a relatively large and stable vessel to maintain balance and provide adequate lift to break the corer out of the sediment and retrieve it.

This method typically preserves the subsurface sediment profile, yielding excellent sample integrity. Because of equipment safety issues and specialized skills related to this type of sampling activity, the vibracorer sampling will be performed by an experienced subcontractor.

Detailed sample retrieval procedures for collecting core samples with the vibracorer are described in technical performance specifications (see Attachment 5). Detailed core sample processing procedures are described in SOP SEDFSP-4, Sediment Core Sample Processing Procedures (see Attachment 2).

Reconnaissance Sampling in Areas of High Currents

Above river mile (RM) 734, it is likely that areas of the river will have currents too strong (3 feet per second [ft/sec] (0.9 meter per second [m/sec] or greater) for collecting samples using grab or core samplers. In such areas, reconnaissance-level sampling may occur during the first several days of mobilization to assess the general nature of the riverbed, which may assist in planning future field efforts. The Helley-Smith bedload transport sampler would be employed under these circumstances under the direction of the STL or FTL. Samples collected using the Helley-Smith sampler will not be retained or submitted for chemical analysis.

Procedures for collecting grab samples with the Helley-Smith sampler are described in Attachment 2 in SOP SEDFSP-6, Sampling Procedures in Areas of Strong Currents.

Above-Water Sediment Sample Collection Procedures

Above-water sediment samples will be obtained from areas above the waterline that were deposited during flood conditions. Sampling of above-water sediments will be accomplished using disposable hand tools. The sampling team will access the sampling sites by vehicle or boat and disembark to retrieve the samples. If historical or cultural resources are discovered at any time during sample retrieval, the sampling activity at that location will cease and the protocol outlined in Section 6.2.3 will be followed.

Detailed sample retrieval and sample processing procedures for collecting above-water grab samples with disposable hand tools are described in Attachment 2 in SOP SEDFSP-5, Above-Water Sampling Procedures. SOP SEDFSP-5A and SOP SEDFSP-5B provide further details on discrete and/or elevation specific composite sampling at standard and selected beaches, respectively (see Section 4.4 for lists of standard and selected beaches).

6.3 Equipment Decontamination Procedures

This section addresses decontamination procedures for sampling equipment that comes into contact with sediment, both in the field and at the land-based processing center. The field team will decontaminate reusable sampling equipment prior to commencement of sampling, between sample locations, and upon completion. It is not necessary to decontaminate equipment between multiple grabs from the same location, or between grabs from multiple locations that will be mixed together to form a single composite sample (for example, elevation-specific beach composites). For sampling from land, separate sample processing equipment (that is, bowls, spoons, trowels) will be dedicated to only one location per day and all materials that come into direct contact with sample materials will be disposed of. Disposable equipment will be used whenever possible to avoid potential cross-contamination and reduce generation of decontamination fluids. Specific procedures for decontamination are described in SOP SEDFSP-8, Decontamination of Sampling Equipment.

Disposable sampling equipment and decontamination materials and liquids will be contained and disposed of in accordance with the procedures set forth in Section 6.4.

6.3.1 Decontamination Prior to Sampling

Equipment that will come into direct contact with sediment during sampling either in vessels or on land will be decontaminated prior to the commencement of each day’s sampling in order to minimize cross-contamination. This includes the van Veen grab samplers, vibracorer barrels, and sample processing equipment (for example, spoons, knives, bowls).

6.3.2 Decontamination During Sampling

The rigor of decontamination depends on the nature of the equipment, as follows.

Rigorous Decontamination

Rigorous decontamination will be performed on all nondisposable equipment used to directly handle and process sediment samples for analysis. This equipment includes sample spoons, knives, bowls, trowels, and any other nondisposable equipment that comes into direct contact with sediment that will be submitted for analysis and is to be reused. Most sample handling and processing equipment does not fall into this category because it will be disposable. The need for rigorous decontamination procedures is expected to be very limited. Specific procedures for rigorous decontamination are described in SOP SEDFSP-8, Decontamination of Sampling Equipment.

Limited Decontamination

Limited decontamination (that is, omission of dilute nitric acid and hexane rinses and aluminum foil wrapping) will be performed on equipment used to access and gather submerged sediment. This equipment includes the van Veen grab sampler, petite ponar sampler, and the vibracore barrel. The rationale and specific procedures for limited decontamination are described in SOP SEDFSP-8, Decontamination of Sampling Equipment.

6.3.3 Decontamination of Sample Containers

The field team will clean the outside of all sealed sample containers with paper towels that are moistened with distilled water to remove visible excess sediment.

6.4 Containment and Disposal of Investigation-Derived Waste

The procedures for the containment and disposal of IDW that will be generated during the field sampling activities will depend on the type and source of waste. Types of IDW are as follows:

- Excess sediment from core samples
- Decontamination fluids
- Disposable equipment (for example, paper towels, gloves, core liners)

IDW will be contained on board the vessels during sampling activities. Each vessel will be equipped with sealable wastewater containers for decontamination fluids, polyethylene drums for visibly contaminated sediment, and heavy-duty garbage bags for disposable equipment. All IDW will be transferred from the containers on board the vessels to the land-based processing center for storage in labeled Washington Department of Transportation (WSDOT)-approved 55-gallon drums. Chemical analysis associated with IDW characterization is identified as a DQO in Appendix A.

6.4.1 Excess Sediment from Grab Samples

In most cases, excess sediment and rejected sample sediment from the below-water grab samples will be returned to the water at the station where the sediments were collected. Sediment that spills onto the deck of the vessel will be rinsed from the deck before moving to the next sample location. Significant volumes of excess sediment will not be retrieved from above-water sample locations because it is easier to control the volume of sediment retrieved using hand tools. This minimal amount of excess sediment will be replaced on the beach where it was collected.

Sediment from below-water grab samples with obvious evidence of contamination (for example, oily sediment) will be contained and stored in the sample processing center for characterization and disposal at an approved facility. Sediment volumes retained from such samples are expected to be minimal.

6.4.2 Core Sample Excess Sediment

The land-based team will process all core samples within the designated land-based processing center. Excess sediment from the cores will be contained in the labeled 55-gallon WSDOT-approved sediment storage drum and temporarily stored within the sample processing center. Upon completion of the field investigation, the waste will be characterized and disposed of at an appropriate disposal facility. It is estimated that the volume of excess core sediment will not exceed 55 gallons.

6.4.3 Decontamination Fluids

All reusable sampling equipment will be decontaminated according to the procedures described in Section 6.3. However, the potential for generation of possibly hazardous decontamination fluids is very limited because most sample handling and processing materials will be disposable or will be subject to limited decontamination.

Fluids generated by limited decontamination of larger sampling equipment will be limited to water and nonphosphate detergents. Given the types of contaminants in the sediment, it is unlikely that the decontamination fluids would become contaminated by short-term contact during washing and rinsing of the van Veen or vibracore barrel. Therefore, the accumulated decontamination fluids from the vessels may be disposed of as nonhazardous wastewater in a municipal wastewater treatment facility.

The rigorous decontamination procedure, which involves nitric acid and hexane rinses, will be used rarely if at all. If such procedures are necessary, the resulting decontamination fluids will be contained and stored in the sample processing center for characterization and disposal at an approved facility.

6.4.4 Disposable Items

Disposable items such as disposable hand tools and bowls, personal protective equipment (PPE), gloves, paper towels, and used core liners will be contained in heavy-duty bags for subsequent disposal in a municipal refuse dumpster. These items are not considered hazardous and may be sent to a municipal landfill. PPE and other equipment items (e.g., bowls, hand tools) should be rendered inoperable before disposal.

6.5 Sample Management Procedures and Documentation

This section identifies the procedures for management and documentation of samples from the time the samples are collected until they are shipped to the laboratory. USEPA's *Contract*

Laboratory Program Guidance for Field Samplers (USEPA 2004) is the basis for management and documentation of samples. The sample management tools, labeling, packaging and shipment, and documentation procedures are described in the subsections below. The RSCC will provide CH2M HILL with the regional sample tracking numbers, the sample tags, and custody seals prior to sample collection.

All field data will be incorporated into Forms II Lite, the field database, which is a component of the data management system (DMS). The DMS is designed to handle large quantities of data and is described in detail in the Data Management Plan (CH2M HILL 2004b). The sample processing coordinator manages Forms II Lite, which is a repository for storing and organizing sediment sample records, chain-of-custody forms, physical and geochemical parameter measurements, and field sampling information. Forms II Lite will be updated on a daily basis by the sample processing coordinator and synchronized daily with the master project database administered by the data manager.

6.5.1 Sample Management Tools

The sample processing coordinator (SPC) will use FORMS II Lite™ at the site on a daily basis as a tool to facilitate the management of samples. FORMS II Lite™ is a Windows-based application software that was developed by the USEPA for use as a sample planning tool, and is now required to be used by contractors performing analyses with USEPA Contract Laboratory Programs (CLPs). FORMS II Lite™ simplifies and accelerates the sample documentation process. FORMS II Lite™ provides the following:

- Automate printing of sample documentation in the field
- Reduce time spent completing sample collection and chain-of-custody documentation
- Facilitate electronic capture and transfer of data before and during sampling activities
- Improve data integrity by automating data transfer

The SPC will use Forms II Lite™ to generate the following forms and sample bottle labels, examples of which are included in Attachment 6, Field Forms:

- USEPA Contract Laboratory Program Inorganic Traffic Report & Chain of Custody Record
- USEPA Contract Laboratory Program Generic Chain of Custody Record
- USEPA Contract Laboratory Program Organic Traffic Report & Chain of Custody Record
- Sample Label Sheet
- Receipt for Samples

In addition to the sample labeling and tracking forms generated by Forms II Lite™, the field teams will record all field sample observations on one of the following three forms:

- Sediment Sample Form
- Core Collection Form
- Sediment Core Log

These forms will be preprinted and bound in spiral-bound field notebooks for ease of handling in the field. Examples of these forms are included in Attachment 6, Field Forms. These examples are preliminary forms.

The procedures for using these forms are discussed in the following sections.

6.5.2 Sample Labeling

Before each round of sampling occurs, the SPC will preprint stick-on sample labels using FORMS II Lite™. Each sample container label will include the following preprinted information:

- Destination laboratory
- Project and site name
- Station/location identifier
- Sample identifier
- Sample matrix
- Preservative (if any)
- Preparation performed (if any); for example, filtered
- Analytical method number

The following information will be hand-written on the sample label at the time of sample retrieval with an indelible marker:

- Collection date and time
- Initials of sampler

If information is entered onto sample containers using stick-on labels, subsequent removal of these labels should not be possible without leaving obvious indications of the attempt. Labels will never be placed over previously recorded information. To make corrections to information recorded on stick-on labels, field team personnel will cross a single line through the error and enter the correct information. All corrections will be initialed and dated by the personnel performing the correction. If possible, all corrections will be made by the individual who made the error.

An example of a generic preprinted container label sheet produced by Forms II Lite™ is included in Attachment 6, Field Forms. The label fields will be customized to include the necessary sample information for the project.

6.5.3 Sample Packaging and Shipment

Upon completion of the sampling, the vessel will dock at the marina and the field sampling team will deliver the samples to the land-based sample processing team. The processing team will ensure that the samples are correctly packaged for shipment to the laboratory. The processing team will pay strict attention to the preservation temperatures and holding times listed in Tables 6-1 and 6-2. The processing team will place one or more custody seals on the front and back of the cooler. Each cooler of samples will be shipped with an individual chain-of-custody form. All bottles pertaining to an individual sample will be packaged in the same cooler to the extent possible.

The processing team will make every effort to ship samples the day after the samples are collected, with the exception of samples collected on Saturday, which will be shipped on the following Monday. All samples collected on Monday through Thursday will be placed in a refrigerator overnight to maintain the temperature requirement, and will be packaged and shipped the following day. Samples collected on Friday and Saturday will be placed in a refrigerator over the weekend and will be packaged and shipped on Monday morning. For analyses that require shorter holding times, coordination will be established with laboratories, and, if necessary, some samples collected on Friday might be shipped on Saturday for Monday delivery.

Samples that will be stored in a refrigerator overnight or over the weekend will be maintained under a locked and secure condition in the sample processing facility prior to shipment. The proper operation of the refrigeration unit will be verified at least once on Sundays, which will be the only nonwork day during the sampling program.

The processing team will be responsible for completing the chain-of-custody forms and shipping the samples. Specifications for completing chain-of-custody forms are discussed in greater detail in the following section.

6.5.4 Sample Documentation

To ensure thorough recordkeeping, standardized forms and procedures will be used for recording field activities and sampling data. All sample field records, forms, and chain-of-custody records will be recorded in waterproof, indelible ink and archived in the project files. If errors are made in any of these documents, field team personnel will cross a single line through the error and enter the correct information. All corrections will be initialed and dated by the personnel performing the correction. If possible, all corrections will be made by the individual who made the error.

The FTLs will ensure that each field notebook page, sediment sampling form, core collection form, and sediment core log form is completed, copied, and sent to the data manager at least weekly during sampling events. At the end of each day of sampling, the SPC will export and e-mail electronic copies of the chain-of-custody forms to the USEPA Data Quality Officer, the appropriate laboratories, the Project Chemist, and the data manager. This information will serve as notification of samples being shipped and of the field crew’s sampling progress.

Daily Field Notebook Specifications

Field notes will be kept in bound daily field notebooks that are made with water-resistant pages, and notes will be taken with indelible pens when possible. In wet and rainy conditions, pencil entries are also acceptable if indelible pens are not functional.

All lines of all pages will be used to prevent later additions of text that may be questioned in legal terms. Any pages not used will be marked through with a line, the author’s initials, and the note “Intentionally Left Blank.”

NOTE: No irrelevant material will be entered into the sample notebooks or daily notebooks.

Daily Notebook Entries

Daily entries will be made chronologically and will always begin on the right-hand page of the notebook. The following information will be included as part of the initial daily entry:

- Date
- Time onsite
- Name and signature of the person making the entry
- Weather conditions
- Field personnel present and their roles onsite
- Level of personal protection
- List of onsite visitors and the level of personal protection of the visitors
- Times of starting and stopping work
- Planned daily activities
- Equipment calibration results
- Any encountered equipment problems
- Any changes in weather—note the time of weather change

Sample Notebook Entries

Sample notebooks will contain the preprinted forms that are designed to cue the field team to record all pertinent sample information. Samples will be collected at specific locations and assigned sample numbers in accordance with the sample numbering scheme generated by Forms II Lite™. The following sample collection information will be documented in appropriate field forms:

- Description of the general sampling area, including site name
- GPS coordinates
- Station/location identifier
- Description of the sample location. If no GPS coordinates, try to estimate the location in comparison to two fixed points. Draw a diagram in the field notebook indicating sample location relative to these fixed points. Include distances in feet.
- Sample matrix and type
- Description of sample
- Sample date and time
- Sample identifier
- Information on how the sample was collected; distinguish among grab, composite, and discrete samples
- Number and type of sample containers collected
- Record of any field measurements taken (pH, turbidity, dissolved oxygen, temperature, conductivity)

- Enter descriptions of sediment samples and cores in order of increasing depth, along with any other observations

Photographs

Photographs of sampling activities as specified in individual SOPs will be completed in accordance with SOP SEDFSP-9, Digital Camera Use and Documentation Procedures.

Chain-of-Custody Specifications

A chain-of-custody form must accompany each shipment of samples through the sampling, laboratory analysis, data validation and data storage processes. The form will ultimately become part of the project file. The chain-of-custody form will be used to verify the accuracy and completeness of sample results received from the laboratories. It will also be the source of information to verify laboratory invoices and approve them for payment. Detailed specifications and rationale for chain-of-custody requirements are presented in QAPP Section 3.3, Sample Handing and Custody.

Chain-of-custody forms will contain information consistent with the sample bottle labels. The chain-of-custody forms must travel with the sample containers to the laboratory to verify samples taken, analyses requested, shipping date, and receipt by the laboratory.

Each chain-of-custody form must be signed by the sampler to indicate who is responsible for the sampling and the field information on the chain-of-custody form. Changes in a chain-of-custody form must be written and initialed on the chain-of-custody form. Changes in the chain-of-custody form will not be made after shipping because of the potential for miscommunication that can occur between the field and the laboratory, and the likelihood that the change will not get recorded on the copy transmitted to the laboratory.

Each chain-of-custody form will include the following elements:

- Project name
- Project number
- Project manager
- Name of laboratory
- Chain-of-custody identifier
- Shipping information
- Site identifier
- Station/location names
- Sample names
- Sampling dates
- Sampling times
- Sample matrices
- Total number of containers
- Requested analytical methods
- Sampling team names
- Remarks
- Relinquished/received signatures with dates and times

6.6 Quality Control Samples

Field quality control (QC) samples will be collected or prepared to assist in assessing data use. These QC samples include field duplicates, laboratory QC samples (for matrix spike [MS] and matrix spike duplicates [MSDs], and temperature blanks. The QC samples will be collected immediately following and using the same procedures as the collection of the target sample.

6.6.1 Field Duplicates

The field duplicate is a split of a well-mixed sample. Field duplicates will be labeled and packaged in the same manner as other samples so that the laboratory cannot distinguish between samples and duplicates. Field duplicates will be collected by alternately filling sample and sample duplicate containers at a location of known or suspected contamination. Each duplicate will be taken using the same sampling and preservation method as other samples. Field duplicates will be collected at a minimum frequency of one in every 10 samples. The locations for field duplicates are listed in the sampling matrix in Attachment 1.

6.6.2 Laboratory QC Samples

Laboratory QC samples will be collected to perform MS and MSD analyses. An MS is an aliquot of a sample spiked with a known concentration of target analytes and provides a measure of the method accuracy. The MSD is a laboratory split sample of the MS and is used to determine the precision of the method.

Twice the normal sample volume will be collected for laboratory QC samples. Laboratory QC samples will be labeled as such on sample bottles and paperwork. The MS/MSDs will be collected at the discretion of the field crew, at a frequency of one in every 20 consecutively collected samples, whichever is greater. The locations for MS/MSDs will be determined by the actual sampling schedule.

6.6.3 Temperature Blanks

Temperature blanks will be included with each cooler shipment containing samples (regardless of targeted analysis) sent to the laboratory. A temperature blank consists of a sample vial filled in the field with de-ionized water, handled like an environmental sample, and returned to the laboratory for temperature measurement. The temperature blank provides a means of verifying that samples have been maintained at the proper temperature (4 °C) following collection and during transport to the laboratory.

TABLE 6-1
Sediment Sample Volumes, Container Types, Preservation Types, and Holding Times
Upper Columbia River RI/FS

Name	Analytical Methods	Containers	Minimum Preservation Temperature	Sample Volume or Weight	Maximum Holding Time
Chemical and Physical					
TCL Pesticides/PCB Aroclors	CLP	Amber glass, Teflon-lined cap	4°C	8 oz	14 days[a]
SVOCs	CLP	Amber glass, Teflon-lined cap	4°C	8 oz	14 days[a]
Metals (including uranium)	CLP	Glass	4°C	8 oz	180 days (except 28 days mercury)
Dioxin/Furans	CLP	Glass	4°C	8 oz	30 days[b]
AVS/SEM	PSEP	Glass	4°C	8 oz	14 days
Grain Size	ASTM D422	Glass	None	8 oz	180 days
TOC	PSEP	Glass	4 °C	4 oz	28 days
Sediment Pore Water Isolation					
Pore Water Isolation by Centrifugation	see Table 6-2	Glass	4 °C	64 oz	See Table 6-2
Bioassay					
10-day Sediment Toxicity Test with *Chironomus tentans*	ASTM Method E 1706-00 (ASTM, 2003) and EPA Method 100.2 (EPA, 2000)	HDPE	4 °C	2 L	14 days
7-Day Sediment Toxicity Test with *Ceriodaphnia dubia*	ASTM Method E 1706-00 (ASTM, 2003)	HDPE	4 °C	500 mL	14 days
28-day Sediment Toxicity Test with *Hyalella azteca*	ASTM Method E 1706-00 (ASTM, 2003) and EPA Method 100.4 (EPA, 2000)	HDPE	4 °C	2 L	14 days
IDW—Solid (as needed)					
TCL Pesticides/PCB Aroclors	CLP	Amber glass	4 °C	8 oz	14 days[a]
SVOCs	CLP	Amber glass	4 °C	8 oz	14 days[a]

TABLE 6-1
Sediment Sample Volumes, Container Types, Preservation Types, and Holding Times
Upper Columbia River RI/FS

Name	Analytical Methods	Containers	Minimum Preservation Temperature	Sample Volume or Weight	Maximum Holding Time
Metals (including uranium)	CLP	Glass	4 °C	8 oz	180 days (except 28 days mercury)
TCLP Pesticides/PCB Aroclors	CLP	Amber glass	4 °C	8 oz	14 days[a]
TCLP SVOCs	CLP	Amber glass	4 °C	8 oz	14 days[a]
TCLP Metals (including uranium)	CLP	Glass	4 °C	8 oz	180 days (except 28 days mercury)

[a] 14 days to extraction, 40 days to analysis.
[b] 30 days to extraction, 45 days to analysis.

TABLE 6-2
Pore Water Sample Volumes, Container Types, Preservation Types, and Holding Times
Upper Columbia River RI/FS

Name	Analytical Methods	Containers	Minimum Preservation Temperature	Sample Volume or Weight	Maximum Holding Time
Dissolved Metals (including uranium)	CLP	Polyethylene	HNO_3 pH < 2, 4°C	200 mL[a]	180 days (except 28 days mercury)

[a]Volume to be isolated from sediment by centrifugation. If centrifugation cannot yield this required volume of porewater, the laboratory will be instructed to prioritize the analyses in the order of metals (including uranium), then mercury.

FIGURE 6-1
Phase I Sediment Sampling Summary Field Schedule
Upper Columbia River RI/FS

		APRIL 2005																											MAY 2005														
VESSEL	**VESSEL/**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**
BASE	**Team ID**	**M**	**T**	**W**	**Th**	**F**	**S**	**S**	**M**	**T**	**W**	**Th**	**F**	**S**	**S**	**M**	**T**	**W**	**Th**	**F**	**S**	**S**	**M**	**T**	**W**	**Th**	**F**	**S**	**S**	**M**	**T**	**W**	**Th**	**F**	**S**	**S**	**M**	**T**	**W**	**Th**	**F**	**S**	**S**
Kettle Falls Marina	A	**M**	**R**	**R**				nwd							nwd				B	B	B	nwd	B						nwd							nwd							nwd
Kettle Falls Marina	B		**M**	**R**				nwd							nwd				B	B	B	nwd	B						nwd							nwd							nwd
Kettle Falls Marina	C		**M**	**R**				nwd							nwd				B	B		nwd							nwd							nwd							nwd
Kettle Falls Marina	D							nwd							nwd	**M**	**R**	VC	VC	VC	VC	nwd	VC	VC					nwd							nwd							nwd
Kettle Falls Marina	LBST	**M**						nwd						**D**	nwd				**M**	Ref	Ref	nwd	**D**						nwd							nwd							nwd
Two Rivers Marina	A							nwd							nwd							nwd		**M**	**R**				nwd						**D**	nwd							nwd
Two Rivers Marina	B							nwd							nwd							nwd		**M**	**R**	B	B	B	nwd							nwd	**D**						nwd
Two Rivers Marina	C							nwd							nwd						**M**	nwd	**R**	B	B				nwd					**D**		nwd							nwd
Two Rivers Marina	D							nwd							nwd							nwd			**M**	**R**	VC	VC	nwd	VC	**D**					nwd							nwd

NOTES:

1. Establish sediment processing station (SPS) at Kettle Falls Marina (KFM).
VESSELS A, B, and C: Mobilize at KFM.
VESSEL A recon upper river and take sediment samples from RM 744 to RM 729.
VESSELS B and C proceed with sediment sampling from RM 728 to RM 667.
VESSELS A, B, and C collect 35 bioassay samples from RM 744 to RM 676.
VESSEL D is a specialized vessel from the vibracoring subcontractor. Recon upper river. Collect 2 cores at 8 stations from RM 742 to RM 676.
(Possible strong currents from about RM 734 to RM 742 could prevent coring in this river area.)

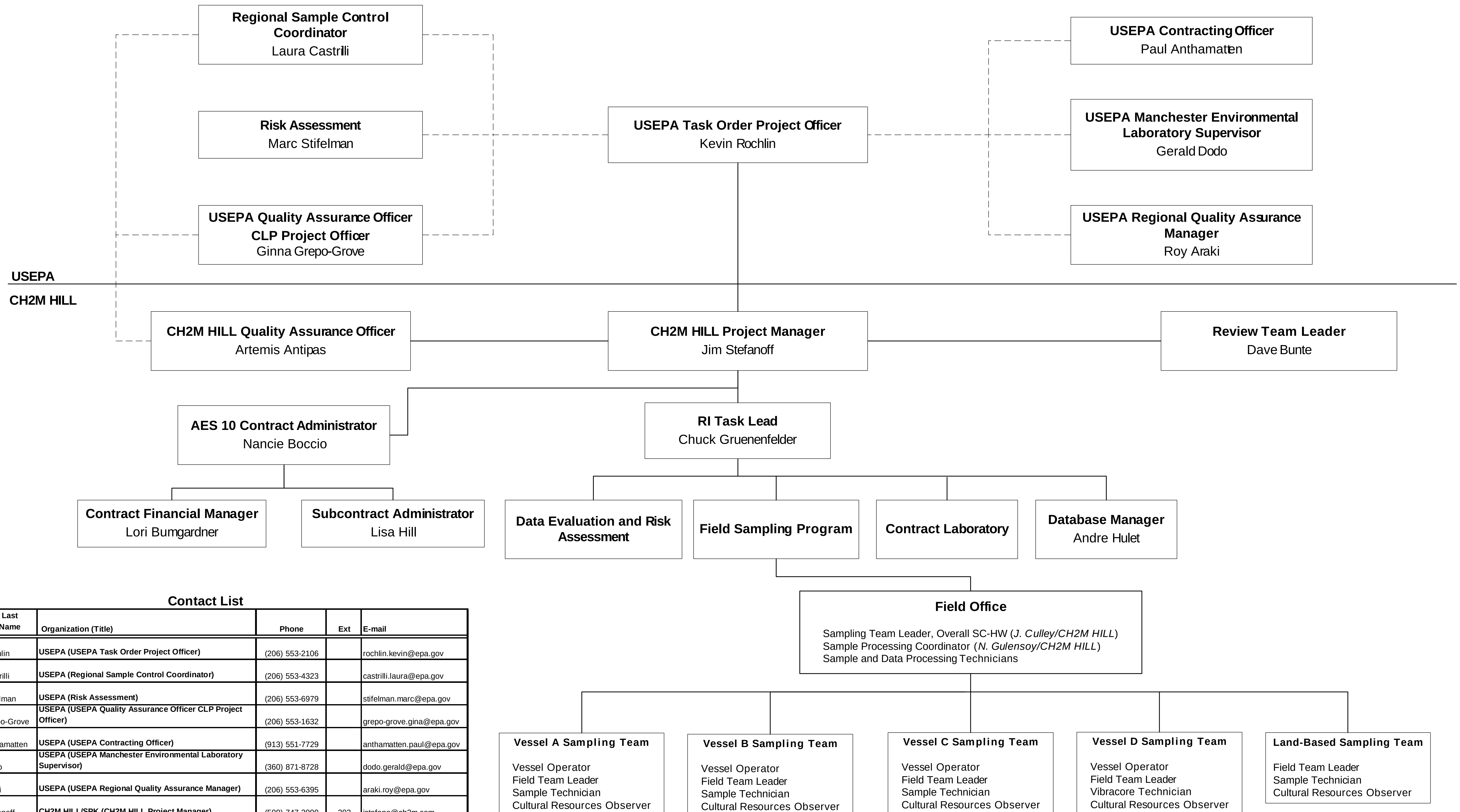
2. Demobilize SPS and vessels at KFM and remobilize at Two Rivers Marina (TRM).
VESSEL A proceed with sediment sampling RM 664 to RM 639.
VESSELS B and C collect 15 bioassay samples from RM 661 to RM 603, then proceed to collect sediment samples from RM 637 to RM 600.

VESSEL D collect 2 cores at 5 stations from RM 661 to RM 605.

3. A land-based sampling team will collect all samples from the 15 beaches and 6 reference stations.

4. No contingency for bad weather is included in the time estimate.

(black) = sediment sampling operations
B = UCR bioassay sampling operations
Ref = reference bioassay sampling operations
D = demobilization
LBST = land-based sampling team
M = mobilization
nwd = nonwork day
R = recon and survey
VC = vibracoring operations



Contact List

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FIGURE 6-2

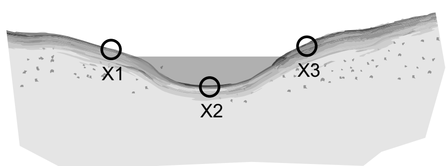
Phase 1 Sediment Sampling Project Organization

Upper Columbia River RI/FS

CH2MHILL

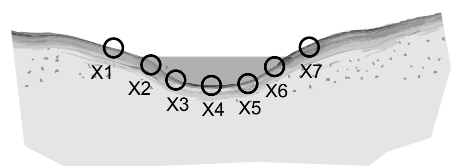
Transect Sampling

Baseline and Standard Focus Samples



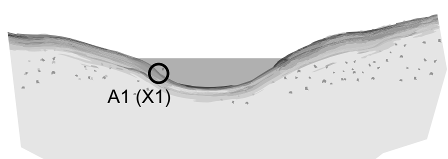
Note: Edge stations (i.e., X1 and X3) are located in the periodically submerged zone and are above water at the time of sampling.

Selected Focus Samples



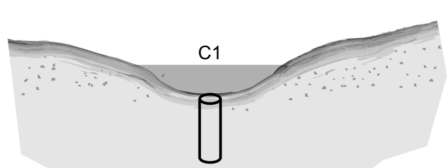
Note: Stations X1 through X7 have prescribed elevations and may or may not be submerged at the time of sampling. Up to nine stations can be sampled at certain transects.

Bioassay Sampling



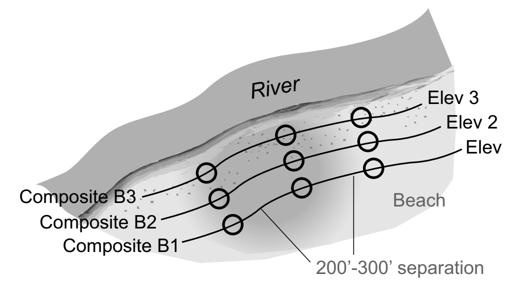
Note: Bioassay station (i.e., A1 (X1) in this illustration) will be field adjusted so that the station is submerged at the time of sampling.

Core Sampling

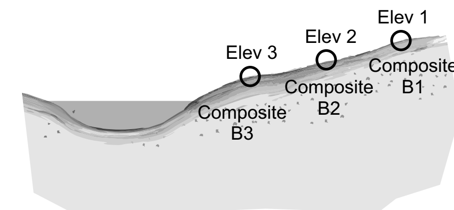


Beach Sampling

Composite Beach Samples



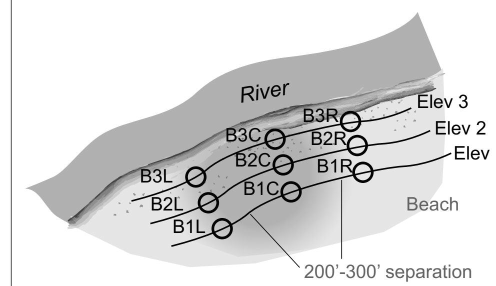
Plan



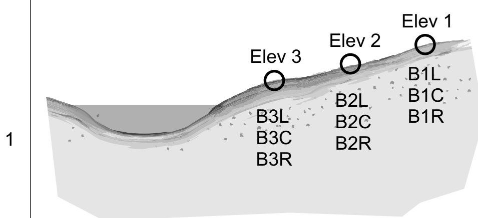
Section

Note: The composite sample location designated for each elevation is at the center sampling point.

Discrete Beach Samples

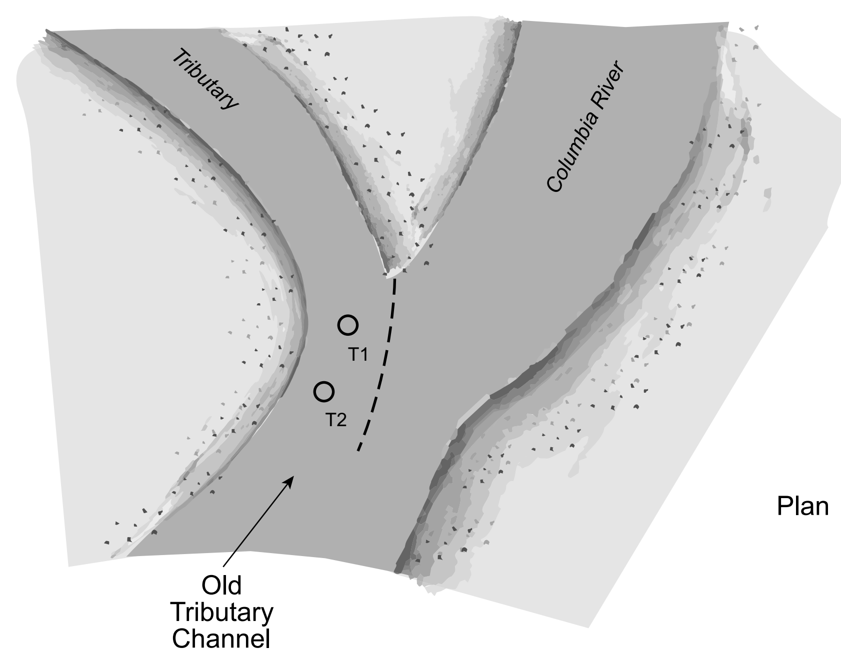


Plan

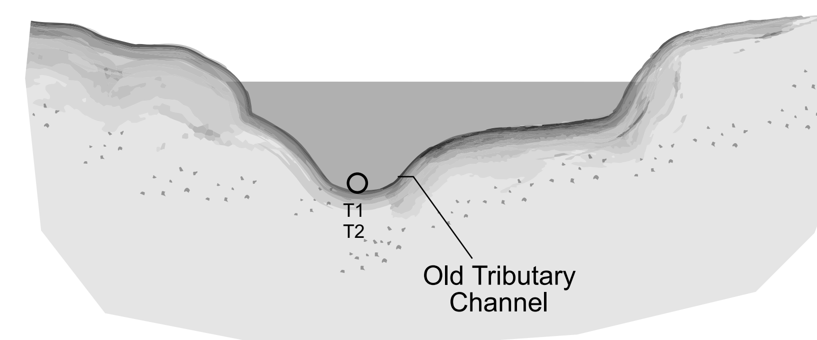


Section

Tributary Mouth Sampling



Plan



Section

Note: Tributary stations (e.g., T1 and T2) are located in the deepest portion of the old tributary channel where the channel enters Lake Roosevelt.

LEGEND

○ Sample Location

FIGURE 6-3
Illustration Depicting Various Sediment Sampling Situations
Upper Columbia River RI/FS

CH2MHILL

SECTION 7

Health and Safety Plan

SECTION 7

Health and Safety Plan

The Health and Safety Plan (HSP) provides safe work practices and control measures used to reduce or eliminate potential hazards. The HSP covers sediment sampling from boats, sediment sampling from beach access areas, vibracore sampling from boats, and sample processing. All field personnel are subject to the requirements of the plan. A copy of the HSP will be kept onsite during field activities and will be reviewed as necessary.

The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the SOPs in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual*, as appropriate. In addition, the plan adopts the procedures in the FSP. The health and safety manager (HSM) will be familiar with these SOPs and the contents of this plan.

The full HSP for the activities described in this FSP is provided as Attachment 7 to serve as a stand-alone document for use by the field sampling and sample processing teams.

SECTION 8

References

SECTION 8

References

American Society for Testing and Materials (ASTM). 2000. Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). ASTM Standard Method No. D 2488. In: *ASTM Book of Standards*. Volume 04.08. American Society for Testing and Materials, West Conshohocken, PA.

CH2M HILL. 2004a. *Draft Phase I Sediment Sampling Approach and Rationale – Upper Columbia River Site CERCLA RI/FS*. Prepared by CH2M HILL and Ecology and Environment, Inc. Prepared for Region 10 USEPA. Seattle, WA.

–––. 2004b. *Draft Data Management Plan, Upper Columbia River Site RI/FS*. Prepared by CH2M HILL and Ecology and Environment, Inc. Prepared for U.S. Environmental Protection Agency, Region 10, Seattle, WA.

U.S. Environmental Protection Agency (USEPA). 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. Office of Emergency and Remedial Response. EPA/540/G-89/004, OSWER Directive 9355.3-01, Washington, D.C. October 1988.

–––. 2000. *Upper Columbia River/Lake Roosevelt River Mile 597 to 745, Preliminary Assessment Report, Washington*. Prepared by Ecology and Environment, Inc.

–––. 2001. *Methods for Collection, Storage, and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual*. EPA 823-B-01-002. October 2001.

–––. 2003. *Upper Columbia River Expanded Site Inspection Report, Northeast Washington, TDD: 01-02-0028*. Region 10 Start – 2, Superfund Technical Assessment and Response Team. Prepared by Ecology and Environment, Inc. and Roy F. Weston, Inc. **{USEPA 2001}**[2] [UCR 247a]

–––. 2004. *Contract Laboratory Program Guidance for Field Samplers*. Office of Superfund Remediation and Technology Innovation. OSWER 9240.0-35. EPA540-R-00-003. August 2004.

Washington State Department of Ecology (Ecology). 2003. *Guidance on the Development of Sediment Sampling and Analysis Plans Meeting the Requirements of the Sediment Management Standards.*

[2] Note: The style **{bold brackets}** indicates the year of the study itself, rather than the year the study results were published.

ATTACHMENT 1

Sampling and Analysis Matrix

ATTACHMENT 1

Sampling and Analysis Matrix

Upper Columbia River RI/FS

VESSEL	Station ID	River Mile	Station Location	Station Type	Pesticides/PCB Aroclors	SVOCs	Metals (including Mercury and Uranium)	Dioxins/Furans	TOC	AVS/SEM	Grain Size	Bioassay 10-day	Bioassay 7-day	Bioassay 28-day	Size-Fractionated Composite (2 samples created in lab)	Pore Water Isolation	Pore Water Dissolved TAL Metals (includes mercury and uranium)	TCLP Metals, TCLP SVOCs, TCLP Pesticides/PCBs	Comments
					4°C, 14 days	4°C, 14 days	4°C, 180 days (except mercury, 28 days)	4°C, 30 days	4°C, 28 days	4°C, 14 days	none rqd, 180 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, as soon as lab receipt	4°C, 0.45-micron filter, nitric acid, 180 days (except mercury, 28 days)	4°C, 180 days for metals, 28 days for mercury, 14 days for others	
					8-oz amber glass teflon-lined cap	8-oz amber glass teflon-lined cap	8-oz glass	8-oz glass	4-oz glass	8-oz glass	8-oz glass	2-L HDPE	500-mL HDPE	2-L HDPE	5-Gal Pail	8 x 8-oz glass	250-mL HDPE	3 x 8-oz glass	
A	2	744	744X2	Transect	X	X	X		X		X								
A	2	744	744X2	Transect (FD)	X	X	X		X		X								FIELD DUPLICATE
A	5	743	743X2	Transect	X	X	X		X		X								
A	8	742	742X2	Transect	X	X	X		X		X								
A	9	742	742X3	Transect	X	X	X		X		X								
A	10	742	742X4	Transect	X	X	X		X		X								
A	22	741	741X1	Transect	X	X	X		X		X								
A	23	741	741X2	Transect	X	X	X		X		X								
A	26	740	740X2	Transect	X	X	X		X		X								
A	27	740	740X3	Transect	X	X	X		X		X								
A	28	739	739X1	Transect	X	X	X		X		X								
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A	28	739	739X1	Transect (MS)	X	X	X		X										LAB QC (MS)
A	28	739	739X1	Transect (MSD)	X	X	X		X										LAB QC (MSD)
A	29	739	739X2	Transect	X	X	X		X		X								
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A	38	736	736X2	Transect	X	X	X		X		X								
A	39	736	736X3	Transect	X	X	X		X		X								
A	40	736	736T1	Tributary	X	X	X		X		X								
A	41	736	736T2	Tributary	X	X	X		X		X								
A	42	735	735X1	Transect	X	X	X		X		X								
A	42	735	735X1	Transect (FD)	X	X	X		X		X								FIELD DUPLICATE
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A	44	735	735X3	Transect	X	X	X		X		X								
A	55	734	734X2	Transect	X	X	X		X		X								
A	56	734	734X3	Transect	X	X	X		X		X								
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A	62	732	732X2	Transect	X	X	X		X		X								
A	63	732	732X3	Transect	X	X	X		X		X								
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A	66	731	731X2	Transect	X	X	X		X		X								
A	66	731	731X2	Transect (FD)	X	X	X		X		X								FIELD DUPLICATE
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A	66	731	731X2	Transect (MSD)	X	X	X		X										LAB QC (MSD)
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A	69	730	730X2	Transect	X	X	X		X		X								
A	71	730	730T1	Tributary	X	X	X		X		X								
A	72	729	729T2	Tributary	X	X	X		X		X								
A	74	729	729X2	Transect	X	X	X		X		X								
A	75	729	729X3	Transect	X	X	X		X		X								
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B	85	728	728X1	Transect (MS)	X	X	X		X										LAB QC (MS)
B	85	728	728X1	Transect (MSD)	X	X	X		X										LAB QC (MSD)
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B	91	726	726X1	Transect	X	X	X		X		X								
B	92	726	726X2	Transect	X	X	X		X		X								
B	93	726	726X3	Transect	X	X	X		X		X								
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B	95	725	725X2	Transect	X	X	X		X		X								
B	96	725	725X3	Transect	X	X	X		X		X								
B	98	724	724X2	Transect	X	X	X		X		X								
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B	107	722	722X2	Transect	X	X	X		X		X								
B	108	722	722X3	Transect	X	X	X		X		X								
B	109	721	721X1	Transect	X	X	X		X		X								

VESSEL	Station ID	River Mile	Station Location	Station Type	Pesticides/PCB Aroclors	SVOCs	Metals (including Mercury and Uranium)	Dioxins/Furans	TOC	AVS/SEM	Grain Size	Bioassay 10-day	Bioassay 7-day	Bioassay 28-day	Size-Fractionated Composite (2 samples created in lab)	Pore Water Isolation	Pore Water Dissolved TAL Metals (includes mercury and uranium)	TCLP Metals, TCLP SVOCs, TCLP Pesticides/PCBs	Comments
					4°C, 14 days	4°C, 14 days	4°C, 180 days (except mercury, 28 days)	4°C, 30 days	4°C, 28 days	4°C, 14 days	none rqd, 180 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, as soon as lab receipt	4°C, 0.45-micron filter, nitric acid, 180 days (except mercury, 28 days)	4°C, 180 days for metals, 28 days for mercury, 14 days for others	
					8-oz amber glass teflon-lined cap	8-oz amber glass teflon-lined cap	8-oz glass	8-oz glass	4-oz glass	8-oz glass	8-oz glass	2-L HDPE	500-mL HDPE	2-L HDPE	5-Gal Pail	8 x 8-oz glass	250-mL HDPE	3 x 8-oz glass	
B	110	721	721X2	Transect	X	X	X		X		X								
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B	132	710	710X1	Transect	X	X	X		X		X								
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B	150	707	707X3	Transect	X	X	X		X		X								
B	152	706	706X2	Transect	X	X	X		X		X								
B	153	706	706X3	Transect	X	X	X		X		X								
B	154	706	706X4	Transect	X	X	X		X		X								
B	155	706	706X5	Transect	X	X	X		X		X								
B	156	706	706X6	Transect	X	X	X		X		X								
B	158	706	706T1	Tributary	X	X	X		X		X								
B	159	706	706T2	Tributary	X	X	X		X		X								
C	160	705	705X1	Transect	X	X	X		X		X								
C	161	705	705X2	Transect	X	X	X		X		X								
C	162	705	705X3	Transect	X	X	X		X		X								
C	166	704	704X2	Transect	X	X	X		X		X								
C	167	704	704X3	Transect	X	X	X		X		X								
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C	169	701	701X1	Transect	X	X	X		X		X								
C	170	701	701X2	Transect	X	X	X		X		X								
C	171	701	701X3	Transect	X	X	X		X		X								
C	181	699	699T1	Tributary	X	X	X		X		X								
C	183	698	698X2	Transect	X	X	X		X		X								
C	184	698	698X3	Transect	X	X	X		X		X								
C	194	695	695X1	Transect	X	X	X		X		X								
C	195	695	695X2	Transect	X	X	X		X		X								
C	196	695	695X3	Transect	X	X	X		X		X								
C	199	693	693X1	Transect	X	X	X		X		X								
C	198	692	692X2	Transect	X	X	X		X		X								
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C	210	689	689X1	Transect	X	X	X		X		X								
C	211	689	689X2	Transect	X	X	X		X		X								
C	214	686	686X1	Transect	X	X	X		X		X								
C	215	686	686X2	Transect	X	X	X		X		X								
C	219	683	683X1	Transect	X	X	X		X		X								
C	220	683	683X2	Transect	X	X	X		X		X								
C	221	683	683X3	Transect	X	X	X		X		X								
C	224	681	681X1	Transect	X	X	X		X		X								
C	223	680	680X2	Transect	X	X	X		X		X								
C	225	679	679X1	Transect	X	X	X		X		X								
C	226	679	679X2	Transect	X	X	X		X		X								
C	227	679	679X3	Transect	X	X	X		X		X								
C	**227**	**679**	**679X3**	**Transect (FD)**	**X**	**X**	**X**		**X**		**X**								**FIELD DUPLICATE**
C	**227**	**679**	**679X3**	**Transect (MS)**	**X**	**X**	**X**		**X**										**LAB QC (MS)**
C	**227**	**679**	**679X3**	**Transect (MSD)**	**X**	**X**	**X**		**X**										**LAB QC (MSD)**
C	229	678	678X2	Transect	X	X	X		X		X								
C	230	678	678X3	Transect	X	X	X		X		X								
C	231	678	678X4	Transect	X	X	X		X		X								
C	232	678	678X5	Transect	X	X	X		X		X								
C	233	678	678X6	Transect	X	X	X		X		X								
C	234	678	678X7	Transect	X	X	X		X		X								
C	235	677	677X1	Transect	X	X	X		X		X								
C	236	677	677X2	Transect	X	X	X		X		X								
C	238	676	676X1	Transect	X	X	X		X		X								
C	239	676	676X2	Transect	X	X	X		X		X								
C	251	673	673X1	Transect	X	X	X		X		X								

ATTACHMENT 1
Sampling and Analysis Matrix
Upper Columbia River RI/FS

VESSEL	Station ID	River Mile	Station Location	Station Type	Pesticides/PCB Aroclors	SVOCs	Metals (including Mercury and Uranium)	Dioxins/Furans	TOC	AVS/SEM	Grain Size	Bioassay 10-day	Bioassay 7-day	Bioassay 28-day	Size-Fractionated Composite (2 samples created in lab)	Pore Water Isolation	Pore Water Dissolved TAL Metals (includes mercury and uranium)	TCLP Metals, TCLP SVOCs, TCLP Pesticides/PCBs	Comments
					4°C, 14 days	4°C, 14 days	4°C, 180 days (except mercury, 28 days)	4°C, 30 days	4°C, 28 days	4°C, 14 days	none rqd, 180 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, as soon as lab receipt	4°C, 0.45-micron filter, nitric acid, 180 days (except mercury, 28 days)	4°C, 180 days for metals, 28 days for mercury, 14 days for others	
					8-oz amber glass teflon-lined cap	8-oz amber glass teflon-lined cap	8-oz glass	8-oz glass	4-oz glass	8-oz glass	8-oz glass	2-L HDPE	500-mL HDPE	2-L HDPE	5-Gal Pail	8 x 8-oz glass	250-mL HDPE	3 x 8-oz glass	
C	252	673	673X2	Transect	X	X	X		X		X								
C	253	673	673X3	Transect	X	X	X		X		X								
C	263	670	670X1	Transect	X	X	X		X		X								
C	264	670	670X2	Transect	X	X	X		X		X								
C	**264**	**670**	**670X2**	**Transect (FD)**	**X**	**X**	**X**		**X**		**X**								**FIELD DUPLICATE**
C	**264**	**670**	**670X2**	**Transect (MS)**	**X**	**X**	**X**		**X**										**LAB QC (MS)**
C	**264**	**670**	**670X2**	**Transect (MSD)**	**X**	**X**	**X**		**X**										**LAB QC (MSD)**
C	265	670	670X3	Transect	X	X	X		X		X								
C	266	667	667X1	Transect	X	X	X		X		X								
C	267	667	667X2	Transect	X	X	X		X		X								
C	268	667	667X3	Transect	X	X	X		X		X								
A	1	744	744A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
A	3	744	744A2(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
A	4	743	743A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
A	6	743	743A2(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
A	7	742	742A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
A	11	742	742A2(X5)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
A	24	741	741A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
A	25	740	740A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
A	30	739	739A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
A	33	738	738A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
A	36	737	737A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
A	37	736	736A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	54	734	734A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	58	733	733A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	70	730	730A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	73	729	729A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	88	727	727A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	**88**	**727**	**727A1(X1)**	**Bio/Tran/Pore Water (FD)**	**X**	**X**	**X**		**X**	**X**	**X**	**X**	**X**	**X**		**X**	**X**		**FIELD DUPLICATE**
B	**88**	**727**	**727A1(X1)**	**Bio/Tran/Pore Water (MS)**	**X**	**X**	**X**		**X**	**X**						**X**	**X**		**LAB QC (MS)**
B	**88**	**727**	**727A1(X1)**	**Bio/Tran/Pore Water (MSD)**	**X**	**X**	**X**		**X**	**X**						**X**	**X**		**LAB QC (MSD)**
B	97	724	724A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	99	724	724A2(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	100	723	723A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	102	723	723A2(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	131	713	713A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	**131**	**713**	**713A1(X3)**	**Bio/Tran/Pore Water (FD)**	**X**	**X**	**X**		**X**	**X**	**X**	**X**	**X**	**X**		**X**	**X**		**FIELD DUPLICATE**
B	**131**	**713**	**713A1(X3)**	**Bio/Tran/Pore Water (MS)**	**X**	**X**	**X**		**X**	**X**						**X**	**X**		**LAB QC (MS)**
B	**131**	**713**	**713A1(X3)**	**Bio/Tran/Pore Water (MSD)**	**X**	**X**	**X**		**X**	**X**						**X**	**X**		**LAB QC (MSD)**
B	137	708	708A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	151	706	706A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	157	706	706A2(X7)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
C	165	704	704A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
C	182	698	698A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
C	197	692	692A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
C	**197**	**692**	**692A1(X1)**	**Bio/Tran/Pore Water (FD)**	**X**	**X**	**X**		**X**	**X**	**X**	**X**	**X**	**X**		**X**	**X**		**FIELD DUPLICATE**
C	212	689	689A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
C	213	687	687A1	Bioassay/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
C	216	686	686A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
C	222	680	680A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
C	228	678	678A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
C	237	677	677A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
C	240	676	676A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
C	**240**	**676**	**676A1(X3)**	**Bio/Tran/Pore Water (FD)**	**X**	**X**	**X**		**X**	**X**	**X**	**X**	**X**	**X**		**X**	**X**		**FIELD DUPLICATE**
B	272	661	661A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	278	658	658A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	**278**	**658**	**658A1(X3)**	**Bio/Tran/Pore Water (FD)**	**X**	**X**	**X**		**X**	**X**	**X**	**X**	**X**	**X**		**X**	**X**		**FIELD DUPLICATE**
B	**278**	**658**	**658A1(X3)**	**Bio/Tran/Pore Water (MS)**	**X**	**X**	**X**		**X**	**X**						**X**	**X**		**LAB QC (MS)**
B	**278**	**658**	**658A1(X3)**	**Bio/Tran/Pore Water (MSD)**	**X**	**X**	**X**		**X**	**X**						**X**	**X**		**LAB QC (MSD)**
B	302	644	644A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	307	642	642A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	323	641	641A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	328	640	640A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	331	637	637A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	339	634	634A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	354	628	628A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
B	362	622	622A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
C	369	616	616A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
C	392	606	606A1(X3)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
C	393	605	605A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
C	401	605	605A2(X8)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		

					4°C, 14 days	4°C, 14 days	4°C, 180 days (except mercury, 28 days)	4°C, 30 days	4°C, 28 days	4°C, 14 days	none rqd, 180 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, as soon as lab receipt	4°C, 0.45-micron filter, nitric acid, 180 days (except mercury, 28 days)	4°C, 180 days for metals, 28 days for mercury, 14 days for others	
					8-oz amber glass teflon-lined cap	8-oz amber glass teflon-lined cap	8-oz glass	8-oz glass	4-oz glass	8-oz glass	8-oz glass	2-L HDPE	500-mL HDPE	2-L HDPE	5-Gal Pail	8 x 8-oz glass	250-mL HDPE	3 x 8-oz glass	
VESSEL	Station ID	River Mile	Station Location	Station Type	Pesticides/PCB Aroclors	SVOCs	Metals (including Mercury and Uranium)	Dioxins/Furans	TOC	AVS/SEM	Grain Size	Bioassay 10-day	Bioassay 7-day	Bioassay 28-day	Size-Fractionated Composite (2 samples created in lab)	Pore Water Isolation	Pore Water Dissolved TAL Metals (includes mercury and uranium)	TCLP Metals, TCLP SVOCs, TCLP Pesticides/PCBs	Comments
C	406	603	603A1(X1)	Bio/Tran/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
A	269	664	664X1	Transect	X	X	X		X		X								
A	270	664	664X2	Transect	X	X	X		X		X								
A	271	664	664X3	Transect	X	X	X		X		X								
A	**271**	**664**	**664X3**	**Transect (FD)**	**X**	**X**	**X**		**X**		**X**								**FIELD DUPLICATE**
A	273	661	661X2	Transect	X	X	X		X		X								
A	**273**	**661**	**661X2**	**Transect (FD)**	**X**	**X**	**X**		**X**		**X**								**FIELD DUPLICATE**
A	**273**	**661**	**661X2**	**Transect (MS)**	**X**	**X**	**X**		**X**										**LAB QC (MS)**
A	**273**	**661**	**661X2**	**Transect (MSD)**	**X**	**X**	**X**		**X**										**LAB QC (MSD)**
A	274	661	661X3	Transect	X	X	X		X		X								
A	276	658	658X1	Transect	X	X	X		X		X								
A	277	658	658X2	Transect	X	X	X		X		X								
A	288	655	655X1	Transect	X	X	X		X		X								
A	289	655	655X2	Transect	X	X	X		X		X								
A	290	655	655X3	Transect	X	X	X		X		X								
A	291	652	652X1	Transect	X	X	X		X		X								
A	292	652	652X2	Transect	X	X	X		X		X								
A	293	652	652X3	Transect	X	X	X		X		X								
A	294	649	649X1	Transect	X	X	X		X		X								
A	295	649	649X2	Transect	X	X	X		X		X								
A	296	649	649X3	Transect	X	X	X		X		X								
A	297	646	646X1	Transect	X	X	X		X		X								
A	298	646	646X2	Transect	X	X	X		X		X								
A	299	646	646X3	Transect	X	X	X		X		X								
A	**299**	**646**	**646X3**	**Transect (FD)**	**X**	**X**	**X**		**X**		**X**								**FIELD DUPLICATE**
A	**299**	**646**	**646X3**	**Transect (MS)**	**X**	**X**	**X**		**X**										**LAB QC (MS)**
A	**299**	**646**	**646X3**	**Transect (MSD)**	**X**	**X**	**X**		**X**										**LAB QC (MSD)**
A	300	644	644X1	Transect	X	X	X		X		X								
A	301	644	644X2	Transect	X	X	X		X		X								
A	304	643	643X1	Transect	X	X	X		X		X								
A	305	643	643X2	Transect	X	X	X		X		X								
A	306	643	643X3	Transect	X	X	X		X		X								
A	308	642	642X2	Transect	X	X	X		X		X								
A	309	642	642X3	Transect	X	X	X		X		X								
A	310	642	642X4	Transect	X	X	X		X		X								
A	311	642	642X5	Transect	X	X	X		X		X								
A	312	642	642X6	Transect	X	X	X		X		X								
A	313	642	642X7	Transect	X	X	X		X		X								
A	324	641	641X2	Transect	X	X	X		X		X								
A	325	641	641X3	Transect	X	X	X		X		X								
A	326	640	640X1	Transect	X	X	X		X		X								
A	327	640	640X2	Transect	X	X	X		X		X								
A	329	639	639T1	Tributary	X	X	X		X		X								
A	**329**	**639**	**639T1**	**Tributary (FD)**	**X**	**X**	**X**		**X**		**X**								**FIELD DUPLICATE**
A	**329**	**639**	**639T1**	**Tributary (MS)**	**X**	**X**	**X**		**X**										**LAB QC (MS)**
A	**329**	**639**	**639T1**	**Tributary (MSD)**	**X**	**X**	**X**		**X**										**LAB QC (MSD)**
A	330	639	639T2	Tributary	X	X	X		X		X								
B	332	637	637X2	Transect	X	X	X		X		X								
B	333	637	637X3	Transect	X	X	X		X		X								
B	334	637	637X4	Transect	X	X	X		X		X								
B	**334**	**637**	**637X4**	**Transect (FD)**	**X**	**X**	**X**		**X**		**X**								**FIELD DUPLICATE**
B	**334**	**637**	**637X4**	**Transect (MS)**	**X**	**X**	**X**		**X**										**LAB QC (MS)**
B	**334**	**637**	**637X4**	**Transect (MSD)**	**X**	**X**	**X**		**X**										**LAB QC (MSD)**
B	335	637	637X5	Transect	X	X	X		X		X								
B	336	637	637X6	Transect	X	X	X		X		X								
B	337	637	637X7	Transect	X	X	X		X		X								
B	340	634	634X2	Transect	X	X	X		X		X								
B	341	634	634X3	Transect	X	X	X		X		X								
B	351	631	631X1	Transect	X	X	X		X		X								
B	352	631	631X2	Transect	X	X	X		X		X								
B	353	631	631X3	Transect	X	X	X		X		X								
B	355	628	628X2	Transect	X	X	X		X		X								
B	356	628	628X3	Transect	X	X	X		X		X								
B	357	625	625X1	Transect	X	X	X		X		X								
B	358	625	625X2	Transect	X	X	X		X		X								
B	**358**	**625**	**625X2**	**Transect (FD)**	**X**	**X**	**X**		**X**		**X**								**FIELD DUPLICATE**
B	**358**	**625**	**625X2**	**Transect (MS)**	**X**	**X**	**X**		**X**										**LAB QC (MS)**
B	**358**	**625**	**625X2**	**Transect (MSD)**	**X**	**X**	**X**		**X**										**LAB QC (MSD)**
B	359	625	625X3	Transect	X	X	X		X		X								
B	360	622	622X1	Transect	X	X	X		X		X								
B	361	622	622X2	Transect	X	X	X		X		X								

					4°C, 14 days	4°C, 14 days	4°C, 180 days (except mercury, 28 days)	4°C, 30 days	4°C, 28 days	4°C, 14 days	none rqd, 180 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, as soon as lab receipt	4°C, 0.45-micron filter, nitric acid, 180 days (except mercury, 28 days)	4°C, 180 days for metals, 28 days for mercury, 14 days for others	
					8-oz amber glass teflon-lined cap	8-oz amber glass teflon-lined cap	8-oz glass	8-oz glass	4-oz glass	8-oz glass	8-oz glass	2-L HDPE	500-mL HDPE	2-L HDPE	5-Gal Pail	8 x 8-oz glass	250-mL HDPE	3 x 8-oz glass	
VESSEL	**Station ID**	**River Mile**	**Station Location**	**Station Type**	**Pesticides/PCB Aroclors**	**SVOCs**	**Metals (including Mercury and Uranium)**	**Dioxins/Furans**	**TOC**	**AVS/SEM**	**Grain Size**	**Bioassay 10-day**	**Bioassay 7-day**	**Bioassay 28-day**	**Size-Fractionated Composite (2 samples created in lab)**	**Pore Water Isolation**	**Pore Water Dissolved TAL Metals (includes mercury and uranium)**	**TCLP Metals, TCLP SVOCs, TCLP Pesticides/PCBs**	**Comments**
B	364	619	619X1	Transect	X	X	X		X		X								
B	365	619	619X2	Transect	X	X	X		X		X								
B	366	619	619X3	Transect	X	X	X		X		X								
B	367	616	616X1	Transect	X	X	X		X		X								
B	368	616	616X2	Transect	X	X	X		X		X								
B	370	616	616T1	Tributary	X	X	X		X		X								
B	371	616	616T2	Tributary	X	X	X		X		X								
B	381	613	613X1	Transect	X	X	X		X		X								
C	382	613	613X2	Transect	X	X	X		X		X								
C	383	613	613X3	Transect	X	X	X		X		X								
C	384	610	610X1	Transect	X	X	X		X		X								
C	**384**	**610**	**610X1**	**Transect (FD)**	**X**	**X**	**X**		**X**		**X**								**FIELD DUPLICATE**
C	385	610	610X2	Transect	X	X	X		X		X								
C	386	610	610X3	Transect	X	X	X		X		X								
C	387	607	607X1	Transect	X	X	X		X		X								
C	388	607	607X2	Transect	X	X	X		X		X								
C	389	607	607X3	Transect	X	X	X		X		X								
C	**389**	**607**	**607X3**	**Transect (FD)**	**X**	**X**	**X**		**X**		**X**								**FIELD DUPLICATE**
C	390	606	606X1	Transect	X	X	X		X		X								
C	391	606	606X2	Transect	X	X	X		X		X								
C	394	605	605X2	Transect	X	X	X		X		X								
C	395	605	605X3	Transect	X	X	X		X		X								
C	396	605	605X4	Transect	X	X	X		X		X								
C	397	605	605X5	Transect	X	X	X		X		X								
C	398	605	605X6	Transect	X	X	X		X		X								
C	**398**	**605**	**605X6**	**Transect (FD)**	**X**	**X**	**X**		**X**		**X**								**FIELD DUPLICATE**
C	399	605	605X7	Transect	X	X	X		X		X								
C	400	605	605X8	Transect	X	X	X		X		X								
C	403	604	604X1	Transect	X	X	X		X		X								
C	404	604	604X2	Transect	X	X	X		X		X								
C	405	604	604X3	Transect	X	X	X		X		X								
C	407	603	603X2	Transect	X	X	X		X		X								
C	**407**	**603**	**603X2**	**Transect (FD)**	**X**	**X**	**X**		**X**		**X**								**FIELD DUPLICATE**
C	408	603	603X3	Transect	X	X	X		X		X								
C	409	600	600X1	Transect	X	X	X		X		X								
C	410	600	600X2	Transect	X	X	X		X		X								
C	411	600	600X3	Transect	X	X	X		X		X								
D	12	742	742C1	Core (0 - 0.5 ft)	X	X	X		X		X								0 to 0.5 ft core
D	12	742	742C1	Core (0.5 - 1 ft)	X	X	X		X		X								0.5 to 1 ft core
D	12	742	742C1	Core (1 - 3 ft)	X	X	X		X		X								1 to 3 ft core
D	12	742	742C1	Core (3 - 5 ft)	X	X	X		X		X								3 to 5 ft core
D	12	742	742C1	Core (5 - 7 ft)	X	X	X		X		X								5 to 7 ft core
D	12	742	742C1	Core (7 - 9 ft)	X	X	X		X		X								7 to 9 ft core
D	57	734	734C1	Core (0 - 0.5 ft)	X	X	X	X	X		X								0 to 0.5 ft core
D	57	734	734C1	Core (0.5 - 1 ft)	X	X	X	X	X		X								0.5 to 1 ft core
D	57	734	734C1	Core (1 - 3 ft)	X	X	X	X	X		X								1 to 3 ft core
D	**57**	**734**	**734C1**	**Core (1 - 3 ft) FD**	**X**	**X**	**X**	**X**	**X**		**X**								**1 to 3 ft core (FD)**
D	57	734	734C1	Core (3 - 5 ft)	X	X	X	X	X		X								3 to 5 ft core
D	**57**	**734**	**734C1**	**Core (3 - 5 ft) MS**	**X**	**X**	**X**		**X**										**3 to 5 ft core (MS)**
D	**57**	**734**	**734C1**	**Core (3 - 5 ft) MSD**	**X**	**X**	**X**		**X**										**3 to 5 ft core (MSD)**
D	57	734	734C1	Core (5 - 7 ft)	X	X	X	X	X		X								5 to 7 ft core
D	57	734	734C1	Core (7 - 9 ft)	X	X	X	X	X		X								7 to 9 ft core
D	105	723	723C1	Core (0 - 0.5 ft)	X	X	X		X		X								0 to 0.5 ft core
D	105	723	723C1	Core (0.5 - 1 ft)	X	X	X		X		X								0.5 to 1 ft core
D	105	723	723C1	Core (1 - 3 ft)	X	X	X		X		X								1 to 3 ft core
D	105	723	723C1	Core (3 - 5 ft)	X	X	X		X		X								3 to 5 ft core
D	105	723	723C1	Core (5 - 7 ft)	X	X	X		X		X								5 to 7 ft core
D	105	723	723C1	Core (7 - 9 ft)	X	X	X		X		X								7 to 9 ft core
D	128	715	715C1	Core (0 - 0.5 ft)	X	X	X	X	X		X								0 to 0.5 ft core
D	128	715	715C1	Core (0.5 - 1 ft)	X	X	X	X	X		X								0.5 to 1 ft core
D	128	715	715C1	Core (1 - 3 ft)	X	X	X	X	X		X								1 to 3 ft core
D	128	715	715C1	Core (3 - 5 ft)	X	X	X	X	X		X								3 to 5 ft core
D	**128**	**715**	**715C1**	**Core (3 - 5 ft) FD**	**X**	**X**	**X**	**X**	**X**		**X**								**3 to 5 ft core (FD)**
D	128	715	715C1	Core (5 - 7 ft)	X	X	X	X	X		X								5 to 7 ft core
D	128	715	715C1	Core (7 - 9 ft)	X	X	X	X	X		X								7 to 9 ft core
D	138	708	708C1	Core (0 - 0.5 ft)	X	X	X		X		X								0 to 0.5 ft core
D	138	708	708C1	Core (0.5 - 1 ft)	X	X	X		X		X								0.5 to 1 ft core
D	138	708	708C1	Core (1 - 3 ft)	X	X	X		X		X								1 to 3 ft core
D	138	708	708C1	Core (3 - 5 ft)	X	X	X		X		X								3 to 5 ft core
D	138	708	708C1	Core (5 - 7 ft)	X	X	X		X		X								5 to 7 ft core
D	138	708	708C1	Core (7 - 9 ft)	X	X	X		X		X								7 to 9 ft core

VESSEL	Station ID	River Mile	Station Location	Station Type	Pesticides/PCB Aroclors	SVOCs	Metals (including Mercury and Uranium)	Dioxins/Furans	TOC	AVS/SEM	Grain Size	Bioassay 10-day	Bioassay 7-day	Bioassay 28-day	Size-Fractionated Composite (2 samples created in lab)	Pore Water Isolation	Pore Water Dissolved TAL Metals (includes mercury and uranium)	TCLP Metals, TCLP SVOCs, TCLP Pesticides/PCBs	Comments
					4°C, 14 days	4°C, 14 days	4°C, 180 days (except mercury, 28 days)	4°C, 30 days	4°C, 28 days	4°C, 14 days	none rqd, 180 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, as soon as lab receipt	4°C, 0.45-micron filter, nitric acid, 180 days (except mercury, 28 days)	4°C, 180 days for metals, 28 days for mercury, 14 days for others	
					8-oz amber glass teflon-lined cap	8-oz amber glass teflon-lined cap	8-oz glass	8-oz glass	4-oz glass	8-oz glass	8-oz glass	2-L HDPE	500-mL HDPE	2-L HDPE	5-Gal Pail	8 x 8-oz glass	250-mL HDPE	3 x 8-oz glass	
D	168	704	704C1	Core (0 - 0.5 ft)	X	X	X	X	X		X								0 to 0.5 ft core
D	168	704	704C1	Core (0.5 - 1 ft)	X	X	X	X	X		X								0.5 to 1 ft core
D	168	704	704C1	Core (1 - 3 ft)	X	X	X	X	X		X								1 to 3 ft core
D	168	704	704C1	Core (3 - 5 ft)	X	X	X	X	X		X								3 to 5 ft core
D	168	704	704C1	Core (5 - 7 ft)	X	X	X	X	X		X								5 to 7 ft core
D	168	704	704C1	Core (7 - 9 ft)	X	X	X	X	X		X								7 to 9 ft core
D	200	692	692C1	Core (0 - 0.5 ft)	X	X	X	X	X		X								0 to 0.5 ft core
D	200	692	692C1	Core (0.5 - 1 ft)	X	X	X	X	X		X								0.5 to 1 ft core
D	200	692	692C1	Core (1 - 3 ft)	X	X	X	X	X		X								1 to 3 ft core
D	**200**	**692**	**692C1**	**Core (1 - 3 ft) MS**	**X**	**X**	**X**		**X**										**1 to 3 ft core (MS)**
D	**200**	**692**	**692C1**	**Core (1 - 3 ft) MSD**	**X**	**X**	**X**		**X**										**1 to 3 ft core (MSD)**
D	200	692	692C1	Core (3 - 5 ft)	X	X	X	X	X		X								3 to 5 ft core
D	**200**	**692**	**692C1**	**Core (3 - 5 ft) FD**	**X**	**X**	**X**	**X**	**X**		**X**								**3 to 5 ft core (FD)**
D	200	692	692C1	Core (5 - 7 ft)	X	X	X	X	X		X								5 to 7 ft core
D	200	692	692C1	Core (7 - 9 ft)	X	X	X	X	X		X								7 to 9 ft core
D	241	676	676C1	Core (0 - 0.5 ft)	X	X	X		X		X								0 to 0.5 ft core
D	241	676	676C1	Core (0.5 - 1 ft)	X	X	X		X		X								0.5 to 1 ft core
D	241	676	676C1	Core (1 - 3 ft)	X	X	X		X		X								1 to 3 ft core
D	241	676	676C1	Core (3 - 5 ft)	X	X	X		X		X								3 to 5 ft core
D	241	676	676C1	Core (5 - 7 ft)	X	X	X		X		X								5 to 7 ft core
D	241	676	676C1	Core (7 - 9 ft)	X	X	X		X		X								7 to 9 ft core
D	275	661	661C1	Core (0 - 0.5 ft)	X	X	X	X	X		X								0 to 0.5 ft core
D	275	661	661C1	Core (0.5 - 1 ft)	X	X	X	X	X		X								0.5 to 1 ft core
D	275	661	661C1	Core (1 - 3 ft)	X	X	X	X	X		X								1 to 3 ft core
D	**275**	**661**	**661C1**	**Core (1 - 3 ft) FD**	**X**	**X**	**X**	**X**	**X**		**X**								**1 to 3 ft core (FD)**
D	275	661	661C1	Core (3 - 5 ft)	X	X	X	X	X		X								3 to 5 ft core
D	275	661	661C1	Core (5 - 7 ft)	X	X	X	X	X		X								5 to 7 ft core
D	275	661	661C1	Core (7 - 9 ft)	X	X	X	X	X		X								7 to 9 ft core
D	303	644	644C1	Core (0 - 0.5 ft)	X	X	X		X		X								0 to 0.5 ft core
D	303	644	644C1	Core (0.5 - 1 ft)	X	X	X		X		X								0.5 to 1 ft core
D	303	644	644C1	Core (1 - 3 ft)	X	X	X		X		X								1 to 3 ft core
D	303	644	644C1	Core (3 - 5 ft)	X	X	X		X		X								3 to 5 ft core
D	303	644	644C1	Core (5 - 7 ft)	X	X	X		X		X								5 to 7 ft core
D	303	644	644C1	Core (7 - 9 ft)	X	X	X		X		X								7 to 9 ft core
D	338	637	637C1	Core (0 - 0.5 ft)	X	X	X	X	X		X								0 to 0.5 ft core
D	338	637	637C1	Core (0.5 - 1 ft)	X	X	X	X	X		X								0.5 to 1 ft core
D	338	637	637C1	Core (1 - 3 ft)	X	X	X	X	X		X								1 to 3 ft core
D	**338**	**637**	**637C1**	**Core (1 - 3 ft) FD**	**X**	**X**	**X**	**X**	**X**		**X**								**1 to 3 ft core (FD)**
D	338	637	637C1	Core (3 - 5 ft)	X	X	X	X	X		X								3 to 5 ft core
D	**338**	**637**	**637C1**	**Core (3 - 5 ft) MS**	**X**	**X**	**X**		**X**										**3 to 5 ft core (MS)**
D	**338**	**637**	**637C1**	**Core (3 - 5 ft) MSD**	**X**	**X**	**X**		**X**										**3 to 5 ft core (MSD)**
D	338	637	637C1	Core (5 - 7 ft)	X	X	X	X	X		X								5 to 7 ft core
D	338	637	637C1	Core (7 - 9 ft)	X	X	X	X	X		X								7 to 9 ft core
D	363	622	622C1	Core (0 - 0.5 ft)	X	X	X		X		X								0 to 0.5 ft core
D	363	622	622C1	Core (0.5 - 1 ft)	X	X	X		X		X								0.5 to 1 ft core
D	363	622	622C1	Core (1 - 3 ft)	X	X	X		X		X								1 to 3 ft core
D	363	622	622C1	Core (3 - 5 ft)	X	X	X		X		X								3 to 5 ft core
D	363	622	622C1	Core (5 - 7 ft)	X	X	X		X		X								5 to 7 ft core
D	363	622	622C1	Core (7 - 9 ft)	X	X	X		X		X								7 to 9 ft core
D	402	605	605C1	Core (0 - 0.5 ft)	X	X	X	X	X		X								0 to 0.5 ft core
D	402	605	605C1	Core (0.5 - 1 ft)	X	X	X	X	X		X								0.5 to 1 ft core
D	402	605	605C1	Core (1 - 3 ft)	X	X	X	X	X		X								1 to 3 ft core
D	**402**	**605**	**605C1**	**Core (1 - 3 ft) FD**	**X**	**X**	**X**	**X**	**X**		**X**								**1 to 3 ft core (FD)**
D	402	605	605C1	Core (3 - 5 ft)	X	X	X	X	X		X								3 to 5 ft core
D	402	605	605C1	Core (5 - 7 ft)	X	X	X	X	X		X								5 to 7 ft core
D	402	605	605C1	Core (7 - 9 ft)	X	X	X	X	X		X								7 to 9 ft core
LBST	13	742	742B1c	Beach	X	X	X	X	X		X								
LBST	14	742	742B1L	Beach															Composited with 742B1c
LBST	15	742	742B1R	Beach															Composited with 742B1c
LBST	16	742	742B2c	Beach	X	X	X	X	X		X								
LBST	**16**	**742**	**742B2c**	**Beach (FD)**	**X**	**X**	**X**	**X**	**X**		**X**								**FIELD DUPLICATE**
LBST	**16**	**742**	**742B2c**	**Beach (MS)**	**X**	**X**	**X**		**X**										**LAB QC (MS)**
LBST	**16**	**742**	**742B2c**	**Beach (MSD)**	**X**	**X**	**X**		**X**										**LAB QC (MSD)**
LBST	17	742	742B2L	Beach															Composited with 742B2c
LBST	18	742	742B2R	Beach															Composited with 742B2c
LBST	19	742	742B3c	Beach	X	X	X	X	X		X								
LBST	20	742	742B3L	Beach															Composited with 742B3c
LBST	21	742	742B3R	Beach															Composited with 742B3c
LBST	45	735	735B1c	Beach	X	X	X		X		X								
LBST	45	735	735B1c	Beach				X											Elevation-based composite
LBST	46	735	735B1L	Beach	X	X	X		X		X								

ATTACHMENT 1
Sampling and Analysis Matrix
Upper Columbia River RI/FS

VESSEL	Station ID	River Mile	Station Location	Station Type	Pesticides/PCB Aroclors	SVOCs	Metals (including Mercury and Uranium)	Dioxins/Furans	TOC	AVS/SEM	Grain Size	Bioassay 10-day	Bioassay 7-day	Bioassay 28-day	Size-Fractionated Composite (2 samples created in lab)	Pore Water Isolation	Pore Water Dissolved TAL Metals (includes mercury and uranium)	TCLP Metals, TCLP SVOCs, TCLP Pesticides/PCBs	Comments
					4°C, 14 days	4°C, 14 days	4°C, 180 days (except mercury, 28 days)	4°C, 30 days	4°C, 28 days	4°C, 14 days	none rqd, 180 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, as soon as lab receipt	4°C, 0.45-micron filter, nitric acid, 180 days (except mercury, 28 days)	4°C, 180 days for metals, 28 days for mercury, 14 days for others	
					8-oz amber glass teflon-lined cap	8-oz amber glass teflon-lined cap	8-oz glass	8-oz glass	4-oz glass	8-oz glass	8-oz glass	2-L HDPE	500-mL HDPE	2-L HDPE	5-Gal Pail	8 x 8-oz glass	250-mL HDPE	3 x 8-oz glass	
LBST	47	735	735B1R	Beach	X	X	X		X		X								
LBST	48	735	735B2c	Beach	X	X	X		X		X								
LBST	48	735	735B2c	Beach				X											Elevation-based composite
LBST	48	735	735B2c	Beach	X	X	X	X	X		X				X				Size-fractionated composite (will be 2 samples)
LBST	**48**	**735**	**735B2c**	**Beach (FD)**	**X**	**X**	**X**	**X**	**X**		**X**				**X**				**FD-Size frac composite (will be 2 samples)**
LBST	48	735	Sieved 735B2c 1	Sieved Beach	X	X	X	X	X										Sieved beach samples + MS/MSD
LBST	**48**	**735**	**Sieved 735B2c 1**	**Sieved Beach (FD)**	**X**	**X**	**X**	**X**	**X**										**FD-Sieved beach samples**
LBST	48	735	Sieved 735B2c 2	Sieved Beach	X	X	X	X	X										Sieved beach samples + MS/MSD
LBST	**48**	**735**	**Sieved 735B2c 2**	**Sieved Beach (FD)**	**X**	**X**	**X**	**X**	**X**										**FD-Sieved beach samples + MS/MSD**
LBST	49	735	735B2L	Beach	X	X	X		X		X								
LBST	50	735	735B2R	Beach	X	X	X		X		X								
LBST	51	735	735B3c	Beach	X	X	X		X		X								
LBST	51	735	735B3c	Beach				X											Elevation-based composite
LBST	52	735	735B3L	Beach	X	X	X		X		X								
LBST	53	735	735B3R	Beach	X	X	X		X		X								
LBST	**53**	**735**	**735B3R**	**Beach (FD)**	**X**	**X**	**X**		**X**		**X**								**FIELD DUPLICATE**
LBST	76	729	729B1c	Beach	X	X	X	X	X		X								
LBST	77	729	729B1L	Beach															Composited with 729B1c
LBST	78	729	729B1R	Beach															Composited with 729B1c
LBST	79	729	729B2c	Beach	X	X	X	X	X		X								
LBST	80	729	729B2L	Beach															Composited with 729B2c
LBST	81	729	729B2R	Beach															Composited with 729B2c
LBST	82	729	729B3c	Beach	X	X	X	X	X		X								
LBST	83	729	729B3L	Beach															Composited with 729B3c
LBST	84	729	729B3R	Beach															Composited with 729B3c
LBST	116	718	718B1c	Beach	X	X	X	X	X		X								
LBST	117	718	718B1L	Beach															Composited with 718B1c
LBST	118	718	718B1R	Beach															Composited with 718B1c
LBST	119	718	718B2c	Beach	X	X	X	X	X		X								
LBST	120	718	718B2L	Beach															Composited with 718B2c
LBST	121	718	718B2R	Beach															Composited with 718B2c
LBST	122	718	718B3c	Beach	X	X	X	X	X		X								
LBST	123	718	718B3L	Beach															Composited with 718B3c
LBST	124	718	718B3R	Beach															Composited with 718B3c
LBST	139	708	708B1c	Beach	X	X	X	X	X		X								
LBST	**139**	**708**	**708B1c**	**Beach (FD)**	**X**	**X**	**X**	**X**	**X**		**X**								**FIELD DUPLICATE**
LBST	**139**	**708**	**708B1c**	**Beach (MS)**	**X**	**X**	**X**		**X**										**LAB QC (MS)**
LBST	**139**	**708**	**708B1c**	**Beach (MSD)**	**X**	**X**	**X**		**X**										**LAB QC (MSD)**
LBST	140	708	708B1L	Beach															Composited with 708B1c
LBST	141	708	708B1R	Beach															Composited with 708B1c
LBST	142	708	708B2c	Beach	X	X	X	X	X		X								
LBST	143	708	708B2L	Beach															Composited with 708B2c
LBST	144	708	708B2R	Beach															Composited with 708B2c
LBST	145	708	708B3c	Beach	X	X	X	X	X		X								
LBST	146	708	708B3L	Beach															Composited with 708B3c
LBST	147	708	708B3R	Beach															Composited with 708B3c
LBST	172	700	700B1c	Beach	X	X	X		X		X								
LBST	172	700	700B1c	Beach				X											Elevation-based composite
LBST	173	700	700B1L	Beach	X	X	X		X		X								
LBST	174	700	700B1R	Beach	X	X	X		X		X								
LBST	175	700	700B2c	Beach	X	X	X		X		X								
LBST	175	700	700B2c	Beach				X											Elevation-based composite
LBST	175	700	700B2c	Beach	X	X	X	X	X		X				X				Size-fractionated composite (will be 2 samples)
LBST	175	700	Sieved 700B2c 1	Sieved Beach	X	X	X	X	X										Sieved beach samples
LBST	175	700	Sieved 700B2c 2	Sieved Beach	X	X	X	X	X										Sieved beach samples
LBST	176	700	700B2L	Beach	X	X	X		X		X								
LBST	177	700	700B2R	Beach	X	X	X		X		X								
LBST	178	700	700B3c	Beach	X	X	X		X		X								
LBST	178	700	700B3c	Beach				X											Elevation-based composite
LBST	179	700	700B3L	Beach	X	X	X		X		X								
LBST	**179**	**700**	**700B3L**	**Beach (FD)**	**X**	**X**	**X**		**X**		**X**								**FIELD DUPLICATE**
LBST	180	700	700B3R	Beach	X	X	X		X		X								
LBST	185	697	697B1c	Beach	X	X	X	X	X		X								
LBST	186	697	697B1L	Beach															Composited with 697B1c
LBST	187	697	697B1R	Beach															Composited with 697B1c
LBST	188	697	697B2c	Beach	X	X	X	X	X		X								
LBST	189	697	697B2L	Beach															Composited with 697B2c
LBST	190	697	697B2R	Beach															Composited with 697B2c
LBST	191	697	697B3c	Beach	X	X	X	X	X		X								
LBST	**191**	**697**	**697B3c**	**Beach (FD)**	**X**	**X**	**X**	**X**	**X**		**X**								**FIELD DUPLICATE**
LBST	**191**	**697**	**697B3c**	**Beach (MS)**	**X**	**X**	**X**		**X**										**LAB QC (MS)**

VESSEL	Station ID	River Mile	Station Location	Station Type	Pesticides/PCB Aroclors	SVOCs	Metals (including Mercury and Uranium)	Dioxins/Furans	TOC	AVS/SEM	Grain Size	Bioassay 10-day	Bioassay 7-day	Bioassay 28-day	Size-Fractionated Composite (2 samples created in lab)	Pore Water Isolation	Pore Water Dissolved TAL Metals (includes mercury and uranium)	TCLP Metals, TCLP SVOCs, TCLP Pesticides/PCBs	Comments
					4°C, 14 days	4°C, 14 days	4°C, 180 days (except mercury, 28 days)	4°C, 30 days	4°C, 28 days	4°C, 14 days	none rqd, 180 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, as soon as lab receipt	4°C, 0.45-micron filter, nitric acid, 180 days (except mercury, 28 days)	4°C, 180 days for metals, 28 days for mercury, 14 days for others	
					8-oz amber glass teflon-lined cap	8-oz amber glass teflon-lined cap	8-oz glass	8-oz glass	4-oz glass	8-oz glass	8-oz glass	2-L HDPE	500-mL HDPE	2-L HDPE	5-Gal Pail	8 x 8-oz glass	250-mL HDPE	3 x 8-oz glass	
LBST	**191**	**697**	**697B3c**	**Beach (MSD)**	**X**	**X**	**X**		**X**										**LAB QC (MSD)**
LBST	192	697	697B3L	Beach															Composited with 697B3c
LBST	193	697	697B3R	Beach															Composited with 697B3c
LBST	201	690	690B1c	Beach	X	X	X	X	X		X								
LBST	202	690	690B1L	Beach															Composited with 690B1c
LBST	203	690	690B1R	Beach															Composited with 690B1c
LBST	204	690	690B2c	Beach	X	X	X	X	X		X								
LBST	205	690	690B2L	Beach															Composited with 690B2c
LBST	206	690	690B2R	Beach															Composited with 690B2c
LBST	207	690	690B3c	Beach	X	X	X	X	X		X								
LBST	208	690	690B3L	Beach															Composited with 690B3c
LBST	209	690	690B3R	Beach															Composited with 690B3c
LBST	242	675	675B1c	Beach	X	X	X	X	X		X								
LBST	**242**	**675**	**675B1c**	**Beach (FD)**	**X**	**X**	**X**	**X**	**X**		**X**								**FIELD DUPLICATE**
LBST	243	675	675B1L	Beach															Composited with 675B1c
LBST	244	675	675B1R	Beach															Composited with 675B1c
LBST	245	675	675B2c	Beach	X	X	X	X	X		X								
LBST	246	675	675B2L	Beach															Composited with 675B2c
LBST	247	675	675B2R	Beach															Composited with 675B2c
LBST	248	675	675B3c	Beach	X	X	X	X	X		X								
LBST	249	675	675B3L	Beach															Composited with 675B3c
LBST	250	675	675B3R	Beach															Composited with 675B3c
LBST	254	673	673B1c	Beach	X	X	X	X	X		X								
LBST	**254**	**673**	**673B1c**	**Beach (FD)**	**X**	**X**	**X**	**X**	**X**		**X**								**FIELD DUPLICATE**
LBST	**254**	**673**	**673B1c**	**Beach (MS)**	**X**	**X**	**X**		**X**										**LAB QC (MS)**
LBST	**254**	**673**	**673B1c**	**Beach (MSD)**	**X**	**X**	**X**		**X**										**LAB QC (MSD)**
LBST	255	673	673B1L	Beach															Composited with 673B1c
LBST	256	673	673B1R	Beach															Composited with 673B1c
LBST	257	673	673B2c	Beach	X	X	X	X	X		X								
LBST	258	673	673B2L	Beach															Composited with 673B2c
LBST	259	673	673B2R	Beach															Composited with 673B2c
LBST	260	673	673B3c	Beach	X	X	X	X	X		X								
LBST	261	673	673B3L	Beach															Composited with 673B3c
LBST	262	673	673B3R	Beach															Composited with 673B3c
LBST	279	658	658B1c	Beach	X	X	X	X	X		X								
LBST	280	658	658B1L	Beach															Composited with 658B1c
LBST	281	658	658B1R	Beach															Composited with 658B1c
LBST	282	658	658B2c	Beach	X	X	X	X	X		X								
LBST	283	658	658B2L	Beach															Composited with 658B2c
LBST	284	658	658B2R	Beach															Composited with 658B2c
LBST	285	658	658B3c	Beach	X	X	X	X	X		X								
LBST	286	658	658B3L	Beach															Composited with 658B3c
LBST	287	658	658B3R	Beach															Composited with 658B3c
LBST	314	642	642B1c	Beach	X	X	X		X		X								
LBST	314	642	642B1c	Beach				X											Elevation-based composite
LBST	315	642	642B1L	Beach	X	X	X		X		X								
LBST	316	642	642B1R	Beach	X	X	X		X		X								
LBST	317	642	642B2c	Beach	X	X	X		X		X								
LBST	317	642	642B2c	Beach				X											Elevation-based composite
LBST	317	642	642B2c	Beach	X	X	X	X	X		X				X				Size-fractionated composite (will be 2 samples)
LBST	317	642	Sieved 642B2c 1	Sieved Beach	X	X	X	X	X										Sieved beach samples
LBST	317	642	Sieved 642B2c 2	Sieved Beach	X	X	X	X	X										Sieved beach samples
LBST	318	642	642B2L	Beach	X	X	X		X		X								
LBST	319	642	642B2R	Beach	X	X	X		X		X								
LBST	320	642	642B3c	Beach	X	X	X		X		X								
LBST	320	642	642B3c	Beach				X											Elevation-based composite
LBST	321	642	642B3L	Beach	X	X	X		X		X								
LBST	**321**	**642**	**642B3L**	**Beach (FD)**	**X**	**X**	**X**		**X**		**X**								**FIELD DUPLICATE**
LBST	322	642	642B3R	Beach	X	X	X		X		X								
LBST	342	633	633B1c	Beach	X	X	X	X	X		X								
LBST	343	633	633B1L	Beach															Composited with 633B1c
LBST	344	633	633B1R	Beach															Composited with 633B1c
LBST	345	633	633B2c	Beach	X	X	X	X	X		X								
LBST	346	633	633B2L	Beach															Composited with 633B2c
LBST	347	633	633B2R	Beach															Composited with 633B2c
LBST	348	633	633B3c	Beach	X	X	X	X	X		X								
LBST	349	633	633B3L	Beach															Composited with 633B3c
LBST	350	633	633B3R	Beach															Composited with 633B3c
LBST	372	615	615B1c	Beach	X	X	X	X	X		X								
LBST	373	615	615B1L	Beach															Composited with 615B1c
LBST	374	615	615B1R	Beach															Composited with 615B1c

ATTACHMENT 1

Sampling and Analysis Matrix

Upper Columbia River RI/FS

					4°C, 14 days	4°C, 14 days	4°C, 180 days (except mercury, 28 days)	4°C, 30 days	4°C, 28 days	4°C, 14 days	none rqd, 180 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, 14 days	4°C, as soon as lab receipt	4°C, 0.45-micron filter, nitric acid, 180 days (except mercury, 28 days)	4°C, 180 days for metals, 28 days for mercury, 14 days for others	
					8-oz amber glass teflon-lined cap	8-oz amber glass teflon-lined cap	8-oz glass	8-oz glass	4-oz glass	8-oz glass	8-oz glass	2-L HDPE	500-mL HDPE	2-L HDPE	5-Gal Pail	8 x 8-oz glass	250-mL HDPE	3 x 8-oz glass	
VESSEL	**Station ID**	**River Mile**	**Station Location**	**Station Type**	**Pesticides/PCB Aroclors**	**SVOCs**	**Metals (including Mercury and Uranium)**	**Dioxins/Furans**	**TOC**	**AVS/SEM**	**Grain Size**	**Bioassay 10-day**	**Bioassay 7-day**	**Bioassay 28-day**	**Size-Fractionated Composite (2 samples created in lab)**	**Pore Water Isolation**	**Pore Water Dissolved TAL Metals (includes mercury and uranium)**	**TCLP Metals, TCLP SVOCs, TCLP Pesticides/PCBs**	**Comments**
LBST	375	615	615B2c	Beach	X	X	X	X	X		X								
LBST	376	615	615B2L	Beach															Composited with 615B2c
LBST	377	615	615B2R	Beach															Composited with 615B2c
LBST	378	615	615B3c	Beach	X	X	X	X	X		X								
LBST	379	615	615B3L	Beach															Composited with 615B3c
LBST	380	615	615B3R	Beach															Composited with 615B3c
LBST	412	600	600B1c	Beach	X	X	X	X	X		X								
LBST	413	600	600B1L	Beach															Composited with 600B1c
LBST	414	600	600B1R	Beach															Composited with 600B1c
LBST	415	600	600B2c	Beach	X	X	X	X	X		X								
LBST	416	600	600B2L	Beach															Composited with 600B2c
LBST	417	600	600B2R	Beach															Composited with 600B2c
LBST	418	600	600B3c	Beach	X	X	X	X	X		X								
LBST	419	600	600B3L	Beach															Composited with 600B3c
LBST	420	600	600B3R	Beach															Composited with 600B3c
LBST	64	732	732R1	Reference/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
LBST	163	726	726R1	Reference/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
LBST	112	721	721R1	Reference/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
LBST	**112**	**721**	**721R1**	**Reference/Pore Water (FD)**	**X**	**X**	**X**		**X**	**X**	**X**	**X**	**X**	**X**		**X**	**X**		**FIELD DUPLICATE**
LBST	164	705	705R1	Reference/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
LBST	217	686	686R1	Reference/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
LBST	218	685	685R1	Reference/Pore Water	X	X	X		X	X	X	X	X	X		X	X		
-	-	-	Sample Processing	IDW - Solid 1	X	X	X											X	IDW Solid Sample
-	-	-	Sample Processing	IDW - Solid 2	X	X	X											X	IDW Solid Sample
-	-	-	Sample Processing	IDW - Solid 3	X	X	X											X	IDW Solid Sample

Note: All quality control samples are in bold text.

AVS/SEM = acid volatile sulfides/simultaneously extracted metals
Bio/Tran/Pore Water = sample location where bioassay, transect, and pore water samples will be collected
°C = degree Celsius
FD = field duplicate
ft = feet
HDPE = high-density polyethylene
IDW = investigation-derived waste
LBST = land-based survey team
MS = matrix spike
MSD = matrix spike duplicate
oz = ounce
PCB = polychlorinated biphenyl
QC = quality control
SVOC = semivolatile organic compound
TAL = Target Analyte List
TCLP = toxicity characteristic leaching procedure
TOC = total organic carbon

ATTACHMENT 2

Standards of Practice

Insert:

SOP SEDFSP-1 Positioning at Below-Water Stations
SOP SEDFSP-2 Positioning and Elevation Control at Above-Water Stations
SOP SEDFSP-3 Below-Water Grab Sampling Procedures
SOP SEDFSP-4 Sediment Core Sample Processing Procedures
SOP SEDFSP-5 Above-Water Grab Sampling Procedures
SOP SEDFSP-5A Composite Sampling Procedures at Standard Beaches
SOP SEDFSP-5B Composite Sampling Procedures at Selected Beaches
SOP SEDFSP-6 Sampling Procedures in Areas of Strong Currents
SOP SEDFSP-7 Methodology for Determining Lake and River Elevations
SOP SEDFSP-8 Decontamination of Sampling Equipment
SOP SEDFSP-9 Digital Camera Use and Documentation Procedures
SOP SEDFSP-10 Preparation of Particle-Size-Fractionated Samples For Chemical Analysis
SOP SEDFSP-11 Sediment Pore Water Isolation and Handling Procedures

STANDARD OF PRACTICE SEDFSP-1

Positioning at Below-Water Stations

Purpose

The purpose of this standard of practice (SOP) is to describe procedures used for locating sampling stations below water.

Scope and Applicability

This SOP is applicable for determining the horizontal and vertical location of below-water stations. The SOP applies to all below-water surface sediment and core sample groups. Below-water sample locations include transect samples, focus area samples, tributary mouth samples, bioassay and reference area samples (including samples from which pore water will be isolated). Under certain conditions (e.g., high water), beach samples may also be obtained from sediment that is submerged at the time of sampling (sample groups are defined in Section 4 of this Field Sampling Plan [FSP]).

Equipment and Materials

The horizontal positioning equipment will consist of a global positioning system (GPS) instrument with Hypack or similar navigation software. The display will be capable of showing the present location of the vessel relative to the desired station location and will provide a bearing and distance to the station. The equipment will be capable of being pre-programmed with the National Oceanic and Atmospheric Administration (NOAA) nautical chart and sampling station locations. In the event normal GPS reception of four or more satellites is not available at a given location because of terrain blocking or other causes, alternative methods will be used to establish positions along a transect.

Vertical positioning will be done with the vessel fathometer, or, in shallow water, a lead line and tape measure or a surveyor's rod.

Typical Procedures/Guidelines

Horizontal Positioning

Horizontal positioning for below-water stations will be accomplished using differential GPS (DGPS) based on the U.S. Coast Guard (USCG) Maritime Differential GPS Service signal or GPS if the USCG differential signal cannot be received. USCG operates a GPS remote broadcast site from Spokane that broadcasts corrected GPS signals on marine radio beacon frequencies. Position errors with this system typically are within 1 to 3 meters (3.3 to 9.8 feet). The following requirements apply to the GPS instrument and will be verified initially by the CH2M HILL Field Operations Manager and subsequently by the CH2M HILL Field Team Leaders (FTLs) during the course of the work:

- The GPS unit will be configured such that satellites less than 8 degrees above the horizon will not be used in position computations.
- A minimum of four satellites will be used for computing all positions.

The GPS antenna will be mounted on the swing davit or top centerline of the A-frame. This will avoid the need for computing distance offsets for the antenna location.

If adequate GPS signals are not received, alternative methods for sample positioning will be used based on radar and/or laser rangefinder equipment. These methods will measure distances to at least two known points on the nautical chart or to two marker buoys equipped with radar reflectors and light reflective surfaces. These marker buoys will be deployed based on GPS positioning so that their locations can be plotted on a special navigation grid sheet along with the station locations to be sampled. The vessel will be navigated until it is within a within a circle of 40 meters (131 feet) or less around the station location. A buoy will be deployed to mark the position. This buoy will have a short mooring line slope of about 1.1 to 1 so as to minimize the lateral excursion of the buoy on the surface of the water. The vessel will be maneuvered so that the buoy is no more than 10 meters (33 feet) from the vessel at the time the sampler or corer contacts the bottom. A radar and/or laser rangefinder fix will be taken at the time of the grab or core.

If GPS can be received at a location on the transect line, a marker buoy will be deployed, and bearings and distances will be used to position the vessel at the desired station locations along the transect. A buoy will be deployed at each station, and the samples taken as described above.

The sampling vessel must locate and remain fixed on the general sampling location before sampling can begin**.** The vessel operator (VO) will be responsible for navigating the boat to each sample location. For submerged sediment sampling, the boat will be positioned so that it is within a circle of 20 meters (66 feet) or less around the planned position at the time that the sediment sampler or corer contacts the bottom. The CH2M HILL FTL will verify that the sample location is within the allowable position circle. If the actual sample position is outside the 20-meter radius, the vessel will be re-positioned and the sample(s) retaken. If conditions are such that the vessel's position cannot be maintained within the 20-meter radius, the sample may be taken outside the allowable position circle. The rationale for positioning more than 20 meters from the planned position will need to be thoroughly documented and reviewed with the CH2M HILL Field Operations Manager at the end of the day.

All submerged sediment samples will be taken without anchoring the vessel except when current or wind conditions preclude holding the vessel on station within the 20-meter position circle. The VO and CH2M HILL FTL will determine whether anchoring is required for taking the sediment sample or core.

When the vessel is not under power, it will typically swing perpendicular to the wind or current. If the sampling equipment is deployed over the side of the vessel instead of the stern, this will be done on the upwind or upcurrent side to prevent the vessel drifting onto the hydrowire (winch wire) once the sampler or corer has contacted the bottom. In shallow water (less than about 10 meters deep) with drift rates exceeding about 0.5 meter per second (m/sec) (1.6 feet per second [ft/sec]), the sampler or corer may not perform correctly because of its lateral speed when it hits the bottom. In addition, for coring operations, the drift rate could bend or break the core barrel once the barrel penetrates the bottom. Under high drift rates, it will be necessary to either anchor or hold the vessel in position using engine power. The adverse effects of drift rate decrease as the water depth increases because the vessel must drift a longer distance on the surface to pull the sampler or corer out of alignment on the bottom.

The angle of the hydrowire to the vertical will be kept to approximately 5 degrees or less for all sampling activities, if possible, and will be measured using a wire angle indicator. Once wire angles exceed 5 degrees, the offset error between the vessel and the sampler increases significantly. If this condition occurs, the vessel will be repositioned and another sample attempt made.

The VO is responsible at all times for the safe and prudent operation of the boat and the conditions under which any operation will be performed. This is particularly important for operations under stormy conditions, in shallow water, in strong currents, or any situation that affects the maneuverability and stability of the boat. Although the CH2M HILL FTL is responsible for all scientific operations, it is the VO who will be responsible for any actions concerning operation of the boat.

Vertical Positioning

The vertical position of below-water stations will be determined using a fathometer. In areas where the depth is too shallow, a lead line or survey rod will be used to measure the distance from the water surface to the riverbed. The depth to the station from the water surface will be converted to elevation based on the pool elevation established at the beginning of the day as described in SOP SEDFSP-7, Methodology for Determining Lake and River Elevations.

STANDARD OF PRACTICE FSPSED-2

Positioning and Elevation Control at Above-Water Stations

Purpose

The purpose of this standard of practice (SOP) is to describe procedures used for locating above-water sampling stations.

Scope and Applicability

This SOP is applicable to the determination of the horizontal and vertical location of above-water stations. The SOP applies to the sample groups containing beach samples and transect samples that are above water at the time of sampling (sample groups are defined in Section 4 of this Field Sampling Plan [FSP]).

Equipment and Materials

- Precision differential global positioning system (DGPS)/GPS backpack receiver (i.e., Trimble, Inc. Pathfinder Pro XR or Pro XRS GPS)
- Laser rangefinder with inclinometer (i.e., Laser Technology Impulse 200 LR Laser Rangefinder with MapStar Compass Module)
- Survey rod and 4- to 5-foot-tall stakes, or hand-portable buoy
- Laser reflectors
- Fiberglass measuring tape (300 feet)
- Wooden stakes (approximately 2 feet long), hammer, and flagging
- Field notebook and waterproof permanent marker
- Personal protection equipment (e.g., nitrile gloves, boots, hip waders)

Typical Procedures/Guidelines

The following procedures can be followed more easily by referring to Figure 6-3 and Figures 3-14 to 3-28 in the main body of this FSP.

Horizontal and Vertical Positioning for Beach Stations

Given that the size and configuration of the accessible beach area changes depending on reservoir pool level, each beach will be sampled at three elevations within a specified area.

The vessel will maneuver as close to the beach as possible, to water depths 2 feet or less. Beach sampling personnel will disembark using a boat ladder and wade ashore with the equipment. In areas where the riverbed is hard, a hand-portable buoy with a 20-pound clump weight and 5-foot mooring line will be deployed in the shallow water by one of the "beach" personnel. This buoy will have an omni-directional prism reflector mounted on top to serve as the reflection point for the laser rangefinder. In the event the buoy becomes obscured by terrain or vegetation during the course of locating the specific sample sites on the beach, the buoy will be moved until it is visible again from the beach. In areas where the riverbed is soft, a 4- to 5-foot-long stake will be driven vertically into the riverbed and a laser reflector placed on top of the stake. The distance from the reflector to the water surface will be measured so that elevations determined by the laser rangefinder above the reflector can be corrected to the distance above the lake level. In some cases where the buoy or target stake cannot be repositioned so that it is visible, a survey rod with laser reflector will be used to raise the laser reflection point higher above the water surface.

The initial sampling location will be determined using DGPS (or GPS if the U.S. Coast Guard DGPS signal cannot be received). The person with the backpack GPS instrument will also operate a handheld laser rangefinder and will walk upslope to the sampling location with the highest elevation, as listed in Attachment 3, Detailed Operations Schedule, and as shown in Figures 3-14 to 3-28 in the main body of this FSP. This will be accomplished by proceeding to a stored waypoint in the GPS unit and adjusting the actual position based on elevation readings from the rangefinder. Elevations will be determined to within ± 2.0 feet. Depending on the model of the rangefinder and its internal inclinometers, vertical angles can be measured to an accuracy of ± 0.1 degree to ± 0.2 degree. Table 1 shows line-of-sight distances versus elevation accuracy. For elevation accuracies of ± 2.0 feet, use of a handheld laser rangefinder will be limited to a maximum distance of 573 feet to 1,143 feet, depending on the inclinometer accuracy.

TABLE 1
Elevation Accuracy Versus Inclinometer Resolution
Upper Columbia River RI/FS

	Elevation Accuracy (degrees) for Line-of-Site Distance (feet)							
Inclinometer Resolution (degrees)	**200**	**400**	**573**	**600**	**800**	**1,000**	**1,143**	**1,200**
0.1	± 0.35	± 0.70	± 1.00	± 1.05	± 1.40	±1.75	± 2.00	± 2.10
0.2	± 0.70	±1.40	± 2.00	± 2.09	± 2.79	± 3.49	± 3.99	± 4.19

The instrument person will continue upslope to the highest station and plant a vertical wooden stake at the spot. For sampling stations where multiple samples are to be obtained (e.g., composite or discrete beach), he or she will then proceed laterally 200 to 300 feet at approximately the same elevation as shown in Figures 3-14 to 3-28, measuring horizontal distance from the stake with the rangefinder. During this process, laser readings will also be taken off the target buoy to ensure that the same elevation is reached as that for the station stake. DGPS/GPS coordinates will be recorded for the lateral station. The process will then be repeated on the other side of the station stake and another sample taken (again, 200 to 300 feet from the center staked station at the target elevation).

The second station downslope from the highest station will be located using the above procedures, and samples taken from the two lateral stations each 200 to 300 feet from the central staked station, all at approximately the same elevation. The final station located at the water's edge will then be staked, and the samples at each of the lateral stations each 200 to 300 feet from the central staked station will be collected.

In the event that a planned station position would fall in an obvious nonbeach area or an area where only coarse-grained sediment and rocks are present, the FTL will make a field decision to adjust the station elevation to meet the intent of the sample or abandon one or more of the three stations at the planned elevation. The rationale for repositioning will be thoroughly documented and reviewed with the CH2M HILL Sampling Team Leader at the end of the day.

Horizontal and Vertical Positioning for a Single Transect Station

The procedure for locating a single sampling station above the water surface will be done using the same equipment as above and the same procedures, except there will be no lateral sample locations. The location of each station is listed in Attachment 3.

STANDARD OF PRACTICE SEDFSP-3

Below-Water Grab Sampling Procedures

Purpose

The purpose of this standard of practice (SOP) is to describe sample collection and processing procedures for sediment samples collected using below-water grab sampling equipment.

Scope and Applicability

This sediment sampling SOP is divided into two procedures: the first procedure is applicable to sample locations that can be accessed by boat without disruption of bottom sediment or damage to the vessel, and the second procedure is applicable to below-water sample locations that are in shallow water or in areas that cannot be accessed by boat. Below-water sample locations include transect samples, focus area samples, tributary mouth samples, and bioassay and reference area samples (including samples from which pore water will be isolated). Under certain conditions (e.g., high water), beach samples may also be obtained from sediment that is submerged at the time of sampling.

The stations where the different types of samples will be collected are listed in the detailed operations schedule in Attachment 3 of this Field Sampling Plan (FSP). Vessel and sample positioning required prior to below-water sediment sampling is described in SOP SEDFSP-1, Positioning at Below-Water Stations.

Below-Water Sampling From Vessel

This procedure is applicable to below-water samples collected using a van Veen grab sampler operated from a vessel.

Equipment and Materials

The equipment and materials required for below-water grab sampling from a vessel are listed in Table 1.

Sample Collection Procedures

Vessels equipped with a van Veen grab sampler will be used to collect below-water sediment samples. A backup van Veen grab will also be available in the event that the primary grab is damaged, malfunctions, or is lost. Sampling locations will be approached at slow boat speeds with minimal wake to minimize disturbance of bottom sediments prior to sampling, particularly in shallow sampling locations. Sediment samples will be handled carefully to minimize disturbance during collection and transportation to the analytical laboratory.

Preparation for Sampling

After all sampling equipment and supplies have been transported to the work vessel, the van Veen grab can be assembled on deck. Because of the depth of water and the weight of the sampler, a hydraulic winching system will be used to control the rate of the sampler ascent and descent. When not in use, the sampler will always be secured when the vessel is underway.

The hydrowire will be attached to the sampler using a ball-bearing swivel (or similar hardware) to minimize any twisting forces during deployment and recovery. The hydrowire, swivel, and shackles will all have a working load capacity at least three times the weight of a full sampler (e.g., approximately 250 kilograms [kg] or 550 pounds [lb]).

At the direction of the CH2M HILL field team leader (FTL), the vessel will move to the sampling station and, depending on surface wind and wave conditions, will be held or anchored onstation using the differential global positioning system (DGPS) (or GPS if the DGPS cannot be received) and navigation system (see SOP SEDFSP-1, Positioning at Below-Water Stations). At this time, relevant information on sampling date, time, station location and coordinates, local water depth, and weather observations will be recorded in the field notebook in accordance with sample documentation requirements identified in the main body of this FSP.

Sampling Procedure

A decontaminated van Veen sampler (see SOP SEDFSP-8, Decontamination of Sampling Equipment) will be used to collect the sediment samples. Once the sampler is ready for deployment, the sampler will be locked open with the safety pin. The sampler will be deployed using the hydraulic winch and an overhead davit or boom. While the winch operator slowly picks up the sampler with the hydrowire, another team member will be responsible for safely guiding the sampler over the side of the boat and into position over the intended sampling location. The safety pin will be removed while keeping hands and fingers outside the sampler. The deckhand will indicate to the winch operator when the sampler is at the surface and ready for sampling. At this time, the CH2M HILL FTL will notify the vessel operator (VO) that sampling will commence and that the VO should prepare to collect a DGPS/GPS fix.

The position of the sampler relative to the riverbed can be shown by configuring the display of the vessel’s depth sounder. Alternatively, the sampler may be lowered at a controlled rate of speed approximately equal to 30 centimeters per second (cm/sec) (1 foot per second [ft/sec]). The location of the sampler as it is lowered through the water column would then be determined either by rigging the hydrowire to a meter wheel or using pre-marked meter lengths on the cable itself.

Under no circumstances should the sampler be allowed to “free fall” to the bottom. Doing so may result in premature triggering of the sampler, or an excessive bow wake around the sampler, or improper orientation of the sampler. When the sampler reaches the mudline, the cable will be drawn taut and DGPS/GPS coordinates recorded. **Note: to ensure that the position fix is representative of the actual location sampled, the antenna for the GPS unit must be located as close as practical to the sampler (e.g., within 1 to 2 meters)**. After the sample is collected, the sampling device will be lifted slowly off the bottom, then steadily raised to the surface at a speed of about 30 cm/sec (1 ft/sec). Care will be used to avoid swinging or tipping the sampler during retrieval.

Once aboard the vessel, the sampler will be gently lowered onto a sampling table or stand. This waist-high stand may be constructed of wood and should be large enough to hold the sampler and allow for at least two team members to retrieve the sample. Ideally, the stand will be approximately 1 meter wide by 1.5 meters long (3 feet by 4 feet), one end of which will extend over the transom or gunwale of the work vessel.

The access doors on the top of the sampler, which consist of wire mesh screens and rubber flaps allow visual characterization of the sediment surface and aid in assessing sample acceptability. Each surface grab sample will be retrieved aboard the vessel and evaluated for the following acceptance criteria, which are illustrated generally in Figure 1:

- Overlying water is present and has low turbidity.
- Adequate penetration depth is achieved.
- The sampler is not overfilled (no contact with doors).
- The sediment surface is undisturbed.
- There are no signs of winnowing or leaking from the sampling device.

Grab samples not meeting these criteria will be rejected near the location of sample collection and steps repeated until the criteria have been met or until three attempts at a location have failed. Deployments will be repeated within a 20-meter (66-foot) radius of the proposed sample location, or other suitable location based on observed conditions, as determined by FTL. If adequate penetration is not achieved after multiple attempts, less volume will be accepted and noted in the field notebook. Chemical replicate samples will be a split sample. The following are minimum penetration depths based on sample grain size:

- Coarse to medium sand: 4 to 5 cm
- Fine sand: 6 to 7 cm
- Silt and clay: 10 cm

Before sample processing commences, the material in the sampler will be photographed and the photograph labeled with station location, date, and time of sample. The overlying water will then be siphoned off near one corner of the sampler. Next, a decontaminated stainless steel trowel or spoon may be used to collect only the upper 10 to 15 cm (4.5 to 6 inches) of sediment from inside the sampler, without touching the sidewalls. The sampler and sampling table will be decontaminated between stations and rinsed with site water between grabs in accordance with the equipment decontamination procedures described in SOP SEDFSP-8, Decontamination of Sampling Equipment.

Sample Processing Procedures

After an acceptable grab sample is retrieved, the following processing steps will be completed on the vessel for all discrete grab samples (the procedures for processing of composite samples obtained below 0water are the same as those described for above-water samples in SOP SEDFSP-5, Above-Water Sampling Procedures):

1. Physical characterization will be performed in general accordance with the American Society for Testing and Materials (ASTM) D2488-00 visual-manual description

procedure. The following information will be recorded on the Sediment Sample Data Sheet and signed by the FTL:

- Date, type, and name of person logging the sample
- Weather conditions
- Sample location number and coordinates
- Project designation
- Depth of water at the location and surface elevation
- Equipment used
- Whether an examination was made by the cultural resources observer and whether the observer established the presence of any historical or cultural resources requiring this target sampling station to be abandoned, in accordance with the process described in the main body of this FSP
- Sediment texture
- Sediment color
- Presence, type, and strength of odors
- Grab penetration depth (nearest centimeter)
- Degree of leakage or sediment surface disturbance
- Any obvious abnormalities such as wood/shell fragments or large organisms
- Estimation of sample recovery volume (e.g., percent full)

2. The sediment will be transferred to an aluminum-foil-lined stainless steel bowl for homogenization with disposable hand tools. Sediment that is in direct contact with the sides of the grab sampler should not be included with the sediment placed in the bowl to avoid potential contamination from the device. Team members conducting the sample processing will don a clean pair of disposable nitrile gloves and collect the upper 10 to 15 centimeters of sediment using disposable hand tools.

3. Any obvious abnormalities present (e.g., wood/shell fragments or large organisms) and coarser grained sediment (e.g., pebbles and gravel) will be removed from the sample by hand or using disposable hand tools.

4. In the event that one grab sample does not have an adequate volume for the sample aliquot, repeat the sampling procedure at the same station and combine and thoroughly homogenize the samples.

5. The homogenized sample will be distributed into the appropriate pre-labeled sample containers, filled to capacity, and stored in a cooler with a maximum temperature of 4 degrees Celsius (°C). Sample storage, packaging, and shipment requirements are identified in Section 6.5 of this FSP.

6. The sampling equipment will be decontaminated according to the procedures described in SOP SEDFSP-8, Decontamination of Sampling Equipment.
7. Any excess sediment remaining after processing will be returned to the water, and the deck will be rinsed clean after all grab samples are collected and before moving to the next station.
8. The sampler will be secured and moved to the next sample location.

Below-Water Sampling in Shallow Water

This procedure is applicable to below-water samples collected in shallow water using hand-operated equipment.

Equipment and Materials

The equipment and materials required for below-water grab sampling by hand in shallow water are listed in Table 2.

Sample Collection Procedures

Shallow-water sampling locations may be accessed by vessel or by land. The sampling team will be equipped with a petite ponar grab sampler and disposable hand tools, with backups available in the event of equipment failure. Sediment samples will be handled carefully to minimize disturbance during collection and transportation to the analytical laboratory.

Preparation for Sampling

All sampling equipment and supplies will be transported to the sampling station by water vessel or land vehicle. For approach by water, the vessel will maneuver as close to shore as possible, to water depths of 2 feet or less, near the sampling station at the direction of the FTL; the field team will disembark with the necessary field equipment. Approach via land vehicle will use the best available path.

At the direction of the CH2M HILL FTL, personnel will identify the sampling station using the DGPS (or GPS if the DGPS cannot be received) and navigation system (see SOP SEDFSP-1, Positioning at Below-Water Stations). The sampler will observe the general hydrologic and geologic conditions present at the proposed location and determine whether the location is suitable for sampling of fine-grained sediment. If the materials present are primarily gravel, cobbles, or rocks, an alternative sample location in the vicinity will be identified and the DGPS or GPS coordinates will be determined and recorded in the field notebook. All relevant information on sampling date, time, station location and coordinates, local water depth, and weather observations will be recorded in the field notebook in accordance with sample documentation requirements identified in the main body of this FSP.

Sampling Procedure

The petite ponar grab sampler is the preferred equipment for collection of sediment samples in shallow water areas. The petite ponar will be operated by hand. Under no circumstances should the sampler be allowed to “free fall” to the bottom. Doing so may result in premature triggering of the sampler, or an excessive bow wake around the sampler, or improper orientation of the sampler. After the sample is collected, the sampling device will be lifted slowly off the bottom, then steadily raised to the surface.

The access doors on the top of the sampler, which consist of wire mesh screens and rubber flaps, allow visual characterization of the sediment surface and aid in assessing sample acceptability. Each surface grab sample will be evaluated for the following acceptance criteria, which are illustrated generally in Figure 1:

- Overlying water is present and has low turbidity.
- Adequate penetration depth is achieved.
- The sampler is not overfilled (no contact with doors).
- The sediment surface is undisturbed.
- There are no signs of winnowing or leaking from the sampling device.

Grab samples not meeting these criteria will be rejected near the location of sample collection and steps repeated until the criteria have been met or until three attempts at a location have failed. If adequate penetration is not achieved after multiple attempts or the sample is too coarsely grained, multiple grabs of lesser volume will be accepted and noted in the field notebook. If all attempts at use of the petite ponar fail, disposable hand tools may be used to gather the sediment sample. At such locations, the reasons for using hand tools will be thoroughly detailed in the field notebook.

Before sample processing commences, the material in the sampler will be photographed and the photograph labeled with station location, date, and time of sample. The overlying water will then be siphoned off near one corner of the sampler. Next, a decontaminated stainless steel trowel or spoon may be used to collect only the upper 10 to 15 cm (4.5 to 6 inches) of sediment from inside the sampler, without touching the sidewalls. The sampler will be decontaminated between stations and rinsed with site water between grabs in accordance with the equipment decontamination procedures described in SOP SEDFSP-8, Decontamination of Sampling Equipment.

Sample Processing Procedures

After an acceptable grab sample is retrieved, the following processing steps will be completed for all discrete grab samples (the procedures for processing of composite samples obtained below water are the same as those described for above-water samples in SOP SEDFSP-5):

1. Physical characterization will be performed in general accordance with the American Society for Testing and Materials (ASTM) D2488-00 visual-manual description procedure. The following information will be recorded on the Sediment Sample Data Sheet and signed by the FTL:

    – Date, type, and name of person logging the sample

    – Weather conditions

    – Sample location number and coordinates

    – Project designation

- Depth of water at the location and surface elevation
- Equipment used
- Whether an examination was made by the cultural resources observer and whether the observer established the presence of any historical or cultural resources requiring this target sampling station to be abandoned, in accordance with the process described in the main body of this FSP
- Sediment texture
- Sediment color
- Presence, type, and strength of odors
- Grab penetration depth (nearest centimeter)
- Degree of leakage or sediment surface disturbance
- Any obvious abnormalities such as wood/shell fragments or large organisms
- Estimation of sample recovery volume (e.g., percent full)

2. The sediment will be transferred to an aluminum-foil-lined stainless steel bowl for homogenization with disposable hand tools. Sediment that is in direct contact with the sides of the grab sampler should not be included with the sediment placed in the bowl to avoid potential contamination from the device. Team members conducting the sample processing will don a clean pair of disposable nitrile gloves and collect the upper 10 to 15 centimeters of sediment using disposable hand tools.
3. Any obvious abnormalities present (e.g., wood/shell fragments or large organisms) and coarser-grained sediment (e.g., pebbles and gravel) will be removed from the sample by gloved hand or by disposable hand tools.
4. In the event that one grab sample does not have an adequate volume for the sample aliquot, repeat the sampling procedure at the same station and combine and thoroughly homogenize the samples.
5. The homogenized sample will be distributed into the appropriate pre-labeled sample containers, filled to capacity, and stored in a cooler with a maximum temperature of 4 °C. Sample storage, packaging, and shipment requirements are identified in Section 6.5 of this FSP.
6. Any reusable sampling equipment will be decontaminated according to the procedures described in SOP SEDFSP-8.
7. Any excess sediment remaining after processing will be returned to the water, and the deck will be rinsed clean after all grab samples are collected and before moving to the next station.
8. The sampler will be secured and moved to the next sample location.

TABLE 1
Equipment List for van Veen Grab Sampling Operations
Upper Columbia River RI/FS

Description	Quantity
van Veen grab—0.11 m^2 area (20-L capacity), stainless steel	1 ea
Lead weights for van Veen grab—3.4 kg (7.5 lb)	2 ea
Lead weights for van Veen grab—5.0 kg (11 lb)	2 ea
Plastic floats for van Veen Grab	2 ea
Spare parts and tool kit for van Veen grab	1 ea
Field Sampling Plan	1 copy
Daily sampling schedule	2 copies
Health and Safety Plan	1 copy
Personal protection equipment as required by the Health and Safety Plan	as needed for day[a]
Field notebook	1 ea
Camera—35 mm with flash unit (or digital with flash unit)	1 ea
For 35 mm camera—Film, 400/36, color print	2 rolls
For digital camera— memory cards	2 ea
Camera kit (batteries, charger, instructions, lens cleaner, and wipes)	1 ea
Pens—ballpoint, black ink	4 ea
Duct tape	2 rolls
Measuring tape	1 ea
Stainless steel ruler	1 ea
Decontamination equipment as listed in SOP SEDFSP-8	as needed for day[a]
Disposable tubing to siphon off water in sampler	as needed for day[a]
Disposable stainless steel spoons, scoops, or spatula for sediment sample transfer	as needed for day[a]
Aluminum-foil-lined stainless steel bowls for sediment homogenization	as needed for day[a]
Sample bottles as specified in the sample matrix table	as needed for day[a]
Coolers with ice for sample storage	as needed for day[a]
Field data sheets, chain-of-custody forms, sample labels, custody seals, and related materials	as needed for day[a]
Nitrile gloves	as needed for day[a]
Paper towels or Kimwipes	as needed for day[a]

[a] To be determined for each day's sampling and stocked before vessel departs.

ea = each
kg = kilogram
L = liter
lb = pound
m^2 = square meter
mm = millimeter

TABLE 2
Equipment List for Petite Ponar Grab Sampling Operations
Upper Columbia River RI/FS

Description	Quantity
Petite ponar grab sampler (2.5-L capacity), stainless steel	1 ea
Spare parts and tool kit for petite ponar grab	1 ea
Field Sampling Plan	1 copy
Daily sampling schedule	2 copies
Health and Safety Plan	1 copy
Personal protection equipment as required by the Health and Safety Plan	as needed for day[a]
Field notebook	1 ea
Camera—35 mm with flash unit (or digital with flash unit)	1 ea
For 35 mm camera—Film, 400/36, color print	2 rolls
For digital camera— memory cards	2 ea
Camera kit (batteries, charger, instructions, lens cleaner, and wipes)	1 ea
Pens—ballpoint, black ink	4 ea
Duct tape	2 rolls
Measuring tape	1 ea
Stainless steel ruler	1 ea
Decontamination equipment as listed in SOP SEDFSP-8	as needed for day[a]
Disposable tubing to siphon off water in sampler	as needed for day[a]
Disposable stainless steel spoons, scoops, or spatula for sediment sample transfer (and for last resort sample collection)	as needed for day[a]
Aluminum-foil-lined stainless steel bowls for sediment homogenization	as needed for day[a]
Sample bottles as specified in the sample matrix table	as needed for day[a]
Coolers with ice for sample storage	as needed for day[a]
Field data sheets, chain-of-custody forms, sample labels, custody seals, and related materials	as needed for day[a]
Nitrile gloves	as needed for day[a]
Paper towels or Kimwipes	as needed for day[a]

[a] To be determined for each day's sampling and stocked before vessel departs.

ea = each
L = liter
mm = millimeter

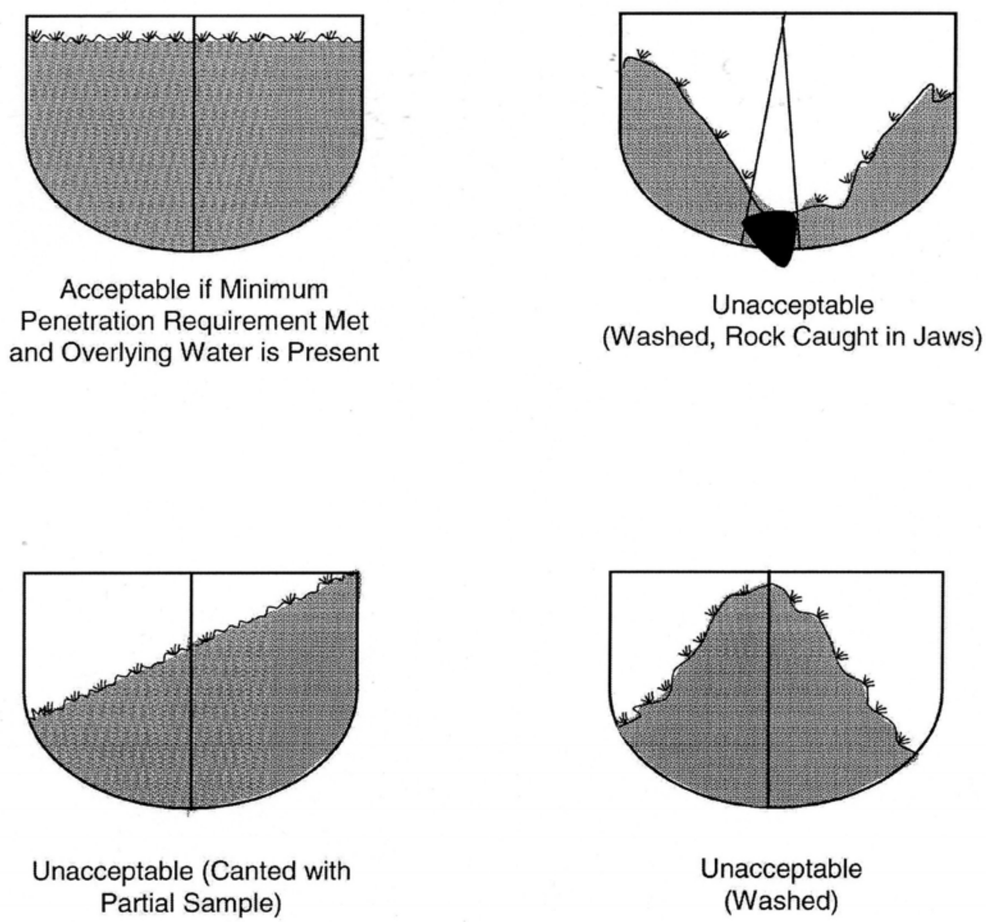


FIGURE 1
Examples of Acceptable
and Unacceptable Grab Samples
Upper Columbia River RI/FS

STANDARD OF PRACTICE SEDFSP-4

Sediment Core Collection and Sample Processing Procedures

Purpose

The purpose of this standard of practice (SOP) is to describe sediment core collection and sample processing procedures.

Scope and Applicability

This sediment core collection and sample processing SOP is applicable to below-water samples collected using a vibracore sampler operated from a vessel. The stations where these samples will be collected are listed in the detailed operations schedule. Vessel and sample positioning required prior to sediment core sampling is described in SOP SEDFSP-1, Positioning at Below-Water Stations. Sediment core collection procedures are described in the vibracore contractor's technical performance specification (Attachment 5 of this FSP).

Equipment and Materials

The equipment and materials required for sediment core sample processing are listed in Table 1.

Core Collection Procedures

Equipment and procedures for obtaining sediment cores are described in the vibracore contractor's technical performance specification (Attachment 5 of this FSP). Multiple cores may be required at a location to achieve sufficient volumes for analysis.

Onboard Core Processing

After an acceptable core is retrieved, the core will be retained in its Lexan sleeve-lined aluminum core and the following processing steps will occur while onboard the vessel:

1. The core penetration depth and the physical characteristics (e.g., color, texture, odor) of the sediment core sample as observed at the ends of the tube will be recorded. The following information will be recorded on the Core Collection Data Sheet to be included in the field notebook (see Attachment 6) and which will be signed by the FTL:
   - Date, type, and name of person logging the sample
   - Weather conditions
   - Sample location number and coordinates

   - Vibracore contractor and equipment used
   - Start/finish date and time of coring
   - Project designation
   - Depth of water at the location and surface elevation
   - Equipment used
   - Whether an examination was made by the cultural resources observer and whether the observer established the presence of any historical or cultural resources requiring this target sampling station to be abandoned in accordance with the process described in the main body of this FSP
   - Core penetration depth (nearest centimeter)
   - Estimated percent recovery

2. The core will be cut in 5-foot sections. The tube containing the core will be capped with plastic caps, sealed with duct tape, and labeled with the station location number and the core top-to-bottom orientation.

3. The core tubes will be stored on the vessel in an upright position, and will be transported to the onshore processing facility for logging, sample segregation, and processing within 24 hours of collection.

Onshore Core Processing and Sample Collection

The onshore field laboratory established at the marina base of operations will be equipped with a core-cutting table, core-processing tables, investigation-derived waste (IDW) storage area, a decontamination area, and a sample storage area with refrigeration. Appropriate lighting will be installed in the core processing area in order to collect consistently high-quality photographs of the opened cores. Once the field laboratory is established, care will be taken to create a core processing area that minimizes the potential for outside contamination. Team members conducting the sample processing will don a clean pair of disposable nitrile gloves. The following core processing steps will be taken inside the field laboratory:

1. The tube containing the core will be cut along the long axis using a circular saw set to a minimum depth to reduce the potential for cross-contamination. The tube will be rotated 180° and cut again.

2. After each core is cut, the entire core tube will be moved to a decontaminated stainless steel sampling tray and opened.

3. Each sediment core will be systematically logged and described. Core descriptions and terms used will follow the criteria presented in ASTM D2488-00, modified as noted below. The following information will be recorded on the Sediment Core Log included in the field notebook for each core and signed by the FTL:

   - Personnel responsible for logging the lithology

- Lithologic description
- Whether an examination was made by the cultural resources observer and whether the observer established the presence of any historical or cultural resources requiring this core to be abandoned in accordance with the process described in the main body of this FSP.
- Sediment texture
- Sediment color
- Presence, type, and strength of odors
- Visual stratification and lenses
- Vegetation
- Debris
- Evidence of biological activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Estimate of the amount of sample compaction (light, moderate, or heavy)
- Other distinguishing characteristics or features

Visual estimates of the grain size percentages of sediment interval lengths within each core will be recorded on the core logs so that the total sum will add up to 100 percent. The sediment may also be described narratively on the log based on the estimated grain size percentages. The dominant constituent grain size will be the primary unit descriptor; the abundance of other grain sizes present will be described using the Unified Soil Classification System (USCS). Note the presence and relative abundance of other features such as organics or debris. Density and consistency will be described using standard terminology.

The boundaries of the lithological units will be determined from differences in the grain size analysis.

4. The cores will be photographed in ample light conditions after being described.

After steps 1 to 4 have been completed, the core will be divided into the following intervals, beginning at the top of the core:

- 0 to 6 inches
- 6 to 12 inches
- Every 2 feet until reaching the core bottom

The subsampling procedures for each interval are as follows:

1. The sediment from each interval will be transferred from the core tray to an aluminum-foil-lined stainless steel bowl and homogenized by mixing with a disposable utensil. Care will be taken to obtain samples from the middle of the core and not use sediment in contact with the core tray.

2. Any obvious abnormalities (e.g., wood/shell fragments or large organisms) and coarser grained particles (e.g., gravel or pebbles) present will be removed from the sample with a disposable utensil or a gloved hand.

3. The homogenized sample will then be distributed into the appropriate pre-labeled sample containers, filled to capacity, and stored in a cooler with a maximum temperature of 4 °C. Sample storage, packaging, and shipment requirements are identified in the main body of this FSP.

4. The sample processing equipment will be decontaminated according to the procedures described in SOP SEDFSP-8, Decontamination of Sampling Equipment.

Any excess sediment remaining after processing will be contained and disposed of at an appropriate disposal facility.

TABLE 1
Equipment List for Core Sample Processing
Upper Columbia River RI/FS

Description	Quantity
Onboard Equipment	
Stainless steel core catcher	6 ea
Aluminum core barrels and Lexan or Tygon liners	6 ea
Plastic core barrel caps	12 ea
Vertical core storage rack	1
Field Sampling Plan	1 copy
Daily sampling schedule	2 copies
Health and Safety Plan	1 copy
Decontamination equipment as listed in SOP SEDFSP-8	as needed for day[a]
Personal protection equipment as required by Health and Safety Plan	as needed for day[a]
Field notebook	1 ea
Hacksaw with 2 extra blades	1 set
Tape measure, 15 ft	2 ea
Flashlight with 2 sets of extra batteries	2 ea
Wire angle indicator	1 ea
Camera—35 mm with flash unit (or digital with flash unit)	1 ea
For 35 mm camera—Film, 400/36, color print	2 rolls
For digital camera— memory cards	2 ea
Camera kit (batteries, charger, instructions, lens cleaner, and wipes)	1 ea
Pens—ballpoint, black ink	4 ea
Duct tape	2 rolls
Nitrile gloves	as needed for day[a]
NOTE: VIBRACORING EQUIPMENT TO BE PROVIDED BY SUBCONTRACTOR PERFORMING THE CORING.	
Onshore Equipment	
Health and Safety Plan and personal protection equipment as required by the health and safety plan	1 copy
Equipment to open, separate, and process the sediment cores, including tools to open and cut core tubes, tape measure, plastic sheeting, disposable stainless steel spatulas, or knives	as needed for each core[a]
Equipment to remove samples from core tubes, homogenize samples, and process samples, including disposable spoons or utensils, aluminum-foil-lined stainless steel bowls, and sample jars	as needed for discrete samples collected from each core[a]
Coolers with ice for sample storage	as needed for day[a]
Field data sheets, chain-of-custody forms, sample labels, custody seals, and related materials	as needed for day[a]
Paper towels or kimwipes	as needed for day[a]

[a] To be determined for each day's sampling and stocked before vessel departs.

ea = each
ft = foot
mm = millimeter

STANDARD OF PRACTICE SEDFSP-5

Above-Water Sampling Procedures

Purpose

The purpose of this standard of practice (SOP) is to describe sample collection and processing procedures using above-water grab sampling equipment.

Scope and Applicability

This sediment sampling SOP is applicable to above-water samples collected using stainless steel spoons, trowels, or other hand tools. Above-water sampling includes collection of discrete grab samples of periodically exposed sediment along transects and in focus areas and collection of discrete grab samples and composite samples in beach areas that may be used for recreation. Plan and section drawings of the various types of above-water samples, along with further sampling details, are provided in Figure 6-3 in the main body of this Field Sampling Plan (FSP). The stations where these samples will be collected are listed in the detailed operations schedule (Attachment 3). Sample positioning required prior to above-water sediment sampling is described in SOP SEDFSP-2, Positioning and Elevation Control at Above-Water Stations.

Equipment and Materials

The equipment and materials required for above-water sampling are listed in Table 1.

Sample Collection Procedures

Preparation for Sampling

All sampling equipment and supplies will be transported to the sampling station by water vessel or land vehicle. For approach by water, the vessel will maneuver as close to shore as possible, to water depths of 2 feet or less, near the sampling station at the direction of the field team leader (FTL); the field team will disembark with the necessary field equipment. Approach via land vehicle will use the best available path.

Discrete Grab Samples

The field sampling team will collect discrete grab sediment samples from above-water transect locations and beach areas according to the following steps:

1. The sample area will be located using the differential global positioning system (DGPS) (or GPS if the DGPS signal cannot be received). It is important that station horizontal **AND** vertical positioning match the locations specified in the detailed operations

schedule and be established under the procedures described in SOP SEDFSP-2, Positioning and Elevation Control at Above-Water Sampling Stations**.**

2. The general sample area/beach will be photographed and sketched in the field notebook, showing nearby features and permanent structures that can be used to locate the sample points on a map.
3. Any overlying snow or debris will be removed with disposable hand tools.
4. The requisite volume of sediment will be removed from surface sediment within a 5-meter (20-foot) radius of the proposed sample location. Disposable hand tools will be used to gather the sediment.
5. The sediment will be transferred into an aluminum-foil-lined stainless steel bowl. The sediment will then be homogenized using disposable hand tools.

Composite Samples

The field sampling team will create composite samples from beach areas according to the following steps:

1. The same procedures described for discrete grab sample collection will be used to locate and obtain the individual samples that will be integrated into a composite sample.
2. The sediment from each individual location contributing to the composite will be placed in a single aluminum-foil-lined stainless steel bowl. The sediment will then be thoroughly homogenized using disposable hand tools.

Sample Processing Procedures

Once the sediment has been transferred to an aluminum-foil-lined stainless steel bowl, the following steps will be taken to process the sample:

1. Physical characterization will be conducted in general accordance with the ASTM D2488-00 visual-manual description procedure. The following information will be recorded on the Sediment Sample Data Sheet which will be signed by the FTL:
   - Date, type, and name of person logging the sample
   - Weather conditions
   - Sample location number and coordinates
   - Project designation
   - Equipment used
   - Whether an examination was made by the cultural resources observer and whether the observer established the presence of any historical or cultural resources requiring this target sampling station to be abandoned in accordance with the process described in the main body of this FSP.
   - Sediment texture

- Sediment color
- Presence, type, and strength of odors
- Sampling depth (nearest centimeter)
- Any obvious abnormalities such as wood fragments or rocks

2. Team members conducting the sample processing will don a clean pair of disposable nitrile gloves.
3. Any obvious abnormalities present (e.g., wood fragments, pebbles, or rocks) will be removed from the sample using a disposable hand tool or gloved hands.
4. The homogenized sample will be distributed into the appropriate pre-labeled sample containers, filled to capacity, and stored in a cooler with a maximum temperature of 4° C. Sample storage, packaging, and shipment requirements are identified in Section 6.5 of the FSP.
5. Any reusable sample collection and processing equipment will be decontaminated, according to the procedures described in SOP SEDFSP-8, Decontamination of Sampling Equipment.
6. Any excess sediment remaining after processing will be returned to the location that it was taken from before moving to the next station.
7. The sampling team will be move to the next sample location.

TABLE 1
Equipment List for Above-Water Sampling
Upper Columbia River RI/FS

Description	Quantity
Handheld laser rangefinder and inclinometer, with 2 sets extra batteries	1 ea
Tape measure	1 ea
Wood stakes and sledge hammer	as needed for day[a]
Field Sampling Plan	1 copy
Daily sampling schedule	2 copies
Health and Safety Plan	1 copy
Personal protection equipment as required by the Health and Safety Plan	as needed for day[a]
Field notebook	1 ea
Camera—35 mm with flash unit (or digital with flash unit)	1 ea
For 35 mm camera—Film, 400/36, color print	2 rolls
For digital camera— memory cards	2 ea
Camera kit (batteries, charger, instructions, lens cleaner, and wipes)	1 ea
Pens—ballpoint, black ink	4 ea
Disposable stainless steel spoons, scoops, or spatula for sediment sample collection and transfer	as needed for day[a]
Aluminum-foil-lined stainless steel bowls for sediment homogenization	as needed for day[a]
Sample bottles as specified in the sample matrix table	as needed for day[a]
Coolers with ice for sample storage	as needed for day[a]
Field data sheets, chain-of-custody forms, sample labels, custody seals, and related materials	as needed for day[a]
Nitrile gloves	as needed for day[a]
Paper towels or Kimwipes	as needed for day[a]

[a] To be determined for each day's sampling and stocked before vessel departs.

Note: The sampling operation will also require the station positioning equipment listed in SOP SEDFSP-2, Positioning and Elevation Control at Above-Water Stations.

ea = each
mm = millimeter

STANDARD OF PRACTICE SEDFSP-5A

Composite Sampling Procedures at Standard Beaches

Purpose

The purpose of this procedure is to describe composite sample collection and processing procedures at the following 12 beaches in the Upper Columbia River (UCR):

- Black Sand Beach—RM 742, East Side
- Dalles Orchard—RM 730, East Side
- North Gorge Campground—RM 718, East Side
- Marcus Island Campground—RM 708, East Side
- Haag Cove—RM 697, West Side
- French Rocks Boat Launch—RM 690, West Side
- Cloverleaf Beach—RM 675, East Side
- AA Campground—RM 673, East Side
- Rogers Bar Campground—RM 658, West Side
- Lincoln Mill Boat Ramp—RM 633, East Side
- Keller Ferry No. 2—RM 615, East Side
- Spring Canyon Campground—RM 600, South Side

The sampling program and target analyte list for these beaches is described in Section 4.4.2 in the main body of this Field Sampling Plan (FSP).

Scope and Applicability

This sediment sampling procedure is applicable to elevation-specific composite sediment samples collected at the above-listed beaches. Most, if not all, of the elevation-specific subsamples that will be obtained to generate the elevation-specific composites will be collected above the water line using hand tools. However, below-water samples may also be required if the water level is higher at the time of sampling than initially expected. The below-water samples will be collected using a van Veen or petite ponar grab sampler. General sample collection and handling procedures for above- and below-water samples are described in SOP SEDFSP-3, Below-Water Grab Sampling Procedures, and SOP SEDFSP-5, Above-Water Grab Sampling Procedures.

Sample Location Configuration

The intent of the sampling program for each standard beach is to obtain elevation-specific composite samples within a designated portion of each beach area. Each elevation-specific composite will be created by mixing equal volumes of sediment obtained at three designated subsample locations along a specified elevation contour. These three subsamples will be combined to create a single composite sample representing that particular elevation within the beach sampling area. At each beach area, three elevation-specific composite samples will be collected.

Figure 1 shows the general layout of the nine elevation-specific subsamples that will be collected and used to prepare the three corresponding elevation-specific composite samples. The coordinates (i.e., northings and eastings) for all of the subsample locations have been assigned (see Attachment 3) and should be moved only if conditions at an assigned location are not conducive to sampling (e.g., presence of rocks) or if the coordinates fall in a location that deviates from the specified elevation by more than 3 feet, as determined by laser hipsometer or similar methods (see SOP SEDFSP-1, Positioning at Below-Water Stations, and SOP SEDFSP-2, Positioning and Elevation Control at Above-Water Stations). In such cases, the sample location should be moved to the nearest location that meets all of the following criteria:

1. Lies along the same approximate elevation contour specified for the composite (± 3 feet)
2. Is within 20 feet of the assigned location
3. Displays grain size characteristics that are generally consistent with the other subsamples and are consistent with the overall objectives of the beach sampling program

In all cases, the coordinates and measured elevation for all individual sample locations will be recorded in the field book for future reference, along with a description of the reasons for relocation. However, because the composite sample can only be assigned one location, the Station ID, coordinates, and measured elevation of the center sample for each elevation contour (C_1, C_2, C_3) will be assigned to the composite sample in the field and project database (see Figure 1).

Sample Compositing Plan

The general sample compositing plan for a standard beach is illustrated in Figure 1.

Sample Collection and Processing Procedures

Preparation for Sampling

All sampling equipment and supplies will be transported to the sampling station by water vessel or land vehicle. It is expected that most beach areas will be sampled by a land-based sampling crew. For approach by water, the vessel will maneuver as close to shore as possible, to water depths of 2 feet or less, near the sampling station at the direction of the field team leader (FTL); the field team will disembark with the necessary field equipment. Care should be taken not to disturb any underwater sampling locations during approach by boat.

Approach via land vehicle will use the best available access route, minimizing potential encroachment across areas of known or suspected cultural/historical resources. In most instances, the land-based crew will access the specific sampling area on foot, transporting the necessary field equipment from the field vehicle.

Sample Collection

The field sampling team will collect, combine, and homogenize elevation-specific subsamples from the assigned locations to generate elevation-specific composite samples. These samples will be prepared according to the following steps:

1. The sample area will be located using the differential global positioning system (DGPS) (or GPS if the DGPS signal cannot be received). It is important that station horizontal **AND** vertical positioning match the locations specified in the detailed operations schedule.
2. The general sample area/beach will be photographed and sketched in the field notebook, showing nearby features and permanent structures that can be used to locate the sample points on a map.
3. Any overlying snow or debris will be removed with disposable hand tools.
4. The required volume of surface sediment (upper 10 to 15 cm) will be collected within a 5-meter (20-foot) radius of the designated sample location. Disposable hand tools will be used to collect the sediment from the individual subsample locations.
5. Disposable glass containers will be used to collect equal volumes of sediment from each of the three subsample locations along a particular elevation contour. The three subsamples from a particular elevation contour will be transferred into an aluminum-foil-lined stainless steel bowl, and will be thoroughly homogenized using disposable hand tools to create one of the three elevation-specific composite samples.
6. Steps 1 to 5 will be repeated to prepare elevation-specific composite samples for the remaining two elevation horizons.

Sample Processing

The collected elevation-specific composite samples will be logged and processed as follows:

1. Physical characterization will be conducted in general accordance with the American Society for Testing and Materials (ASTM) D2488-00 visual-manual description procedure. The following information will be recorded on the Sediment Sample Data Sheet (see Attachment 6), which will be signed by the FTL:
   - Date, type, and name of person logging the sample
   - Weather conditions
   - Sample location number and coordinates
   - Project designation
   - Equipment used

- Whether an examination was made by the cultural resources observer and whether the observer established the presence of any historical or cultural resources requiring this target sampling station to be abandoned in accordance with the process described in the main body of this FSP
- Sediment texture
- Sediment color
- Presence, type, and strength of odors
- Sampling depth (nearest centimeter)
- Compositional abnormalities, such as excess wood fragments, rocks, or anthropogenic debris (e.g., glass or metal).
- Sample ID numbers; number and type of sample containers

2. Team members conducting the sample processing will don a clean pair of disposable nitrile gloves.
3. At the discretion of the FTL, selected materials of certain size and/or composition (e.g., wood fragments, twigs, rocks or large pebbles, glass fragments, or other anthropogenic debris), will be removed from the homogenized composite sample using a disposable hand tool or gloved hands.
4. The homogenized sample will be distributed into the appropriate pre-labeled sample containers, filled to capacity, and stored in a cooler with a maximum temperature of 4° C. Sample storage, packaging, and shipment requirements are identified in Section 6.5 of this FSP.
5. Any reusable sample collection and processing equipment will be decontaminated, according to the procedures described in SOP SEDFSP-8, Decontamination of Sampling Equipment.
6. Any excess sediment remaining after processing will be returned to the location that it was taken from before moving to the next station.
7. The process will be repeated until all standard beach composite samples are collected and processed.

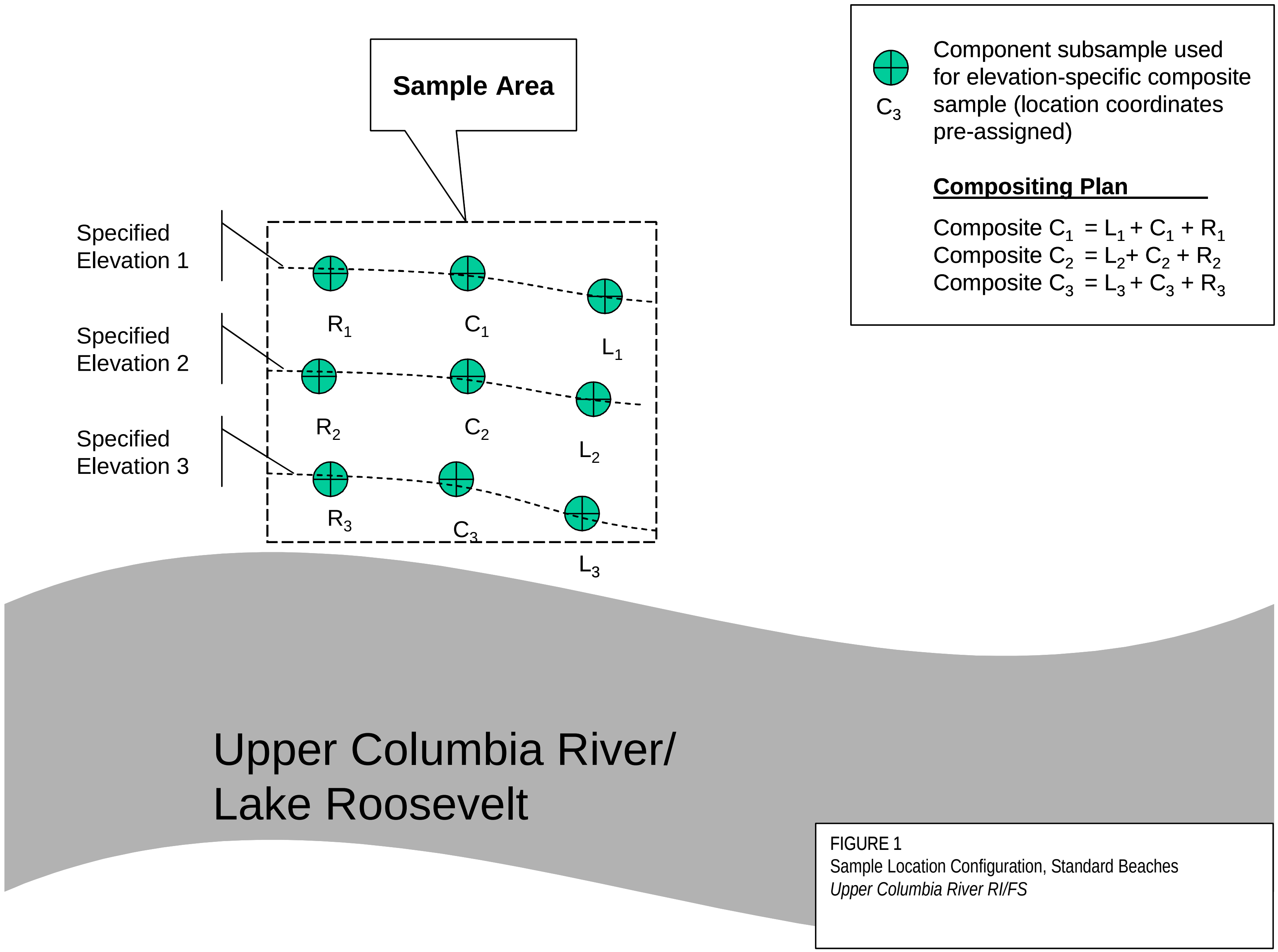


FIGURE 1
Sample Location Configuration, Standard Beaches
Upper Columbia River RI/FS

STANDARD OF PRACTICE SEDFSP-5B

Composite Sampling Procedures at Selected Beaches

Purpose

The purpose of this procedure is to describe discrete and composite sample collection and processing procedures at the following three beaches in the Upper Columbia River (UCR):

- Northport City Boat Launch—RM 735, East Side
- Kettle Falls Swim Beach—RM 700, East Side
- Columbia Campground—RM 642, East Side

The sampling program and target analyte list for these beaches is described in Section 4.4.2 in the main body of this Field Sampling Plan (FSP).

Scope and Applicability

This sediment sampling procedure is applicable to discrete and composite sediment samples collected at the above-listed beaches. Most, if not all, of the samples will be collected above the water line using hand tools. However, below-water samples may also be required if the water level is higher at the time of sampling than initially expected. The below-water samples will be collected using a van Veen or petite ponar grab sampler. General sample collection and handling procedures for above and below water samples are described in SOP SEDFSP-3, Below-Water Grab Sampling Procedures, and SOP SEDFSP-5, Above-Water Grab Sampling Procedures.

Sample Location Configuration

The intent of the sampling program for the three selected beaches is to obtain nine discrete samples, three elevation-specific composite samples, and one whole beach composite sample within a pre-selected portion of each beach. Discrete samples will be collected at nine individual stations within the designated beach sampling area. These discrete samples will be analyzed for pesticides/polychlorinated biphenyl aroclors, semivolatile organic compounds, metals, total organic carbon, and grain size. Elevation-specific composites will be created by mixing equal volumes of sediment from three discrete sample stations collected along a specified elevation contour. These elevation-specific composite samples will be analyzed for dioxins and furans. The whole beach composite sample will be made up of samples taken from the nine discrete station locations and will be separated into two distinct particle size-based fractions for chemical analysis. Particle size fractionation will be conducted in the laboratory and is described in SOP SEDFSP-10, Preparation of Particle-Size-Fractionated Samples For Chemical Analysis.

The general configuration of the nine sample locations at each select beach is shown in Figure 1. The coordinates (i.e., northings and eastings) for all of the nine discrete sample locations within each beach area have been assigned (see Attachment 3) and should only be moved if conditions at an assigned location are not conducive to sampling (e.g., presence of rocks) or if the coordinates fall in a location that deviates from the specified elevation by more than 3 feet, as determined by laser hipsometer or similar methods (see SOP SEDFSP-1, Positioning at Below-Water Stations, and SOP SEDFSP-2, Positioning and Elevation Control at Above-Water Stations). In such cases, the sample location should be moved to the nearest location that meets all of the following criteria:

1. Lies along the same approximate elevation contour specified for the composite ($\pm$ 3 feet)
2. Is within 20 feet of the assigned location
3. Displays grain size characteristics that are generally consistent with the other discrete samples and are consistent with the overall objectives of the beach sampling program

In all cases, the coordinates and measured elevation for all individual sample locations will be recorded in the field book for assignment to the discrete samples obtained at those locations. A description of the reasons for relocation will also be recorded. However, because a composite sample can only be assigned one location, the Station ID, coordinates, and measured elevation of the center sample for each elevation-specific contour (i.e., C_1, C_2, and C_3), and for the center of the whole-beach sample area (i.e., C_2) will be assigned to the composite samples in the field and project database (see Figure 1).

Sample Compositing Plan

The general sample compositing plan for a selected beach is illustrated in Figure 1.

Sample Collection and Processing Procedures

Preparation for Sampling

All sampling equipment and supplies will be transported to the sampling station by water vessel or land vehicle. It is expected that most beach areas will be sampled by a land-based sampling crew. For approach by water, the vessel will maneuver as close to shore as possible, to water depths of 2 feet or less, near the sampling station at the direction of the field team leader (FTL); the field team will disembark with the necessary field equipment. Care should be taken not to disturb any underwater sampling locations during approach by boat. Approach via land vehicle will use the best available access route, minimizing potential encroachment across areas of known or suspected cultural/historical resources. In most instances, the land-based crew will access the specific sampling area on foot, transporting the necessary field equipment from the field vehicle.

Collection of Discrete Samples

The field sampling team will collect discrete grab sediment samples from the select beach areas according to the following steps:

1. The sample area will be located using the differential global positioning system (DGPS) (or GPS if the DGPS signal cannot be received). It is important that station horizontal **AND** vertical positioning match the locations specified in the detailed operations schedule.
2. The general sample area/beach will be photographed and sketched in the field notebook, showing nearby features and permanent structures that can be used to locate the sample points on a map.
3. Any overlying snow or debris will be removed with disposable hand tools.
4. The required volume of surface sediment (upper 10 to 15 cm) will be collected within a 5-meter (20-foot) radius of the designated sample location. Disposable hand tools will be used to collect the sediment from each of the nine discrete sampling locations.
5. Each discrete sediment sample will be placed into an aluminum-foil-lined stainless steel bowl, and will then be homogenized using disposable hand tools.

Collection of Composite Samples

In addition to the discrete samples described above, equal volumes of sediment from each individual location (approximately 1 liter) contributing to a composite (i.e., three component subsamples obtained along a specified elevation for elevation-specific composite, or nine component subsamples obtained from the sample area for whole-beach composites) will be collected. A disposable glass container will be used to measure equal volumes of sediment from each discrete subsample location. The subsamples will be transferred into a single aluminum-foil-lined stainless steel bowl. The sediment will then be thoroughly homogenized using disposable hand tools to create the resulting elevation-specific or whole-beach composite.

Sample Processing

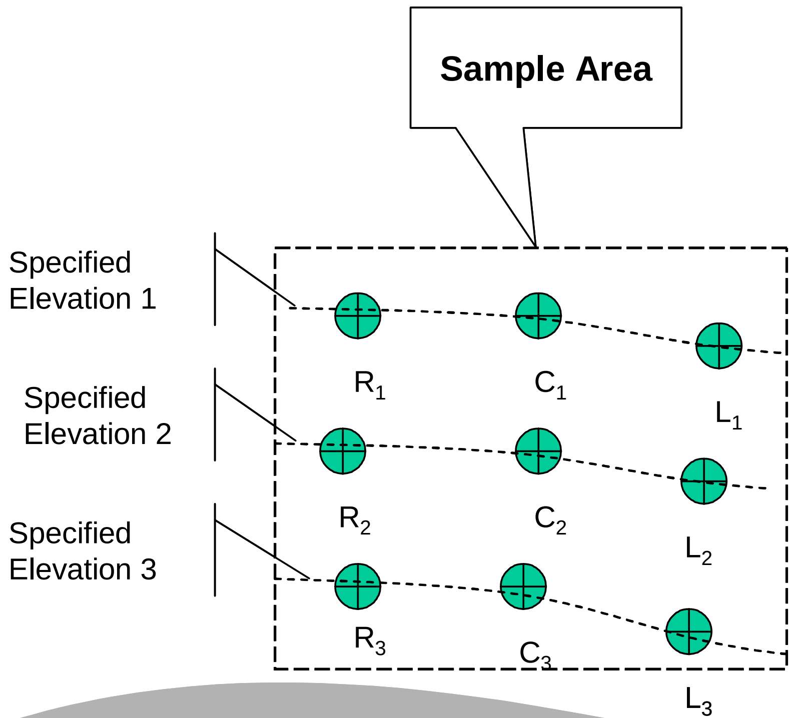
The same sample processing procedures apply to the individual discrete samples and the composite samples collected at a selected beach, as follows:

1. Physical characterization will be conducted in general accordance with the American Society for Testing and Materials (ASTM) D2488-00 visual-manual description procedure. The following information will be recorded on the Sediment Sample Data Sheet (see Attachment 6), which will be signed by the FTL:
   - Date, type, and name of person logging the sample
   - Weather conditions
   - Sample location number and coordinates
   - Project designation
   - Equipment used
   - Whether an examination was made by the cultural resources observer and whether the observer established the presence of any historical or cultural resources requiring

this target sampling station to be abandoned in accordance with the process described in the main body of this FSP

- Sediment texture
- Sediment color
- Presence, type, and strength of odors
- Sampling depth (nearest centimeter)
- Compositional abnormalities such as excess wood fragments, rocks, or anthropogenic debris (e.g., glass or metal).
- Sample ID numbers; number and type of sample containers

2. Team members conducting the sample processing will don a clean pair of disposable nitrile gloves.
3. At the discretion of the FTL, selected materials of certain size and/or composition (e.g., wood fragments, twigs, rocks or large pebbles, glass fragments, or other anthropogenic debris), will be removed from the homogenized sample using a disposable hand tool or gloved hands.
4. The homogenized sample will be distributed into the appropriate pre-labeled sample containers, filled to capacity, and stored in a cooler with a maximum temperature of 4° C. Sample storage, packaging, and shipment requirements are identified in Section 6.5 of this FSP.
5. Any reusable sample collection and processing equipment will be decontaminated, according to the procedures described in SOP SEDFSP-8, Decontamination of Sampling Equipment.
6. Any excess sediment remaining after processing will be returned to the location that it was taken from before moving to the next station.
7. The process will be repeated until all selected beach samples are collected and processed.



C_3 — Discrete sample component (location coordinates pre-assigned). Subsample of elevation-specific composite and whole-beach size-fractionated composite.

Elevation-Specific Compositing Plan for Dioxin/Furan Analysis

Elevation-Specific Composite $C_1 = L_1 + C_1 + R_1$
Elevation-Specific Composite $C_2 = L_2 + C_2 + R_2$
Elevation-Specific Composite $C_3 = L_3 + C_3 + R_3$

Compositing Plan for Whole-Beach Size-Fractionated Composite

Whole-Beach Composite $C_2 = L_1 + C_1 + R_1 + L_2 + C_2 + R_2 + L_3 + C_3 + R_3$

Upper Columbia River/ Lake Roosevelt

FIGURE 1
Sample Location Configuration, Selected Beaches
Upper Columbia River RI/FS

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STANDARD OF PRACTICE SEDFSP-6

Sampling Procedures in Areas of Strong Currents

Purpose

The purpose of this standard of practice (SOP) is to describe procedures for collecting reconnaissance-level samples in the free-run river reach of the upper Columbia River from about river mile (RM) 736 to the United States/Canada border.

Scope and Applicability

Certain areas of the river likely will have currents too strong (3 feet per second [ft/sec] (0.9 meter per second [m/sec] or greater) for collecting samples using grab or core samplers. In such areas, if current speeds are 10 ft/sec (3.0 m/sec) or less and it is deemed safe to operate the vessel in the river conditions at hand, sampling will be done using a Helley-Smith bedload transport sampler. This sampler is designed to operate in strong currents and will be used to collect a surface sample of the riverbed material. Sample stations will be established in the field by the senior project field leader based on river currents. The material collected will provide information on the nature of the riverbed. Samples collected under this procedure will not be retained or submitted for chemical analysis.

Equipment and Materials

The equipment and materials required for sampling with the Helley Smith bedload transport sampler are listed in Table 1.

Sample Collection Procedures

The Helley-Smith bedload transport sampler is shown in Figure 1. This is a 65-pound (29.5 kilogram) cable-suspended sampler approximately 3 feet long and 15 inches high, with a 3-inch x 3-inch (76 millimeter [mm] x 76 mm) opening. A tailfin arrangement and sliding collar allows adjustment of the balance point so that the sampler is stable and oriented to the river flow direction. The collar is set so that the sampler will touch the water tail-first to aid in rapid orientation with the streamlines of flow. This suspension attitude also ensures that the sampler orifice will lift up immediately when the unit is raised from the bed to eliminate loss of sample. The sampler proposed for use will have a mesh bag capable of retaining grains as small as 0.25 mm (fine sand).

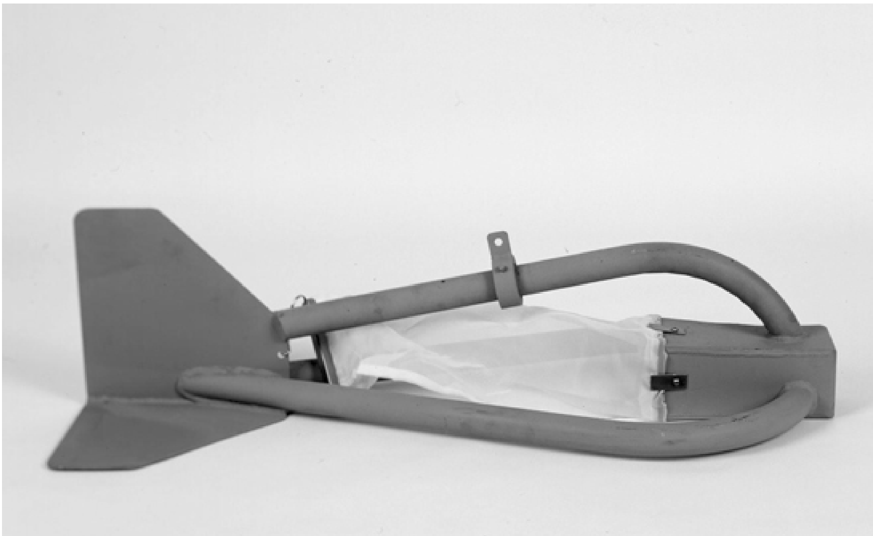

FIGURE 1
Helley-Smith Bedload Transport Sampler (model US BL-84)
Upper Columbia River RI/FS

Preparation for Sampling

After all sampling equipment and supplies have been transported to the work vessel, the Helley-Smith bedload sampler can be assembled on deck. The hydrowire will be attached to the sampler with a swivel and shackle having a working load capacity of at least 5 times the full weight of the sampler (160 kilograms, or 350 pounds). Because of the depth of water and the weight of the sampler, a hydraulic winching system will be used to control the rate of the sampler ascent and descent. When not in use, the sampler will always be secured when the vessel is underway.

At the direction of the CH2M HILL field team leader (FTL), the vessel will move to the sampling station and, depending on surface wind and wave conditions, will be held or anchored onstation using the differential global positioning system (DGPS) (or GPS if the DGPS cannot be received) and navigation system. At that time, relevant information on sampling date, time, station location and coordinates, local water depth, and weather observations will be recorded in the field notebook in accordance with sample documentation requirements identified below.

The vessel will be held in position heading into the current with engine power so that the vessel is holding steady at zero velocity relative to the riverbed. The deckhand will indicate to the winch operator when the sampler is ready for sampling. At that time, the CH2M HILL FTL will notify the vessel operator (VO) that sampling will commence and that the VO should prepare to collect a DGPS/GPS fix.

Sampling Procedure

The davit or A-frame will be used to lower the sampler over the stern of the vessel until the sampler contacts the riverbed. The time the sampler rests on the riverbed typically will be 30 to 60 seconds, but will be adjusted based on trial and error by how fast the current fills the collection bag with sediment. It may be necessary to gently drag the sampler forward to collect the sample. Sampling times will be adjusted so that the sampler is retrieved with about one-half the bag full (approximately 0.7 liter). Retrieval will be done by power winch.

Once aboard the vessel, the sampler will be gently lowered onto a sampling table or stand and the contents of the bag emptied into a stainless steel bowl. This waist-high stand may be constructed of wood and should be large enough to hold the sampler and allow for at least two team members to retrieve the sample. Ideally, the stand will be approximately 1 meter wide by 1.5 meters long (3 feet x 4 feet), one end of which will extend over the transom or gunwale of the work vessel. A 15-centimeter (cm) (6-inch)-deep plastic tray or pan can be placed directly under the sampler on the stand; this tray will serve to collect any water and/or sediment that leaks from the sampler.

Sample Processing Procedures

After an acceptable Helley-Smith sample is retrieved, the following processing steps will be completed on the vessel:

1. Physical characterization will be performed in general accordance with the American Society for Testing and Materials (ASTM) D2488-00 visual-manual description procedure. The following information will be recorded on the Sediment Sample Data Sheet and signed by the FTL:

   – Date, type, and name of person logging the sample

   – Weather conditions

   – Sample location number and coordinates

   – Project designation

   – Depth of water

   – Equipment used

   – Whether an examination was made by the cultural resources observer and whether the observer established the presence of any historical or cultural resources requiring this target sampling station to be abandoned in accordance with the process described in the main body of this FSP

   – Sediment texture

   – Sediment color

   – Presence, type, and strength of odors

   – Any obvious abnormalities such as wood/shell fragments or large organisms

  - Visual estimate of grain size percentage and presence of slag, including the estimated percent slag

2. Following inspection, photographing, and logging of the sample, the sample will be returned to the water before moving to the next station.
3. The sampler will be secured and moved to the next sample location.

TABLE 1
Equipment List for Helley-Smith Bedload Sampling Operations
Upper Columbia River RI/FS

Description	Quantity
Helley-Smith bedload sampler	1 ea
Replacement mesh bags for Helley-Smith sampler	10 ea
Spare parts and tool kit for Helley-Smith sampler	1 ea
Field Sampling Plan	1 copy
Daily sampling schedule	2 copies
Health and Safety Plan	1 copy
Decontamination equipment as listed in SOP SEDFSP-8	as needed for day[a]
Personal protection equipment as required by Health and Safety Plan	as needed for day[a]
Sampling forms	as needed for day[a]
Field notebook	1 ea
Camera—35 mm with flash unit (or digital with flash unit)	1 ea
For 35 mm camera—Film, 400/36, color print	2 rolls
For digital camera— memory cards	2 ea
Camera kit (batteries, recharger, instructions, lens cleaner, and wipes)	1 ea
Pens—ballpoint, dark blue ink	4 ea
Duct tape	2 rolls
Measuring tape	1 ea
Stainless steel ruler	1 ea
Paper towels or Kimwipes	as needed for day[a]

[a] To be determined for each day's sampling and stocked before vessel departs.

ea = each
mm = millimeter

STANDARD OF PRACTICE SEDFSP- 7

Methodology for Determining Lake and River Elevations

Purpose

The purpose of this standard of practice (SOP) is to describe the procedures used for determining the elevation of the surface of the water for Lake Roosevelt and the free-flowing river reach starting at approximately Northport, Washington, to the U.S./Canada border. The stillwater level (SWL) is the elevation that a water surface assumes in the absence of all wave action and will be the reference elevation used for determining elevations above and below the water surface.

Scope and Applicability

This SOP is applicable for determining elevations of all above-water stations and of the lakebed, based on the elevation of the water surface of the lake for stations adjacent to the lake, and based on elevation markers onshore in the free-run reach of the river.

Equipment and Materials

- Precision global positioning system (GPS)/differential GPS (DGPS) backpack receiver (i.e., Trimble, Inc., Pathfinder Pro XR or Pro XRS GPS)
- Laser range-finder with inclinometer (i.e., Laser Technology Impulse 200 LR Laser Rangefinder with MapStar Compass Module)
- Field notebook

Typical Procedures/Guidelines

Elevations for Above-Water Stations in Lake Roosevelt

The procedures in this section apply to the area of the lake downstream from the free-run portion of the river and generally will be applicable from about Northport, Washington, to Grand Coulee Dam, depending on the actual pool elevation and flows in the upper reach of the river.

Prior to the start of field sampling, a CH2M HILL survey team will determine elevations of selected points on existing fixed structures in the water, such as dock pilings, at Kettle Falls Marina and Two Rivers Marina. In the absence of fixed structures in the water, selected points on land visible from the moorage area will be established and their elevations determined. The survey team will use Real-Time Kinetic (RTK) GPS equipment to survey the elevations. This method uses a mobile GPS base unit that is set up on an existing survey monument with known horizontal and vertical coordinates. The base unit transmits a radio signal to a rover unit up to 3 miles away or more, depending on terrain and obstacles such as trees. The rover unit is used to determine the horizontal and vertical coordinates of the point of interest using the base-unit signal and GPS signals.

Elevations will be determined relative to the North American Vertical Datum 1988 (NAVD88), from which elevations in the Mean Sea Level Datum or National Geodetic Vertical Datum of 1929 (NGVD29) may be computed by application of an adjustment factor to those in NAVD88.

During field sampling, the CH2M HILL vessel personnel will measure the vertical distance from an elevation mark to the lake's surface and calculate the SWL. This vertical distance may be measured by a measuring tape or by the laser rangefinder discussed in SOP SPSED-2, Positioning and Elevation Control at Above-Water Stations.

The SWL will be determined in the morning prior to departure for that day's work and again upon return at the end of the day. Also, in the morning and evening, lake elevation readings from Grand Coulee Dam will be recorded. The morning values for lake elevation will be used throughout the day to determine the lake elevation at the above-water sampling sites (i.e., beach samples and transect samples). The elevation at a particular site will be calculated using linear interpolation of the elevation differences between the dam and the marina based on the river mile location of the site of interest.

The lake elevation readings at the marina at the end of the field day will be taken shortly after arrival at the marina. Adjustments to the lake elevation for the above-water sites sampled that day will not be made for changes in lake elevation over the course of the day. However, the readings will be recorded in the field notebook for post-processing if further refinement of elevations is required at a later date. In general, the elevation of the lake is not expected to vary more than 0.5 foot or so over any 24-hour period during the low-pool period when the sediment sampling is being done.

Elevations for Above-Water Stations in Upper River Reach

These procedures apply to the area of the river in which the water is free-flowing. In general, this is the reach from about Northport to the international border, or approximately River Mile (RM) 734 to RM 744. U.S. Geological Survey Gaging Station 12399500 records water elevation in real time at RM 745. The elevation of the water surface at this location may vary 4 feet or more within a few hours, depending on dam discharges from Canada and other inflows to the river. As a result, the water surface elevation can vary over a large range throughout the day, which requires a different approach for determining SWL from those used for the lake.

Prior to the start of field sampling, a CH2M HILL survey team will have determined elevations of markers at each beach station. For each beach station, they will establish a temporary elevation marker using a steel rod driven into the ground at the location of the highest elevation for that particular beach station. The elevation of the top of the monument will be determined and suitable signaling ribbon or cloth will be placed so that the monument can be seen from a boat in the river. A similar process will be followed for each of the above-water transect sample stations. The surveyors will also proceed downstream from Northport and determine the location where "lake elevation" procedures start.

The survey team will use Real-Time Kinetic (RTK) GPS equipment to survey elevations using the mobile base unit and rover unit discussed above. However, the surveyor with the rover unit will operate out of a jet boat to establish the elevation markers. The surveyor on land will move the base unit, as needed, to known survey monuments located along the highway to ensure that the rover unit remains within receiving distance.

Elevations will be determined relative to the NAVD88, from which elevations in the Mean Sea Level Datum or NGVD29 may be computed by application of an adjustment factor to those in NAVD88.

During sediment sampling, the elevation markers will be used to determine sampling elevation for the beach and above-water transect samples. As a result of using elevation markers, it will not be necessary to measure vertical distances above the SWL in order to determine elevations during sampling. Instead, vertical distance from the elevation markers will be measured using the laser rangefinder discussed in SOP FSPSED-2. The elevation of the SWL will also be measured using the elevation marker as a reference.

STANDARD OF PRACTICE SEDFSP-8

Decontamination of Sampling Equipment

Purpose

The purpose of this standard of practice (SOP) is to describe decontamination of sampling equipment prior to, during, and after sampling.

Scope and Applicability

This SOP for decontamination of sampling equipment is applicable to nondisposable sampling equipment that comes into contact with sediment, both in the field and at the land-based processing center. All nondisposable equipment will be decontaminated between uses. This means that decontamination will occur at the following times:

- Prior to commencement of the sampling event
- Between sample locations
- Between core sampling intervals
- Upon completion of the sampling event

It is not necessary to decontaminate sampling equipment between multiple grabs from the same location and core sample interval, or between grabs from different locations that will be composited together to form a single composite sample (e.g., elevation-specific beach composites).

The rigor of decontamination depends on the nature of the equipment, as follows:

- Rigorous decontamination will be performed on all equipment used to directly handle and process sediment samples for analysis. This equipment includes sample spoons, knives, bowls, trowels, and any other nondisposable equipment that comes into contact with sediment that will be submitted for analysis.

- Limited decontamination will be performed on equipment used to access and gather submerged sediment. This equipment includes the van Veen grab sampler and vibracore barrel. The possibility of cross-contamination using this equipment is limited because sediment gathered by the van Veen will be removed for sample processing without touching the sidewalls of the sampler, and the core samples obtained from the vibracore barrel will be retained in disposable tubes.

Equipment and Materials

- Emergency eyewash
- Distilled water rinse
- Potable water rinse
- Alconox (or other nonphosphate detergent) and potable water solution

- 10 percent nitric acid solution (HNO_3)
- Hexane
- Large plastic tubs and buckets for detergent solution and water rinse
- 4 spray bottles
- Nylon bristle brushes
- Plastic sheeting
- Sealable tubs or drums to contain rinsate fluids
- Aluminum foil
- Personal protective equipment (PPE), including nitrile gloves and goggles
- Paper towels or Kimwipes

Equipment Decontamination Procedures

Preparation for Decontamination

Safety goggles and nitrile gloves will be worn by all personnel who are assisting in the decontamination of equipment. Sealable containers, such as tubs, will be used to collect all rinsate fluids.

Decontamination Procedure for van Veen Sampler and Vibracore Barrel

The field sampling team will decontaminate large sampling equipment using the following steps:

1. Rinse excess sediment from equipment using site water.
2. Transfer equipment to decontamination station (plastic covered area with full containment of all fluids)
3. Wash all equipment surfaces that contacted the potentially contaminated sediment with detergent solution (Alconox or other laboratory-grade detergent), using a brush as needed to remove particulate matter and surface films.
4. Rinse with potable water.
5. Maintain decontaminated equipment in a position and location where it will not come into contact with contaminants.
6. Transfer decontamination fluids to a sealable container.

Decontamination Procedure for Nondisposable Sample-Handling and Processing Equipment

The field sampling team will decontaminate nondisposable sampling-handling and processing equipment using the following steps:

1. Rinse excess sediment from equipment using site water.
2. Transfer equipment to decontamination station tubs.

3. Wash all equipment surfaces that contacted the potentially contaminated sediment with detergent solution (Alconox or other laboratory-grade detergent), using a brush as needed to remove particulate matter and surface films.
4. Rinse with potable water.
5. Rinse with 10 percent nitric acid (HNO3).
6. Rinse with distilled water in spray bottle.
7. Spray with hexane in spray bottle.
8. Air dry.
9. Rinse with distilled water in spray bottle.
10. Air dry.
11. Wrap equipment with aluminum foil, if appropriate, to reduce the need for subsequent cleaning if equipment is to be stored or transported.
12. Transfer decontamination fluids to a sealable container.

Used PPE and decontamination fluids will be disposed with other investigation-derived waste as described in Section 6.4 of the Field Sampling Plan (FSP).

Key Checks/Items

The need for rigorous decontamination procedures is expected to be limited because all sample handling and processing equipment that comes into direct contact with the sediment submitted for analysis will be disposable. Under these circumstances, field blanks demonstrating the adequacy of decontamination are not required and are not included as part of the field sampling program. However, if, during implementation of the sampling, equipment is reused, field blanks will be added to the program as an addendum to this FSP.

STANDARD OF PRACTICE SEDFSP-9

Digital Camera Use and Documentation Procedures

Purpose

The purpose of this standard of practice (SOP) is to describe the use of digital cameras and procedures for digital camera data management.

Scope and Applicability

This SOP is applicable to taking digital photographs and placing the digital data in a database. Digital photographs may be taken to document field activities, site conditions and features, and sampling locations.

Equipment and Materials

- Digital camera
- Spare batteries
- 12-volt charger
- Digital camera carrying case and manual
- Digital Photograph Data Form
- Permanent marker
- Personal computer
- Dry-erase wipe board and markers

Typical Camera Features

- Save pictures (in standard mode) directly to a memory stick or comparable
- Auto focus; manual focus available if required
- Zoom
- Brightness control
- Playback of photos on camera screen
- Display of photograph number, date, and time
- Flash
- Timer
- Display showing time remaining on battery and remaining disk capacity
- Ability to protect and delete images that have been taken

Camera Use

Digital cameras will be checked out to a member of each field team to document field activities. Each field team will be directly responsible for the camera and ensure that it is not exposed to excessive heat/cold or moisture. The field team leader (FTL) will be responsible for digital photograph documentation or for assigning documentation duties to a team member.

Digital photographs will be taken to document field activities and locations. Examples of field activities for which photo documentation will be useful include: (1) sample collected in bowls, van Veen, or Helley-Smith along with station and sample identifiers drawn on dry erase board, (2) station vicinity with associated river mile and compass directions noted, and (3) field sampling techniques utilized, such as equipment use/operation.

Digital photographs will be collected at a high-pixel setting such that enlargements can be made with minimal degradation in picture quality.

Photograph Documentation

Field Team Responsibilities

Each field team will keep a daily hard copy log of all photographs. These data are to be recorded on the Digital Photograph Data Form provided in Attachment 6, Field Forms. The following digital photograph data will be collected:

- Camera number—listed on the top of each camera.
- Project and Event ID—this information is obtained from the FTL.
- Team members—list each team member.
- Photograph number—record the number of the photograph and the photograph file name (as coded below).
- Date and time—as provided by the camera display .
- Description—the target of the photograph.
- Station—identify a station ID (such as sample location ID), if applicable. If a photograph is being taken for a particular station that has a defined station ID, the station ID and date will be written on a wipe board. The wipe board with the station ID designation will be included in the frame of the photograph. For photographs of stations that contain multiple depth intervals for sampling, the appropriate depth interval will also be included on the wipe board.
- Northing and easting—list the coordinates of the subject of the photograph and the compass direction in which the picture is being taken. The coordinates of the location where the photograph was taken will be recorded (if applicable) in the Notes section of the Digital Photograph Data Form. Coordinates can be acquired from a global positioning system (GPS) or from the GIS system if the location has been surveyed.

Coordinates do not need to be recorded for a station if the location was surveyed prior to photograph collection.

- Notes—record any other pertinent information (including coordinates of location where picture was taken [see above])

Digital Photograph File Name

At the end of each field day, the member of the field team who checked out the camera will transfer the electronic data from the camera to the field operations computer located at the Sediment Processing Station. The folder structure will be as follows:

\\DATA\PHOTOS\VESSEL_xx\YYYYMMDD\

file 1

file 2

file 3

file N

\VESSEL_yy\ YYYYMMDD\

file 1

file 2

file 3

file N

The third structure level shown above (e.g., VESSEL xx, VESSEL yy) continues for all sampling teams. The notation YYYYMMDD represents the year, month, day. The individual files for the day (e.g., file1, file 2, file N) will be placed within this folder using the default file identifier provided by the camera.

For photos that do not lend themselves to use of a wipe board, a station identifier, and brief description should be added to the file name manually as the files are uploaded.

Transfer of Information and Archive

After the photograph disks have been uploaded, the original hard copy of the photograph log will be initialed and dated by the team member who downloaded the photographs, then archived by the sampling team leader.

Sample Processing Coordinator Responsibilities

The sample processing coordinator will be responsible for: (1) reviewing electronic photographs and the logs as they are made available to ensure consistency and completeness of annotations; (2) collecting and archiving the hard copies of the photograph logs; (3) reviewing electronic photographs and the logs as they are made available to ensure consistency and completeness of annotations; and (4) notifying the sampling team leader of apparent inconsistencies and making recommendations for corrective action.

Key Checks/Items

- Make sure the camera’s battery is fully charged on a daily basis
- Keep extra memory sticks available
- To save battery life, use flash only when necessary
- Make sure the camera quality level is set at “best”
- Review photograph records periodically to ensure that the electronic photographs and the data log agree
- Leave enough time at the end of the field day to transfer the data

STANDARD OF PRACTICE SEDFSP-10

Preparation of Particle-Size-Fractionated Samples For Chemical Analysis

Purpose

The purpose of this standard of practice (SOP) is to describe procedures for creating particle-size-fractionated samples from large-volume composite samples obtained from each of the following three Upper Columbia River (UCR) beaches:

- Northport City Boat Launch—RM 735, East Side
- Kettle Falls Swim Beach—RM 700, East Side
- Columbia Campground—RM 642, East Side

Scope and Applicability

This procedure describes the methods and equipment to be used to separate each large-volume composite sample into the two designated particle size fractions using air drying followed by sieving. Aliquots of the as-received, wet, composite sediment sample will be taken for grain size (American Society of Testing and Materials [ASTM] D422) and chemical analysis (pesticides/polychlorinated biphenyl [PCB] aroclors, semivolatile organic compounds [SVOCs], metals, dioxins/furans, and total organic carbon [TOC]) before air drying and fractionation. Two air-dried particle size fractions will be isolated for chemical analysis (pesticides/PCB/aroclors, SVOCs, metals, dioxins/furans, TOC): the fraction between 2 millimeters (mm) and 75 microns, and the fraction that is less than 75 microns.

The procedures for collecting the sediment samples that make up the large-volume composite sample of beach sediment are described in SOP SEDFSP-3, Below-Water Grab Sampling Procedures (for any below-water beach samples), and SOP SEDFSP-5, Above-Water Grab Sampling Procedures. The sampling design for the large-volume composite samples is described in Section 4.4.1 in the main body of this Field Sampling Plan (FSP). SOP SEDFSP-5B, Composite Sampling Procedures at Selected Beaches, provides detailed sample collection steps for discrete and elevation-specific composite sampling at the above-listed UCR beaches.

Equipment and Materials

The equipment and materials required for dry sieving and sample processing are listed in Table 1. Because of the potential for cross-contamination, new stainless steel sieves and pans are required for each sample. Sieves and pans will be dedicated to a particular sample.

Preparation

To minimize effects due to chemical changes, dry sieving will take place as soon as possible after the sediments are received and dried by the laboratory. Sediment samples should be maintained at 4 degrees Celsius (°C) after collection and during storage before and after air drying/sieving. Air drying will be carried out in a location where cross-contamination with airborne particles (from samples or the laboratory environment) will be minimized.

Dry Sieving

The dry sieving procedure will begin with preparatory processing at the laboratory, followed by air drying and sieving.

Preparatory Processing

The large-volume composite sediment samples will be transferred to the laboratory in a 5-gallon pail, and the following processing steps will be taken:

1. Open the sample container and, using clean (rinsed with 1+4 HNO_3, methanol, American Society for Testing and Materials (ASTM) type 1 reagent-grade water) stainless steel or Teflon utensils, mix any separated water back into the sediment. Even if clearly separated water is not present, the sediment must be mixed well (no clumps, water evenly distributed, homogeneous color) before proceeding with the next step. Personnel will wear disposable nitrile gloves (non-powdered) at all times when handling the sample and sieving equipment.

2. Using clean (rinsed with 1+4 HNO_3, methanol, ASTM type 1 reagent-grade water) stainless steel or Teflon utensils, transfer the appropriate amounts of sediment to jars for the required chemical analyses of the wet sediment. (If pesticides/PCB aroclors, SVOCs, metals, dioxins/furans, and TOC are analyzed, this will require about 36 ounces of sediment). These sample aliquots will each be preserved before analysis by storing at 4 °C. Remix sediment as needed if settling occurs before individual aliquots are removed.

3. Using the same utensils, remove 8 ounces of the composite wet sediment for grain size analysis (ASTM D422). The sample integrity will be maintained before analysis by ensuring that no moisture changes occur. Remix sediment as needed if settling occurs before the grain size aliquot is removed.

Air Drying

Air drying will be conducted until there is sufficient volume (approximately 36 ounces) for full chemical analysis of each particle size fraction. Each composite sample will be dried to constant moisture content at ambient laboratory conditions (approximately 40 percent humidity and 20 °C) as follows:

1. Fill out the moisture analysis bench sheet with all the necessary information (e.g., project, sample ID, date, time, performed by), and label each drying pan with the

appropriate sample identity. Record room temperature and relative humidity with each weight measurement and again on each day of drying.

2. Record the tare weight of each empty drying pan.
3. Add 1 to 2 kilograms (kg) of well-mixed (remix if needed) wet sediment to each drying pan. It is estimated that about one pan will supply enough dry material for two 8-ounce jars. Therefore, four to five pans of sediment will need to be dried to provide enough material for each of the indicated analyses. **Regardless of the amount of dried sediment actually obtained from one pan, the laboratory will need to dry and sieve enough material so that the required chemical analyses can be carried out on both of the fractions.**
4. Use the mixing utensil to spread the contents evenly across the surface area of the pan.
5. Immediately measure the wet weight of each soil and pan combination. Calculate the initial (as received) weight wet of the sediment.
6. Place the drying pan in a clean area, open to ambient room conditions. The nominal room condition is a temperature of 20 °C (±2 °C) and 40 percent (±5 percent) relative humidity.
7. As the sediment begins to dry, use a clean mixing utensil (clean between uses by rinsing with 1+4 HNO_3 acid, performing several deionized water rinses, followed by air drying), or dedicate a mixing utensil to each sample, to gently till the sediment to promote air drying. Use great care as not to spill or otherwise lose sediment in this tilling process. If any large aggregates of sediment are present, break them up to promote drying, but do not grind or reduce the particle size of the sediment.
8. Reweigh the sample at intervals of approximately 24 hours or less. Record and track the moisture content change with each weighing.
9. Continue the tilling and reweighing process until the sediment has reached its air dry condition, indicated by no further change in the sediment's air-dried weight.

Sieving (Fractionation)

After the sediment has reached its air dry condition, each sample will be sieved to obtain enough material in the two size fractions (2 mm to 75 microns, and less than 75 microns) for each analysis. Sieving will be conducted as follows:

1. Fill out the sieving bench sheet with all the necessary information (e.g. project, sample ID, date, time, performed by) and label the sample bottle with the appropriate sample identity.
2. Assemble a sieving tower with the coarsest sieve (2 mm) on top and the finest sieve (75 microns) at the bottom, underlain by the fine material pan.
3. The final weight of the dried sediment and drying pan will be used to calculate the total amount of sediment sieved. Record the weight ($W_{initial}$) if it is not already recorded from Step 9 of the air-drying procedure. After enough sediment has been sieved to meet the

requirements for chemical analysis in each fraction, reweigh the dried sediment (if any remains) and pan to obtain the tare weight (W_{final}).

Calculate the total weight sieved as follows:

$$W\ (sieved) = W_{initial} - W_{final}$$

4. Record the tare weights of three clean stainless steel bowls (after sieving, the fractions will be transferred to these bowls).
5. Transfer about 0.5 kg (or other portions depending on the sieve capacity) of the air-dried sediment from the drying pan into the 2-mm sieve. Place the cover on the sieve. The suggested starting condition for sieving is to place the sieve set on a Ro-tap or other similar sieve shaker for 15 minutes. Note: Intermediate sieve sizes (e.g., 65 mesh) or other sieving times may be required for efficient sieving depending on the nature of the dried sediment. These are acceptable as long as the goal of obtaining acceptable 2-mm to 75-micron and <75-micron fractions is met. If other sieve sizes are used, also transfer those fractions to tared bowls for determination of the fraction mass.
6. Continue with sieving until all fine material has passed through the respective sieve.
7. Remove the 2-mm sieve and transfer the retained dried sediment (i.e., dried sediment greater than 2-mm) to a tared stainless steel bowl. Record the weight of the >2-mm fraction and bowl after sieving is complete (i.e., enough material obtained for analysis). Calculate the weight of >2-mm material isolated. Store the sieve for processing the next portion of the sample.
8. Remove the 75-micron sieve and transfer the retained sediment (i.e., sediment between 2 mm and 75 microns) to a tared, clean stainless steel bowl. Record the weight of the 2-mm to 75-micron fraction and bowl after sieving is complete (i.e., enough material obtained for analysis). Calculate the weight of the 2-mm to 75-micron material that has been isolated. Store the sieve for processing the next portion of the sample.
9. Remove the pan at the bottom of the sieving tower and transfer the retained sediment (i.e., sediment smaller than 75 microns) to a different tared, clean stainless steel bowl. Record the weight of the <75-micron fraction and bowl after sieving is complete (i.e., enough material obtained for analysis). Calculate the weight of <75-micron material isolated. Store the pan for processing the next portion of the sample.
10. Restack the sieving tower and repeat Steps 2 through 9 until there is sufficient volume of each grain size fraction for chemical analysis.
11. Using the total weight of sediment sieved and the weight of each fraction isolated, calculate the percent of the total for each size range.

Sample Processing

Each particle size fraction will be homogenized in the bowl by mixing with clean stainless steel or Teflon lab utensils. The homogenized sediment will then be transferred into the appropriate pre-labeled sample containers, filled to capacity, and stored in a cooler with a maximum temperature of 4 °C. There will be a separate sample identification number for the 2-mm to 75-micron fraction and a separate sample identification number for the <75-micron sample. Sample storage, packaging, and shipment requirements are identified in Section 6.5 of the FSP.

All sample handling procedures, including the designated sample identification number for each particle size fraction, will be documented in the laboratory notebook.

TABLE 1
Equipment List for Size Fractionation
Upper Columbia River RI/FS

Description	Quantity
New stainless steel sieves (standard 8-inch or 12-inch) in 2-mm and 75-micron sizes, and other sizes as needed, initially cleaned by the following sequence of rinses: 1+4 HNO_3, deionized (DI) water, methanol, and final multiple DI water rinses.	1 set per sample
Sieve shaker, either Ro-Tap or Gilson model SS-12R (or equal), may be used.	1
Stainless steel pan and cover, initially cleaned by the following sequence of rinses: 1+4 HNO_3, DI water, methanol, and final multiple DI water rinses.	1 per sample
New sample drying pans. Large cooking sheet 16” X 24” with 1” side walls, aluminum or stainless steel, capable of holding 1 to 2 kg of soil. Cleaned using the following sequence of rinses: 1+4 HNO_3, DI water, methanol, and final multiple DI water rinses. Allowed to air dry prior to use.	4 sets per sample
Mixing utensils. Stainless steel or Teflon implements suitable for hand mixing the samples on the drying pans. Clean and free of rust, oxides, or other contamination. Initially cleaned by the following sequence of rinses: 1+4 HNO_3, DI water, methanol, and final multiple DI water rinses.	As needed
Laboratory scales. Certified accuracy, suitable for measuring the tare weight of the sample drying pan, as well as the gross weight of the soil and pan for moisture determination. 2.5-kg capacity and 500-gram capacity or similar.	1 of each capacity
Cleaning solutions. 1+4 HNO_3, methanol, DI water (type 1 reagent-grade water or equal), for use in cleaning drying pans, utensils, or other instruments between uses.	As needed
Laboratory personal protective equipment (PPE). Lab coats, nitrile gloves, particle masks, and safety glasses. Clean and to be worn at all times when handling samples.	As needed
Hydrometer to measure and record room temperature and humidity.	1
Disposable scoops or spatulas for sample transfer to sieves and sample jars.	As needed
Moisture analysis bench sheets (electronic or hardcopy), formatted to record and track each sample's moisture content to its air dry basis.	As needed
Laboratory notebook.	1
Camera—35 mm with flash unit (or digital with flash unit).	1
Sample bottles and labels.	As specified in the sample matrix table
Pens—ballpoint, black ink.	As needed
DI water.	As needed
Coolers with ice for sample storage.	As needed
Chain-of-custody forms, sample labels, custody seals, and related materials.	As needed
Paper towels or Kimwipes.	As needed

STANDARD OF PRACTICE SEDFSP-11

Sediment Pore Water Isolation and Handling Procedures

Purpose

The purpose of this standard of practice (SOP) is to describe procedures for isolating pore water (interstitial water) from sediments using a centrifuge and preparing pore water samples for dissolved metals analysis. The procedures for collecting the sediment samples from which the pore water will be isolated are described in SOP SEDFSP-3, Below-Water Grab Sampling Procedures.

Scope and Applicability

This procedure includes isolation methods for low-speed centrifugation (high-speed centrifugation is not required because the samples are to be filtered prior to preservation). Sediment pore water isolation yields samples that will be used to better understand partitioning of metals between solid and aqueous phases and any associated effects on biotoxicity. This procedure is specifically designed to mimic the porewater that the bioassay species are exposed to rather than an attempt to draw conclusions about in situ pore water. This method employs centrifugation to remove pore water from the interstitial spaces of the sediment by gravitational force. The extract will then be filtered through a 0.45-micron filter, placed in a sample bottle, and acidified to a pH less than 2 using HNO_3.

Equipment and Materials

The equipment and materials required for pore water isolation, filtration, and preservation are listed in Table 1.

Preparation

Pore water isolation and sample processing should take place as soon as possible after sediment sample collection to minimize effects due to chemical changes. Sediment samples should be maintained at 4 degrees Celsius (°C) after collection. Samples will be centrifuged at 10 °C to retain a temperature approximating ambient reservoir conditions.

Isolation

Each sediment sample for pore water isolation will consist of eight 8-ounce glass jars. It is anticipated that, for certain samples, the entire sample aliquot will need to be centrifuged to obtain sufficient pore water volume (minimum 200 milliliters [mL]) for inductively coupled plasma (ICP) metals and mercury analysis. Even then, the amount of water may be limited, and not all targeted analytical volumes may be attained for some samples (e.g., mercury analysis). If a sample volume less than the target volume is isolated, it is necessary to ensure that there is enough volume to attain a detection level suitable for project decisions (see Table 2-1 in the main body of the Quality Assurance Project Plan [QAPP]). The following steps should be taken for each sediment sample:

1. Open the sample containers and mix any separated water back into the sediment.
2. Before any settling occurs, transfer a portion of the sediment in each sample jar into centrifuge bottles and balance according to weight. Bottles should be balanced to within about 5 grams of each other.
3. Centrifuge samples in a swing-bucket rotor for 30 minutes at 3,000g at 10 °C. (Note: Stokes Law predicts that a particle of density 1.25 will fall > 14 centimeters [cm] under this applied force for 30 minutes in a rotor with a radius of 23 cm).
4. Carefully decant the supernatant (pore water) from each centrifuge bottle into a trace metals clean plastic bottle. If the supernatant appears excessively cloudy, it may be necessary to isolate the water and centrifuge again for 30 minutes at 3,000g.
5. Repeat the previous steps as necessary to obtain sufficient volume for analysis. If less than 200 mL of pore water is obtained from the centrifuged sediment samples, the laboratory will be instructed, if necessary, to prioritize the analyses in the order of metals (including uranium), then mercury.
6. Document centrifuging procedure and volume yield on a Centrifuge Volume Log, below.

Filtration and Placement in Sample Bottles

The supernatant for each sample will be removed from the container using a trace metals cleaned plastic syringe. A 0.45-micron membrane filter will then be attached to the end of the syringe to allow filtering before the supernatant is transferred into prepared (i.e., HNO_3 acidified) sample bottles. If sufficient volume exists, the first 5 to 10 mL of filtrate should be discarded.

Preservation

Following acidification, samples will be stored in a cooler or refrigerator with a maximum temperature of 4 °C. Sample storage, packaging, and shipment requirements are identified in Section 6.5 of the Field Sampling Plan (FSP).

All sample handling procedures will be documented in the laboratory notebook.

TABLE 1
Equipment List for Pore Water Isolation
Upper Columbia River RI/FS

Description	Quantity
Centrifuge, refrigerated, 250-mL or greater capacity, capable of at least 3,000g	1
Rotor head	1
Decontaminated polycarbonate centrifuge bottles, 0.25 L or 0.5 L	As needed
Decontaminated or disposable scoops or spatulas for sample transfer to centrifuge bottles	As needed
Laboratory notebook	1
Camera—35 mm with flash unit (or digital with flash unit)	1
0.45-micron cellulose nitrate syringe filters and syringes	As needed
HNO_3 (for preservation)	As needed
Sample bottles and labels	As specified in the sample matrix table
Pens—ballpoint, black ink	As needed
Deionized water	As needed
Coolers with ice for sample storage	As needed
Field data sheets, chain-of-custody forms, sample labels, custody seals, and related materials	As needed
Nitrile gloves	As needed
Paper towels or kimwipes	As needed

Centrifuge Volume Log

Project:	**Date**	**Initials**
Centrifuge/Speed	Sediment per Bottle (g)	No. of Bottles
Lab Sample ID	Centrifuge Start/End Time	Volume Generated (mL) per Centrifuge Bottle

ATTACHMENT 3

Detailed Operations Schedule

ATTACHMENT 3
Detailed Operations Schedule
Upper Columbia River RI/FS

															Enter 1st Value	Enter 0 or 1	Enter 1st Value
Vessel/Team	**Station ID**	**River Mile**	**Station Location**	**Station Type**	**Focus Area**	**Station Elevation (ft MSL)**	**Northing**	**Easting**	**Sample Type**	**Start Point (RM)**	**To & From Dist (mi)**	**Ttime (Travel Time) (hr)**	**Tsam (Sample Time) (hr)**	**Tsum (Ttime + Tsam) (hr)**	**Csum (Cumul. Time) (hr)**	**ASSIGN DAY**	**cDay (Cumul. Days)**
A	2	744	744X2	Transect	1	1309	745526.7	2408926.3	X2b	700	44	1.9	1.6	3.5	3.5	0	0
A	5	743	743X2	Transect	1	1269	741149.5	2406993.3	X2b	700	1	0.0	1.6	1.6	5.2	0	0
A	8	742	742X2	Transect	1	1261	735831.3	2406547.3	X2b	700	1	0.0	1.6	1.6	**6.8**	1	**1**
A	9	742	742X3	Transect	1	1276	735891.0	2406387.5	X3b	700	42	1.8	1.6	3.4	3.4	0	1
A	10	742	742X4	Transect	1	1284	735954.3	2406218.3	X4b	700	0	0.0	1.6	1.6	5.0	0	1
A	22	741	741X1	Transect	1	1263	732980.8	2401995.9	X1a	700	42	1.8	1.8	3.6	**8.7**	1	**2**
A	23	741	741X2	Transect	1	1261	733231.0	2401837.5	X2b	700	41	1.8	1.6	3.4	3.4	0	2
A	26	740	740X2	Transect	1	1271	730268.7	2397548.3	X2b	700	1	0.0	1.6	1.6	5.0	0	2
A	27	740	740X3	Transect	1	1281	730394.3	2397417.3	X3a	700	40	1.7	1.8	3.5	**8.6**	1	**3**
A	28	739	739X1	Transect		1276	727206.0	2393408.9	X1a	700	39	1.7	1.8	3.5	3.5	0	3
A	29	739	739X2	Transect		1250	727502.8	2393311.4	X2b	700	0	0.0	1.6	1.6	5.1	0	3
A	31	738	738X1	Transect		1275	724394.2	2390000.7	X1a	700	39	1.7	1.8	3.5	**8.6**	1	**4**
A	32	738	738X2	Transect		1267	724398.8	2389832.5	X2b	700	38	1.7	1.6	3.3	3.3	0	4
A	34	737	737X1	Transect		1283	721880.3	2385138.2	X1a	700	1	0.0	1.8	1.8	5.1	0	4
A	35	737	737X2	Transect		1258	722369.5	2385369.7	X2b	700	37	1.6	1.6	3.2	**8.3**	1	**5**
A	38	736	736X2	Transect		1258	720969.9	2380171.9	X2b	700	36	1.6	1.6	3.2	3.2	0	5
A	39	736	736X3	Transect		1283	721337.2	2380005.3	X3a	700	0	0.0	1.8	1.8	5.0	0	5
A	40	736	736T1	Tributary		1290	721580.5	2377789.6	T1b	700	0	0.0	1.6	1.6	6.6	0	5
A	41	736	736T2	Tributary		1262	720437.3	2378377.6	T2b	700	36	1.6	1.6	3.2	**9.7**	1	**6**
A	42	735	735X1	Transect		1264	718510.8	2378418.0	X1a	700	35	1.5	1.8	3.3	3.3	0	6
A	43	735	735X2	Transect		1220	718704.8	2378191.3	X2b	700	0	0.0	1.6	1.6	4.9	0	6
A	44	735	735X3	Transect		1286	718894.6	2377969.7	X3a	700	35	1.5	1.8	3.3	**8.2**	1	**7**
A	55	734	734X2	Transect		1258	715818.9	2374625.9	X2a	700	34	1.5	1.8	3.3	3.3	0	7
A	56	734	734X3	Transect		1276	716240.6	2374369.0	X3a	700	0	0.0	1.8	1.8	5.1	0	7
A	59	733	733X2	Transect		1248	713302.1	2370383.4	X2b	700	34	1.5	1.6	3.1	**8.2**	1	**8**
A	60	733	733X3	Transect		1287	713659.0	2370043.2	X3a	700	33	1.4	1.8	3.2	3.2	0	8
A	61	732	732X1	Transect		1280	708868.8	2369119.0	X1a	700	1	0.0	1.8	1.8	5.1	0	8
A	62	732	732X2	Transect		1255	709397.8	2368048.2	X2a	700	32	1.4	1.8	3.2	**8.3**	1	**9**
A	63	732	732X3	Transect		1276	710019.2	2366790.2	X3a	700	32	1.4	1.8	3.2	3.2	0	9
A	65	731	731X1	Transect		1278	705079.6	2365136.2	X1a	700	1	0.0	1.8	1.8	5.0	0	9
A	66	731	731X2	Transect		1246	705266.3	2364849.1	X2b	700	0	0.0	1.6	1.6	6.6	0	9
A	67	731	731X3	Transect		1278	705915.2	2363851.5	X3a	700	31	1.3	1.8	3.1	**9.8**	1	**10**
A	68	730	730X1	Transect		1256	701335.7	2362096.9	X1a	700	30	1.3	1.8	3.1	3.1	0	10
A	69	730	730X2	Transect		1243	701610.9	2361603.8	X2b	700	0	0.0	1.6	1.6	4.7	0	10
A	71	730	730T1	Tributary		1277	697874.9	2359149.6	T1b	700	30	1.3	1.6	2.9	**7.6**	1	**11**
A	72	729	729T2	Tributary		1249	698016.9	2358004.9	T2b	700	29	1.3	1.6	2.9	2.9	0	11
A	74	729	729X2	Transect		1209	698216.9	2358254.9	X2b	700	0	0.0	1.6	1.6	4.5	0	11
A	75	729	729X3	Transect		1281	698634.5	2358042.9	X3a	700	29	1.3	1.8	3.1	**7.5**	1	**12**
B	85	728	728X1	Transect		1255	696560	2353246	X1a	700	28	1	2	3	3	0	0
B	86	728	728X2	Transect		1203	696799.6	2353175.4	X2b	700	0	0.0	1.6	1.6	4.6	0	0
B	87	728	728X3	Transect		1295	696973.9	2353124.0	X3b	700	28	1.2	1.6	2.8	**7.4**	1	**1**

ATTACHMENT 3
Detailed Operations Schedule
Upper Columbia River RI/FS

															Enter 1st Value	Enter 0 or 1	Enter 1st Value
Vessel/Team	**Station ID**	**River Mile**	**Station Location**	**Station Type**	**Focus Area**	**Station Elevation (ft MSL)**	**Northing**	**Easting**	**Sample Type**	**Start Point (RM)**	**To & From Dist (mi)**	**Ttime (Travel Time) (hr)**	**Tsam (Sample Time) (hr)**	**Tsum (Ttime + Tsam) (hr)**	**Csum (Cumul. Time) (hr)**	**ASSIGN DAY**	**cDay (Cumul. Days)**
B	89	727	727X2	Transect		1204	692719.5	2350059.0	X2b	700	27	1.2	1.6	2.8	2.8	0	1
B	90	727	727X3	Transect		1283	693187.9	2349442.4	X3a	700	0	0.0	1.8	1.8	4.6	0	1
B	91	726	726X1	Transect		1258	689691.6	2345948.0	X1a	700	27	1.2	1.8	3.0	**7.5**	1	**2**
B	92	726	726X2	Transect		1208	690067.2	2345736.2	X2b	700	26	1.1	1.6	2.7	2.7	0	2
B	93	726	726X3	Transect		1280	690468.4	2345509.8	X3a	700	0	0.0	1.8	1.8	4.5	0	2
B	94	725	725X1	Transect	2	1273	685637.9	2341645.8	X1a	700	26	1.1	1.8	2.9	**7.5**	1	**3**
B	95	725	725X2	Transect	2	1224	685668.0	2341181.9	X2b	700	25	1.1	1.6	2.7	2.7	0	3
B	96	725	725X3	Transect	2	1278	685740.8	2340502.4	X3a	700	0	0.0	1.8	1.8	4.5	0	3
B	98	724	724X2	Transect	2	1230	681238.5	2341220.5	X2b	700	25	1.1	1.6	2.7	**7.2**	1	**4**
B	101	723	723X2	Transect	2	1222	676418.0	2340066.2	X2b	700	23	1.0	1.6	2.6	2.6	0	4
B	103	723	723X4	Transect	2	1281	677272.5	2338870.7	X4a	700	0	0.0	1.8	1.8	4.4	0	4
B	104	723	723X5	Transect	2	1275	677733.8	2338225.3	X5b	700	23	1.0	1.6	2.6	**7.0**	1	**5**
B	106	722	722X1	Transect	2	1271	673421.2	2335174.6	X1a	700	22	1.0	1.8	2.8	2.8	0	5
B	107	722	722X2	Transect	2	1213	674355.6	2335127.9	X2b	700	0	0.0	1.6	1.6	4.4	0	5
B	108	722	722X3	Transect	2	1279	674722.7	2335109.5	X3a	700	22	1.0	1.8	2.8	**7.1**	1	**6**
B	109	721	721X1	Transect	2	1270	675258.5	2329676.0	X1a	700	21	0.9	1.8	2.7	2.7	0	6
B	110	721	721X2	Transect	2	1231	675650.8	2329755.0	X2b	700	0	0.0	1.6	1.6	4.3	0	6
B	111	721	721X3	Transect	2	1275	676086.0	2329842.6	X3a	700	0	0.0	1.8	1.8	6.1	0	6
B	113	718	718X1	Transect		1279	665983.0	2322539.4	X1a	700	21	0.9	1.8	2.7	**8.8**	1	**7**
B	114	718	718X2	Transect		1216	665917.5	2321228.4	X2b	700	18	0.8	1.6	2.4	2.4	0	7
B	115	718	718X3	Transect		1275	665859.7	2320074.2	X3a	700	0	0.0	1.8	1.8	4.2	0	7
B	125	715	715X1	Transect		1265	653566.5	2312510.3	X1a	700	3	0.1	1.8	1.9	6.1	0	7
B	126	715	715X2	Transect		1191	654361.0	2311758.0	X2b	700	15	0.7	1.6	2.3	**8.4**	1	**8**
B	127	715	715X3	Transect		1286	654634.0	2311499.5	X3a	700	15	0.7	1.8	2.5	2.5	0	8
B	129	713	713X1	Transect		1270	644268.8	2312229.1	X1a	700	2	0.1	1.8	1.9	4.3	0	8
B	130	713	713X2	Transect		1206	643824.2	2311462.6	X2b	700	0	0.0	1.6	1.6	5.9	0	8
B	132	710	710X1	Transect		1278	629488.9	2320904.0	X1a	700	13	0.6	1.8	2.4	**8.3**	1	**9**
B	133	710	710X2	Transect		1203	629304.9	2318497.3	X2b	700	10	0.4	1.6	2.0	2.0	0	9
B	134	710	710X3	Transect		1285	629162.6	2316637.1	X3a	700	0	0.0	1.8	1.8	3.8	0	9
B	135	708	708X1	Transect	3	1260	621718.7	2313023.4	X1a	700	2	0.1	1.8	1.9	5.7	0	9
B	136	708	708X2	Transect	3	1194	622529.4	2312639.5	X2b	700	8	0.3	1.6	1.9	**7.7**	1	**10**
B	148	707	707X1	Transect	3	1277	618884.8	2307315.3	X1a	700	7	0.3	1.8	2.1	2.1	0	10
B	149	707	707X2	Transect	3	1185	620517.7	2307132.8	X2b	700	0	0.0	1.6	1.6	3.7	0	10
B	150	707	707X3	Transect	3	1265	624439.9	2306694.4	X3a	700	0	0.0	1.8	1.8	5.5	0	10
B	152	706	706X2	Transect	3	1239	618348.7	2304038.6	X2b	700	1	0.0	1.6	1.6	7.1	0	10
B	153	706	706X3	Transect	3	1215	619171.0	2302884.0	X3b	700	6	0.3	1.6	1.9	**9.0**	1	**11**
B	154	706	706X4	Transect	3	1193	619824.1	2301967.0	X4b	700	6	0.3	1.6	1.9	1.9	0	11
B	155	706	706X5	Transect	3	1235	620848.5	2300528.6	X5b	700	0	0.0	1.6	1.6	3.5	0	11
B	156	706	706X6	Transect	3	1233	621992.7	2298921.9	X6b	700	0	0.0	1.6	1.6	5.1	0	11
B	158	706	706T1	Tributary	3	1244	622220.5	2297035.6	T1b	700	0	0.0	1.6	1.6	6.7	0	11
B	159	706	706T2	Tributary	3	1283	621343.9	2297605.1	T2b	700	6	0.3	1.6	1.9	**8.5**	1	**12**

															Enter 1st Value	Enter 0 or 1	Enter 1st Value
Vessel/Team	**Station ID**	**River Mile**	**Station Location**	**Station Type**	**Focus Area**	**Station Elevation (ft MSL)**	**Northing**	**Easting**	**Sample Type**	**Start Point (RM)**	**To & From Dist (mi)**	**Ttime (Travel Time) (hr)**	**Tsam (Sample Time) (hr)**	**Tsum (Ttime + Tsam) (hr)**	**Csum (Cumul. Time) (hr)**	**ASSIGN DAY**	**cDay (Cumul. Days)**
C	160	705	705X1	Transect	3	1274	616199	2304352	X1a	700	5	0	2	2	2	0	0
C	161	705	705X2	Transect	3	1129	616931.3	2299179.2	X2b	700	0	0.0	1.6	1.6	3.6	0	0
C	162	705	705X3	Transect	3	1282	617039.5	2298414.7	X3a	700	0	0.0	1.8	1.8	5.4	0	0
C	166	704	704X2	Transect	3	1192	611669.2	2300098.2	X2b	700	1	0.0	1.6	1.6	7.1	0	0
C	167	704	704X3	Transect	3	1268	611571.9	2298151.8	X3a	700	4	0.2	1.8	2.0	**9.0**	1	**1**
C	169	701	701X1	Transect		1259	598876.6	2296564.8	X1a	700	1	0.0	1.8	1.8	1.8	0	1
C	170	701	701X2	Transect		1154	599108.1	2295100.1	X2b	700	0	0.0	1.6	1.6	3.4	0	1
C	171	701	701X3	Transect		1282	599247.2	2294220.4	X3a	700	0	0.0	1.8	1.8	5.2	0	1
C	181	699	699T1	Tributary		1216	585602.5	2299472.7	T1b	700	2	0.1	1.6	1.7	6.9	0	1
C	183	698	698X2	Transect		1145	585550.8	2293876.9	X2b	700	3	0.1	1.6	1.7	**8.7**	1	**2**
C	184	698	698X3	Transect		1289	585941.7	2292763.9	X3a	700	2	0.1	1.8	1.9	1.9	0	2
C	194	695	695X1	Transect		1249	571838.5	2293079.5	X1b	700	3	0.1	1.6	1.7	3.6	0	2
C	195	695	695X2	Transect		1130	572001.3	2292163.6	X2b	700	0	0.0	1.6	1.6	5.2	0	2
C	196	695	695X3	Transect		1274	572458.7	2289589.1	X3a	700	5	0.2	1.8	2.0	**7.2**	1	**3**
C	199	693	693X1	Transect		1252	566370.2	2282722.1	X3b	700	7	0.3	1.6	1.9	3.5	0	3
C	198	692	692X2	Transect		1124	564954.4	2284072.8	X2b	700	1	0.0	1.6	1.6	1.6	0	3
C	210	689	689X1	Transect		1257	550386.2	2281727.4	X1a	700	3	0.1	1.8	1.9	5.5	0	3
C	211	689	689X2	Transect		1108	550664.4	2281233.7	X2b	700	11	0.5	1.6	2.1	**7.6**	1	**4**
C	214	686	686X1	Transect		1253	536230.4	2279244.3	X1a	700	14	0.6	1.8	2.4	2.4	0	4
C	215	686	686X2	Transect		1105	536193.1	2278498.8	X2b	700	0	0.0	1.6	1.6	4.0	0	4
C	219	683	683X1	Transect		1268	523837.4	2285323.6	X1a	700	3	0.1	1.8	1.9	5.9	0	4
C	220	683	683X2	Transect		1104	521936.2	2280599.5	X2b	700	17	0.7	1.6	2.3	**8.3**	1	**5**
C	221	683	683X3	Transect		1277	521277.6	2278996.1	X3a	700	17	0.7	1.8	2.5	2.5	0	5
C	224	681	681X1	Transect	4	1254	511824.8	2282028.9	X3a	700	2	0.1	1.8	1.9	6.1	0	5
C	223	680	680X2	Transect	4	1114	510741.8	2283787.2	X2b	700	1	0.0	1.6	1.6	4.2	0	5
C	225	679	679X1	Transect	4	1272	506210.4	2289348.1	X1a	700	22	1.0	1.8	2.8	**8.8**	1	**6**
C	226	679	679X2	Transect	4	1105	505870.6	2285333.4	X2b	700	21	0.9	1.6	2.5	2.5	0	6
C	227	679	679X3	Transect	4	1288	505674.4	2283015.8	X3a	700	0	0.0	1.8	1.8	4.3	0	6
C	229	678	678X2	Transect	4	1198	501395.7	2288345.7	X2b	700	1	0.0	1.6	1.6	6.0	0	6
C	230	678	678X3	Transect	4	1206	501047.9	2286741.2	X3b	700	22	1.0	1.6	2.6	**8.5**	1	**7**
C	231	678	678X4	Transect	4	1110	500854.1	2285846.9	X4b	700	22	1.0	1.6	2.6	2.6	0	7
C	232	678	678X5	Transect	4	1168	500590.4	2284630.4	X5b	700	0	0.0	1.6	1.6	4.2	0	7
C	233	678	678X6	Transect	4	1205	500363.2	2283582.4	X6b	700	0	0.0	1.6	1.6	5.8	0	7
C	234	678	678X7	Transect	4	1277	500246.7	2283044.5	X7a	700	22	1.0	1.8	2.8	**8.5**	1	**8**
C	235	677	677X1	Transect	4	1272	497187.0	2291602.1	X1a	700	23	1.0	1.8	2.8	2.8	0	8
C	236	677	677X2	Transect	4	1099	495748.0	2286441.6	X2b	700	0	0.0	1.6	1.6	4.4	0	8
C	238	676	676X1	Transect	4	1273	492360.9	2292940.2	X1a	700	1	0.0	1.8	1.8	6.2	0	8
C	239	676	676X2	Transect	4	1102	490676.6	2287306.6	X2b	700	24	1.0	1.6	2.6	**8.9**	1	**9**
C	251	673	673X1	Transect		1279	478031.3	2296471.1	X1a	700	27	1.2	1.8	3.0	3.0	0	9
C	252	673	673X2	Transect		1078	476976.4	2294761.9	X2b	700	0	0.0	1.6	1.6	4.6	0	9
C	253	673	673X3	Transect		1278	476283.6	2293639.1	X3a	700	27	1.2	1.8	3.0	**7.5**	1	**10**

															Enter 1st Value	Enter 0 or 1	Enter 1st Value
Vessel/Team	**Station ID**	**River Mile**	**Station Location**	**Station Type**	**Focus Area**	**Station Elevation (ft MSL)**	**Northing**	**Easting**	**Sample Type**	**Start Point (RM)**	**To & From Dist (mi)**	**Ttime (Travel Time) (hr)**	**Tsam (Sample Time) (hr)**	**Tsum (Ttime + Tsam) (hr)**	**Csum (Cumul. Time) (hr)**	**ASSIGN DAY**	**cDay (Cumul. Days)**
C	263	670	670X1	Transect		1275	460341.3	2292726.8	X1a	700	30	1.3	1.8	3.1	3.1	0	10
C	264	670	670X2	Transect		1116	461016.0	2291963.5	X2b	700	0	0.0	1.6	1.6	4.7	0	10
C	265	670	670X3	Transect		1292	462084.5	2290729.1	X3a	700	30	1.3	1.8	3.1	**7.8**	1	**11**
C	266	667	667X1	Transect		1271	447611.0	2286610.3	X1a	700	33	1.4	1.8	3.2	3.2	0	11
C	267	667	667X2	Transect		1116	447734.1	2285792.6	X2b	700	0	0.0	1.6	1.6	4.8	0	11
C	268	667	667X3	Transect		1279	448364.4	2281606.6	X3a	700	33	1.4	1.8	3.2	**8.1**	1	**12**
A	1	744	744A1(X1)	Bio/Tran	1	1311	745535	2409134	A1xb	700	44	2	2	4	4	0	12
A	3	744	744A2(X3)	Bio/Tran	1	1317	745493.6	2408048.7	A2xb	700	0	0.0	2.0	2.0	6.0	0	12
A	4	743	743A1(X1)	Bio/Tran	1	1273	741132.7	2407134.9	A1xb	700	44	1.9	2.0	4.0	**9.9**	1	**13**
A	6	743	743A2(X3)	Bio/Tran	1	1286	741183.6	2406704.7	A2xb	700	43	1.9	2.0	3.9	3.9	0	13
A	7	742	742A1(X1)	Bio/Tran	1	1262	735798.8	2406634.0	A1xb	700	1	0.0	2.0	2.1	6.0	0	13
A	11	742	742A2(X5)	Bio/Tran	1	1286	736021.3	2406038.9	A2xb	700	42	1.8	2.0	3.9	**9.9**	1	**14**
A	24	741	741A1(X3)	Bio/Tran	1	1283	733472.9	2401684.3	A1xb	700	41	1.8	2.0	3.8	3.8	0	14
A	25	740	740A1(X1)	Bio/Tran	1	1279	729935.4	2397896.0	A1xb	700	1	0.0	2.0	2.1	5.9	0	14
A	30	739	739A1(X3)	Bio/Tran		1282	727724.9	2393238.5	A1xb	700	40	1.7	2.0	3.8	**9.7**	1	**15**
A	33	738	738A1(X3)	Bio/Tran		1283	724403.3	2389664.0	A1xb	700	38	1.7	2.0	3.7	3.7	0	15
A	36	737	737A1(X3)	Bio/Tran		1278	722643.2	2385499.2	A1xb	700	1	0.0	2.0	2.1	5.8	0	15
A	37	736	736A1(X1)	Bio/Tran		1279	720662.9	2380311.3	A1xb	700	37	1.6	2.0	3.6	**9.4**	1	**16**
B	54	734	734A1(X1)	Bio/Tran		1276	715464	2374842	A1xb	700	34	1	2	4	4	0	12
B	58	733	733A1(X1)	Bio/Tran		1249	713181.2	2370498.6	A1xb	700	1	0.0	2.0	2.1	5.6	0	12
B	70	730	730A1(X3)	Bio/Tran		1256	701727.7	2361394.7	A1xb	700	33	1.4	2.0	3.5	**9.1**	1	**13**
B	73	729	729A1(X1)	Bio/Tran		1244	698099.8	2358314.4	A1xb	700	29	1.3	2.0	3.3	3.3	0	13
B	88	727	727A1(X1)	Bio/Tran		1234	692351.9	2350542.9	A1xb	700	2	0.1	2.0	2.1	5.4	0	13
B	97	724	724A1(X1)	Bio/Tran	2	1244	681191.9	2341411.8	A1xb	700	27	1.2	2.0	3.2	**8.6**	1	**14**
B	99	724	724A2(X3)	Bio/Tran	2	1253	681383.5	2340625.4	A2xb	700	24	1.0	2.0	3.1	3.1	0	14
B	100	723	723A1(X1)	Bio/Tran	2	1241	676211.0	2340355.9	A1xb	700	1	0.0	2.0	2.1	5.2	0	14
B	102	723	723A2(X3)	Bio/Tran	2	1252	676811.8	2339515.3	A2xb	700	23	1.0	2.0	3.0	**8.2**	1	**15**
B	131	713	713A1(X3)	Bio/Tran		1251	643425.9	2310775.9	A1xb	700	13	0.6	2.0	2.6	2.6	0	15
B	137	708	708A1(X3)	Bio/Tran	3	1261	623154.3	2312343.5	A1xb	700	5	0.2	2.0	2.3	4.9	0	15
B	151	706	706A1(X1)	Bio/Tran	3	1249	617635.9	2305039.5	A1xb	700	2	0.1	2.0	2.1	7.0	0	15
B	157	706	706A2(X7)	Bio/Tran	3	1261	623017.5	2297482.9	A2xb	700	6	0.3	2.0	2.3	**9.3**	1	**16**
C	165	704	704A1(X1)	Bio/Tran	3	1249	611943	2305584	A1xb	700	2	0	2	2	2	0	12
C	182	698	698A1(X1)	Bio/Tran		1249	584491.8	2296891.7	A1xb	700	6	0.3	2.0	2.3	4.4	0	12
C	197	692	692A1(X1)	Bio/Tran		1244	561668.5	2289736.1	A1xb	700	14	0.6	2.0	2.6	**7.1**	1	**13**
C	212	689	689A1(X3)	Bio/Tran		1262	552857.6	2277341.9	A1xb	700	11	0.5	2.0	2.5	2.5	0	13
C	213	687	687A1	Bioassay		1249	540946.2	2279358.2	A1b	700	2	0.1	1.6	1.7	4.2	0	13
C	216	686	686A1(X3)	Bio/Tran		1256	536103.6	2276706.2	A1xb	700	1	0.0	2.0	2.1	6.3	0	13
C	222	680	680A1(X1)	Bio/Tran	4	1240	511573.7	2288374.7	A1xb	700	26	1.1	2.0	3.2	**3.2**	1	**14**
C	228	678	678A1(X1)	Bio/Tran	4	1246	501699.7	2289748.2	A1xb	700	22	1.0	2.0	3.0	3.0	0	14
C	237	677	677A1(X3)	Bio/Tran	4	1255	494981.5	2283725.8	A1xb	700	1	0.0	2.0	2.1	5.1	0	14
C	240	676	676A1(X3)	Bio/Tran	4	1250	489785.6	2284274.2	A1xb	700	25	1.1	2.0	3.1	**8.2**	1	**15**

ATTACHMENT 3
Detailed Operations Schedule
Upper Columbia River RI/FS

															Enter 1st Value	Enter 0 or 1	Enter 1st Value
Vessel/Team	**Station ID**	**River Mile**	**Station Location**	**Station Type**	**Focus Area**	**Station Elevation (ft MSL)**	**Northing**	**Easting**	**Sample Type**	**Start Point (RM)**	**To & From Dist (mi)**	**Ttime (Travel Time) (hr)**	**Tsam (Sample Time) (hr)**	**Tsum (Ttime + Tsam) (hr)**	**Csum (Cumul. Time) (hr)**	**ASSIGN DAY**	**cDay (Cumul. Days)**
B	272	661	661A1(X1)	Bio/Tran		1241	421917	2274990	A1xb	639	22	1	2	3	3	0	0
B	278	658	658A1(X3)	Bio/Tran		1252	406702.3	2272005.2	A1xb	639	3	0.1	2.0	2.2	5.2	0	0
B	302	644	644A1(X3)	Bio/Tran	5	1256	363543.0	2246443.6	A1xb	639	19	0.8	2.0	2.9	**8.0**	1	1
B	307	642	642A1(X1)	Bio/Tran	5	1249	352459.6	2249569.4	A1xb	639	3	0.1	2.0	2.2	2.2	0	1
B	323	641	641A1(X1)	Bio/Tran	5	1249	346965.2	2249307.6	A1xb	639	1	0.0	2.0	2.1	4.3	0	1
B	328	640	640A1(X3)	Bio/Tran	5	1254	341502.1	2248112.0	A1xb	639	1	0.0	2.0	2.1	6.3	0	1
B	331	637	637A1(X1)	Bio/Tran	Ecology	1237	325865.5	2250937.1	A1xb	639	3	0.1	2.0	2.2	**8.5**	1	**2**
B	339	634	634A1(X1)	Bio/Tran		1247	310998.4	2245735.3	A1xb	639	8	0.3	2.0	2.4	2.4	0	2
B	354	628	628A1(X1)	Bio/Tran		1240	328838.0	2220289.2	A1xb	639	6	0.3	2.0	2.3	4.7	0	2
B	362	622	622A1(X3)	Bio/Tran		1243	345525.6	2203438.9	A1xb	639	23	1.0	2.0	3.0	**7.7**	1	**3**
C	369	616	616A1(X3)	Bio/Tran		1255	354353	2168924	A1xb	639	23	1	2	3	3	0	0
C	392	606	606A1(X3)	Bio/Tran	6	1249	347454.4	2133226.4	A1xb	639	10	0.4	2.0	2.5	5.5	0	0
C	393	605	605A1(X1)	Bio/Tran	6	1251	349742.0	2126931.2	A1xb	639	35	1.5	2.0	3.6	**9.1**	1	**1**
C	401	605	605A2(X8)	Bio/Tran	6	1251	353919.1	2133457.6	A2xb	639	34	1.5	2.0	3.5	3.5	0	1
C	406	603	603A1(X1)	Bio/Tran	6	1237	353031.2	2122449.4	A1xb	639	38	1.7	2.0	3.7	**7.2**	1	**2**
A	269	664	664X1	Transect		1226	431365	2286624	X1b	639	25	1	2	3	3	0	0
A	270	664	664X2	Transect		1101	431488.2	2285481.8	X2b	639	0	0.0	1.6	1.6	4.3	0	0
A	271	664	664X3	Transect		1298	431822.4	2282390.3	X3a	639	0	0.0	1.8	1.8	6.1	0	0
A	273	661	661X2	Transect		1096	424486.3	2273202.5	X2b	639	25	1.1	1.6	2.7	**8.8**	1	**1**
A	274	661	661X3	Transect		1267	425996.1	2272148.0	X3a	639	22	1.0	1.8	2.8	2.8	0	1
A	276	658	658X1	Transect		1274	406982.0	2277481.2	X1a	639	3	0.1	1.8	1.9	4.7	0	1
A	277	658	658X2	Transect		1077	406900.1	2275938.1	X2b	639	0	0.0	1.6	1.6	6.3	0	1
A	288	655	655X1	Transect		1279	390603.6	2269910.2	X1a	639	19	0.8	1.8	2.6	**8.9**	1	**2**
A	289	655	655X2	Transect		1062	392510.4	2267931.5	X2b	639	16	0.7	1.6	2.3	2.3	0	2
A	290	655	655X3	Transect		1273	394259.2	2266116.8	X3a	639	0	0.0	1.8	1.8	4.1	0	2
A	291	652	652X1	Transect		1260	390089.0	2252389.3	X1a	639	3	0.1	1.8	1.9	6.0	0	2
A	292	652	652X2	Transect		1048	391676.2	2252464.3	X2b	639	13	0.6	1.6	2.2	**8.2**	1	**3**
A	293	652	652X3	Transect		1272	393398.8	2252545.7	X3a	639	13	0.6	1.8	2.4	2.4	0	3
A	294	649	649X1	Transect		1280	385428.6	2241512.7	X1a	639	3	0.1	1.8	1.9	4.3	0	3
A	295	649	649X2	Transect		1058	386525.1	2237786.2	X2b	639	0	0.0	1.6	1.6	5.9	0	3
A	296	649	649X3	Transect		1280	386862.8	2236638.4	X3a	639	10	0.4	1.8	2.2	**8.1**	1	**4**
A	297	646	646X1	Transect		1270	373583.7	2243287.2	X1a	639	7	0.3	1.8	2.1	2.1	0	4
A	298	646	646X2	Transect		1045	373181.0	2242609.1	X2b	639	0	0.0	1.6	1.6	3.7	0	4
A	299	646	646X3	Transect		1275	371748.4	2240197.3	X3a	639	0	0.0	1.8	1.8	5.5	0	4
A	300	644	644X1	Transect	5	1260	364272.8	2249620.1	X1a	639	2	0.1	1.8	1.9	7.4	0	4
A	301	644	644X2	Transect	5	1035	364136.4	2249026.6	X2b	639	5	0.2	1.6	1.8	**9.2**	1	**5**
A	304	643	643X1	Transect	5	1260	358094.3	2249527.7	X3a	639	4	0.2	1.8	2.0	2.0	0	5
A	305	643	643X2	Transect	5	1037	358027.5	2248211.7	X2b	639	0	0.0	1.6	1.6	3.6	0	5
A	306	643	643X3	Transect	5	1282	357940.2	2246434.8	X3a	639	0	0.0	1.8	1.8	5.4	0	5
A	308	642	642X2	Transect	5	1239	352439.2	2249161.2	X2b	639	1	0.0	1.6	1.6	7.0	0	5
A	309	642	642X3	Transect	5	1148	352395.3	2248278.7	X3b	639	3	0.1	1.6	1.7	**8.7**	1	**6**

ATTACHMENT 3
Detailed Operations Schedule
Upper Columbia River RI/FS

																Enter 1st Value	Enter 0 or 1	Enter 1st Value
Vessel/Team	**Station ID**	**River Mile**	**Station Location**	**Station Type**	**Focus Area**	**Station Elevation (ft MSL)**	**Northing**	**Easting**	**Sample Type**	**Start Point (RM)**	**To & From Dist (mi)**	**Ttime (Travel Time) (hr)**	**Tsam (Sample Time) (hr)**	**Tsum (Ttime + Tsam) (hr)**	**Csum (Cumul. Time) (hr)**	**ASSIGN DAY**	**cDay (Cumul. Days)**
A	310	642	642X4	Transect	5	1042	352348.4	2247429.4	X4b	639	3	0.1	1.6	1.7	1.7	0	6
A	311	642	642X5	Transect	5	1114	352332.4	2247017.0	X5b	639	0	0.0	1.6	1.6	3.3	0	6
A	312	642	642X6	Transect	5	1176	352313.3	2246633.0	X6b	639	0	0.0	1.6	1.6	4.9	0	6
A	313	642	642X7	Transect	5	1274	352293.9	2246243.1	X7a	639	0	0.0	1.8	1.8	6.7	0	6
A	324	641	641X2	Transect	5	1006	346913.2	2248104.6	X2b	639	3	0.1	1.6	1.7	**8.5**	1	**7**
A	325	641	641X3	Transect	5	1274	346830.3	2246598.3	X3a	639	2	0.1	1.8	1.9	1.9	0	7
A	326	640	640X1	Transect	5	1268	341677.2	2251628.7	X1a	639	1	0.04	1.8	1.8	3.7	0	7
A	327	640	640X2	Transect	5	1048	341618.4	2250447.0	X2b	639	0	0.00	1.6	1.6	5.3	0	**7**
A	329	639	639T1	Tributary		1085	335996.6	2253047.9	T1b	639	1	0.04	1.6	1.6	7.0	0	7
A	330	639	639T2	Tributary		1116	334486.3	2252429.0	T2b	639	0	0.0	1.6	1.6	**8.6**	1	**8**
B	332	637	637X2	Transect	Ecology	1151	325962	2250565	X2b	639	2	0	2	2	2	0	3
B	333	637	637X3	Transect	Ecology	1116	326096.0	2250051.7	X3b	639	0	0.0	1.6	1.6	3.3	0	3
B	334	637	637X4	Transect	Ecology	1006	326297.5	2249279.2	X4b	639	0	0.0	1.6	1.6	4.9	0	3
B	335	637	637X5	Transect	Ecology	1220	326516.1	2248438.1	X5b	639	0	0.0	1.6	1.6	6.5	0	3
B	336	637	637X6	Transect	Ecology	1246	326684.4	2247792.1	X6b	639	2	0.1	1.6	1.7	**8.2**	1	**4**
B	337	637	637X7	Transect	Ecology	1284	326858.5	2247123.3	X7a	639	2	0.1	1.8	1.9	1.9	0	4
B	340	634	634X2	Transect		1015	313209.9	2243569.8	X2b	639	3	0.1	1.6	1.7	3.6	0	4
B	341	634	634X3	Transect		1274	317586.0	2240714.1	X3a	639	1	0.0	1.8	1.8	5.5	0	4
B	351	631	631X1	Transect		1272	315196.0	2226855.9	X1a	639	3	0.1	1.8	1.9	7.4	0	4
B	352	631	631X2	Transect		985	316791.5	2227759.8	X2b	639	8	0.3	1.6	1.9	**9.3**	1	**5**
B	353	631	631X3	Transect		1281	318144.1	2228526.0	X3a	639	8	0.3	1.8	2.1	2.1	0	5
B	355	628	628X2	Transect		980	330111.2	2220225.8	X2b	639	3	0.1	1.6	1.7	3.9	0	5
B	356	628	628X3	Transect		1290	331482.2	2220157.6	X3a	639	0	0.0	1.8	1.8	5.7	0	5
B	357	625	625X1	Transect		1269	328012.3	2203052.9	X1a	639	3	0.1	1.8	1.9	7.6	0	5
B	358	625	625X2	Transect		981	328661.4	2203631.6	X2b	639	14	0.6	1.6	2.2	**9.8**	1	**6**
B	359	625	625X3	Transect		1281	330898.6	2205626.0	X3a	639	14	0.6	1.8	2.4	2.4	0	6
B	360	622	622X1	Transect		1274	342801.1	2199767.6	X1a	639	3	0.1	1.8	1.9	4.3	0	6
B	361	622	622X2	Transect		981	344441.9	2201978.7	X2b	639	0	0.0	1.6	1.6	5.9	0	6
B	364	619	619X1	Transect		1271	344121.0	2185689.2	X1a	639	23	1.0	1.8	2.8	**8.7**	1	**7**
B	365	619	619X2	Transect		930	347500.0	2185521.0	X2b	639	20	0.9	1.6	2.5	2.5	0	7
B	366	619	619X3	Transect		1284	348246.2	2185483.8	X3b	639	0	0.0	1.6	1.6	4.1	0	7
B	367	616	616X1	Transect		1270	347607.6	2169238.0	X1a	639	3	0.1	1.8	1.9	6.0	0	7
B	368	616	616X2	Transect		945	350172.5	2169118.5	X2b	639	23	1.0	1.6	2.6	**8.6**	1	**8**
B	370	616	616T1	Tributary		998	354086.8	2167357.4	T1b	639	23	1.0	1.6	2.6	2.6	0	8
B	371	616	616T2	Tributary		1028	352344.2	2166665.5	T1b	639	23	1.0	1.6	2.6	5.2	0	8
B	381	613	613X1	Transect		1275	340941.7	2162301.4	X1a	639	29	1.3	1.8	3.1	**8.3**	1	**9**
C	382	613	613X2	Transect		929	340863	2160717	X2b	639	26	1	2	3	3	0	2
C	383	613	613X3	Transect		1284	340787.0	2159195.7	X3a	639	0	0.0	1.8	1.8	4.5	0	2
C	384	610	610X1	Transect		1241	336622.0	2148737.0	X1b	639	3	0.1	1.6	1.7	6.3	0	2
C	385	610	610X2	Transect		952	338048.1	2149165.9	X2b	639	29	1.3	1.6	2.9	**9.1**	1	**3**
C	386	610	610X3	Transect		1277	339725.1	2149670.3	X3a	639	29	1.3	1.8	3.1	3.1	0	3

															Enter 1st Value	Enter 0 or 1	Enter 1st Value
Vessel/Team	**Station ID**	**River Mile**	**Station Location**	**Station Type**	**Focus Area**	**Station Elevation (ft MSL)**	**Northing**	**Easting**	**Sample Type**	**Start Point (RM)**	**To & From Dist (mi)**	**Ttime (Travel Time) (hr)**	**Tsam (Sample Time) (hr)**	**Tsum (Ttime + Tsam) (hr)**	**Csum (Cumul. Time) (hr)**	**ASSIGN DAY**	**cDay (Cumul. Days)**
C	387	607	607X1	Transect		1259	340950.2	2132907.7	X1a	639	3	0.1	1.8	1.9	5.0	0	3
C	388	607	607X2	Transect		906	343088.5	2134595.5	X2b	639	0	0.0	1.6	1.6	6.6	0	3
C	389	607	607X3	Transect		1278	345255.1	2136305.4	X3a	639	32	1.4	1.8	3.2	**9.8**	1	**4**
C	390	606	606X1	Transect	6	1292	346406.5	2130362.4	X1a	639	33	1.4	1.8	3.2	3.2	0	4
C	391	606	606X2	Transect	6	923	346817.8	2131486.6	X2b	639	0	0.0	1.6	1.6	4.8	0	4
C	394	605	605X2	Transect	6	1137	350203.6	2127652.5	X2b	639	0	0.0	1.6	1.6	6.4	0	4
C	395	605	605X3	Transect	6	1119	350748.6	2128503.9	X3b	639	34	1.5	1.6	3.1	**9.5**	1	**5**
C	396	605	605X4	Transect	6	1075	351394.7	2129513.4	X4b	639	34	1.5	1.6	3.1	3.1	0	5
C	397	605	605X5	Transect	6	936	352041.8	2130524.5	X5b	639	0	0.0	1.6	1.6	4.7	0	5
C	398	605	605X6	Transect	6	1027	352733.3	2131604.8	X6b	639	0	0.0	1.6	1.6	6.3	0	5
C	399	605	605X7	Transect	6	1246	353469.0	2132754.3	X7b	639	34	1.5	1.6	3.1	**9.4**	1	**6**
C	400	605	605X8	Transect	6	1251	353919.1	2133457.6	X8b	639	34	1.5	1.6	3.1	3.1	0	6
C	403	604	604X1	Transect	6	1273	351445.6	2125221.5	X1a	639	1	0.0	1.8	1.8	4.9	0	6
C	404	604	604X2	Transect	6	915	355562.9	2127387.0	X2b	639	35	1.5	1.6	3.1	**8.0**	1	**7**
C	405	604	604X3	Transect	6	1285	357937.8	2128636.1	X3a	639	35	1.5	1.8	3.3	3.3	0	7
C	407	603	603X2	Transect	6	923	354381.1	2122382.1	X2b	639	0	0.0	1.6	1.6	4.9	0	7
C	408	603	603X3	Transect	6	1285	357489.1	2122227.3	X3b	639	36	1.6	1.6	3.2	**8.1**	1	**8**
C	409	600	600X1	Transect		1271	348050.4	2109136.4	X1a	639	39	1.7	1.8	3.5	3.5	0	8
C	410	600	600X2	Transect		923	350746.7	2107854.7	X2b	639	0	0.0	1.6	1.6	5.1	0	8
C	411	600	600X3	Transect		1266	352135.6	2107194.5	X3a	639	39	1.7	1.8	3.5	**8.6**	1	**9**
D	12	742	742C1	Core	1	1261	735831	2406547	C1b	700	84	9	3	12	12	1	1
D	57	734	734C1	Core		1258	715818.9	2374625.9	C1b	700	68	7.4	2.7	10.1	**10.1**	1	**2**
D	105	723	723C1	Core	2	1222	676418.0	2340066.2	C1b	700	46	5.0	2.7	7.7	**7.7**	1	**3**
D	128	715	715C1	Core		1191	654361.0	2311758.0	C1b	700	15	1.6	2.7	4.3	4.3	0	3
D	138	708	708C1	Core	3	1194	622529.4	2312639.5	C1b	700	15	1.6	2.7	4.3	**8.7**	1	**4**
D	168	704	704C1	Core	3	1192	611669.2	2300098.2	C1b	700	4	0.4	2.7	3.1	3.1	0	4
D	200	692	692C1	Core		1124	564954.4	2284072.8	C1b	700	20	2.2	2.7	4.9	**8.0**	1	**5**
D	241	676	676C1	Core	4	1102	490676.6	2287306.6	C1b	700	48	5.2	2.7	7.9	**7.9**	1	**6**
D	275	661	661C1	Core		1096	424486.3	2273202.5	C1b	639	22	2.4	2.7	5.1	5.1	0	6
D	303	644	644C1	Core	5	1160	363993.5	2248404.4	C1b	639	22	2.4	2.7	5.1	**10.2**	1	**7**
D	338	637	637C1	Core		1116	326096.0	2250051.7	C1b	639	2	0.2	2.7	2.9	2.9	0	7
D	363	622	622C1	Core		1063	343627.2	2200880.9	C1b	639	32	3.5	2.7	6.2	**9.1**	1	**8**
D	402	605	605C1	Core	6	1119	350748.6	2128503.9	C1b	639	68	7.4	2.7	10.1	**10.1**	1	**9**
BS	13	742	742B1c	Beach	1	1306	734803	2405413	B1c	700	84	2	6	7	7	1	1
BS	14	742	742B1L	Beach	1	1306	734772.3	2405313.7	B1L	700			0.0	0.0	0.0	0	1
BS	15	742	742B1R	Beach	1	1313	734805.4	2405482.3	B1R	700			0.0	0.0	0.0	0	1
BS	16	742	742B2c	Beach	1	1287	734852.0	2405407.0	B2c	700	0	0.0	0.0	0.0	0.0	0	1
BS	17	742	742B2L	Beach	1	1300	734804.6	2405301.7	B2L	700			0.0	0.0	0.0	0	1
BS	18	742	742B2R	Beach	1	1294	734845.3	2405487.5	B2R	700			0.0	0.0	0.0	0	1
BS	19	742	742B3c	Beach	1	1285	734897.2	2405401.0	B3c	700	0	0.0	0.0	0.0	0.0	0	1
BS	20	742	742B3L	Beach	1	1291	734836.2	2405291.2	B3L	700			0.0	0.0	0.0	0	1

ATTACHMENT 3
Detailed Operations Schedule
Upper Columbia River RI/FS

															Enter 1st Value	Enter 0 or 1	Enter 1st Value
Vessel/Team	**Station ID**	**River Mile**	**Station Location**	**Station Type**	**Focus Area**	**Station Elevation (ft MSL)**	**Northing**	**Easting**	**Sample Type**	**Start Point (RM)**	**To & From Dist (mi)**	**Ttime (Travel Time) (hr)**	**Tsam (Sample Time) (hr)**	**Tsum (Ttime + Tsam) (hr)**	**Csum (Cumul. Time) (hr)**	**ASSIGN DAY**	**cDay (Cumul. Days)**
BS	21	742	742B3R	Beach	1	1283	734888.2	2405493.5	B3R	700			0.0	0.0	0.0	0	1
BS	45	735	735B1c	Beach		1282	715724.3	2376406.4	B1c	700	70	1.4	5.6	7.0	**7.0**	1	**2**
BS	46	735	735B1L	Beach		1286	715915.8	2376220.1	B1L	700			0.0	0.0	0.0	0	2
BS	47	735	735B1R	Beach		1270	715766.4	2376659.9	B1R	700			0.0	0.0	0.0	0	2
BS	48	735	735B2c	Beach		1279	715794.8	2376444.2	B2c	700	0	0.0	0.0	0.0	0.0	0	2
BS	49	735	735B2L	Beach		1283	715938.9	2376290.6	B2L	700			0.0	0.0	0.0	0	2
BS	50	735	735B2R	Beach		1270	715823.2	2376656.7	B2R	700			0.0	0.0	0.0	0	2
BS	51	735	735B3c	Beach		1262	715877.9	2376485.3	B3c	700	0	0.0	0.0	0.0	0.0	0	2
BS	52	735	735B3L	Beach		1273	715964.2	2376372.7	B3L	700			0.0	0.0	0.0	0	2
BS	53	735	735B3R	Beach		1262	715885.3	2376653.6	B3R	700			0.0	0.0	0.0	0	2
BS	76	729	729B1c	Beach		1268	696977.3	2355995.2	B1c	700	58	2.5	5.6	8.1	**8.1**	1	**3**
BS	77	729	729B1L	Beach		1270	696977.6	2355945.3	B1L	700	0	0.0	0.0	0.0	0.0	0	3
BS	78	729	729B1R	Beach		1265	696987.0	2356044.9	B1R	700	0	0.0	0.0	0.0	0.0	0	3
BS	79	729	729B2c	Beach		1264	696992.9	2355994.8	B2c	700	0	0.0	0.0	0.0	0.0	0	3
BS	80	729	729B2L	Beach		1266	696993.0	2355944.9	B2L	700	0	0.0	0.0	0.0	0.0	0	3
BS	81	729	729B2R	Beach		1261	697001.6	2356044.0	B2R	700	0	0.0	0.0	0.0	0.0	0	3
BS	82	729	729B3c	Beach		1259	697011.5	2355994.9	B3c	700	0	0.0	0.0	0.0	0.0	0	3
BS	83	729	729B3L	Beach		1261	697010.9	2355945.0	B3L	700	0	0.0	0.0	0.0	0.0	0	3
BS	84	729	729B3R	Beach		1256	697018.6	2356043.1	B3R	700	0	0.0	0.0	0.0	0.0	0	3
BS	116	718	718B1c	Beach		1289	664049.6	2322434.4	B1c	700	18	0.4	5.6	6.0	6.0	0	3
BS	117	718	718B1L	Beach		1280	663805.2	2322361.8	B1L	700	0	0.0	0.0	0.0	0.0	0	3
BS	118	718	718B1R	Beach		1273	664265.6	2322316.1	B1R	700	0	0.0	0.0	0.0	0.0	0	3
BS	119	718	718B2c	Beach		1270	664073.2	2322286.2	B2c	700	0	0.0	0.0	0.0	6.0	0	3
BS	120	718	718B2L	Beach		1266	663969.2	2322062.2	B2L	700	0	0.0	0.0	0.0	0.0	0	3
BS	121	718	718B2R	Beach		1259	664320.8	2322279.9	B2R	700	0	0.0	0.0	0.0	0.0	0	3
BS	122	718	718B3c	Beach		1257	664180.5	2321660.1	B3c	700	0	0.0	0.0	0.0	6.0	0	3
BS	123	718	718B3L	Beach		1252	663931.3	2321705.9	B3L	700	0	0.0	0.0	0.0	0.0	0	3
BS	124	718	718B3R	Beach		1249	664417.0	2321598.6	B3R	700	0	0.0	0.0	0.0	0.0	0	3
BS	139	708	708B1c	Beach	3	1282	619792.0	2309057.5	B1c	700	18	0.4	5.6	6.0	**11.9**	1	**4**
BS	140	708	708B1L	Beach	3	1284	619710.3	2308823.4	B1L	700	0	0.0	0.0	0.0	0.0	0	4
BS	141	708	708B1R	Beach	3	1284	619878.2	2309291.2	B1R	700	0	0.0	0.0	0.0	0.0	0	4
BS	142	708	708B2c	Beach	3	1278	619907.3	2309011.8	B2c	700	0	0.0	0.0	0.0	0.0	0	4
BS	143	708	708B2L	Beach	3	1278	619828.4	2308781.9	B2L	700	0	0.0	0.0	0.0	0.0	0	4
BS	144	708	708B2R	Beach	3	1278	619988.2	2309240.7	B2R	700	0	0.0	0.0	0.0	0.0	0	4
BS	145	708	708B3c	Beach	3	1279	620020.6	2308967.1	B3c	700	0	0.0	0.0	0.0	0.0	0	4
BS	146	708	708B3L	Beach	3	1280	619941.6	2308737.2	B3L	700	0	0.0	0.0	0.0	0.0	0	4
BS	147	708	708B3R	Beach	3	1280	620101.5	2309196.0	B3R	700	0	0.0	0.0	0.0	0.0	0	4
BS	172	700	700B1c	Beach		1276	592475.8	2295999.6	B1c	700	0	0.0	5.6	5.6	5.6	0	4
BS	173	700	700B1L	Beach		1289	592237.6	2296086.7	B1L	700	0	0.0	0.0	0.0	0.0	0	4
BS	174	700	700B1R	Beach		1276	592715.0	2295932.6	B1R	700	0	0.0	0.0	0.0	0.0	0	4
BS	175	700	700B2c	Beach		1267	592468.8	2295941.6	B2c	700	0	0.0	0.0	0.0	5.6	0	4

ATTACHMENT 3
Detailed Operations Schedule
Upper Columbia River RI/FS

															Enter 1st Value	Enter 0 or 1	Enter 1st Value
Vessel/Team	**Station ID**	**River Mile**	**Station Location**	**Station Type**	**Focus Area**	**Station Elevation (ft MSL)**	**Northing**	**Easting**	**Sample Type**	**Start Point (RM)**	**To & From Dist (mi)**	**Ttime (Travel Time) (hr)**	**Tsam (Sample Time) (hr)**	**Tsum (Ttime + Tsam) (hr)**	**Csum (Cumul. Time) (hr)**	**ASSIGN DAY**	**cDay (Cumul. Days)**
BS	176	700	700B2L	Beach		1259	592223.6	2295985.6	B2L	700	0	0.0	0.0	0.0	0.0	0	4
BS	177	700	700B2R	Beach		1259	592714.0	2295900.6	B2R	700	0	0.0	0.0	0.0	0.0	0	4
BS	178	700	700B3c	Beach		1245	592462.8	2295896.6	B3c	700	0	0.0	0.0	0.0	5.6	0	4
BS	179	700	700B3L	Beach		1232	592211.6	2295924.6	B3L	700	0	0.0	0.0	0.0	0.0	0	4
BS	180	700	700B3R	Beach		1240	592712.0	2295871.5	B3R	700	0	0.0	0.0	0.0	0.0	0	4
BS	185	697	697B1c	Beach		1284	580474.5	2289871.2	B1c	700	6	0.1	5.6	5.7	**11.3**	1	**5**
BS	186	697	697B1L	Beach		1288	580682.5	2290002.2	B1L	700	0	0.0	0.0	0.0	0.0	0	5
BS	187	697	697B1R	Beach		1284	580263.5	2289734.6	B1R	700	0	0.0	0.0	0.0	0.0	0	5
BS	188	697	697B2c	Beach		1282	580330.7	2290077.6	B2c	700	0	0.0	0.0	0.0	0.0	0	5
BS	189	697	697B2L	Beach		1281	580538.8	2290208.7	B2L	700	0	0.0	0.0	0.0	0.0	0	5
BS	190	697	697B2R	Beach		1280	580119.8	2289941.1	B2R	700	0	0.0	0.0	0.0	0.0	0	5
BS	191	697	697B3c	Beach		1277	580187.0	2290282.5	B3c	700	0	0.0	0.0	0.0	0.0	0	5
BS	192	697	697B3L	Beach		1278	580395.0	2290413.5	B3L	700	0	0.0	0.0	0.0	0.0	0	5
BS	193	697	697B3R	Beach		1277	579976.1	2290146.0	B3R	700	0	0.0	0.0	0.0	0.0	0	5
BS	201	690	690B1c	Beach		1285	556609.8	2280937.4	B1c	700	10	0.2	5.6	5.8	5.8	0	5
BS	202	690	690B1L	Beach		1282	556815.3	2281077.7	B1L	700	0	0.0	0.0	0.0	0.0	0	5
BS	203	690	690B1R	Beach		1289	556398.8	2280800.9	B1R	700	0	0.0	0.0	0.0	0.0	0	5
BS	204	690	690B2c	Beach		1277	556497.7	2281166.7	B2c	700	0	0.0	0.0	0.0	5.8	0	5
BS	205	690	690B2L	Beach		1272	556654.7	2281358.3	B2L	700	0	0.0	0.0	0.0	0.0	0	5
BS	206	690	690B2R	Beach		1262	556262.9	2281079.0	B2R	700	0	0.0	0.0	0.0	0.0	0	5
BS	207	690	690B3c	Beach		1257	556390.2	2281390.4	B3c	700	0	0.0	0.0	0.0	5.8	0	5
BS	208	690	690B3L	Beach		1252	556558.3	2281574.6	B3L	700	0	0.0	0.0	0.0	0.0	0	5
BS	209	690	690B3R	Beach		1257	556239.4	2281192.7	B3R	700	0	0.0	0.0	0.0	0.0	0	5
BS	242	675	675B1c	Beach		1277	484436.1	2294283.7	B1c	700	40	0.8	5.6	6.4	**12.2**	1	**6**
BS	243	675	675B1L	Beach		1279	484399.6	2294139.0	B1L	700	0	0.0	0.0	0.0	0.0	0	6
BS	244	675	675B1R	Beach		1279	484502.6	2294162.4	B1R	700	0	0.0	0.0	0.0	0.0	0	6
BS	245	675	675B2c	Beach		1273	484438.7	2293990.4	B2c	700	0	0.0	0.0	0.0	0.0	0	6
BS	246	675	675B2L	Beach		1272	484193.6	2294041.2	B2L	700	0	0.0	0.0	0.0	0.0	0	6
BS	247	675	675B2R	Beach		1265	484430.9	2293741.3	B2R	700	0	0.0	0.0	0.0	0.0	0	6
BS	248	675	675B3c	Beach		1255	484252.2	2293687.9	B3c	700	0	0.0	0.0	0.0	0.0	0	6
BS	249	675	675B3L	Beach		1255	484021.5	2293797.4	B3L	700	0	0.0	0.0	0.0	0.0	0	6
BS	250	675	675B3R	Beach		1262	484473.9	2293578.4	B3R	700	0	0.0	0.0	0.0	0.0	0	6
BS	254	673	673B1c	Beach		1281	476032.3	2293641.1	B1c	700	54	1.1	5.6	6.7	**6.7**	1	**7**
BS	255	673	673B1L	Beach		1284	476233.7	2293627.9	B1L	700	0	0.0	0.0	0.0	0.0	0	7
BS	256	673	673B1R	Beach		1282	475834.4	2293654.3	B1R	700	0	0.0	0.0	0.0	0.0	0	7
BS	257	673	673B2c	Beach		1278	476030.5	2293865.4	B2c	700	0	0.0	0.0	0.0	0.0	0	7
BS	258	673	673B2L	Beach		1273	476231.9	2293854.8	B2L	700	0	0.0	0.0	0.0	0.0	0	7
BS	259	673	673B2R	Beach		1282	475831.8	2293879.5	B2R	700	0	0.0	0.0	0.0	0.0	0	7
BS	260	673	673B3c	Beach		1289	476029.6	2294091.4	B3c	700	0	0.0	0.0	0.0	0.0	0	7
BS	261	673	673B3L	Beach		1270	476232.8	2294074.7	B3L	700	0	0.0	0.0	0.0	0.0	0	7
BS	262	673	673B3R	Beach		1289	475827.4	2294104.6	B3R	700	0	0.0	0.0	0.0	0.0	0	7

Vessel/Team	Station ID	River Mile	Station Location	Station Type	Focus Area	Station Elevation (ft MSL)	Northing	Easting	Sample Type	Start Point (RM)	To & From Dist (mi)	Ttime (Travel Time) (hr)	Tsam (Sample Time) (hr)	Tsum (Ttime + Tsam) (hr)	Csum (Cumul. Time) (hr)	ASSIGN DAY	cDay (Cumul. Days)
															Enter 1st Value	Enter 0 or 1	Enter 1st Value
BS	279	658	658B1c	Beach		1281	399670.7	2271681.6	B1c	639	19	0.4	5.6	6.0	6.0	0	7
BS	280	658	658B1L	Beach		1285	399870.5	2271676.2	B1L	639	0	0.0	0.0	0.0	0.0	0	7
BS	281	658	658B1R	Beach		1280	399470.6	2271676.3	B1R	639	0	0.0	0.0	0.0	0.0	0	7
BS	282	658	658B2c	Beach		1281	399677.0	2271832.1	B2c	639	0	0.0	0.0	0.0	6.0	0	7
BS	283	658	658B2L	Beach		1285	399869.6	2271884.1	B2L	639	0	0.0	0.0	0.0	0.0	0	7
BS	284	658	658B2R	Beach		1272	399494.1	2271917.3	B2R	639	0	0.0	0.0	0.0	0.0	0	7
BS	285	658	658B3c	Beach		1269	399683.2	2271948.6	B3c	639	0	0.0	0.0	0.0	6.0	0	7
BS	286	658	658B3L	Beach		1285	399876.8	2271993.5	B3L	639	0	0.0	0.0	0.0	0.0	0	7
BS	287	658	658B3R	Beach		1257	399484.3	2271982.7	B3R	639	0	0.0	0.0	0.0	0.0	0	7
BS	314	642	642B1c	Beach	5	1283	348695.6	2249899.0	B1c	639	19	0.4	5.6	6.0	**12.0**	1	**8**
BS	315	642	642B1L	Beach	5	1286	348520.4	2250084.6	B1L	639	0	0.0	0.0	0.0	0.0	0	8
BS	316	642	642B1R	Beach	5	1284	348936.5	2249948.0	B1R	639	0	0.0	0.0	0.0	0.0	0	8
BS	317	642	642B2c	Beach	5	1265	348660.1	2249554.6	B2c	639	0	0.0	0.0	0.0	0.0	0	8
BS	318	642	642B2L	Beach	5	1265	348411.1	2249603.2	B2L	639	0	0.0	0.0	0.0	0.0	0	8
BS	319	642	642B2R	Beach	5	1265	348909.2	2249541.0	B2R	639	0	0.0	0.0	0.0	0.0	0	8
BS	320	642	642B3c	Beach	5	1249	348629.7	2249243.3	B3c	639	0	0.0	0.0	0.0	0.0	0	8
BS	321	642	642B3L	Beach	5	1250	348380.7	2249279.8	B3L	639	0	0.0	0.0	0.0	0.0	0	8
BS	322	642	642B3R	Beach	5	1252	348869.7	2249185.6	B3R	639	0	0.0	0.0	0.0	0.0	0	8
BS	342	633	633B1c	Beach		1296	311733.3	2236863.7	B1c	639	6	0.1	5.6	5.7	5.7	0	8
BS	343	633	633B1L	Beach		1299	311859.7	2236650.9	B1L	639	0	0.0	0.0	0.0	0.0	0	8
BS	344	633	633B1R	Beach		1280	311683.6	2237109.9	B1R	639	0	0.0	0.0	0.0	0.0	0	8
BS	345	633	633B2c	Beach		1273	311774.1	2236890.6	B2c	639	0	0.0	0.0	0.0	5.7	0	8
BS	346	633	633B2L	Beach		1273	311943.6	2236708.8	B2L	639	0	0.0	0.0	0.0	0.0	0	8
BS	347	633	633B2R	Beach		1278	311730.1	2237138.4	B2R	639	0	0.0	0.0	0.0	0.0	0	8
BS	348	633	633B3c	Beach		1259	311819.7	2236919.1	B3c	639	0	0.0	0.0	0.0	5.7	0	8
BS	349	633	633B3L	Beach		1269	311981.1	2236731.6	B3L	639	0	0.0	0.0	0.0	0.0	0	8
BS	350	633	633B3R	Beach		1271	311759.4	2237163.7	B3R	639	0	0.0	0.0	0.0	0.0	0	8
BS	372	615	615B1c	Beach		1284	346280.4	2164764.3	B1c	639	42	0.8	5.6	6.4	**12.2**	1	**9**
BS	373	615	615B1L	Beach		1282	346085.8	2164604.7	B1L	639	0	0.0	0.0	0.0	0.0	0	9
BS	374	615	615B1R	Beach		1286	346444.7	2164950.9	B1R	639	0	0.0	0.0	0.0	0.0	0	9
BS	375	615	615B2c	Beach		1279	346494.7	2164547.0	B2c	639	0	0.0	0.0	0.0	0.0	0	9
BS	376	615	615B2L	Beach		1275	346327.1	2164369.1	B2L	639	0	0.0	0.0	0.0	0.0	0	9
BS	377	615	615B2R	Beach		1281	346666.3	2164722.8	B2R	639	0	0.0	0.0	0.0	0.0	0	9
BS	378	615	615B3c	Beach		1275	346708.8	2164329.1	B3c	639	0	0.0	0.0	0.0	0.0	0	9
BS	379	615	615B3L	Beach		1270	346594.7	2164103.4	B3L	639	0	0.0	0.0	0.0	0.0	0	9
BS	380	615	615B3R	Beach		1273	346907.5	2164475.2	B3R	639	0	0.0	0.0	0.0	0.0	0	9
BS	412	600	600B1c	Beach		1281	347015.4	2105040.2	B1c	639	78	1.6	5.6	7.2	**7.2**	1	**10**
BS	413	600	600B1L	Beach		1279	346990.3	2104791.1	B1L	639	0	0.0	0.0	0.0	0.0	0	10
BS	414	600	600B1R	Beach		1284	347007.7	2105289.3	B1R	639	0	0.0	0.0	0.0	0.0	0	10
BS	415	600	600B2c	Beach		1272	347180.3	2105037.1	B2c	639	0	0.0	0.0	0.0	0.0	0	10
BS	416	600	600B2L	Beach		1273	347127.7	2104787.7	B2L	639	0	0.0	0.0	0.0	0.0	0	10

ATTACHMENT 3
Detailed Operations Schedule
Upper Columbia River RI/FS

															Enter 1st Value	Enter 0 or 1	Enter 1st Value
Vessel/Team	**Station ID**	**River Mile**	**Station Location**	**Station Type**	**Focus Area**	**Station Elevation (ft MSL)**	**Northing**	**Easting**	**Sample Type**	**Start Point (RM)**	**To & From Dist (mi)**	**Ttime (Travel Time) (hr)**	**Tsam (Sample Time) (hr)**	**Tsum (Ttime + Tsam) (hr)**	**Csum (Cumul. Time) (hr)**	**ASSIGN DAY**	**cDay (Cumul. Days)**
BS	417	600	600B2R	Beach		1278	347150.8	2105289.7	B2R	639	0	0.0	0.0	0.0	0.0	0	10
BS	418	600	600B3c	Beach		1263	347287.9	2105034.7	B3c	639	0	0.0	0.0	0.0	0.0	0	10
BS	419	600	600B3L	Beach		1259	347286.3	2104786.9	B3L	639	0	0.0	0.0	0.0	0.0	0	10
BS	420	600	600B3R	Beach		1267	347293.4	2105287.3	B3R	639	0	0.0	0.0	0.0	0.0	0	10
BS	64	732	732R1	Reference		1440	706787	2369873	R1	700	64	1	2	3	3	0	0
BS	163	726	726R1	Reference		1712	691978.9	2335785.6	R1	700	6	0.1	2.1	2.2	5.6	0	1
BS	112	721	721R1	Reference		1301	677785.9	2328148.8	R1	700	26	0.5	2.1	2.6	**8.2**	1	**1**
BS	164	705	705R1	Reference		1359	615533.1	2297457.2	R1	700	5	0.1	2.1	2.2	2.2	0	1
BS	217	686	686R1	Reference		1348	533958.6	2273870.2	R1	700	19	0.4	2.1	2.5	4.7	0	1
BS	218	685	685R1	Reference		1297	528493.8	2284498.9	R1	700	16	0.3	2.1	2.4	**7.1**	1	**2**

Notes:

1. Vessels A, B, and C have 20-knot cruising speed with full 3,000-lb load.

2. Vessel D is a specialized vessel from the vibracoring subcontractor. Assume 8 knots.

3. Vehicle speed for land-based sampling team = 50 mph.

4. The schedule does not include the day of mobilization and 2 days of shakedown and reconnaissance cruises prior to start of sampling.

5. Vessel/Team Description

VESSEL A: RM 735 to U.S./Canada border, then RM 734 to RM 605
Start: Kettle Falls Marina. Assume boat is able to collect sediment samples in upper river.
After completing upper river, vessel operates in area RM 734 to RM 605.

VESSEL B: RM 734 to RM 605
Start: Kettle Falls Marina.

VESSEL C: RM 734 to RM 605
Start: Kettle Falls Marina.

VESSEL D: Vibracores RM 735 to U.S./Canada border, then RM 734 to RM 605
Start: Kettle Falls Marina. Assume coring vessel is able to perform coring in upper river.

LBST: Land-based sampling team (for all beach and reference samples)
Start: Kettle Falls Marina. Assumes LBST can reach all of the beach sites.

															Enter 1st Value	Enter 0 or 1	Enter 1st Value
Vessel/Team	**Station ID**	**River Mile**	**Station Location**	**Station Type**	**Focus Area**	**Station Elevation (ft MSL)**	**Northing**	**Easting**	**Sample Type**	**Start Point (RM)**	**To & From Dist (mi)**	**Ttime (Travel Time) (hr)**	**Tsam (Sample Time) (hr)**	**Tsum (Ttime + Tsam) (hr)**	**Csum (Cumul. Time) (hr)**	**ASSIGN DAY**	**cDay (Cumul. Days)**

6. Description of Samples and Task Duration

X1a, X3a, X4a, X5a, X7a, X9a = Transect Sample Above Water:
Collected from ground material at specified elevation.
Assume 2-liter sample size for chemical tests.

X1b, X2b, X3b, X4b, X5b, X6b, X7b, X8b = Transect Sample Below Water:
Sample collected using grab sampler from boat.
Assume 2-liter sample size for chemical tests.

A1xb, A2xb = Bioassay Sample Below Water with Transect Sample:
Sample collected using grab sampler from boat.
Assume 8-liter sample size for bioassay and chemical tests.

A1b, A2b = Bioassay Sample Below Water without Transect Sample:
Sample collected using grab sampler from boat.
Assume 6-liter sample size for bioassay and chemical tests.

B1c = Beach Sample Above Water Level.
Beach sample includes the following nine sampling locations on the beach:
- B1c = Sample at center of sample row farthest from shoreline, with geographical coordinates in the table.
- B1L = Sample 200-300 ft laterally to LEFT of B1c, looking downslope.
- B1R = Sample 200-300 ft laterally to RIGHT of B1c, looking downslope.
- B2c = Sample at center of middle sample row. Locate position in the field.
- B2L = Sample 200-300 ft laterally to LEFT of B2c, looking downslope.
- B2R = Sample 200-300 ft laterally to RIGHT of B2c, looking downslope.
- B3c = Sample at center of sample row closest to shoreline. Locate position in the field.
- B3L = Sample 200-300 ft laterally to LEFT of B3c, looking downslope.
- B3R = Sample 200-300 ft laterally to RIGHT of B3c, looking downslope.

T1b, T2b = Tributary Sample Below Water.
Sample collected using grab sampler from boat in center of thalweg.
Vessel to survey several sections across thalweg to determine tributary channel alignment.
Assume 2-liter sample size for chemical tests.

C1b = Core Sample Below Water.
Use vibracorer. Collect 10-ft core.

ATTACHMENT 3
Detailed Operations Schedule
Upper Columbia River RI/FS

Vessel/Team	Station ID	River Mile	Station Location	Station Type	Focus Area	Station Elevation (ft MSL)	Northing	Easting	Sample Type	Start Point (RM)	To & From Dist (mi)	Ttime (Travel Time) (hr)	Tsam (Sample Time) (hr)	Tsum (Ttime + Tsam) (hr)	Csum (Cumul. Time) (hr) Enter 1st Value	ASSIGN DAY Enter 0 or 1	cDay (Cumul. Days) Enter 1st Value

R1 = Reference Station Sample Below Water
Samples to be collected at designated locations determined in the field.

7. Staging Areas

Kettle Falls Marina at RM 700 (stations from RM 744 to RM 670)
Two Rivers Marina at RM 639 (stations from RM 667 to RM 600)

8. On-Water Operations to be Performed in Daylight.
Hours of daylight do not include civil twilight (approximately 25 to 30 minutes before sunrise and after sunset.)

Date	Sunrise (PDT)	Sunset (PDT)	Daylight (Hr & Min)
04-Apr-05	6:39	19:44	13:05
15-Apr-05	6:18	20:00	13:42
01-May-05	5:50	20:22	14:32

9. Assumed Task Time (hr)

Below Water - Transect or Tributary Sample Without Bioassay (X1b, X2b, X3b, X4b, X5b, X6b, X7b, X8b, X9b, T1b, T2b)

Position Boat	Rig Grab	Collect/Retrieve	Process Sample	Paperwork	Decon	TOTAL
0.33	0.16	0.15	0.50	0.20	0.30	1.6

Below Water - Bioassay Sample with Transect Sample (A1xb, A2xb)
(Assume minimum 6-liter sample collected on first cast.)

Position Boat	Rig Grab	Collect/Retrieve	Process Sample	Paperwork	Decon	TOTAL
0.33	0.16	0.15	0.70	0.40	0.30	2.0

Below Water - Bioassay Sample Without Transect Sample (A1b, A2b)
(Assume minimum 6-liter sample collected on first cast.)

Position Boat	Rig Grab	Collect/Retrieve	Process Sample	Paperwork	Decon	TOTAL
0.33	0.16	0.15	0.50	0.20	0.30	1.6

Below Water - Core Sample (C1b) at 2 cores per site

Position Boat	Rig Corer	Collect/Retrieve	Process Sample	Paperwork	Decon	TOTAL
0.50	0.40	1.00	0.60	0.20	n/a	2.7

Above Water - Transect Sample (X1a, X2a, X3a, X4a, X5a, X6a, X7a, X8a, X9a)

Position Boat	Rig Equip.	Collect/Retrieve	Process Sample	Paperwork	Decon	TOTAL
0.10	0.20	0.50	0.50	0.20	0.30	1.8

Above Water - Beach Sample B1c by LBST (Also includes time required for B2c and B3c.)

Find Station	Rig Equip.	Collect/Retrieve	Process Sample	Paperwork	Decon	TOTAL
0.10	0.20	3.10	1.50	0.20	0.50	5.6

															Enter 1st Value	Enter 0 or 1	Enter 1st Value
Vessel/Team	**Station ID**	**River Mile**	**Station Location**	**Station Type**	**Focus Area**	**Station Elevation (ft MSL)**	**Northing**	**Easting**	**Sample Type**	**Start Point (RM)**	**To & From Dist (mi)**	**Ttime (Travel Time) (hr)**	**Tsam (Sample Time) (hr)**	**Tsum (Ttime + Tsam) (hr)**	**Csum (Cumul. Time) (hr)**	**ASSIGN DAY**	**cDay (Cumul. Days)**

Below Water - Reference Sample (R1) by LBST

(Assume minimum 6-liter sample collected with petite ponar)

Find Station	Rig Grab	Collect/Retrieve	Process Sample	Paperwork	Decon	TOTAL
0.8	0.16	0.15	0.50	0.20	0.30	2.1

10. Abbreviations

A = VESSEL A (Elcon Construction Co. M/V Reel Easy)
B = VESSEL B (Zephyr Marine M/V Minotaur)
Bio/tran = bioassay and transect
C = VESSEL C (Zephyr Marine M/V Maximus)
D = VESSEL D (TEG Oceanographic)
dna = does not apply, as station is in a free-run part of the river. Water elevations unknown.
ft = feet
LBST = land-based sampling team
mph = miles per hour
MSL = mean sea level
PDT = Pacific Daylight Time
RM = river mile
SWL = stillwater level (elevation of water surface in the absence of waves)

ATTACHMENT 4

Detailed Personnel Schedule

ATTACHMENT 4
Detailed Personnel Schedule
Upper Columbia River RI/FS

Unit	Operation	Vessel Port	Sediment Processing Station	APRIL 2005 4 M	5 T	6 W	7 Th	8 F	9 Sa	10 Su	11 M	12 T	13 W	14 Th	15 F	16 Sa	17 Su	18 M	19 T	20 W	21 Th	22 F	23 Sa	24 Su	25 M	26 T	27 W	28 Th	29 F	30 Sa	MAY 2005 1 Su	2 M	3 T	4 W	5 Th	6 F	7 Sa	8 Su	9 M	10 T	11 W	12 Th	13 F	14 Sa	15 Su	
VESSEL A	Mobilize/Recon	Kettle Falls	Kettle Falls	FA1						nwd							nwd							nwd							nwd							nwd							nwd	
VESSEL A	Recon	Kettle Falls	Kettle Falls	TA1	FA2	FA3				nwd							nwd							nwd							nwd							nwd							nwd	
VESSEL A	Sed.Samp.	Kettle Falls	Kettle Falls	A	TA2	TA3	FA4	FA5	FA6	nwd	FA7	FA8	FA9	FA10	FA11	FA12	nwd	FA14	FA15	FA16				nwd							nwd							nwd							nwd	
VESSEL A	Bioassay/Ref Sampling	Kettle Falls	Kettle Falls	LA1	A	A	TA4	TA5	TA6	nwd	TA7	TA8	TA9	TA10	TA11	FA13	nwd	TA13	TA14	TA15	FA17	FA18	FA19	nwd	FA20						nwd							nwd							nwd	
VESSEL A	DM/RM	KF/Two Rivers	KF/Two Rivers		RA	RA	A	A	A	nwd	A	A	A	A	A	TA12	nwd	A	A	A	TA16	TA17	TA18	nwd	TA19	FA21					nwd							nwd							nwd	
VESSEL A	Recon	Two Rivers	Two Rivers		LA2	LA3	RA	RA	RA	nwd	RA	RA	RA	RA	RA	A	nwd	RA	RA	RA	A	A	A	nwd	A	TA20	FA22				nwd							nwd							nwd	
VESSEL A	Sed.Samp. LK	Two Rivers	Two Rivers							nwd						RA	nwd				RA	RA	RA	nwd	RA	A	FA23	FA24	FA25	FA26	nwd	FA27	FA28	FA29	FA30	FA31		nwd							nwd	
VESSEL A	Demob	Two Rivers	Two Rivers							nwd							nwd				LA4			nwd		RA	TA21	TA22	TA23	TA24	nwd	TA25	TA26	TA27	TA28	TA29	FA32	nwd							nwd	
VESSEL A										nwd							nwd							nwd			A	A	A	A	nwd	A	A	A	A	A	TA30	nwd							nwd	
VESSEL A										nwd							nwd							nwd			RA	RA	RA	RA	nwd	RA	RA	RA	RA	RA	A	nwd							nwd	
VESSEL A										nwd							nwd							nwd			LA5	LA6			nwd							nwd							nwd	
VESSEL B	Mobilize/Recon	Kettle Falls	Kettle Falls		FB1					nwd							nwd							nwd							nwd							nwd							nwd	
VESSEL B	Recon	Kettle Falls	Kettle Falls		TB1	FB2				nwd							nwd							nwd							nwd							nwd							nwd	
VESSEL B	Sed.Samp.LK	Kettle Falls	Kettle Falls		B	TB2	FB3	FB4	FB5	nwd	FB6	FB7	FB8	FB9	FB10	FB11	nwd	FB12	FB14	FB15				nwd							nwd							nwd							nwd	
VESSEL B	Bioassay/Ref Sampling	Kettle Falls	Kettle Falls			B	TB3	TB4	TB5	nwd	TB6	TB7	TB8	TB9	TB10	TB11	nwd	FB13	TB13	TB14	FB16	FB17	FB18	nwd	FB19						nwd							nwd							nwd	
VESSEL B	DM/RM	KF/Two Rivers	KF/Two Rivers			LB1	B	B	B	nwd	B	B	B	B	B	B	nwd	TB12	B	B	TB15	TB16	TB17	nwd	TB18	FB20					nwd							nwd							nwd	
VESSEL B	Recon	Two Rivers	Two Rivers				RB	RB	RB	nwd	RB	RB	RB	RB	RB	RB	nwd	B	RB	RB	B	B	B	nwd	B	TB19	FB21				nwd							nwd							nwd	
VESSEL B	Bioassay Sampling	Two Rivers	Two Rivers				LB2			nwd							nwd	RB			RB	RB	RB	nwd	RB	B	TB20	FB22	FB23	FB25	nwd							nwd							nwd	
VESSEL B	Sed.Samp. LK	Two Rivers	Two Rivers							nwd							nwd				LB3			nwd		RB	B	TB21	FB24	TB23	nwd	FB26	FB27	FB28	FB29	FB30	FB31	nwd							nwd	
VESSEL B	Demob	Two Rivers	Two Rivers							nwd							nwd							nwd			RB	B	TB22	B	nwd	TB24	TB25	TB26	TB27	TB28	TB29	nwd	FB32						nwd	
VESSEL B										nwd							nwd							nwd				RB	B	RB	nwd	B	B	B	B	B	B	nwd	TB30						nwd	
VESSEL B										nwd							nwd							nwd				LB4	RB		nwd	RB	RB	RB	RB	RB	RB	nwd	B						nwd	
VESSEL B										nwd							nwd							nwd					LB5		nwd							nwd							nwd	
VESSEL C	Mobilize/Recon	Kettle Falls	Kettle Falls		FC1					nwd							nwd							nwd							nwd							nwd							nwd	
VESSEL C	Recon	Kettle Falls	Kettle Falls		TC1	FC2				nwd							nwd							nwd							nwd							nwd							nwd	
VESSEL C	Sed.Samp. LK	Kettle Falls	Kettle Falls		C	TC2	FC3	FC4	FC5	nwd	FC6	FC7	FC8	FC9	FC10	FC11	nwd	FC12	FC14	FC15				nwd							nwd							nwd							nwd	
VESSEL C	Bioassay/Ref Sampling	Kettle Falls	Kettle Falls			C	TC3	TC4	TC5	nwd	TC6	TC7	TC8	TC9	TC10	TC11	nwd	FC13	TC13	TC14	FC16	FC17		nwd							nwd							nwd							nwd	
VESSEL C	DM/RM	KF/Two Rivers	KF/Two Rivers			LC1	C	C	C	nwd	C	C	C	C	C	C	nwd	TC12	C	C	TC15	TC16	FC18	nwd							nwd							nwd							nwd	
VESSEL C	Recon	Two Rivers	Two Rivers				RC	RC	RC	nwd	RC	RC	RC	RC	RC	RC	nwd	C	RC	RC	C	C	TC17	nwd	FC19						nwd							nwd							nwd	
VESSEL C	Bioassay Sampling	Two Rivers	Two Rivers				LC2			nwd							nwd	RC			RC	RC	C	nwd	TC18	FC20	FC21				nwd							nwd							nwd	
VESSEL C	Sed.Samp. LK	Two Rivers	Two Rivers							nwd							nwd				LC3		RC	nwd	C	TC19	FC22	FC23	FC24	FC25	nwd	FC26	FC27	FC28	FC29			nwd							nwd	
VESSEL C	Demob	Two Rivers	Two Rivers							nwd							nwd							nwd	RC	C	TC20	TC21	TC22	TC23	nwd	TC24	TC25	TC26	TC27	FC30		nwd							nwd	
VESSEL C										nwd							nwd							nwd		RC	C	C	C	C	nwd	C	C	C	C	TC28		nwd							nwd	
VESSEL C										nwd							nwd							nwd		LC4	RC	RC	RC	RC	nwd	RC	RC	RC	RC	C		nwd							nwd	
VESSEL C										nwd							nwd							nwd			LC5				nwd							nwd							nwd	
VESSEL D	Mobilize/Recon	Kettle Falls	Kettle Falls							nwd							nwd	FD1						nwd							nwd							nwd							nwd	
VESSEL D	Recon	Kettle Falls	Kettle Falls							nwd							nwd	V	FD2					nwd							nwd							nwd							nwd	
VESSEL D	Vibracoring	Kettle Falls	Kettle Falls							nwd							nwd	D	V	FD3	FD4	FD5	FD6	nwd	FD7	FD8					nwd							nwd							nwd	
VESSEL D	DM/RM	KF/Two Rivers	KF/Two Rivers							nwd							nwd	LD1	D	V	V	V	V	nwd	V	FD9	FD10				nwd							nwd							nwd	
VESSEL D	Recon	Two Rivers	Two Rivers							nwd							nwd		RD	D	D	D	D	nwd	D	V	V	FD11			nwd							nwd							nwd	
VESSEL D	Vibracoring	Two Rivers	Two Rivers							nwd							nwd		LD2	RD	RD	RD	RD	nwd	RD	D	D	V	FD12	FD13	nwd	FD14						nwd							nwd	
VESSEL D	Demob	Two Rivers	Two Rivers							nwd							nwd							nwd		RD	RD	D	V	V	nwd	V	FD15					nwd							nwd	
VESSEL D										nwd							nwd							nwd				RD	D	D	nwd	D	V					nwd							nwd	
VESSEL D										nwd							nwd							nwd					RD	RD	nwd	RD	D					nwd							nwd	
VESSEL D										nwd							nwd							nwd					LD3	LD4	nwd							nwd							nwd	
LBST	Mobilize	Kettle Falls	Kettle Falls	BL1						nwd							nwd							nwd							nwd							nwd							nwd	
LBST	Sample Sediments	Kettle Falls	Kettle Falls	BT1	BL2	BL3	BL4	BL5	BL6	nwd	BL7	BL8	BL9	BL10	BL11		nwd							nwd							nwd							nwd							nwd	
LBST	Demob	Kettle Falls	Kettle Falls	RS	BT2	BT3	BT4	BT5	BT6	nwd	BT7	BT8	BT9	BT10	BT11	BL12	nwd							nwd							nwd							nwd							nwd	
LBST	Mobilize	Kettle Falls	Kettle Falls		RS	RS	RS	RS	RS	nwd	RS	RS	RS	RS	RS	BT12	nwd				BL13			nwd							nwd							nwd							nwd	
LBST	Reference Samples	Kettle Falls	Kettle Falls							nwd							nwd				BT13	BL14	BL15	nwd							nwd							nwd							nwd	
LBST	Demob	Kettle Falls	Kettle Falls							nwd							nwd				RS	BT14	BT15	nwd	BL16						nwd							nwd							nwd	
LBST										nwd							nwd					RS	RS	nwd	BT16						nwd							nwd							nwd	
SPS	Mobilize	Kettle Falls	Kettle Falls	PC1						nwd							nwd							nwd							nwd							nwd							nwd	
SPS	Process Sediments	Kettle Falls	Kettle Falls	PT1	PC2	PC3	PC4	PC5	PC6	nwd	PC7	PC8	PC9	PC10	PC11	PC12	nwd	PC14	PC15	PC16	PC17	PC18	PC19	nwd	PC20	PC21					nwd							nwd							nwd	
SPS	DM/RM	KF/Two Rivers	KF/Two Rivers	PD1	PT2	PT3	PT4	PT5	PT6	nwd	PT7	PT8	PT9	PT10	PT11	PT12	nwd	PT14	PT15	PT16	PT17	PT18	PT19	nwd	PT20	PT21	PC22				nwd							nwd							nwd	
SPS	Process Sediments	Two Rivers	Two Rivers	PE1	PD2	PD3	PD4	PD5	PD6	nwd	PD7	PD8	PD9	PD10	PD11	PD12	nwd	PD14	PD15	PD16	PD17	PD18	PD19	nwd	PD20	PD21	PT22	PC23	PC24	PC26	nwd	PC27	PC28	PC29	PC30	PC31	PC32	nwd	PC33						nwd	
SPS	Demob	Two Rivers	Two Rivers		PE2	PE3	PE4	PE5	PE6	nwd	PE7	PE8	PE9	PE10	PE11	PE12	nwd	PE14	PE15	PE16	PE17	PE18	PE19	nwd	PE20	PE21	PD22	PT23	PT24	PT26	nwd	PT27	PT28	PT29	PT30	PT31	PT32	nwd	PT33	PC34					nwd	
SPS										nwd						PC13	nwd							nwd			PE22	PD23	PD24	PD26	nwd	PD27	PD28	PD29	PD30	PD31	PD32	nwd	PD33	PT34					nwd	
SPS										nwd						PT13	nwd							nwd				PE23	PE24	PE26	nwd	PE27	PE28	PE29	PE30	PE31	PE32	nwd	PE33	PD34					nwd	
SPS										nwd						PD13	nwd							nwd					PC25		nwd							nwd		PE34					nwd	
SPS										nwd						PE13	nwd							nwd					PT25		nwd							nwd							nwd	
SPS										nwd							nwd							nwd					PD25		nwd							nwd							nwd	
SPS										nwd							nwd							nwd					PE25		nwd							nwd							nwd	
Shore HQ	Daily Mgmt.	Kettle Falls	Kettle Falls	FM1	FM2	FM3	FM4	FM5	FM6	nwd	FM7	FM8	FM9	FM10	FM11	FM12	nwd	FM13	FM14	FM15	FM16	FM17	FM18	nwd	FM19	FM21	FM22				nwd							nwd							nwd	
Shore HQ	Daily Mgmt.	Two Rivers	Two Rivers							nwd							nwd							nwd				FM23	FM24	FM25	nwd	FM26	FM27	FM28	FM29	FM30	FM31	nwd	FM32	FM33					nwd	
			Calendar Days	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	TOTAL
			Boat Days	1	2	3	4	5	6	6	7	8	9	10	11	12	12	13	14	15	16	17	18	18	19	20	21	22	23	24	24	25	26	27	28	29	30	30	31	32	33	34	35	36	36	MANDAYS[a]
CH2M HILL Field Team Leader				1	3	3	3	3	3	nwd	3	3	3	3	3	4	nwd	6	4	4	4	4	4	nwd	4	5	6	4	5	4	nwd	4	4	3	3	3	2	nwd	1	0	0	0	0	0	nwd	109
CH2M HILL Sample Processing Coordinator				1	1	1	1	1	1	nwd	1	1	1	1	1	2	nwd	1	1	1	1	1	1	nwd	1	1	1	1	2	1	nwd	1	1	1	1	1	1	nwd	1	1	0	0	0	0	nwd	34
CH2M HILL Sample Process Technician/Data Management Specialist				1	1	1	1	1	1	nwd	1	1	1	1	1	2	nwd	1	1	1	1	1	1	nwd	1	1	1	1	2	1	nwd	1	1	1	1	1	1	nwd	1	1	0	0	0	0	nwd	34
CH2M HILL Sampling Team Leader				1	1	1	1	1	1	nwd	1	1	1	1	1	1	nwd	1	1	1	1	1	1	nwd	1	1	1	1	1	1	nwd	1	1	1	1	1	1	nwd	1	1	0	0	0	0	nwd	32
CH2M HILL Field Planning Leader				1	1	3	2	0	0	nwd	0	0	0	0	0	0	nwd	1	1	0	3	0	0	nwd	0	1	2	2	2	1	nwd	0	0	0	0	0	0	nwd	0	0	0	0	0	0	nwd	20
CH2M HILL Remedial Investigation Task Leader				0	0	0	0	0	0	nwd	0	0	0	0	0	0	nwd	0	0	0	0	0	0	nwd	0	0	0	0	0	0	nwd	0	0	0	0	0	0	nwd	0	0	0	0	0	0	nwd	0
CH2M HILL Beach Leader				1	1	1	1	1	1	nwd	1	1	1	1	1	1	nwd	0	0	0	1	1	1	nwd	1	0	0	0	0	0	nwd	0	0	0	0	0	0	nwd	0	0	0	0	0	0	nwd	16
CH2M HILL or E&E Sampling Technician on Vessel				1	3	3	3	3	3	nwd	3	3	3	3	3	3	nwd	3	3	3	3	3	3	nwd	3	3	3	3	3	3	nwd	3	3	3	3	3	2	nwd	1	0	0	0	0	0	nwd	88
CH2M HILL or E&E Sample Process Technician				1	1	1	1	1	1	nwd	1	1	1	1	1	2	nwd	1	1	1	1	1	1	nwd	1	1	1	1	2	1	nwd	1	1	1	1	1	1	nwd	1	1	0	0	0	0	nwd	34
CH2M HILL or E&E Equip/Transport Specialist				1	1	1	1	1	1	nwd	1	1	1	1	1	2	nwd	1	1	1	1	1	1	nwd	1	1	1	1	2	1	nwd	1	1	1	1	1	1	nwd	1	1	0	0	0	0	nwd	34
CH2M HILL or E&E Beach Technician				1	1	1	1	1	1	nwd	1	1	1	1	1	1	nwd	0	0	0	1	1	1	nwd	1	0	0	0	0	0	nwd	0	0	0	0	0	0	nwd	0	0	0	0	0	0	nwd	16
Boat Operator				1	3	3	3	3	3	nwd	3	3	3	3	3	3	nwd	4	4	4	4	4	4	nwd	4	4	4	4	4	4	nwd	4	4	3	3	3	2	nwd	1	0	0	0	0	0	nwd	102
Cultural Resource Observer				1	2	2	4	4	4	nwd	4	4	4	4	4	3	nwd	3	4	4	5	5	5	nwd	4	4	4	4	4	4	nwd	4	3	3	3	2	1	nwd	0	0	0	0	0	0	nwd	106
Vibracore Subcontractor Personnel				0	0	0	0	0	0	nwd	0	0	0	0	0	0	nwd	1	1	1	1	1	1	nwd	1	1	1	1	1	1	nwd	1	1	0	0	0	0	nwd	0	0	0	0	0	0	nwd	14
			TOTAL	12	19	21	22	20	20	nwd	20	20	20	20	20	24	nwd	23	22	21	27	24	24	nwd	23	23	25	23	28	22	nwd	21	20	17	17	16	12	nwd	8	5	0	0	0	0	nwd	639

ATTACHMENT 4
Detailed Personnel Schedule
Upper Columbia River RI/FS

			Sediment	APRIL 2005																											MAY 2005														
		Vessel	Processing	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Unit	Operation	Port	Station	M	T	W	Th	F	Sa	Su	M	T	W	Th	F	Sa	Su	M	T	W	Th	F	Sa	Su	M	T	W	Th	F	Sa	Su	M	T	W	Th	F	Sa	Su	M	T	W	Th	F	Sa	Su

[a]Total number of mandays does not include travel to and from Kettle Falls or Two Rivers Marina from Spokane or Seattle area.

Notes:
1. VESSEL A is for upper river and lake areas. VESSELS B and C are for lake only. VESSEL D is a specialized platform from the vibracoring subcontractor.
2. One-day overlap between departing and arriving CH2M HILL Field Team Leader on vessels.
3. One-half day overlap between departing and arriving Sediment Processing Station personnel in which the replacement team arrives the evening before to work with the departing team the next morning.

Abbreviations (Unique identifier is assigned each day for CH2M HILL or E&E personnel):
FA1...n, FB1...n, FC1...n, etc. = CH2M HILL field team leader on VESSEL A, B, C, or D. Each is HAZWOPER 40-hr trained.
TA1...n, TB2...n, TC3...n, etc. = sample technician on VESSEL A, B, C, or D. Each is HAZWOPER 40-hr trained.
(NOTE: E&E may supply some of the sample technician personnel in lieu of CH2M HILL.)
A, B, C, D = Operator for Vessel A, B, C, or D.
RA, RB, RC, RS, RD = Cultural resources observer for Vessel A, B, C, or D and for beach/shoreline sampling
V = Subcontracted vibracoring technician (subcontractor)

PC1, PC2, PC3, etc = CH2M HILL sample processing coordinator. Each is HAZWOPER 40-hr trained.
PT1, PT2, PT3 = Sample processing technician (CH2M HILL or E&E). Each is HAZWOPER 40-hr trained.
PD1, PD2, PD3, etc. = CH2M HILL sample processing technician/data management specialist. Each is HAZWOPER 40-hr trained.
PE1, PE2, PE3, etc. = Equipment/transportation specialist (CH2M HILL or E&E). Each is HAZWOPER 40-hr trained.

BL1,BL2, BL3, etc. = CH2M HILL beach leader for LBST
BT1, BT2, BT3, etc. = Beach sampling technician (CH2M HILL or E&E)
FM1, FM2, FM3, etc. = CH2M HILL sampling team leader
LA1, LA2, LA3, etc. = CH2M HILL field planning leader (D.Winstanley, K. Lilly, M. Gauthier, G.Vedera) for VESSEL A.
LB1, LB2, LB3, etc. = CH2M HILL field planning leader (Dan Winstanley, Ken Lilly, Marilyn Gauthier, Glen Vedera) for VESSEL B.
LC1, LC2, LC3, etc. = CH2M HILL field planning leader (Dan Winstanley, Ken Lilly, Marilyn Gauthier, Glen Vedera) for VESSEL C.
RL1, RL2, RL3, etc.= CH2M HILL remedial investigation task leader (Chuck Gruenenfelder)

DM = demobilization at marina
KF = Kettle Falls
LBST = land-based sampling team
LK = lake (RM 734-RM 600)
nwd = nonwork day
RM = remobilization at new marina
SPS = sample processing station
UR = upper river (RM 735-RM 744)

f

ATTACHMENT 5

Vibracoring Technical Performance Specification

CH2M HILL
Bellevue, Washington

REQUEST FOR PROPOSAL
for
VIBRACORING

February 18, 2005

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ANNOUNCEMENT

CH2M HILL announces a Request for Proposal (RFP) for collecting sediment samples at 13 locations in the Upper Columbia River (UCR) using vibracoring methods.

Sediment coring operations will be performed from near the Grand Coulee Dam to near the U.S./Canada border in water depths of less than 30 feet to as deep as 215 feet, depending on lake level. Coring operations will be conducted in Franklin D. Roosevelt Lake and possibly the free-flowing part of the river from about Northport, WA to the U.S./Canada border if river conditions permit operations.

The UCR sediment sampling program is associated with a Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Remedial Investigation/Feasibility Study (RI/FS). CH2M HILL is performing the RI/FS activities for the UCR site pursuant to U.S. Environmental Protection Agency (EPA) Architect and Engineering Services Contract Number 68-S7-04-01. EPA has obtained the necessary research permits for coring activities that will take place in portions of the lake and river and/or within portions of the National Recreation Area as administered by the National Park Service (NPS).

Respondents shall submit copies of their proposal as specified herein by 5:00 p.m. PST, March 3, 2005 as follows:

Submit one (1) original copy to:

Kim Moore
Contract Specialist
CH2M HILL, INC.
P.O. Box 91500
777-108th Ave., NE
Bellevue, WA 98004
(Tel: 425-233-3438, FAX: 425-468-3011, E-Mail: Kim.Moore@ch2m.com)

Submit two (2) copies to:

Ken Lilly
Project Vessel Coordinator
CH2M HILL, INC.
P.O. Box 91500
777-108th Ave., NE
Bellevue, WA 98004
(Tel: 425-233-3345, FAX: 425-468-3011, E-Mail: Ken.Lilly@ch2m.com)

LATE SUBMISSIONS ONLY WILL BE CONSIDERED IF THERE ARE AN INSUFFICIENT NUMBER OF QUALIFIED BIDDERS MEETING THE SUBMITTAL DEADLINE

Questions regarding this RFP may be obtained by contacting Kim Moore or Ken Lilly. Alternate contact is Dan Winstanley at CH2M HILL (425-453-3130, E-mail: Dan.Winstanley@ch2m.com, or FAX: 425-468-3100).

1 INTRODUCTION

The UCR site is located in north central Washington and extends from the U.S./Canada border to Grand Coulee Dam, a distance of approximately 147 statute miles. Figure 3-3 (extracted and modified from another report) in Appendix B shows the project area. The UCR site includes a free-flowing reach of the Columbia River as well as Franklin D. Roosevelt Lake (Lake Roosevelt). The transition between the free-flowing river and Lake Roosevelt occurs approximately 15 miles south of the U.S.-Canada border and 132 miles upriver from the Grand Coulee Dam when the reservoir is full.

Previous sediment, water, and biota investigations by federal and state agencies have identified the presence of contamination within the U.S. portion of the UCR from the Grand Coulee Dam to the Canadian border. Other studies have evaluated contaminant source areas and effects north of the Canadian border. Potential sources of contamination include mining and milling operations, smelting operations, pulp and paper production, sewage treatment plants, and other industrial activities. Contaminants found by the studies include heavy metals such as cadmium, copper, lead, mercury, and zinc, as well as organic contaminants such as polychlorinated dibenzo-p-dioxins (dioxins), polychlorinated dibenzofurans (furans), and polychlorinated biphenyls (PCBs).

In August 1999, the Confederated Tribes of the Colville Indian Reservation (Colville Tribes) petitioned EPA to conduct an assessment of hazardous substance contamination at the Upper Columbia River. The petition expressed concerns about possible risks to people's health and the environment from contamination in the river. In December 2000, EPA completed a preliminary assessment. Based on a review of available information and existing data, EPA determined that further data collection was warranted.

In 2001, EPA conducted an expanded site inspection (ESI) at the Upper Columbia River and collected sediment samples to assess contaminant concentrations in river sediment and to determine whether further detailed investigation, such as an RI/FS, was warranted. The results of the investigation showed that widespread contamination is present in the lake and riverine sediment and that an RI/FS is necessary to evaluate possible risks to human health and the environment.

Only a limited number of sediment cores have been collected from the UCR site. Most of the sediment samples collected to data have been surficial grab samples from the uppermost 4 to 6 inches of the sediment column. Surficial samples indicate grain types ranging from silt to sand. Gravel-sized particles might be present in certain areas, whereas other areas may have silty clay material. In the upper reaches of the river, particularly above Northport, angular grains of slag likely will be present in large amounts intermixed with quartz sand grains.

2 LAKE AND RIVER HYDROLOGY

The Grand Coulee Dam at River Mile (RM) 597) was completed in 1941 to provide power generation, irrigation, and flood control. Between the dam and the international border, the flow regime is predominantly controlled by the operation of the Grand Coulee Dam.

In the upper reach of the river from about RM 729 to the international border at RM 744, the flow is influenced both by the lake level controlled by the Grand Coulee Dam, discharges from the Hugh Keenleyside Dam in British Columbia, and unregulated discharges from tributaries into the Columbia River.

The USGS has operated a flow gage at the U.S.-Canada border continuously since March 1, 1938. The average river flow since 1938 has been about 100,000 cubic feet per second (cfs). Annual peak river flows typically occur in June. The highest flow since the completion of the Grand Coulee Dam in 1941 was 550,000 cfs in June 1948. The highest flow to occur in the last 20 years was 305,000 cfs in June 1997. Depending on flows, water elevations measured at the gage may vary 4 to 5 feet over a period of a few hours.

3 NAVIGATION

The Normal Pool Elevation (NPE) is 1288.6 ft-MSL (Mean Sea Level) for Lake Roosevelt. The free-flowing portion of the river at NPE is from about RM 736 to the international border. During the period of this project, the pool elevation is scheduled to be at approximately 1255 ft-MSL or almost 35 feet lower than the NPE. (Note that because of the low snow pack so far in the winter of 2004/2005, the planned drawdown of the lake may not take place as scheduled, and pool elevations could be higher than 1255 ft-MSL.) If the drawdown takes place, the free-flowing portion of the river is expected to extend somewhere between RM 725 to near RM 729, or about 4.5 to 8.5 river miles downstream from the town of Northport, WA (Figure 3-3).

The reach from about RM 734 to RM 744 is known to have strong currents and navigational hazards posing high risk to vessel operators not familiar with the river. Currents exceeding 10 feet/sec (5.9 knots) are known to exist at various locations. Currents as high as 18 ft/sec (10.7 knots) have been observed under low pool and high river flow conditions during the spring months.

The following NOAA nautical charts cover the project area and are based mostly on hydrographic surveys from 1947-1949:

- 18551 – *Franklin D. Roosevelt Lake Southern Part*
- 18553 - *Franklin D. Roosevelt Lake Northern Part*

Soundings on both charts are referenced to NPE of 1288.6 ft-MSL from the dam to RM 736 off the mouth of Deep Creek. Soundings upriver from Deep Creek (Figure 3-3) are based on a gradient datum varying from 1288.6 ft-MSL at Deep Creek to 1292.6 ft-MSL at the international border.

Vessel operators not familiar with operating boats from about Deep Creek to the international border are cautioned that the depths shown on the charts vary each season, depending on changes caused by flows in the river and reservoir pool levels. This reach also has areas of very swift currents. It shall be the responsibility of the coring subcontractor and/or his associated vessel operator to determine if the services of an experienced river guide are required and to procure such services.

All positioning shall be by Differential GPS (DGPS) using the Coast Guard Maritime Differential GPS Service. The closest reference station is Spokane, WA broadcasting on 316 kHz at a rate of 100 bps. The coring vessel operator shall be responsible for navigating the vessel to each station and for maintaining position while the core is taken.

4 CORING OPERATIONS

During the period that coring operations are performed, CH2M HILL will be conducting sediment sampling operations using 3 vessels based out of Kettle Falls Marina (RM 700) and will have a Sediment Processing Station located at the marina. Late in April, CH2M HILL will move operations to the Two-Rivers Marina (RM 639) to finish sampling. If the lake is drawn down to 1255 ft MSL as presently planned, these two marinas, along with Keller Ferry Marina at RM 615, are the only full service marinas that can operate. It is presently planned that all coring operations will be completed in 10-12 workdays. See Appendix A for a tentative schedule.

The CH2M HILL Field Team Leader (FTL) on board the coring vessel will assist the vibracoring subcontractor (VS) in the deployment and recovery of the vibracorer, as needed and directed by the VS. The FTL will be responsible for ensuring that field operations meet the requirements for the project, but the means and methods for collecting the cores shall be the responsibility of the VS and coring vessel operator. The VS and vessel operator at all times shall be responsible for the prudent and safe operation of the vibracoring equipment and vessel and shall be responsible for approving or disapproving any particular operation or maneuvering of the vibracorer or vessel. It is the responsibility of the VS and/or vessel operator to confirm the adequacy of the two marinas for boat launching and retrieval.

CH2M HILL will provide the position coordinates for the coring stations and other details concerning mobilization and field procedures prior to the start of field operations.

The VS shall be responsible for the security of any of his or her vessels and equipment and the manner in which any of the vessels are moored or transported.

The work consists of the following:

1. Vibracoring to obtain a maximum 10-ft. long core. Lexan plastic core barrel liners are to be 4 inches in diameter. Two cores will be taken at each station and as close to each other as possible. The approximate locations are shown in Figure 3.3 in Appendix B and are listed below along with water depths relative to a lake level of 1255 ft MSL:

- 742C1 30 ft (very approximate, depending on river stage)
- 734C1 30 ft (very approximate, depending on river stage)

- 723C1 32 ft
- 715C1 76 ft
- 708C1 59 ft
- 704C1 63 ft
- 692C1 130 ft
- 676C1 153 ft
- 661C1 159 ft
- 644C1 94 ft
- 637C1 136 ft
- 622C1 175 ft
- 605C1 180 ft.

2. Providing and operating a vessel and/or drilling barge for deploying and recovering the vibracorer. Transit distances of up to 84 river miles (statute miles) roundtrip in one day will be required to perform coring at a single station. Roundtrip transit distances range from 2 to 84 miles.

SPECIAL NOTE REGARDING VESSELS

The VS is afforded as much flexibility as possible for determining the type of vessel and/or drilling barge to be used. If the VS has a suitably powered drilling barge, it may be used as the sole platform for transit and coring. Alternatively, a drilling barge towed by another vessel may be used. In any case, all vessels, including barges, must be seaworthy enough to handle occasional strong winds over 30 knots and rough wave conditions of 2 to 3 feet. It is recognized that coring operations likely would not take place under such adverse weather, but the vessels must be sufficiently seaworthy to navigate such conditions to reach shelter.

Positioning

The vessel operator will position the coring vessel to within 20 meters (66 feet) of the pre-planned coordinate and hold the vessel in position using engines or anchors during the coring operations. The winch cable must remain vertical over the vibracorer from the time the core reaches the riverbed to the time that its tip clears the riverbed upon recovery. If the vessel drifts off station before the core is taken, the vessel operator shall reposition the vessel.

In addition to the VS personnel, the CH2M HILL FTL and possibly a Cultural Resources Observer (CRO) will be onboard. The CRO will observe the procedures and visually examine the core for any cultural or historical artifacts.

5 VIBRACORING EQUIPMENT, VESSEL(s) AND PERSONNEL REQUIREMENTS

The following list shows the preferred minimum requirements for the coring equipment, vessel(s), and for the personnel who will be performing the work.

VIBRACORING EQUIPMENT

Vibracorer: The vibrating head may be electric, hydraulic, or pneumatic, capable of operating in water depths of up to 215 feet, and capable of taking a maximum core length of 10 feet.

Core Liners: Clear Lexan tubes, 4 inches in diameter with plastic core catchers affixed to the inside of each tube. Provide liners and sufficient spares for 26 cores.

Core-Catcher and Core-Nose: Provide at least 4 stainless steel core-catchers and 2 stainless steel core noses. The stainless steel core-catchers will be used in the event that the plastic core catchers do not perform well.

Caps and Tape: Provide a quantity of core liner caps and suitable tape to secure both ends of the liner upon retrieval. The quantities provided shall be sufficient for the complete project.

VIBRACORING PROCEDURES

The basic procedure will be to lower the coring device to the river bottom and activate the vibratory power head to drive the core barrel into the sediment. A position fix will be taken and a water depth reading will be taken to be recorded by the CH2M HILL FTL. Vibration will be continued until the desired depth of penetration is achieved or refusal is met. Refusal is defined as three minutes of vibration with less than six inches of penetration by the core barrel. The depth of core penetration will be determined by the vibracoring subcontractor.

The core will then be retrieved, the outsides sprayed off with river water, and the corer lowered onto a cradle on the vessel. The core catcher will be detached from the liner, and the bottom of the liner will be capped, taped, and marked "BOT" for bottom. The sediment recovery length will be measured, and the excess length of liner above the top of the core will be cut off. The top will be capped, taped, and labeled "TOP". The core will then be cut into specified lengths of 5 feet or less, as determined by the CH2M HILL FTL, and the ends capped and taped. The core will be labeled with all relevant sampling information according to the *Field Sampling Plan* and the *Field Instructions* for the project. Each core section will be stored vertically in a cooler at 4°C and securely restrained for transport to shore at the end of the coring for the day.

A second core will be taken within 20 meters of the location of the first core. Procedures for this core are the same as described above.

VESSEL REQUIREMENTS (ALL VESSELS)

Vessel Cruising Speed (Includes Self-Propelled Drilling Barge or Towed Barge): At least 8 knots when fully loaded.

Range: At least 150 statute miles between refueling

Winch for Vibracoring Operations: Power winch with a minimum 2,500 lb. line pull and a minimum of 500 ft. of wire having a minimum safe working load of 2,000 lb. The winch shall have a cable readout display or a meter wheel to show the amount of wire paid out.

Stern or Bow A-Frame or Hoisting Frame: Clearance of the bottom of the sheave for the winch wire cable above the gunwale, railing, or deck shall be a minimum of 6 feet. Pull-back loads could be about 2,000 lb., depending on the resistance of the lakebed sediment during pullout. Alternatively, the A-Frame or hoisting frame may be situated over a "moon pool" through the hull of the vessel.

Sounding Equipment: The coring vessel shall have a fathometer with display screen showing the water surface and lakebed. The fathometer shall have digital depth readout and be capable of sounding to at least a 400-foot depth. Fathometer resolution shall be +/- 0.2 foot or better.

Navigation Equipment: The coring vessel shall have differential GPS with Hypack or similar navigation software. The display shall be capable of showing the present location of the vessel relative to the desired station location and shall provide a bearing and distance to the station. The equipment shall be capable of being pre-programmed with the NOAA nautical chart and sampling station locations. The DGPS antenna shall be mounted on the A-Frame or hoisting frame so that position corrections do not need to be made for antenna location.

Radar and Communications Equipment: It is desirable, but not required, that the coring vessel be equipped with radar for navigating in poor visibility. Two-way marine VHF radio and cellular telephone communications capability are mandatory.

Flat Deck Work Area: The coring vessel shall have scuppers or other openings so that any material spilled onto deck can be washed overboard in order to maintain a safe walking surface. The deck surface shall have a non-slip walking surface and have a gunwale or railing surrounding the deck except for openings for the A-frame or other hoisting gear.

Storage of Cores: Provide a means of securely stowing the core sections in a vertical position for transport to shore. The core sections shall be in an enclosure that permits placement of ice-bags around the cores by CH2M HILL so that the cores are maintained at a temperature above freezing to 4°C. (CH2M HILL will furnish the bags of ice.)

Enclosed Cabin or Shelter Area: All vessels and barges shall have a heated cabin or enclosed area for navigating and for sheltering onboard personnel. A minimum 1.5 ft wide x 3.33 ft long table top for use by the scientific personnel, such as for lap top computers and record books, shall be located inside the cabin or shelter.

Electric Power: At least one receptacle with two 3-prong sockets having 110 VAC 15 amps. The receptacle shall be no more than 3 feet from the cabin table.

Water: One garden hose with adjustable nozzle with a minimum 1.5 gal/min flow from the lake for use by scientific personnel for washing off sampling and coring equipment.

U.S. Coast Guard Requirements: All vessels shall meet U.S. Coast Guard requirements for that class of vessel. The vessel operator shall supply USCG-approved personal flotation devices for up to 6 visiting personnel. (Normally, only the CH2M HILL FTL and CRO will be aboard, but there could be occasions where additional visitors are onboard for short periods of time.)

Other: The tow vessel and/or drilling barge shall be equipped with one marine toilet with appropriate privacy for use by both male and female personnel.

SPECIAL REQUIREMENTS FOR UPPER-RIVER VESSEL ONLY

The project has one station (742C1) in the potentially fast free-flowing section of the river approximately 8 miles upstream from Northport, WA. As discussed earlier, this part of the river has areas of swift currents and shoals that present special navigation risks. It will be the responsibility of the VS and vessel operator to acquire the services of an experienced river guide, if deemed necessary. It is presently planned that the VS, vessel operator, CH2M HILL, and river guide (if deemed necessary by the VS and vessel operator) will conduct a site reconnaissance for this river reach prior to any attempt to do vibracoring upstream from Northport. It shall be the decision of the VS whether or not to attempt vibracoring at 742C1 or any other stations upstream from Northport.

PREFERRED REQUIREMENTS FOR VIBRACORING FIELD OPERATOR

Provide a resume for the person in charge of performing the coring operations in the field that shows at least three years of experience performing vibracoring using the type of equipment proposed for this RFP or very similar equipment. Describe the experience of the field operator and provide a list of past projects, along with at least two references that may be contacted by CH2M HILL.

PREFERRED REQUIREMENTS FOR VESSEL OPERATOR

The vessel operator shall have a minimum of two years of experience operating the type of vessel or drilling barge proposed. A resume showing the experience of the operator and a list of past projects shall be included, along with at least two references that may be contacted by CH2M HILL. Any USCG licenses or certificates shall be listed. The documentation must show that the operator is familiar with operating DGPS and the navigational software proposed for the project. Although previous vessel experience involving sediment sampling is not required, it will be given additional points during the selection process. In addition, experience with boating operations in strong currents will be given additional points, as will direct experience of operating vessels on Lake Roosevelt.

6 SCOPE OF SERVICES

There will be three phases to the project: (1) Planning, (2) Mobilization and Demobilization, and (3) Field Operations. The scope of services for each of these phases is listed below.

PHASE I – PLANNING

Provide consulting services on an hourly basis to CH2M HILL as requested prior to the start of field operations. These services will pertain to CH2M HILL planning for the in-water operations and for adjustments to the procedures for coring operations.

PHASE II – MOBILIZATION AND DEMOBILIZATION

The vibracoring vessel owner shall provide for all transportation and the associated costs of the vessel(s) to and from the project site, and shall be responsible for preparing the vessel(s) for operations. In the field, the vessel operator and coring personnel shall assist CH2M HILL, as requested.

PHASE III– FIELD OPERATIONS

CH2M HILL will be responsible for all moorage fees and will make arrangements for moorage prior to the start of the field work. The vessel operator shall be responsible for ensuring that the vessel and/or barge is properly moored, taking into account exposure to winds and waves. The vessel operator shall be responsible for any damage to the vessel and its propulsion system resulting from operations of the vessel. Accidental fuel or oil releases from the vessel are the responsibility of the vessel operator.

The vibracoring subcontractor shall provide, but not be limited to, the following services during field operations:

1. Vessel(s) in good operating condition meeting the requirements specified above.
2. All navigation and operation of the vessel(s).
3. All fueling, maintenance, and repairs to the vessel(s).
4. Lodging, meals, and transportation for the vessel operator(s) and field operator(s).
5. Training of personnel designated by CH2M HILL in operation of any equipment requiring CH2M HILL assistance during coring operations.
6. Vessel and coring safety instructions at the start of the project and when any new personnel are onboard.

7 CONTENTS OF PROPOSALS

COVER LETTER (2 page limit)

Provide a cover letter summarizing the key points of the proposal and the overall vision for providing services.

A. DESCRIPTION OF VIBRACORING EQUIPMENT

See Section 5 for specifications on certain items. The submittal on vibracoring equipment shall include:

- Manufacturer and model of vibratory head
- Description of the vibracoring system to be used (power source, size, weight, etc.)

- Short discussion of the capabilities of the vibracorer, including conditions for which it is not expected to perform well (i.e., river current limits, bottom slope, sediment types, etc.)

B. DESCRIPTION OF VESSEL AND EQUIPMENT

See Section 5 for specifications on specific items. The submittal on vessel and equipment must provide enough information so that CH2M HILL can determine whether or not the vessel and equipment meet the requirements for the project. Some of the items listed below were not included in Section 4, but are to be addressed in the submittal. Photographs of the vessel may be included, but are not required.

- Name of Vessel (Provide the name of the boat, boat license number, and the state in which it is licensed.)
- Boat and/or Barge Dimensions and Hull Material
- Minimum Operating Depth
- Cruising Speed and/or Towing Speed
- Range at Cruising Speed or Towing Speed (Also include fuel capacity.)
- Sounding Equipment (Include make, model, and technical specification sheet from manufacturer.)
- Navigation Equipment and Software (Include make, model, and manufacturer's technical specification sheet for the DGPS unit. Provide company name and software name for navigation software. Provide description of equipment for displaying position of vessel and station location.)
- Radar (if any) and Communications Equipment (Provide makes and models.)
- Flat Deck Work Area (Provide length and width of usable area.)
- Enclosed Cabin or Shelter Area (State number of people that can be in the cabin at one time.)
- Electric Power
- Water
- U.S. Coast Guard Compliance
- Other (Include any information about the vessel that pertains to its capabilities to perform the work required.)

B. VIBRACORER OPERATOR AND VESSEL OPERATOR

List the name of the vibracorer operator and vessel operator and provide a resume of their experience based on the requirements discussed in Section 5.

C. AVAILABILITY

Indicate the minimum time required for notification to start field work. Also, indicate whether you are willing to work past the number of days presently planned for the project.

D. SPECIAL STATEMENT FOR UPPER RIVER OPERATIONS

The station at RM 742 may require transit through an area of strong currents and shoals to reach the site, as discussed earlier. State specifically whether or not your vessel is capable of transiting areas of strong currents and if you are willing to consider operating the vessel in the free-flowing section of the river from about RM 734 to the international border. It will be your responsibility to acquire the services of an experienced river guide if deemed necessary. As part of the contract, you will be allowed to perform a reconnaissance of the upper river to determine if you could reach the site and maintain station to collect a core.

E. FEE SCHEDULE

The proposal shall include fee schedules applicable for up to a 20 workday period. The fee schedule shall include the following:

Consulting Fee Cost

Provide the hourly cost for providing consulting services to CH2M HILL prior to the start of field operations for the personnel who would provide this service.

Daily Cost

Provide the daily cost for the vessel and/or barge and personnel. This cost includes all the operational costs for the vessel, including fuel and the cost for lodging, meals, transportation, and miscellaneous expenses for the vessel operator. On-water operations shall be limited to 12 hours or less per workday. For bidding purposes assume a minimum of 10 boat-days in which the vessel and/or barge will be underway.

Standby Cost

In the event of adverse weather or circumstances beyond the control of the Vibracoring Subcontractor, it may be necessary to temporarily suspend work for all, or a portion of, any given planned workday. Provide a daily standby cost if no field operations are performed and the vessel and/or barge remain idle.

Consumables Cost

Provide a lump sum cost for consumable items, such as 4-inch diameter Lexan core barrel liners, caps, tape, and so forth, for taking 26 cores. Provide a unit cost for consumable items, which will be used in the event the number of cores exceeds 26.

Mobilization and Demobilization Cost

Provide a lump sum cost for mobilizing and transport of the vessel and/or barge and coring equipment and personnel to the project site and for demobilization and transport back to home location.

River Guide Cost

Include the cost for an experienced river guide if the vessel will operate in the upper reach of the river from about RM 736 to the U.S./Canada border.

8 CH2M HILL RIGHTS AND OPTIONS

CH2M HILL reserves the right to postpone selection for its own convenience, to withdraw this Request for Proposal at any time, and to reject any and all submittals without indicating any reason for such rejection. CH2M HILL accepts no financial responsibility for any costs incurred by a Respondent to this Request for Proposal. Submitted proposals become the property of CH2M HILL. Additional material submitted will not be returned unless the Respondent requests it to be at the time of submittal. CH2M HILL reserves the right to remedy technical errors in response to the RFP and to modify the published scope of services. Any interpretation of, or change in, this Request for Proposal will be made by addendum, and shall become part of the Request and any subsequent contract awarded.

CH2M HILL will make arrangements and pay for moorage at Two-Rivers Marina and Kettle Falls Marina, but the vessel operator will be responsible for fueling and fuel costs.

9 EVALUATION CRITERIA AND SELECTION PROCESS

Each proposal will be reviewed by a CH2M HILL Technical Screening Committee based on the primary evaluation criteria set forth in Table 1. Cost evaluation criteria are listed in Table 2. No interviews will be held, but references may be contacted and additional information, as needed, obtained from Respondents.

TABLE 1 – TECHNICAL EVALUATION CRITERIA

Criteria	Points
1. VIBRACORING EQUIPMENT AND VESSEL(s)	
1.1 Compliance with equipment and vessel requirements in RFP	30
1.2 Capability to collect cores specified in RFP	40
2. VESSEL OPERATOR	
2.1 Experience with oceanographic or limnologic field operations involving deployment and recovery of coring devices or other oceanographic equipment.	30
2.2 Experience operating type of vessel proposed.	10
2.3 Experience operating vessels on Lake Roosevelt	10
3. VIBRACORING OPERATOR	
3.1 Experience with vibracoring equipment and operations	40
4. EQUIPMENT AND PERSONNEL AVAILABILITY	
4.1 Capacity and flexibility to meet project schedules, including extension of work schedule and ability to supply backup operator and equipment.	20
5. UPPER RIVER OPERATIONS	
5.1 Willingness and capability to operate in upper reach of river.	20
TOTAL POSSIBLE	200

TABLE 2 – COST EVALUATION CRITERIA

Criteria	Points
1. Consulting fee cost	10
2. Daily cost	140
3. Standby cost	20
4. Consumables cost	10
5. Mobilization & demobilization cost	20
TOTAL POSSIBLE	200

APPENDIX A Tentative Schedule

The tentative schedule shown below assumes no lost days due to weather or other unforeseeable problems. Thus, the minimum duration of the project is estimated to be approximately 10 boat-days for coring operations. If the core at RM 742 cannot be taken, coring operations could be completed in 9 boat-days.

The workweek normally will be Monday-Saturday, with Sunday off. Workdays will vary from 8-12 hours, depending on progress and scheduled operations.

ACTIVITY	DATE
CH2M HILL receive RFPs	March 3
CH2M HILL reviews RFPs and selects successful company	March 7
CH2M HILL completes contracting	March 17
CH2M HILL issues Notice-to-Proceed	March 17
Vibracoring Subcontractor mobilizes at Kettle Falls Marina	April 18
Perform reconnaissance of upper reach of river	April 19
Start coring at RM 742 (if river conditions permit)	April 20
End coring operations (RM 676) from Kettle Falls Marina	April 26
Demobilize at Kettle Falls; remobilize at Two-Rivers Marina	April 27
Perform reconnaissance of lower reach of river	April 28
Start coring at RM 661	April 29
End coring operations at RM 605	May 2
Demobilizes	May 3

APPENDIX B Project Area Map with Coring Locations

ATTACHMENT 6

Field Forms

Forms II Lite Chain-of-Custody Forms

USEPA Contract Laboratory Program
Inorganic Traffic Report & Chain of Custody Record

Case No:	39563	L
DAS No:	DAS34	
SDG No:		

Date Shipped:	01/20/2005
Carrier Name:	FedEx
Airbill:	
Shipped to:	ChemTech Consulting Group 284 Sheffield Street Mountainside NJ 07092 (908) 789-8900

Chain of Custody Record — Sampler Signature:

	Relinquished By	(Date / Time)	Received By	(Date / Time)
1				
2				
3				
4				

For Lab Use Only

Lab Contract No:	
Unit Price:	
Transfer To:	
Lab Contract No:	
Unit Price:	

INORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME	ORGANIC SAMPLE No.	FOR LAB USE ONLY Sample Condition On Receipt
MC0001	Sediment/ JOE SAMPLER	M/C	TM (21)	136 (1)	Marcus Island 1	S: 01/20/2005 14:55	MC0001	
MC0002	Sediment/ JOE SAMPLER	M/C	TM (21)	125 (1)	Marcus Island 2	S: 01/20/2005 14:55	MC0002	
MC0003	Sediment/ JOE SAMPLER	M/C	TM (21)	142 (1)	Marcus Island 3	S: 01/20/2005 14:55	MC0003	

Shipment for Case Complete? N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Cooler Temperature Upon Receipt:	Chain of Custody Seal Number:
Analysis Key:	**Concentration:** L = Low, M = Low/Medium, H = High	**Type/Designate:** Composite = C, Grab = G		**Custody Seal Intact?** ___ **Shipment Iced?** ___

TM = CLP TAL Total Metals

TR Number: 3-042025758-012005-0004

LABORATORY COPY

PR provides preliminary results. Requests for preliminary results will increase analytical costs.

Send Copy to: Sample Management Office, Attn: Heather Bauer, CSC, 15000 Conference Center Dr., Chantilly, VA 20151-3819; Phone 703/818-4200; Fax 703/818-4602

EPA

USEPA Contract Laboratory Program
Generic Chain of Custody

Reference Case 39563
Client No: DAS34
SDG No:

L

Date Shipped:	01/20/2005
Carrier Name:	UPS
Airbill:	
Shipped to:	American Analytical & Technical Services, Inc. 1700 West Albany Suite C Broken Arrow OK 74012 (918) 251-2858

Chain of Custody Record

Sampler Signature:

	Relinquished By	(Date / Time)	Received By	(Date / Time)
1				
2				
3				
4				

For Lab Use Only

Lab Contract No:
Unit Price:
Transfer To:
Lab Contract No:
Unit Price:

SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME		FOR LAB USE ONLY Sample Condition On Receipt
MC0001	Sediment/ JOE SAMPLER	M/C	PCB (21), PCDD (21)	139, 140 (2)	Marcus Island 1	S: 01/20/2005	14:55	
MC0002	Sediment/ JOE SAMPLER	M/C	PCB (21), PCDD (21)	130, 131 (2)	Marcus Island 2	S: 01/20/2005	14:55	
MC0003	Sediment/ JOE SAMPLER	M/C	PCB (21), PCDD (21)	144, 145 (2)	Marcus Island 3	S: 01/20/2005	14:55	

Shipment for Case Complete?N	Sample(s) to be used for laboratory QC:	Additional Sampler Signature(s):	Cooler Temperature Upon Receipt:	Chain of Custody Seal Number:

Analysis Key: Concentration: L = Low, M = Low/Medium, H = High Type/Designate: Composite = C, Grab = G

Custody Seal Intact? ___ Shipment Iced? ___

PCB = PCBs (AROCLORS), PCDD = Dioxins and Furans

TR Number: 3-042025758-012005-0002

LABORATORY COPY

PR provides preliminary results. Requests for preliminary results will increase analytical costs.
Send Copy to: Sample Management Office, Attn: Heather Bauer, CSC, 15000 Conference Center Dr., Chantilly, VA 20151-3819; Phone 703/818-4200; Fax 703/818-4602

F2V5.1.047

USEPA Contract Laboratory Program
Organic Traffic Report & Chain of Custody Record

Case No: 39563
DAS No: DAS34
SDG No:

L

Date Shipped: 01/20/2005	**Chain of Custody Record**	**Sampler Signature:**	**For Lab Use Only**
Carrier Name: UPS	**Relinquished By** (Date / Time)	**Received By** (Date / Time)	**Lab Contract No:**
Airbill:	1		**Unit Price:**
Shipped to: American Analytical & Technical Services, Inc. 1700 West Albany Suite C Broken Arrow OK 74012 (918) 251-2858	2		**Transfer To:**
	3		**Lab Contract No:**
	4		**Unit Price:**

ORGANIC SAMPLE No.	MATRIX/ SAMPLER	CONC/ TYPE	ANALYSIS/ TURNAROUND	TAG No./ PRESERVATIVE/ Bottles	STATION LOCATION	SAMPLE COLLECT DATE/TIME	INORGANIC SAMPLE No.	FOR LAB USE ONLY Sample Condition On Receipt
MC0001	Sediment/ JOE SAMPLER	M/C	BNA/PEST (21)	138 (1)	Marcus Island 1	S: 01/20/2005 14:55	MC0001	
MC0002	Sediment/ JOE SAMPLER	M/C	BNA/PEST (21)	127 (1)	Marcus Island 2	S: 01/20/2005 14:55	MC0002	
MC0003	Sediment/ JOE SAMPLER	M/C	BNA/PEST (21)	143 (1)	Marcus Island 3	S: 01/20/2005 14:55	MC0003	

Shipment for Case Complete?N	**Sample(s) to be used for laboratory QC:**	**Additional Sampler Signature(s):**	Cooler Temperature Upon Receipt:	**Chain of Custody Seal Number:**	
Analysis Key:	**Concentration:** L = Low, M = Low/Medium, H = High	**Type/Designate:** Composite = C, Grab = G		**Custody Seal Intact?** ___	**Shipment Iced?** ___

BNA/PEST = CLP TCL Semivolatiles and Pesticides/PC

TR Number: 3-042025758-012005-0005

LABORATORY COPY

PR provides preliminary results. Requests for preliminary results will increase analytical costs.
Send Copy to: Sample Management Office, Attn: Heather Bauer, CSC, 15000 Conference Center Dr., Chantilly, VA 20151-3819; Phone 703/818-4200; Fax 703/818-4602

F2V5.1.047

TYPICAL SAMPLE CONTAINER LABELS

Project No: QW-123 Case No:39563
Station No: Marcus Flats Sample No: MC0001
Station Loc: Marcus Island 1 Designate: Comp
Sampling Date/Time: 01/20/2005 / 14:55

Project No: QW-123 Case No:39563
Station No: Marcus Flats Sample No: MC0001
Station Loc: Marcus Island 1 Designate: Comp
Sampling Date/Time: 01/20/2005 / 14:55

Project No: QW-123 Case No:39563
Station No: Marcus Flats Sample No: MC0001
Station Loc: Marcus Island 1 Designate: Comp
Sampling Date/Time: 01/20/2005 / 14:55

Project No: QW-123 Case No:39563
Station No: Marcus Flats Sample No: MC0001
Station Loc: Marcus Island 1 Designate: Comp
Sampling Date/Time: 01/20/2005 / 14:55

Project No: QW-123 Case No:39563
Station No: Marcus Flats Sample No: MC0002
Station Loc: Marcus Island 2 Designate: Comp
Sampling Date/Time: 01/20/2005 / 14:55

Project No: QW-123 Case No:39563
Station No: Marcus Flats Sample No: MC0002
Station Loc: Marcus Island 2 Designate: Comp
Sampling Date/Time: 01/20/2005 / 14:55

Project No: QW-123 Case No:39563
Station No: Marcus Flats Sample No: MC0002
Station Loc: Marcus Island 2 Designate: Comp
Sampling Date/Time: 01/20/2005 / 14:55

Project No: QW-123 Case No:39563
Station No: Marcus Flats Sample No: MC0002
Station Loc: Marcus Island 2 Designate: Comp
Sampling Date/Time: 01/20/2005 / 14:55

Project No: QW-123 Case No:39563
Station No: Marcus Flats Sample No: MC0003
Station Loc: Marcus Island 3 Designate: Comp
Sampling Date/Time: 01/20/2005 / 14:55

Project No: QW-123 Case No:39563
Station No: Marcus Flats Sample No: MC0003
Station Loc: Marcus Island 3 Designate: Comp
Sampling Date/Time: 01/20/2005 / 14:55

EPA Region 3
U.S. ENVIRONMENTAL PROTECTION AGENCY

RECEIPT FOR SAMPLES

PROJECT NO.	PROJECT NAME	NAME & LOCATION OF FACILITY/SITE
QW-123		EXAMPLE SITE
SAMPLERS: (SIGNATURE)		

STATION NO.	LOCATION/DESCRIPTION	DATE	TIME	Comp/Grab	NO. OF EPA CONTAINERS	SPLIT SAMPLE Y OR N	EPA SAMPLE TAG NO.'S
Marcus Flats	Marcus Island 1	01/20/2005	14:55	C	5	Yes	136, 138, 139, 140, 141
Marcus Flats	Marcus Island 2	01/20/2005	14:55	C	5	Yes	125, 127, 130, 131, 132
Marcus Flats	Marcus Island 3	01/20/2005	14:55	C	5	Yes	142, 143, 144, 145, 146

SPLIT SAMPLES TRANSFERRED BY: (PRINT)	DATE	SPLIT SAMPLES RECEIVED BY ☐ OR DECLINED BY ☐ (PRINT)	DATE/TIME
(SIGN)	TIME	(SIGN)	TELEPHONE
		TITLE	

Field Record Forms

Sediment Sample Data Sheet (p. 1 of 4)
Upper Columbia River - Phase I Sampling
FIELD DATA

Date (mm/dd/yy)	Station ID	Name of person recording data	Vessel/Crew ID
			A B C D LBST

Field Team Leader (FTL):

Field Team Members:

Weather	
Temp:	Other:
Wind:	Waves:

Sample Type (circle)	Above water	beach	discrete	composite		size fractionation	
		baseline	focus				
	Below water	baseline	focus	tributary	bioassay	reference	core

Sample QA/QC Type	Normal (N)	Field duplicate (FD)	Matrix spike (MS)	Matrix spike duplicate (MSD)

Equipment Used: van Veen trowel vibracorer other:

Grab Penetration Depth (cm):

Cultural Resources Observed? Y N Name of Examiner:

Comments:

If composite, list all stations/interval:

If core, list sample interval: ____________ ft below top of core

Deviations from Plan:

Comments and Sketches:

FTL Signature

CH2MHILL

Sediment Sample Data Sheet (p. 2 of 4)
Upper Columbia River - Phase I Sampling
SAMPLE DATA (Station ID:________________)

Grab 1						
Time (military)		Start		Finish		
Coordinates			**Elevation (ft), Datum:**____________			
NORTHING	EASTING	Surface Elev.		Water Depth		Sample Elevation
		-		=		
Sample Quality:	Degree				Comments:	
Leakage	none	minor	moderate	excessive		
Winnowing	none	minor	moderate	excessive		
Overfill	none	minor	moderate	excessive		
Disturbance	none	minor	moderate	excessive		
Volume Recovered (%)						
Sediment Characteristics						
Grain Size:	Cobble	Gravel	Sand (C/M/F)	Silt	Clay	
(approx. % of each)			/ /			
Color (circle) :	Light	Dark	Gray	Brown	Black	Other:
Odor (circle) :	Normal	Sewage	Petroleum	Chemical	H2S	Other:
Presence of:	Y/N	Description and Quantity				
Organisms						
Debris						
Other						
Comments:						

Grab 2						
Time (military)		Start:		Finish:		
Coordinates			**Elevation (ft), Datum:**____________			
NORTHING	EASTING	Surface Elev.		Water Depth		Sample Elevation
		-		=		
Sample Quality:	Degree				Comments:	
Leakage	none	minor	moderate	excessive		
Winnowing	none	minor	moderate	excessive		
Overfill	none	minor	moderate	excessive		
Disturbance	none	minor	moderate	excessive		
Volume Recovered (%)						
Sediment Characteristics						
Grain Size:	Cobble	Gravel	Sand (C/M/F)	Silt	Clay	
(approx. % of each)			/ /			
Color (circle) :	Light	Dark	Gray	Brown	Black	Other:
Odor (circle) :	Normal	Sewage	Petroleum	Chemical	H2S	Other:
Presence of:	Y/N	Description and Quantity				
Organisms						
Debris						
Other						
Comments:						

FTL Signature ____________________________________

CH2MHILL

Sediment Sample Data Sheet (p. 3 of 4)
Upper Columbia River - Phase I Sampling
SAMPLE DATA Station ID:_________________)

Grab 3						
Time (military)		Start:		Finish:		
Coordinates			**Elevation (ft), Datum:**____________			
NORTHING	EASTING	Surface Elev.		Water Depth		Sample Elevation
		-		=		
Sample Quality:	Degree				Comments:	
Leakage	none	minor	moderate	excessive		
Winnowing	none	minor	moderate	excessive		
Overfill	none	minor	moderate	excessive		
Disturbance	none	minor	moderate	excessive		
Volume Recovered (%)						
Sediment Characteristics						
Grain Size:	Cobble	Gravel	Sand (C/M/F)	Silt	Clay	
(approx. % of each)			/ /			
Color (circle) :	Light	Dark	Gray	Brown	Black	Other:
Odor (circle) :	Normal	Sewage	Petroleum	Chemical	H2S	Other:
Presence of:	Y/N	Description and Quantity				
Organisms						
Debris						
Other						
Comments:						

Grab 4						
Time (military)		Start:		Finish:		
Coordinates			**Elevation (ft), Datum:**____________			
NORTHING	EASTING	Surface Elev.		Water Depth		Sample Elevation
		-		=		
Sample Quality:	Degree				Comments:	
Leakage	none	minor	moderate	excessive		
Winnowing	none	minor	moderate	excessive		
Overfill	none	minor	moderate	excessive		
Disturbance	none	minor	moderate	excessive		
Volume Recovered (%)						
Sediment Characteristics						
Grain Size:	Cobble	Gravel	Sand (C/M/F)	Silt	Clay	
(approx. % of each)			/ /			
Color (circle) :	Light	Dark	Gray	Brown	Black	Other:
Odor (circle) :	Normal	Sewage	Petroleum	Chemical	H2S	Other:
Presence of:	Y/N	Description and Quantity				
Organisms						
Debris						
Other						
Comments:						

FTL Signature ________________________________

CH2MHILL

Sediment Sample Data Sheet (p. 4 of 4)
Sample Container Log (Station ID: ________)

Check Sample Collected:

	Analysis	Container
☐	Pesticides/PCB Aroclors	8-oz amber glass
☐	SVOCs	8-oz amber glass
☐	Metals (including mercury and uranium)	8-oz glass
☐	Dioxins/Furans	8-oz glass
☐	TOC	4-oz glass
☐	AVS/SEM	8-oz glass
☐	Grain Size	8-oz glass
☐	Bioassay 10-day	2-L HDPE
☐	Bioassay 7-day	500-mL HDPE
☐	Bioassay 28-day	2-L HDPE
☐	Size-Fractionated Composite (2 samples created in lab)	5-gallon Pail
☐	Pore Water Isolation	8 x 8-oz glass
☐	Pore Water Dissolved TAL Metals (includes mercury and uranium)	250-mL HDPE
☐	TCLP Metals, TCLP SVOCs, TCLP Pesticides/PCBs	3 x 8-oz glass

Comments: ____

FTL Signature ____

CH2MHILL

Core Collection Data Sheet
Upper Columbia River - Phase I Sampling

Date (mm/dd/yy)	Time (hh:mm)	Location	Station ID	Name of Sample Logger	Vessel No.

Field Team Leader (FTL):

Field Team Members:

Coordinates		Elevation (feet), datum:_______			Weather
Northing	Easting	Surface Elev.	Water Depth	Sample Elev.	temp:
					wind:
					waves:
					other:

Contractor: ______________________

Equipment Used: ______________________

No. of successful cores: Total no.of cores: ______________________

	Core 1	Core 2	Core 3	Core 4	Core 5	Core 5
Start Time:						
Finish Time:						
Core Penetration Depth (cm):						
Estimated Length Recovered (feet):						
Visible Mud Line (Y/N)?:						

(Complete for each core attempt and indicate cores retained for processing)

Cultural Resources Observed: Y N Name of Examiner: ______________________

Comments:

Presence of:	Y/N	Description and Quantity
Organisms		
Debris		
Slag		
Other		

Deviations from plan: ______________________

Sketches (as needed):

Comments: ______________________

FTL Signature:

Beach Sediment Sample Data Sheet (p. 1 of 2)
Upper Columbia River - Phase I Sampling

Date (mm/dd/yy)	circle: PST or PDT Time (hh:mm)	Station ID	Name of Person Recording Data	Weather
				Temp: other:
Field Team Leader (FTL):				Wind:

Field Team Members:

Sample ID	**Sample Type (circle)**	**Coordinates, datum:_____________**				
		NORTHING		**EASTING**		**Elevation (ft)**
	Disc. Comp. Split					
Sample Characteristics						
Sample Depth (cm):	**Grain Size:**	Cobble	Gravel	Sand (C/M/F)	Silt	Clay
	(approx. % of each)			/ /		
Color (circle) :	Light	Dark	Gray	Brown	Black	Other:
Odor (circle) :	Normal	Sewage	Petroleum	Chemical	H2S	Other:

Sample ID	**Sample Type (circle)**	**Coordinates, datum:_____________**				
		NORTHING		**EASTING**		**Elevation (ft)**
	Disc. Comp. Split					
Sample Characteristics						
Sample Depth (cm):	**Grain Size:**	Cobble	Gravel	Sand (C/M/F)	Silt	Clay
	(approx. % of each)			/ /		
Color (circle) :	Light	Dark	Gray	Brown	Black	Other:
Odor (circle) :	Normal	Sewage	Petroleum	Chemical	H2S	Other:

Sample ID	**Sample Type (circle)**	**Coordinates, datum:_____________**				
	Disc. Comp. Split					
Sample Characteristics						
Sample Depth (cm):	**Grain Size:**	Cobble	Gravel	Sand (C/M/F)	Silt	Clay
	(approx. % of each)			/ /		
Color (circle) :	Light	Dark	Gray	Brown	Black	Other:
Odor (circle) :	Normal	Sewage	Petroleum	Chemical	H2S	Other:

Sample ID	**Sample Type (circle)**	**Coordinates, datum:_____________**				
		NORTHING		**EASTING**		**Elevation (ft)**
	Disc. Comp. Split					
Sample Characteristics						
Sample Depth (cm):	**Grain Size:**	Cobble	Gravel	Sand (C/M/F)	Silt	Clay
	(approx. % of each)			/ /		
Color (circle) :	Light	Dark	Gray	Brown	Black	Other:
Odor (circle) :	Normal	Sewage	Petroleum	Chemical	H2S	Other:

Sample ID	**Sample Type (circle)**	**Coordinates, datum:_____________**				
		NORTHING		**EASTING**		**Elevation (ft)**
	Disc. Comp. Split					
Sample Characteristics						
Sample Depth (cm):	**Grain Size:**	Cobble	Gravel	Sand (C/M/F)	Silt	Clay
	(approx. % of each)			/ /		
Color (circle) :	Light	Dark	Gray	Brown	Black	Other:
Odor (circle) :	Normal	Sewage	Petroleum	Chemical	H2S	Other:

Beach Sediment Sample Data Sheet (p. 2 of 2)
Upper Columbia River - Phase I Sampling

Sample ID	**Sample Type (circle)**	**Coordinates, datum:______________**				
		NORTHING		**EASTING**		**Elevation (ft)**
	Disc. Comp. Split					
Sample Characteristics						
Sample Depth (cm):	**Grain Size:**	Cobble	Gravel	Sand (C/M/F)	Silt	Clay
	(approx. % of each)			/ /		
Color (circle) :	Light	Dark	Gray	Brown	Black	Other:
Odor (circle) :	Normal	Sewage	Petroleum	Chemical	H2S	Other:
Sample ID	**Sample Type (circle)**	**Coordinates, datum:______________**				
		NORTHING		**EASTING**		**Elevation (ft)**
	Disc. Comp. Split					
Sample Characteristics						
Sample Depth (cm):	**Grain Size:**	Cobble	Gravel	Sand (C/M/F)	Silt	Clay
	(approx. % of each)			/ /		
Color (circle) :	Light	Dark	Gray	Brown	Black	Other:
Odor (circle) :	Normal	Sewage	Petroleum	Chemical	H2S	Other:
Sample ID	**Sample Type (circle)**	**Coordinates, datum:______________**				
		NORTHING		**EASTING**		**Elevation (ft)**
	Disc. Comp. Split					
Sample Characteristics						
Sample Depth (cm):	**Grain Size:**	Cobble	Gravel	Sand (C/M/F)	Silt	Clay
	(approx. % of each)			/ /		
Color (circle) :	Light	Dark	Gray	Brown	Black	Other:
Odor (circle) :	Normal	Sewage	Petroleum	Chemical	H2S	Other:
Sample ID	**Sample Type (circle)**	**Coordinates, datum:______________**				
		NORTHING		**EASTING**		**Elevation (ft)**
	Disc. Comp. Split					
Sample Characteristics						
Sample Depth (cm):	**Grain Size:**	Cobble	Gravel	Sand (C/M/F)	Silt	Clay
	(approx. % of each)			/ /		
Color (circle) :	Light	Dark	Gray	Brown	Black	Other:
Odor (circle) :	Normal	Sewage	Petroleum	Chemical	H2S	Other:

Sample QA/QC Type	Normal (N)	Field duplicate (FD)	Matrix spike (MS)	Matrix spike duplicate (MSD)	Field blank (FB)

Equipment Used: trowel other:

Cultural Resources Observed: Y N Name of Examiner:
Comments:

Deviations from Plan:

Comments:

Sketches:

FTL Signature:

Digital Photograph Data Form

Camera Number:	Project Number:	Team Members:
Project:		

Photo Number		Date/Time	Description	Station	Coordinates		Notes:
No.	Photo ID				Northing	Easting	

ATTACHMENT 7

Health and Safety Plan

Health and Safety Plan
Sediment Sampling at Upper Columbia River Site

Health and Safety Plan Overview

This Health and Safety Plan (HSP) will be kept onsite during field activities and will be reviewed as necessary. The plan will be amended or revised as project activities or conditions change or when supplemental information becomes available. The plan adopts, by reference, the Standards of Practice (SOPs) in the CH2M HILL *Corporate Health and Safety Program, Program and Training Manual*, as appropriate. In addition, this plan adopts procedures described in the UCR Phase I Sediment Field Sampling Plan. The Safety Coordinator—Hazardous Waste (SC-HW) is to be familiar with these SOPs and the contents of this plan. CH2M HILL personnel and subcontractors must sign Attachment 1.

Project Information and Description

PROJECT NO: 315904

CLIENT: U.S. EPA Region 10

PROJECT/SITE NAME: Upper Columbia River (UCR) Site CERCLA RI/FS, Phase 1

SITE ADDRESS: Coulee City, WA, to Kettle Falls, WA

CH2M HILL PROJECT MANAGER: Jim Stefanoff/SPK

CH2M HILL OFFICE: Spokane

DATE HEALTH AND SAFETY PLAN PREPARED: January 2005

DATE(S) OF SITE WORK: April 2005 through December 2005

SITE ACCESS: Contact National Park Service before entering any gated areas.

SITE SIZE: 150-mile reach of the Columbia River (Upper Columbia Basin), including portions of the Pend Oreille River basin

SITE TOPOGRAPHY: Rolling hills, river embankments, and surface water

PREVAILING WEATHER: Lake Roosevelt's semi-arid climate lies to the west of the Cascades and east of the Rockies. In comparison to Western Washington, the UCR site is much drier, with summers that are hotter and winters that are colder. Average January temperatures in eastern Washington range from less than -7°C (20°F) to -1°C (30°F), often dropping down to -18°C (0°F). July averages are from 18° to 24°C (65° to 75°F). However, daytime temperatures are often above 32°C (90°F). In addition, the climate within the Lake Roosevelt watershed varies a great deal from one end of the lake to the other. The southern portion of the lake near Grand Coulee is hotter and dryer. Average annual precipitation near the dam is about 10 inches. Area vegetation includes shrub steppe species such as sagebrush and bitterbrush. As the lake gets closer to the Canadian border, precipitation continues to increase, coming close to 20 inches annually at the Canadian border.

SITE DESCRIPTION AND HISTORY: Pending Superfund site, primarily concerned with mining/milling-related impacts on water quality and sediment. The largest concerns are the tailings discharges from the Cominco smelter in Trail, British Columbia.

DESCRIPTION OF SPECIFIC TASKS TO BE PERFORMED: Sediment sampling from boats, sediment sampling from beach access areas, vibracore sampling from boats, and sample preparation.

Site Map

This page is reserved for a Site Map.

Note locations of Support, Decontamination, and Exclusion Zones; site telephone; first aid station; evacuation routes; and assembly areas.

Project HS&E Change Management Form

*This evaluation form should be reviewed on a **continuous** basis to determine whether the current site health and safety plan adequately addresses ongoing project work, and should be completed whenever new tasks are contemplated or changed conditions are encountered..*

Project Task:	
Project Number:	Project/Task Manager:
Name:	Employee #:

	Evaluation Checklist	Yes	No
1.	Have the CH2M HILL staff listed in the original HSP changed?		
2.	Has a new subcontractor been added to the project?		
3.	Is any chemical or product to be used that is not listed in Attachment 2 of the plan?		
4.	Have additional tasks been added to the project that were not originally addressed in the plan?		
5.	Have new contaminants or higher than anticipated levels of original contaminants been encountered?		
6.	Have other safety, equipment, activity, or environmental hazards been encountered that are not addressed in the plan?		

If the answer is "YES" to Question 3, an HSP revision is NOT needed. However, please take the following actions:

- ♦ Add the chemical to Attachment 2, and ensure that employees handling the chemical are trained and training documentation is added to Attachment 3.

If the answer is "YES" to Questions 1, 2, or 4 to 6, an HSP revision MAY BE NEEDED. Please contact HS&E directly.

1.0 Tasks to be Performed Under this Plan

1.1 Description of Tasks

Refer to project documents (that is, Field Sampling Plan) for detailed task information. A hazard analysis (Section 1.2) has been performed for each task and is incorporated in this plan through task-specific hazard controls and requirements for monitoring and protection. Tasks other than those listed below require an approved amendment or revision to this plan before tasks begin. Refer to Section 8.2 for procedures related to "clean" tasks that do not involve hazardous waste operations and emergency response (HAZWOPER).

1.1.1 HAZWOPER-Regulated Tasks

- Vibracore
- Sediment sampling transect, bio-assay, beach, pore water)

1.1.2 Non-HAZWOPER-Regulated Tasks

Under specific circumstances, the training and medical monitoring requirements of federal or state HAZWOPER regulations are not applicable. It must be demonstrated that the tasks can be performed without the possibility of exposure in order to use non-HAZWOPER-trained personnel. **Prior approval from the Health and Safety Manager (HSM) is required before these tasks are conducted on regulated hazardous waste sites.**

Tasks

- Sample preparation and packaging for shipment
- Onsite administrative support
- Field operations support (sample runner and gathering supplies)
- Surveying and field reconnaissance

Controls

- Brief on hazards, limits of access, and emergency procedures
- Post contaminant areas as appropriate (refer to Section 8.2 for details)
- Sample and monitor as appropriate (refer to Section 5.0)

1.2 Task Hazard Analysis

(Refer to Section 2.0 for hazard controls)

Potential Hazards	Tasks	
	Vibracore	Sediment Sampling
Flying debris/objects	X	X
Noise >85 dBA	X	
Electrical	X	X
Suspended loads	X	
Slip, trip, fall	X	X
Back injury	X	X
Visible lightning	X	X
Fires	X	
Entanglement	X	
Drilling	X	
Heavy equipment	X	
Working in/over water	X	X

2.0 Hazard Controls

This section provides safe work practices and control measures used to reduce or eliminate potential hazards.

In addition to the controls specified in this section, Project Activity Self-Assessment Checklists are contained in Attachment 5. These checklists are to be used to assess the adequacy of CH2M HILL and subcontractor site-specific safety requirements. The objective of the self-assessment process is to identify gaps in project safety performance and prompt for corrective actions in addressing these gaps. Self-assessment checklists should be completed early in the project, when tasks or conditions change, or when otherwise specified by the HSM. The self-assessment checklists, including documented corrective actions, should be made part of the permanent project records and be promptly submitted to the HSM. The self-assessment checklist for the drilling/vibra-coring task is required when the task or exposure is initiated and weekly while the task or exposure is taking place. The checklist will be submitted to the project HSM weekly.

Self Assessment Checklists: The self assessment checklist for the following tasks and exposures are required when the task or exposure is initiated and weekly while the task or exposure is taking place, and submitted to the project H&S manager weekly.

- Drilling/Vibracore

In addition to the basic training requirements for construction sites, the following specialty training is required:

- **Safety Coordinator Training**—CH2M HILL SC-HW must have completed SC-HW training.
- **HAZWOPER Training**—All staff performing sediment sampling activities must have current 40-hour training and be medically monitored. Cultural resource staff will be required to have 24-hour Hazardous Waste Limited training. Vessel skippers, onsite administrative support, sample preparation/packaging staff, surveyors, and field operations support staff will not be required to have HAZWOPER training because they will not be handling potentially contaminated material.
- **Field Awareness Safety Training**—Onsite administrative support, sample preparation/packaging staff, and field operations support staff will be required to take this online course before conducting fieldwork on this project.
- **Fire Extinguisher—**The assigned SC-HW onsite must take the online fire extinguisher training course.
- **Bloodborne Pathogen Training—**The assigned SC-HW onsite must take the online bloodborne pathogen training course.
- **First Aid and CPR**—The assigned SC-HW must have current FA/CPR training.
- **Dangerous Goods Shipping Training**—The assigned SC-HW onsite must complete the online DG training course.

Required Forms
The following forms are required to be completed by the drilling subcontractor as part of the Behavior Based Loss Prevention System for drilling operations.
Activity Hazard Analysis (AHA)
Pre Task Safety Plan (PTSP)

Behavior Based Loss Prevention System

A Behavior Based Loss Prevention System (BBLPS is a system to prevent or reduce losses using behavior-based tools and proven management techniques to focus on behaviors or acts that could lead to losses. The Safety Coordinator (SC) and is responsible for implementing the BBLPS on the project site. The Safety Coordinator shall oversee the subcontractor's implementation of their AHAs and PTSPs processes on the project.

Activity Hazard Analysis

An Activity Hazard Analysis (AHA) defines the activity being performed, the hazards posed and control measures required to perform the work safely. Workers are briefed on the AHA before doing the work and their input is solicited prior, during and after the performance of work to further identify the hazards posed and control measures required. Activity Hazard Analysis will be prepared before beginning drilling using the AHA form provided in **Attachment 6**. The AHA shall identify the work tasks required along with potential H&S hazards and recommended control measures for each work task. In addition, a listing of the equipment to be used, inspection requirements and training requirements for the safe operation of the equipment listed must be identified. Subcontractors are required to provide AHA's specific to drilling for acceptance by CH2M HILL. Additions or changes in field activities, equipment, tools or material to perform work or additional/different hazard encountered that require additional/different hazard control measures requires either a new AHA to be prepared or an existing AHA to be revised.

Pre-Task Safety Plans

Daily safety meetings are held with all project personnel in attendance to review the hazards posed and required H&S procedures/AHAs. The PTSPs serve the same purpose as these general assembly safety meetings, but the PTSPs are held between the crew supervisor and their work crews to focus on those hazards posed to individual work crews. At the start of each day's activities, the crew supervisor completes the PTSP, provided in **Attachment 6**, with input from the work crew, during their daily safety meeting. The day's tasks, personnel, tools and equipment that will be used to perform these tasks are listed, along with the hazards posed and required H&S procedures, as identified in the AHA. The use of PTSPs, better promotes worker participation in the hazard recognition and control process, while reinforcing the task-specific hazard and required H&S procedures with the crew each day. The use of PTSPs is a common safety practice in the construction industry. Project-Specific Hazards

2.1 Project-Specific Hazards

2.1.1 Arsenic

- Do not enter regulated work areas unless training, medical monitoring, and personal protective equipment (PPE) requirements established by the HSM have been met.
- Do not eat, drink, smoke, chew tobacco or gum, or apply cosmetics when conducted sampling activities.
- Arsenic is considered a Confirmed Human Carcinogen.
- Respiratory protection and other exposure controls selection shall be based on the most recent exposure monitoring results obtained from the HSM.

2.1.2 Lead

The following requirements pertain to lead-contaminated soils:

- Depending on soil type, watering of soil may be required several days prior to commencing ground-intrusive activities.

Personnel working in the vicinity of lead-contaminated soil will wear disposable coveralls or equal and exercise enhanced personal hygiene (for example, frequent hand washing prior to eating, drinking, and smoking; separation of work and street clothing/footwear).

2.1.3 Vibracore

- Only authorized personnel are permitted to operate the rig.
- Stay clear of the rig during every startup.
- Stay clear of the rotating augers and other rotating components of the rig.
- Stay as clear as possible of all hoisting operations. Loads shall not be hoisted over the head of personnel.
- Do not wear loose-fitting clothing or other items such as rings or watches that could get caught in moving parts. Long hair should be kept restrained.
- If equipment becomes electrically energized, personnel shall be instructed not to touch any part of the equipment or attempt to touch any person who may be in contact with the electrical current. The utility company or appropriate party shall be contacted to have the line de-energized prior to approaching the equipment.
- Smoking around vibracore operations is prohibited.

2.1.4 Working Above or Near Water

- Fall protection should be provided to prevent personnel from falling into water. Where fall protection systems are not provided and the danger of drowning exists, U.S. Coast Guard-approved personal flotation devices (PFDs), or a life jacket, shall be worn.
- Inspect PFDs prior to use. Do not use defective PFDs.
- A minimum of one ring buoy with 90 feet of 3/8-inch solid-braid polypropylene (or equal) rope must be provided for emergency rescue.
- Use sampling and other equipment according to the manufacturers' instructions.
- No smoking is permitted on board vessels or during refueling operations.
- The boat skipper has the final authority with regard to boat safety and navigational safety.
- Use the checklist below to evaluate vessel integrity.

Boater's Checklist		
	Yes	**No**
Personal Flotation Devices (PFDs)		
Visual Distress Signals		
Anchor and Anchor Line		
Sound-Producing Devices		
Navigation Lights and Shapes		
Fire Extinguishers		
Alternative Propulsion (for example, paddles)		

Boater's Checklist		
	Yes	**No**
Overall Vessel Condition Satisfactory		
State Requirements		
Marine Sanitation Device		
Navigation Rules		
Ropes and Buoys		
First Aid Kit and Bloodborne Pathogen Kit		
Nonslip Deck		
Personnel Access Ladder		

2.1.5 Outdoor Safety Tips

- When scheduling daily sampling events, always inform someone as to where you are going, your route, and when you expect to return. **Stick to your plan**.
- Carry enough water for each person, each day of your sampling trips (plastic gallon jugs are handy and portable).
- If caught in a storm, find shelter as soon as possible and report your situation to the Field Team Leader.
- If your vehicle breaks down:
  - Stay near the vehicle. Your emergency supplies are there. A vehicle can be seen for miles, but a person on foot is very difficult to find.
  - Keep clothing on and dress in layers.
  - If you have water, **drink it**. Do not ration it.
  - If water is limited, keep your mouth shut. Do not talk, do not eat, do not smoke, do not drink alcohol, do not take salt.
  - A roadway is a sign of civilization. If you find a road, **stay on it**.
- Report all incidents, no matter how minor, to your crew chief/lead, task manager, design manager, or Project Manager as appropriate.
- Incident reports are required for all incidents.
- Two-track roads are inherently difficult; use caution.
- Park the vehicle in a location where it can be accessed easily in the event of an emergency.
- Pay attention, constantly observe the work area for hazards, and implement every effort needed to protect CH2M HILL personnel from onsite hazards.
- Carry emergency supplies of food, water, and clothing.
- Field work will be done during the daylight hours.

2.1.6 Field Vehicles

- Familiarize yourself with rental vehicle features:

  - Mirror and seat adjustments
  - Cruise control features
  - Pre-program radio stations

- Always wear seat belt while operating vehicle—drivers and passengers.
- Adjust headrest to proper position.
- Tie down loose items if using a van.
- Pull off the road, put the car in park, and turn on flashers before talking on a mobile phone.
- **Always obtain and maintain a field kit, consisting of a fire extinguisher, first aid kit, and flares.**
- Make a vehicle mechanical check and check fuel and fluid levels and tire condition.
- Carry a spare tire. Return to the field operations center immediately after replacing a flat.
- Close car doors slowly and carefully. Fingers can get pinched in doors or the car/ truck.
- Park in a manner that will allow for safe exit from vehicle and, where practicable, park the vehicle so that it can serve as a barrier.
- Operate the vehicle only when in possession of a valid driver's license.
- Always drive within the speed limit.
- Do not drive if you are fatigued.
- Use flashers/hazards when locating or stopping at work areas.
- Park in a manner that will allow for safe exit from vehicle.
- All staff working adjacent to a traveled way or within a work area must wear reflective/high-visibility safety vests.

2.1.7 Inclement Weather

- This project may be conducted during months of the year in which severe storms occur at a higher frequency and develop rapidly. Personnel are to take heed of the weather forecast for the day and pay attention for signs of changing weather that indicate an impending storm. Signs include towering thunderheads, darkening skies, or a sudden increase in wind. If stormy weather ensues, field personnel should discontinue work and seek shelter until the storm has passed.
- Protective measures during a lightning storm include seeking shelter; avoiding projecting above the surrounding landscape (don't stand on a hilltop or stand under a lone tree; seek low areas); staying away from open water, metal equipment, wire fences, and metal pipes; and positioning people several yards apart.
- Remember that lightning may strike several miles from the parent cloud, so work should be stopped/restarted accordingly. If you feel your hair stand on end or smell ozone, lightning may be about to strike you. Immediately drop to your knees and bend forward—**do not** lie flat on the ground.
- Flash floods are also a concern with the high mountains surrounding the lake. Pay close attention to thunderstorms in the mountains and be aware of flash flood potential. Look for signs of floodplains.

- High winds can cause unsafe surface water conditions, and sampling activities should be halted until wind dies down. High winds can also knock over trees, so walking through forested areas during high-wind situations should be avoided. If winds increase, seek shelter or evacuate the area. Proper body protection should be worn in case the winds hit suddenly, because body temperature can decrease rapidly.

2.1.8 Uneven Walking Surfaces

- Employees walking in ditches, swales, and other drainage structures adjacent to roads or across undeveloped land must use caution to prevent slips and falls that can result in twisted or sprained ankles, knees, and backs.
- Whenever possible observe the conditions from a flat surface and do not enter a steep ditch or side of a steep road bed.
- If steep terrain must be negotiated, sturdy shoes or boots that provide ankle support should be used. The need for ladders or ropes to provide stability should be evaluated.
- Watch for icy conditions, and be aware of slips, trips, and falls.
- Wear sturdy footwear appropriate for site walk activities (that is, hiking boots or work boots).

2.2 General Hazards

2.2.1 General Practices and Housekeeping

(Reference CH2M HILL SOP HS-20, *General Practices*)

- Site work should be performed during daylight hours whenever possible. Work conducted during hours of darkness requires enough illumination intensity to read a newspaper without difficulty.
- Good housekeeping must be maintained at all times in all project work areas.
- Common paths of travel should be established and kept free from the accumulation of materials.
- Keep access to aisles, exits, ladders, stairways, scaffolding, and emergency equipment free from obstructions.
- Provide slip-resistant surfaces, ropes, and/or other devices to be used.
- Specific areas should be designated for the proper storage of materials.
- Tools, equipment, materials and supplies shall be stored in an orderly manner.
- As work progresses, scrap and unessential materials must be neatly stored or removed from the work area.
- Containers should be provided for collecting trash and other debris and shall be removed at regular intervals.
- All spills shall be quickly cleaned up. Oil and grease shall be cleaned from walking and working surfaces.

2.2.2 Hazard Communication

(Reference CH2M HILL SOP HS-05, *Hazard Communication)*

- Complete an inventory of chemicals brought onsite by CH2M HILL using Attachment 2.
- Confirm that an inventory of chemicals brought on site by CH2M HILL subcontractors is available.
- Request or confirm locations of Material Safety Data Sheets (MSDSs) from the U.S. Environmental Protection Agency (USEPA), contractors, and subcontractors for chemicals to which CH2M HILL employees potentially are exposed.
- Before or as the chemicals arrive onsite, obtain an MSDS for each hazardous chemical.
- Label chemical containers with the identity of the chemical and with hazard warnings, and store properly.

- Give employees required chemical-specific HAZCOM training using Attachment 3.

- Store all materials properly, giving consideration to compatibility, quantity limits, secondary containment, fire prevention, and environmental conditions.

2.2.3 Shipping and Transportation of Chemical Products

(Reference CH2M HILL's *Procedures for Shipping and Transporting Dangerous Goods)*

Chemicals brought to the site might be defined as hazardous materials by the U.S. Department of Transportation (DOT). All staff who ship the materials or transport them by road must receive CH2M HILL training in shipping dangerous goods. All hazardous materials that are shipped (for example, via Federal Express) or are transported by road must be properly identified, labeled, packed and documented by trained staff. Contact the HSM or the Equipment Coordinator for additional information.

2.2.4 Lifting

(Reference CH2M HILL SOP HS-29, *Lifting*)

Proper lifting techniques must be used when lifting any object, as follows:

- Split heavy loads into smaller loads
- Use mechanical lifting aids whenever possible
- Have someone assist with the lift, especially for heavy or awkward loads
- Make sure the path of travel is clear prior to the lift

2.2.5 Fire Prevention

(Reference CH2M HILL SOP HS-22, *Fire Prevention*)

- Fire extinguishers shall be provided so that the travel distance from any work area to the nearest extinguisher is less than 100 feet. When 5 gallons or more of a flammable or combustible liquid is being used, an extinguisher must be within 50 feet. Extinguishers must meet the following conditions:

  - Be maintained in a fully charged and operable condition
  - Be visually inspected each month
  - Undergo a maintenance check each year

- The area in front of extinguishers must be kept clear.

- Combustible materials stored outside should be at least 10 feet from any building.

- Solvent waste and oily rags must be kept in a fire-resistant, covered container until removed from the site.

- Flammable/combustible liquids must be kept in approved containers and must be stored in an approved storage cabinet.

2.2.6 Electrical

(Reference CH2M HILL SOP HS-23, *Electrical*)

- Do not tamper with electrical wiring and equipment unless qualified to do so. All electrical wiring and equipment must be considered energized until lockout/tagout procedures are implemented.

- Inspect electrical equipment, power tools, and extension cords for damage prior to use. Do not use defective electrical equipment; remove it from service.

- All temporary wiring, including extension cords and electrical power tools, must have ground fault circuit interrupters (GFCIs) installed.

- Extension cords must be:

- Equipped with third-wire grounding
  - Covered, elevated, or protected from damage when passing through work areas
  - Protected from pinching if routed through doorways
  - Not fastened with staples, hung from nails, or suspended with wire

- Electrical power tools and equipment must be effectively grounded or double-insulated Underwriters Laboratories, Inc. (UL)-approved.
- Operate and maintain electric power tools and equipment according to the manufacturers' instructions.
- Maintain safe clearance distances between overhead power lines and any electrical conducting material unless the power lines have been de-energized and grounded, or where insulating barriers have been installed to prevent physical contact. Maintain at least 10 feet from overhead power lines for voltages of 50 kV or less, and 10 feet plus ½-inch for every 1 kV over 50 kV.
- Temporary lights shall not be suspended by their electric cord unless designed for suspension. Lights shall be protected from accidental contact or breakage.
- Protect all electrical equipment, tools, switches, and outlets from environmental elements.

2.2.7 Heat Stress

(Reference CH2M HILL SOP HS-09, *Heat and Cold Stress*)

- Drink 16 ounces of water before beginning work. Disposable cups and water maintained at 50 to 60 ^{o}F should be available. Under severe conditions, drink 1 to 2 cups every 20 minutes, for a total of 1 to 2 gallons per day. Do not use alcohol in place of water or other nonalcoholic fluids. Decrease your intake of coffee and caffeinated soft drinks during working hours.
- Acclimate yourself by slowly increasing workloads (for example, do not begin with extremely demanding activities).
- Use cooling devices such as cooling vests to aid natural body ventilation. These devices add weight, so their use should be balanced against efficiency.
- Use mobile showers or hose-down facilities to reduce body temperature and cool protective clothing.
- Conduct field activities in the early morning or evening and rotate shifts of workers, if possible.
- Avoid direct sun whenever possible, which can decrease physical efficiency and increase the probability of heat stress. Take regular breaks in a cool, shaded area. Use a wide-brim hat or an umbrella when working under direct sun for extended periods.
- Provide adequate shelter/shade to protect personnel against radiant heat (sun, flames, hot metal).
- Maintain good hygiene standards by frequently changing clothing and showering.
- Observe one another for signs of heat stress. Persons who experience signs of heat syncope, heat rash, or heat cramps should consult the SC-HW to avoid progression of heat-related illness.

SYMPTOMS AND TREATMENT OF HEAT STRESS

	Heat Syncope	Heat Rash	Heat Cramps	Heat Exhaustion	Heat Stroke
Signs and Symptoms	Sluggishness or fainting while standing erect or immobile in heat.	Profuse tiny, raised, red, blister-like vesicles on affected areas, along with prickling sensations during heat exposure.	Painful spasms in muscles used during work (arms, legs, or abdomen); onset during or after work hours.	Fatigue, nausea, headache, giddiness; skin clammy and moist; complexion pale, muddy, or flushed; may faint on standing; rapid thready pulse and low blood pressure; oral temperature normal or low	Red, hot, dry skin; dizziness; confusion; rapid breathing and pulse; high oral temperature.
Treatment	Remove to cooler area. Rest lying down. Increase fluid intake. Recovery usually is prompt and complete.	Use mild drying lotions and powders, and keep skin clean for drying skin and preventing infection.	Remove to cooler area. Rest lying down. Increase fluid intake.	Remove to cooler area. Rest lying down, with head in low position. Administer fluids by mouth. Seek medical attention.	Cool rapidly by soaking in cool, but **not** cold, water. Call ambulance, and get medical attention immediately.

2.2.8 Cold Stress

(Reference CH2M HILL SOP HS-09, *Heat and Cold Stress*)

- Be aware of the symptoms of cold-related disorders and wear proper, layered clothing for the anticipated fieldwork. Appropriate rain gear is a must in cool weather.
- Consider monitoring the work conditions and adjusting the work schedule using guidelines developed by the U.S. Army (wind-chill index) and the National Safety Council (NSC).
- Persons who experience initial signs of immersion foot, frostbite, or hypothermia should consult the SC-HW to avoid progression of cold-related illness.
- Observe one another for initial signs of cold-related disorders.
- Obtain and review weather forecast—be aware of predicted weather systems along with sudden drops in temperature, increase in winds, and precipitation.

SYMPTOMS AND TREATMENT OF COLD STRESS

	Immersion (Trench) Foot	Frostbite	Hypothermia
Signs and Symptoms	Feet discolored and painful; infection and swelling present.	Blanched, white, waxy skin, but tissue resilient; tissue cold and pale.	Shivering, apathy, sleepiness; rapid drop in body temperature; glassy stare; slow pulse; slow respiration.
Treatment	Seek medical treatment immediately.	Remove victim to a warm place. Re-warm area quickly in warm, but **not** hot, water. Have victim drink warm fluids, but **not** coffee or alcohol. Do not break blisters. Elevate the injured area, and get medical attention.	Remove victim to a warm place. Have victim drink warm fluids, but **not** coffee or alcohol. Get medical attention.

2.3 Biological Hazards and Controls

2.3.1 Snakes

Snakes typically are found in underbrush and areas with tall grass. If you encounter a snake, stay calm and look around; there may be other snakes. Turn around and walk away on the same path you used to approach the area. If a person is bitten by a snake, wash and immobilize the injured area, keeping it lower than the heart if possible. Seek medical attention immediately. **DO NOT** apply ice, cut the wound, or apply a tourniquet. Try to identify the type of snake: note color, size, patterns, and markings.

2.3.2 Poison Ivy, Oak, and Sumac

Poison ivy, poison oak, and poison sumac typically are found in brush or wooded areas. They are more commonly found in moist areas or along the edges of wooded areas. Become familiar with the identity of these plants. Wear protective clothing that covers exposed skin and clothes. Avoid contact with plants and the outside of protective clothing. If skin contacts a plant, wash the area with soap and water immediately. If the reaction is severe or worsens, seek medical attention.

2.3.3 Ticks

Ticks typically are in wooded areas, bushes, tall grass and brush. Ticks are black, black and red, or brown and can be up to one-quarter inch in size. Wear tightly woven light-colored clothing with long sleeves and pant legs tucked into boots; spray **only outside** of clothing with permethrin or permanone and spray skin with only DEET; and check yourself frequently for ticks.

If bitten by a tick, grasp it at the point of attachment and carefully remove it. After removing the tick, wash your hands and disinfect and press the bite areas. Save the removed tick. Report the bite to Human Resources. Look for the following symptoms of Lyme disease or Rocky Mountain spotted fever:

- Lyme Disease: A rash might appear that looks like a bull's eye with a small welt in the center.
- Rocky Mountain Spotted Fever: A rash of red spots under the skin 3 to 10 days after the tick bite.

In both cases, chills, fever, headache, fatigue, stiff neck, and bone pain may develop. If symptoms appear, seek medical attention.

2.3.4 Bees and Other Stinging Insects

Bees and other stinging insects may be encountered almost anywhere and may present a serious hazard, particularly to people who are allergic. Watch for and avoid nests. Keep exposed skin to a minimum. Carry a kit if you have had allergic reactions in the past, and inform the SC-HW and/or buddy. If a stinger is present, remove it carefully with tweezers. Wash and disinfect the wound, cover it, and apply ice. Watch for allergic reaction; seek medical attention if a reaction develops.

2.3.5 Bloodborne Pathogens

(Reference CH2M HILL SOP HS-36, *Bloodborne Pathogens*)

Exposure to bloodborne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material. Exposure controls and PPE are required as specified in CH2M HILL SOP HS-36, *Bloodborne Pathogens*. Hepatitis B vaccination must be offered before the person participates in a task where exposure is a possibility.

2.4 Radiological Hazards and Controls

Refer to CH2M HILL's *Corporate Health and Safety Program, Program and Training Manual*, and *Corporate Health and Safety Program, Radiation Protection Program Manual*, for standards of practice in contaminated areas.

Hazards	Controls
None Known	None Required

2.5 Contaminants of Concern

(Refer to *Contaminant Source Summary Technical Memorandum Jan 24, 2005* for more detailed contaminant information)

Contaminant	**Location and Maximum[a] Concentration**	**Exposure Limit[b]**	**IDLH[c]**	**Symptoms and Effects of Exposure**	**PIP[d] (eV)**
Arsenic	Present in slag material	0.01 mg/m^3	5 Ca	Ulceration of nasal septum, respiratory irritation, dermatitis, gastrointestinal disturbances, peripheral neuropathy, hyperpigmentation	NA
Barium		.5 mg/m^3	50	Irritation to eyes, skin, upper respiratory system; skin burns; gastro-enteritis; slow pulse	UK
Cadmium		0.005 mg/m^3	9 Ca	Pulmonary edema, coughing, chest tightness/pain, headache, chills, muscle aches, nausea, vomiting, diarrhea, difficulty breathing, loss of sense of smell, emphysema, mild anemia	NA
Chromium		0.5 mg/m^3	25	Irritated eyes, sensitization dermatitis, histologic fibrosis of lungs	NA
Cobalt (Metal Dusts)		0.05 mg/m^3	20	Coughing; difficulty breathing; wheezing; decreased pulmonary function; diffuse nodule fibrosis; dermatitis; respiratory hypersensitivity; asthma	NA
Copper		1 mg/m^3	100	Irritation to eyes, skin, nose, and pharynx; metallic taste; dermatitis	NA
Lead		0.05 mg/m^3	100	Weakness lassitude, facial pallor, pal eye, weight loss, malnutrition, abdominal pain, constipation, anemia, gingival lead line, tremors, paralysis of wrist and ankles, encephalopathy, kidney disease, irritated eyes, hypertension	NA
Manganese		1 mg/m^3	500	Insomnia; mental confusion; metal fume fever; dry throat; cough; flu-like fever; vomit; malaise	NA
Nickel		.015 mg/m^3	10 Ca	Dermatitis; allergic asthma	NA
Zinc		5 mg/m^3	500	Chills; aches; nausea; fever; cough; dry throat; headache; blurred vision; vomit; fatigue	NA

[a] Specify sample designation and media: SB (Soil Boring), A (Air), D (Drums), GW (Groundwater), L (Lagoon), TK (Tank), S (Surface Soil), SL (Sludge), SW (Surface Water).
[b] Appropriate value of PEL, REL, or TLV listed.
[c] IDLH = immediately dangerous to life and health (units are the same as specified "Exposure Limit" units for that contaminant); NL = No limit found in reference materials; CA = Potential occupational carcinogen.
[d] PIP = photoionization potential; NA = Not applicable; UK = Unknown.

2.6 Potential Routes of Exposure

Dermal: Contact with contaminated media. This route of exposure is minimized through proper use of PPE, as specified in Section 4.0.	**Inhalation:** Vapors and contaminated particulates. This route of exposure is minimized through proper respiratory protection and monitoring, as specified in Sections 4.0 and 5.0, respectively.	**Other:** Inadvertent ingestion of contaminated media. This route should not present a concern if good hygiene practices are followed (for example, wash hands and face before drinking or smoking).

3.0 Project Organization and Personnel

3.1 CH2M HILL Employee Medical Surveillance and Training

(Reference CH2M HILL SOPs HS-01, *Medical Surveillance*, and HS-02, *Health and Safety Training)*

The employees listed below are enrolled in the CH2M HILL Comprehensive Health and Safety Program and meet state and federal hazardous waste operations requirements for 40-hour initial training, 3-day on-the-job experience, and 8-hour annual refresher training. Employees designated “SC-HW” have completed a 12-hour Safety Coordinator - Hazardous Waste course, and have documented requisite field experience. An SC-HW with a level designation (D, C, B) equal to or greater than the level of protection being used must be present during all tasks performed in exclusion or decontamination zones. Employees designated “FA-CPR” are currently certified by the American Red Cross, or equivalent, in first aid and CPR. At least one FA-CPR designated employee must be present during all tasks performed in exclusion or decontamination zones. The employees listed below are currently active in a medical surveillance program that meets state and federal regulatory requirements for hazardous waste operations. Certain tasks (for example, confined-space entry) and contaminants (for example, lead) may require additional training and medical monitoring.

Pregnant employees are to be informed of and are to follow the procedures in CH2M HILL’s SOP HS-04, *Reproduction Protection*, including obtaining a physician’s statement of the employee’s ability to perform hazardous activities before being assigned fieldwork.

Employee Name	Office	Responsibility	SC-HW/FA-CPR
John Culley	SPK	Sampling Team Leader/SC-HW/Health and Safety Manager	Level C SC-HW; FA-CPR
Glen Vedera	SEA	Field Team Leader/SC-HW	Level C SC-HW; FA-CPR
Josh Butler	BOI	Field Team Leader/SC-HW	Level C SC-HW; FA-CPR
Greg Warren	BOI	Field Team Leader/SC-HW	Level C SC-HW; FA-CPR
Jeff Franklin	BOI	Field Team Leader/SC-HW	Level C SC-HW; FA-CPR
Jim Crawford	SEA	Field Team Leader/SC-HW	Level C SC-HW; FA-CPR
Jeff Schut	CVO	Field Team Leader/SC-HW	Level C SC-HW; FA-CPR
Alan Chang	CVO	Field Team Leader/SC-HW	Level C SC-HW; FA-CPR
Evan Gray	SEA	Field Team Leader/SC-HW	Level C SC-HW; FA-CPR
Brad Paulson	SEA	Field Team Leader/SC-HW	Level C SC-HW; FA-CPR
Arrie Symmes	SPK	Field Team Member	FA-CPR
Nathan Williams	SPK	Field Team Member	FA-CPR
Greg Morgan	SPK	Field Team Member	FA-CPR

The staff listed below will not be required to have current 40-hour HAZWOPER training, nor be medically monitored (that is, vessel skippers, onsite administrative support, sample preparation/packaging staff, and field operations support) because they will not be handling potentially contaminated material.

Employee Name	Office	Responsibility	Training
Nahide Gulensoy	SPK	Field Team Member	Field Awareness Training
Cultural Resource Staff	Colville Tribe	Archeologist	24hr Hazwoper
Cultural Resource Staff	Spokane Tribe	Archeologist	24hr Hazwoper

3.2 Field Team Chain of Command and Communication Procedures

3.2.1 Environmental Protection Agency

Contact Name: Task Order Project Officers, Kevin Rochlin/Sally Thomas
Phone: 206-553-2106/2101

3.2.2 CH2M HILL

Project Manager: Jim Stefanoff/SPK
Health and Safety Manager (HSM): John Culley/SPK
Sampling Team Leader/SC-HW: John Culley/SPK

The SC-HW is responsible for contacting the Field Team Leader and Project Manager. In general, the Project Manager will contact USEPA. The HSM should be contacted as appropriate.

3.2.3 CH2M HILL Subcontractors

(Reference CH2M HILL SOP HS-55, *Subcontractor, Contractor, and Owner*)

Subcontractor: Ecology and Environment
Subcontractor Contact Name: Mark Longtine
Telephone: 206/624-9537
Subcontractor Task(s): Field Support **Safety Procedures Required:** None (This subcontractor is covered by this HSP, and must comply with all requirements according to CH2M HILL standards)

Subcontractor: E2
Subcontractor Contact Name: Rich Creed
Telephone: 509/946-0341
Subcontractor Task(s): Field Support **Safety Procedures Required:** None (This subcontractor is covered by this HSP, and must comply with all requirements according to CH2M HILL standards)

Subcontractor: Whiteshield
Subcontractor Contact Name: Stuart Fricke
Telephone: 509/734-0789
Subcontractor Task(s): Field Support **Safety Procedures Required:** None (This subcontractor is covered by this HSP, and must comply with all requirements according to CH2M HILL standards)

Subcontractor: **TBD**
Subcontractor Contact:
Phone:
Subcontractor Tasks: Vibracore
Safety Procedures Required: Subcontractor must have their company's safe operating procedures onsite when field activities commence, or complete the AHA in Attachment 6.

Subcontractor: Elcon
Subcontractor Contact: Brook Ellingwood
Phone: 509/926-8366
Subcontractor Tasks: Vessel Operators (skippers)
Safety Procedures Required: Written safety procedures for boating operations and inspection checklists must be onsite during field activities.

Subcontractor: Zephyer
Subcontractor Contact: Matt Cuplip
Phone: 510/914-0157
Subcontractor Tasks: Vessel Operators (skippers)
Safety Procedures Required: Written safety procedures for boating operations and inspection checklists must be onsite during field activities.

The subcontractors listed above are covered by this HSP and must be provided a copy of this plan. However, this plan does not address hazards associated with the tasks and equipment that the subcontractor has expertise in (for example, drilling, excavation work, electrical). Subcontractors are responsible for the health and safety procedures specific to their work and are required to submit these procedures to CH2M HILL for review before the start of field work. Subcontractors must comply with the established health and safety plan(s). The CH2M HILL SC-HW should verify that subcontractor employee training, medical clearance, and fit test records are current and must monitor and enforce compliance with the established plan(s) CH2M HILL's oversight does not relieve subcontractors of their responsibility for effective implementation and compliance with the established plan(s).

CH2M HILL should continuously endeavor to observe subcontractors' safety performance. This endeavor should be reasonable, and include observing for hazards or unsafe practices that are both readily observable and occur in common work areas. CH2M HILL is not responsible for exhaustive observation for hazards and unsafe practices. In addition to this level of observation, the SC-HW is responsible for confirming CH2M HILL subcontractor performance against both the subcontractor's safety plan and applicable self-assessment checklists. Self-assessment checklists contained in Attachment 5 are to be used by the SC-HW to review subcontractor performance.

Health and safety related communications with CH2M HILL subcontractors should be conducted as follows:

- Brief subcontractors on the provisions of this plan and require them to sign the Employee Signoff Form included in Attachment 1.
- Request subcontractor(s) to brief the project team on the hazards and precautions related to their work.
- When apparent noncompliance or unsafe conditions or practices are observed, notify the subcontractor safety representative and require corrective action – the subcontractor is responsible for determining and implementing necessary controls and corrective actions.
- When repeat noncompliance or unsafe conditions are observed, notify the subcontractor safety representative and stop affected work until adequate corrective measures are implemented.
- When an apparent imminent danger exists, immediately remove all affected CH2M HILL employees and subcontractors, notify subcontractor safety representative, and stop affected work until adequate corrective measures are implemented. Notify the Project Manager and HSM as appropriate.
- Document all oral health and safety-related communications in project the field logbook, daily reports, or other records.

3.2.4 Third-Party Contractors

(Reference CH2M HILL SOP HS-55, *Subcontractor, Contractor, and Owner*)

Contractor: **TBD**
Contractor Contact Name:
Telephone:

This plan does not cover contractors who are contracted directly to USEPA. CH2M HILL is not responsible for the health and safety or means and methods of the contractor's work, and we must never assume such responsibility through our actions (for example, advising on health and safety issues). In addition to this plan, CH2M HILL staff should review contractor safety plans so that we remain aware of appropriate precautions that apply to us. Except in unusual situations when conducted by the HSM, CH2M HILL must never comment on or approve contractor safety procedures. Self-assessment checklists contained in Attachment 5 are to be used by the SC-HW to review the contractor's performance ONLY as it pertains to evaluating our exposure and safety.

Health and safety-related communications with contractors should be conducted as follows:

- Request the contractor to brief CH2M HILL employees and subcontractors on the precautions related to the contractor's work.
- When an apparent contractor noncompliance or unsafe condition or practice poses a risk to CH2M HILL employees or subcontractors, take the following actions:
  - Notify the contractor safety representative
  - Request that the contractor determine and implement corrective actions
  - If needed, stop affected CH2M HILL work until contractor corrects the condition or practice. Notify USEPA, the Project Manager, and the HSM as appropriate.
- If apparent contractor noncompliance or unsafe conditions or practices are observed, inform the contractor safety representative. Our obligation is limited strictly to informing the contractor of our observation—the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- If an apparent imminent danger is observed, immediately warn the contractor employee(s) in danger and notify the contractor safety representative. Our obligation is limited strictly to immediately warning the affected individual(s) and informing the contractor of our observation—the contractor is solely responsible for determining and implementing necessary controls and corrective actions.
- Document all oral health and safety related communications in the project field logbook, daily reports, or other records.

4.0 Personal Protective Equipment (PPE)

(Reference CH2M HILL SOP HS-07, *Personal Protective Equipment*, HS-08, *Respiratory Protection*)

PPE Specifications [a]

Task	Level	Body	Head	Respirator [b]
• Sample preparation and packaging for shipment • Onsite administrative support • Field operations support (that is, sample runner and gathering supplies) • Surveying/Field Recon	N/A	Work clothes; steel-toe, leather work boots; work gloves.	Hardhat [c] Safety glasses Ear protection [d]	None required
• Vibracore • Sediment sampling	Modified D	**Coveralls:** Cotton coveralls, or uncoated Tyvek if cannot be kept clean **Body:** Personal floatation device if working from vessel or along shoreline with steep embankment. **Boots:** Steel-toe safety boots, leather or chemically resistant soles. **Gloves:** Surgical-style nitrile chemical-resistant gloves. * Specialized PPE for inclement weather if necessary (for example, rain gear and cold weather gear)	Hardhat [c] Safety glasses Ear protection [d]	None required

Reasons for Upgrading or Downgrading Level of Protection

Upgrade[e]	Downgrade
• Request from individual performing tasks. • Change in work tasks that will increase contact or potential contact with hazardous materials. • Occurrence or likely occurrence of gas or vapor emission. • Known or suspected presence of dermal hazards. • Instrument action levels (Section 5.0) exceeded.	• New information indicating that situation is less hazardous than originally thought. • Change in site conditions that decreases the hazard. • Change in work task that will reduce contact with hazardous materials.

[a] Modifications are as indicated. CH2M HILL will provide PPE only to CH2M HILL employees.
[b] No facial hair that would interfere with respirator fit is permitted.
[c] Hardhat and splash-shield areas are to be determined by the SC-HW.
[d] Ear protection should be worn when conversations cannot be held at distances of 3 feet or less without shouting.
[e] Performing a task that requires an upgrade to a higher level of protection (for example, Level D to Level C) is permitted only when the PPE requirements have been approved by the HSM and an SC-HW qualified at that level is present.

5.0 Air Monitoring/Sampling

(Reference CH2M HILL SOP HS-06, *Air Monitoring)*

5.1 Air Monitoring Specifications

Instrument	Tasks	Action Levels[a]		Frequency [b]	Calibration
Dust Monitor: Visual	• Vibracore • Sediment sampling	Visual Dust→	Initiate dust control methods (for example, apply water mist).	Initially and periodically during tasks	N/A

[a] Action levels apply to sustained breathing-zone measurements above background.
[b] The exact frequency of monitoring depends on field conditions and is to be determined by the SC-HW; generally, every 5 to 15 minutes if acceptable; more frequently may be appropriate. Monitoring results should be recorded. Documentation should include instrument and calibration information, time, measurement results, personnel monitored, and place/location where measurement is taken (for example, "Breathing Zone/MW-3", "at surface/SB-2").

5.2 Calibration Specifications

(Refer to the respective manufacturer's instructions for proper instrument maintenance procedures)

Instrument	Gas	Span	Reading	Method

NOT APPLICABLE

5.3 Air Sampling

Sampling, in addition to real-time monitoring, may be required by other Occupational Safety and Health Administration (OSHA) regulations where there may be exposure to certain contaminants. Air sampling typically is required when site contaminants include lead, cadmium, arsenic, asbestos, and certain volatile organic compounds (VOCs). Contact the HSM immediately if these contaminants are encountered.

Method Description

Not required at this time. If conditions change (that is, increase in contaminant levels, more invasive activities are performed, or media to be sampled has a greater potential to become airborne) and the exposure potential increases, then air sampling may be required.

6.0 Decontamination

(Reference CH2M HILL SOP HS-13, *Decontamination*)

The SC-HW must establish and monitor the decontamination procedures and their effectiveness. Decontamination procedures found to be ineffective will be modified by the SC-HW. The SC-HW must ensure that procedures are established for disposing of materials generated on the site.

6.1 Decontamination Specifications

Personnel	Sample Equipment	Heavy Equipment
• Boot wash/rinse • Glove wash/rinse • Outer glove removal • Body suit removal • Inner glove removal • Respirator removal • Hand wash/rinse • Face wash/rinse • Shower ASAP • Dispose of PPE in municipal trash, or contain for disposal • Dispose of personnel rinse water to facility or sanitary sewer, or contain for offsite disposal	• Wash/rinse equipment • Solvent rinse equipment • Contain solvent waste for offsite disposal • Dispose of decontamination water to facility or sanitary sewer, or contain for offsite disposal	• Power wash • Steam clean • Dispose of equipment rinse water to facility or sanitary sewer, or contain for offsite disposal

6.2 Diagram of Personnel Decontamination Line

No eating, drinking, or smoking is permitted in contaminated areas and in exclusion or decontamination zones. The SC-HW should establish areas for eating, drinking, and smoking. Contact lenses are not permitted in exclusion or decontamination zones.

Figure 6-1 illustrates a conceptual establishment of work zones, including the decontamination line. Work zones are to be modified by the SC-HW to accommodate task-specific requirements.

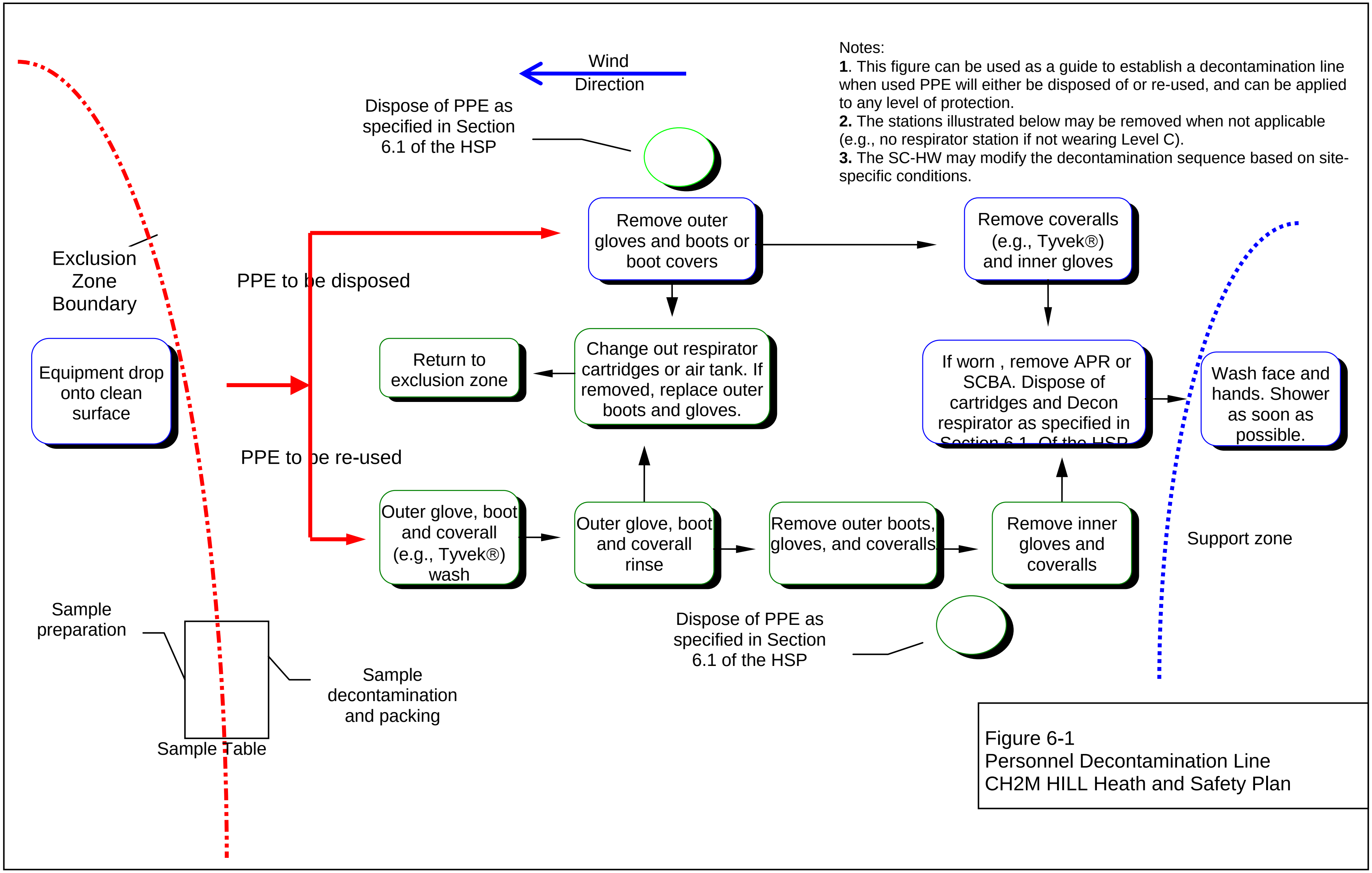

Figure 6-1
Personnel Decontamination Line
CH2M HILL Heath and Safety Plan

7.0 Spill-Containment Procedures

Sorbent material will be maintained in the support zone. Incidental spills will be contained with sorbent material and disposed of properly.

8.0 Site Control Plan

8.1 Site Control Procedures

(Reference CH2M HILL SOP HS-11, *Site Control)*

- The SC-HW will conduct a site safety briefing (see below) before starting field activities or as tasks and site conditions change.
- Topics for briefing on site safety: general discussion of HSP, site-specific hazards, locations of work zones, PPE requirements, equipment, special procedures, emergencies.
- The SC-HW records attendance at safety briefings in a logbook and documents the topics discussed.
- Establish support, decontamination, and exclusion zones. Delineate with flags or cones as appropriate. Support zone should be upwind of the site. Use access control at entry and exit from each work zone.
- Establish onsite communication consisting of the following:
  - Line-of-sight and hand signals
  - Air horn
  - Two-way radio or cellular telephone if available
- Establish offsite communication.
- Establish and maintain the “buddy system.”
- Initial air monitoring is conducted by the SC-HW in appropriate level of protection.
- The SC-HW is to conduct periodic inspections of work practices to determine the effectiveness of this plan – refer to Sections 2.0 and 3.0. Deficiencies are to be noted, reported to the HSM, and corrected. ttt

8.2 HAZWOPER Compliance Plan

(Reference CH2M HILL SOP HS-19, *Site-Specific Written Safety Plans)*

Certain parts of the site are covered by state or federal HAZWOPER standards and therefore require training and medical monitoring. Anticipated HAZWOPER tasks (Section 1.1.1) might occur consecutively or concurrently with respect to non-HAZWOPER tasks. This section lists procedures to be followed when approved activities specified in Section 1.1.2 do not require 24- or 40-hour training. Non-HAZWOPER-trained personnel also must be trained in accordance with all other state and federal OSHA requirements.

- In many cases, air sampling, in addition to real-time monitoring, must confirm that there is no exposure to gases or vapors before non-HAZWOPER-trained personnel are allowed on the site, or while non-HAZWOPER-trained staff are working in proximity to HAZWOPER activities. Other data (for example, soil) also must document that there is no potential for exposure. The HSM must approve the interpretation of these data. Refer to subsections 2.5 and 5.3 for contaminant data and air sampling requirements, respectively.
- When non-HAZWOPER-trained personnel are at risk of exposure, the SC-HW must post the exclusion zone and inform non-HAZWOPER-trained personnel of the following:
  - Nature of the existing contamination and its locations
  - Limitations of their access
  - Emergency action plan for the site
- When exposure is possible, non-HAZWOPER-trained personnel must be removed from the site until it can be demonstrated that there is no longer a potential for exposure to health and safety hazards.

9.0 Emergency Response Plan

(Reference CH2M HILL, SOP HS-12, *Emergency Response*)

9.1 Pre-Emergency Planning

The SC-HW will perform applicable pre-emergency planning tasks before starting field activities and coordinates emergency response with CH2M HILL onsite parties, the support facilities (for example, marinas), and local emergency service providers as appropriate. Pre-emergency planning tasks include the following:

Emergency Contacts

National Park Service
Monitors Marine-band Channel 16 (Can be used to contact NPS in the event of an emergency)

All CH2M HILL sampling vessels will remain on Channel 16 to monitor lake emergencies. In the event that non-emergency communication is necessary between vessels, the skipper or Field Team Leader will direct the desired vessel to switch to Channel 68.

Stevens County Dispatch – 509/684-2555
(from Hunters to Canadian Border)

In the event of an emergency, this number should also be used. The dispatcher will command emergency services to a proposed location with respect to your position on the lake. Maps are provided in your vessel kits to identify the rendezvous location

Lincoln County Dispatch – 509/725-3501
(from Hunters to Coulee Dam)

In the event of an emergency, this number should also be used. The dispatcher will command emergency services to a proposed location with respect to your position on the lake. Maps are provided in your vessel kits to identify the rendezvous location

Alternates
Spokane Tribe Fire Emergency – 509/258-4566
Colville Tribe Fire Emergency – 509/634-3100

Safety Coordinator (SC-HW) and/or Sample Processing Station
Name: John Culley/SPK (206) 660-3367

Will remain on Channel 16 to monitor lake emergencies. In the event that non-emergency communication is necessary between vessels and this station, this will be achieved on Channel 68.

Project Manager
Name: Jim Stefanoff/SPK or Chuck Gruenenfelder/SPK
Phone: 509/747-2000

Hospital Name/Address: Mount Carmel Hospital — **Hospital Phone #:** (509) 684-2561
982 E. Columbia Street, COLVILLE, WA
or
Lincoln Hospital — **Hospital Phone #:** (509) 725-7101
10 Nichols Street, Davenport, WA
or
Coulee Community Hospital — **Hospital Phone #:** (509) 633-1753
Address 411 Fortuyn Rd, Grand Coulee, WA

- Determine what offsite communication equipment is needed (for example, nearest telephone, cell phone).
- Confirm and post emergency telephone numbers, evacuation routes, assembly areas, and route to hospital; communicate the information to onsite personnel.
- Review changed site conditions, onsite operations, and personnel availability in relation to emergency response procedures.
- Where appropriate and acceptable to USEPA, inform emergency room and ambulance and emergency response teams of anticipated types of site emergencies.
- Inventory and check site emergency equipment, supplies, and potable water.
- Communicate emergency procedures for personnel injury, exposures, fires, explosions, and releases.
- Rehearse the emergency response plan before site activities begin, including driving route to hospital.
- Brief new workers on the emergency response plan.

The SC-HW will evaluate emergency response actions and initiate appropriate follow-up actions.

9.2 Emergency Equipment and Supplies

The SC-HW should mark the locations of emergency equipment on the site map and post the map.

Emergency Equipment and Supplies	Location
20-lb (or two 10-lb) fire extinguisher (A, B, and C classes)	Required On Board Vessel and in Ground-Based Sampling Vehicle
First aid kit	Support Zone/Field Vehicle/Vessel
Potable water	Support & Decon Zone/Field Vehicle/Vessel
Bloodborne-pathogen kit	Support Zone/Field Vehicle/Vessel
Cellular phones and marine-band radios	Support Zone/Field Vehicle/Vessel

9.3 Incident Response

In fires, explosions, or chemical releases, actions to be taken include the following:

- Shut down CH2M HILL operations and evacuate the immediate work area.
- Notify appropriate response personnel.
- Account for personnel at the designated assembly area(s).
- Assess the need for site evacuation, and evacuate the site as warranted.

9.4 Emergency Medical Treatment

The emergency procedures listed below may also be applied to non-emergency incidents. Injuries and illnesses (including overexposure to contaminants) must be reported to Human Resources (See Attachment 4). If there is doubt about whether medical treatment is necessary, or if the injured person is reluctant to accept medical treatment, contact the CH2M HILL medical consultant. During non-emergencies, follow these procedures as appropriate.

- Notify appropriate emergency response authorities listed in Section 9.1
- The Field Team Leader of the specific crew will assume charge during a medical emergency until the ambulance arrives or until the injured person is admitted to the emergency room.
- Prevent further injury.
- Initiate first aid and CPR where feasible.

- Get medical attention immediately.
- Perform decontamination where feasible; lifesaving and first aid or medical treatment take priority.
- Make certain that the injured person is accompanied to the emergency room.
- When contacting the medical consultant, state that the situation is a CH2M HILL matter, and give your name and telephone number, the name of the injured person, the extent of the injury or exposure, and the name and location of the medical facility where the injured person was taken.

9.5 Evacuation

- Evacuation routes and assembly areas (and alternative routes and assembly areas) are specified on the site map.
- Evacuation route(s) and assembly area(s) will be designated by the SC-HW before work begins.
- Personnel will assemble at the assembly area(s) upon hearing the emergency signal for evacuation.
- The SC-HW and a “buddy” will remain on the site after the site has been evacuated (if safe) to assist local responders and advise them of the nature and location of the incident.
- The SC-HW will account for all personnel in the onsite assembly area.
- A designated person will account for personnel at alternate assembly area(s).

9.6 Evacuation Signals

Signal	Meaning
Grasping throat with hand	Emergency—help me.
Thumbs up	OK; understood.
Continuous sounding of horn	Emergency; leave site now.

9.7 Incident Notification and Reporting

- Upon any project incident (for example, fire, spill, injury, near miss, death), immediately notify the Project Manager and HSM. Call emergency beeper number if the HSM is unavailable.
- For CH2M HILL work-related injuries or illnesses, contact and help the Human Resources administrator complete an Incident Report Form (IRF). An IRF must be completed within 24 hours of the incident.
- For CH2M HILL subcontractor incidents, complete the Subcontractor Accident/Illness Report Form and submit to the HSM.
- Notify and submit reports to USEPA as required in the contract.

10.0 Approval

This site-specific HSP has been written for use by CH2M HILL only. CH2M HILL claims no responsibility for its use by others unless that use has been specified and defined in project or contract documents. The plan is written for the specific site conditions, purposes, dates, and personnel specified and must be amended if those conditions change.

10.1 Original Plan

Written By: John Culley/SPK **Date:** January 2005

Approved By:  **Date: March 15, 2005**

John Culley/SPK

10.2 Revisions

Revisions Made By: **Date:**

Revisions to Plan:

Revisions Approved By: **Date:**

11.0 Attachments

HEALTH AND SAFETY PLAN

Attachment 1. Employee Signoff Form

CH2MHILL

SIGNOFF FORM

Health and Safety Plan

- The CH2M HILL project employees and subcontractors listed below have been provided with a copy of this HSP, have read and understood it, and agree to abide by its provisions.

Project Name: Upper Columbia RI Phase 1 **Project Number:** 315904

EMPLOYEE NAME (Please print)	**EMPLOYEE SIGNATURE**	**COMPANY**	**DATE**

HEALTH AND SAFETY PLAN

Attachment 2. Project-Specific Chemical Product Hazard Communication Form

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Project-Specific Chemical Product Hazard Communication Form

This form must be completed prior to performing activities that expose personnel to hazardous chemicals products. Upon completion of this form, the SC-HW shall verify that training is provided on the hazards associated with these chemicals and the control measures to be used to prevent exposure to CH2M HILL and subcontractor personnel. Labeling and MSDS systems will also be explained.

Project Name: Upper Columbia RI Phase 1 **Project Number:** 315904

MSDSs will be maintained at the following location(s):

Hazardous Chemical Products Inventory

Chemical	Quantity	Location	MSDS Available	Container labels	
				Identity	Hazard
Nitric acid	< 500 ml	Support Zone / sample bottles			
Methanol	< 1 Gallon	Support/Decon Zones			
Hexane	< 1 Gallon	Support/Decon Zones			
Alconox/Liquinox	< 1liter	Support/Decon Zones			

Refer to SOP HS-05 *Hazard Communication* for more detailed information.

HEALTH AND SAFETY PLAN

Attachment 3. Chemical-Specific Training Form

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CHEMICAL-SPECIFIC TRAINING FORM

Location:	Project #: 315904
HCC:	Trainer:

TRAINING PARTICIPANTS:

NAME	SIGNATURE	NAME	SIGNATURE

REGULATED PRODUCTS/TASKS COVERED BY THIS TRAINING:

The HCC shall use the product MSDS to provide the following information concerning each of the products listed above.

- ☐ Physical and health hazards
- ☐ Control measures that can be used to provide protection (including appropriate work practices, emergency procedures, and personal protective equipment to be used)
- ☐ Methods and observations used to detect the presence or release of the regulated product in the workplace (including periodic monitoring, continuous monitoring devices, visual appearance or odor of regulated product when being released, etc.)

Training participants shall have the opportunity to ask questions concerning these products and, upon completion of this training, will understand the product hazards and appropriate control measures available for their protection.

Copies of MSDSs, chemical inventories, and CH2M HILL's written hazard communication program shall be made available for employee review in the facility/project hazard communication file.

HEALTH AND SAFETY PLAN

Attachment 4. Emergency Contacts

Emergency Contacts

24-hour CH2M HILL Emergency Beeper – 888/444-1226

Medical Emergency See Below	**CH2M HILL Medical Consultant** Health Resources Dr. Jerry H. Berke, M.D., M.P.H. 600 West Cummings Park, Suite 3400 Woburn, MA 01801-6350 1-781-938-4653 or 1-800-350-4511 **(After hours calls will be returned within 20 minutes)**
Fire/Spill Emergency See Below	**Local Occupational Physician** N/A
Security & Police See Below	**Corporate Director Health and Safety** Name: Dave Waite/SEA Phone: 425/453-5000 **24-hour emergency beeper: 888-444-1226**
Utilities Emergency Water: N/A Gas: N/A Electric: N/A	**Regional Health & Safety Manager (HSM)** Name: John Culley/SPK Phone: 509/747-2000
Safety Coordinator (SC-HW) Name: John Culley/SPK Phone: 509/747-2000	**Regional Human Resources Department** Name: Holly Michel/SEA Phone: 425/453-5000
Project Manager Name: Jim Stefanoff/SPK Phone: 509/747-2000	**Corporate Human Resources Department** Name: Pete Hannan/COR Phone: 303/771-0900
Federal Express Dangerous Goods Shipping Phone: 800/238-5355 **CH2M HILL Emergency Number for Shipping Dangerous Goods** Phone: 800/255-3924	**Worker's Compensation:** Contact Regional HR dept. to have form completed or contact Julie Zimmerman after hours: 303/664-3304 **Automobile Accidents:** Rental: Carol Dietz/COR 303/713-2757 CH2M HILL owned vehicle: Zurich Insurance Co. 1-800/987-3373

National Park Service

Monitors Marine-band Channel 16 (Can be used to contact NPS in the event of an emergency)

All CH2M HILL sampling vessels will remain on Channel 16 to monitor lake emergencies. In the event that non-emergency communication is necessary between vessels, the skipper or Field Team Leader will direct the desired vessel to switch to Channel 68.

Stevens County Dispatch – 509/684-2555
(from Hunters to Canadian Border)

In the event of an emergency, this number should also be used. The dispatcher will command emergency services to a proposed location with respect to your position on the lake. Maps are provided in your vessel kits to identify the rendezvous location

Lincoln County Dispatch – 509/725-3501
(from Hunters to Coulee Dam)

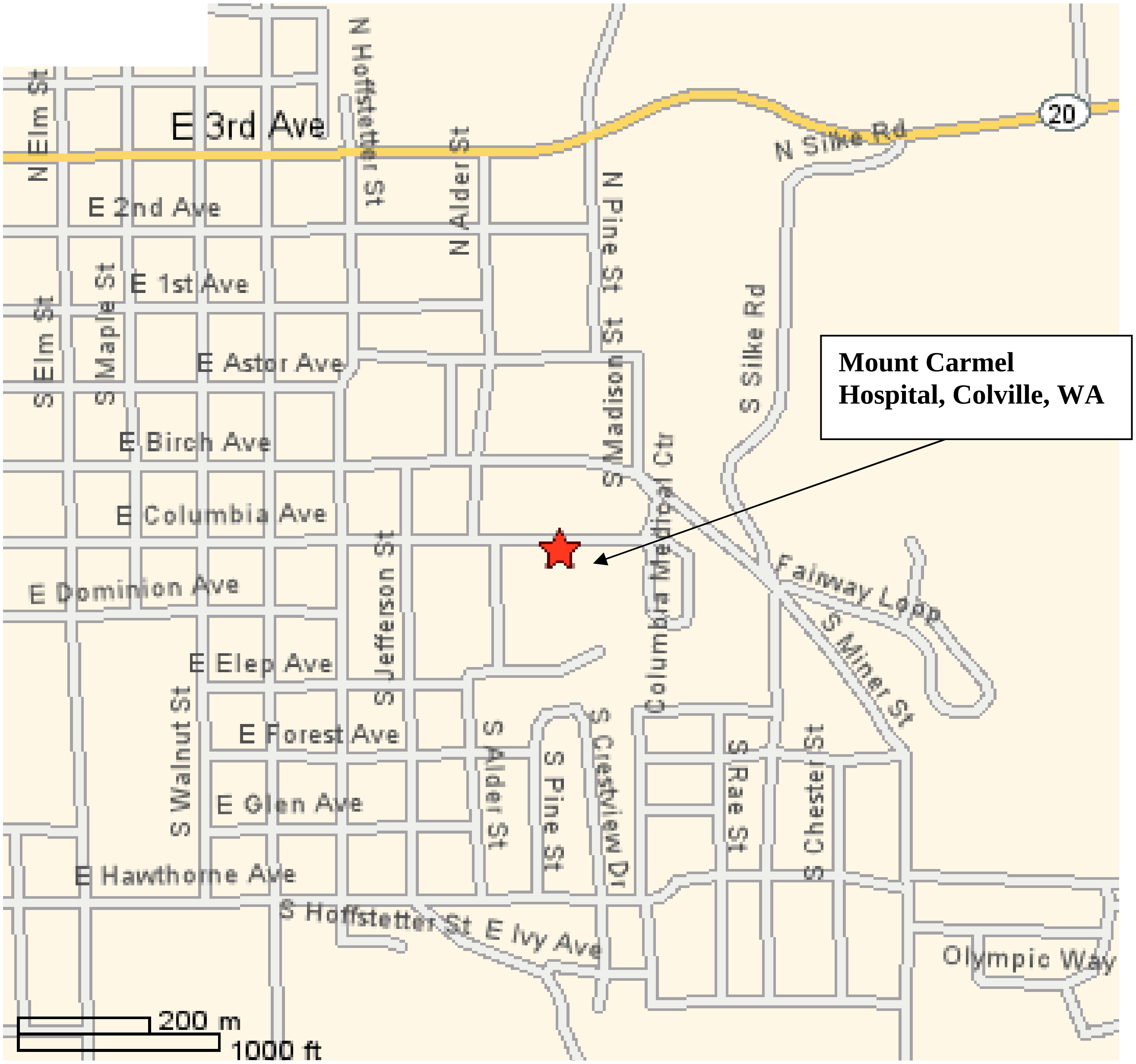
In the event of an emergency, this number should also be used. The dispatcher will command emergency services to a proposed location with respect to your position on the lake. Maps are provided in your vessel kits to identify the rendezvous location

Alternates
Spokane Tribe Fire Emergency – 509/258-4566
Colville Tribe Fire Emergency – 509/634-3100

Hospital Name/Address: Mount Carmel Hospital 982 E. Columbia Street, COLVILLE, WA or	**Hospital Phone #:** (509) 684-2561
Lincoln Hospital 10 Nichols Street, Davenport, WA or	**Hospital Phone #:** (509) 725-7101
Coulee Community Hospital Address 411 Fortuyn Rd, Grand Coulee, WA	**Hospital Phone #:** (509) 633-1753

Directions to Hospital

See maps next page


Mount Carmel
Hospital, Colville, WA
E 3rd Ave
20
N Silke Rd
N Elm St
E 2nd Ave
N Hoffstetter St
N Alder St
N Pine St
E 1st Ave
S Elm St
S Maple St
E Astor Ave
S Madison St
S Silke Rd
E Birch Ave
Columbia Medical Ctr
E Columbia Ave
E Dominion Ave
Fairway Loop
S Miner St
E Elep Ave
S Jefferson St
S Walnut St
E Forest Ave
S Alder St
S Pine St
S Crestview Dr
S Rae St
S Chester St
E Glen Ave
E Hawthorne Ave
S Hoffstetter St
E Ivy Ave
Olympic Way
200 m
1000 ft


Lincoln Hospital
Davenport, WA
Creston View Rd N
McInnis Rd N
Wheatland Rd N
8th St
7th St
5th St
Ross St
11th St
Sinclair St
E 4th St
Nichols St
3rd St
2nd St
1st St
Sunset Hwy Rd E
Old St 2
25
2
Logan St
Morgan St
Davenport
Park St
9th St
6th St
Merriam St
10th St
Marshall St
Maxwell St
Main St
200 m
1000 ft

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HEALTH AND SAFETY PLAN

Attachment 5. Project Activity Self-Assessment Checklists

H&S Self-Assessment Checklist - DRILLING/VIBRACORING

This checklist shall be used by CH2M HILL personnel **only** and shall be completed at the frequency specified in the project's Health and Safety Plan/Field Safety Instructions (HSP/FSI).

This checklist is to be used at locations where: 1) CH2M HILL employees are potentially exposed to hazards associated with drilling operations (complete Sections 1 and 3), and/or 2) CH2M HILL oversight of a drilling subcontractor is required (complete entire checklist).

SC-HW may consult with drilling subcontractors when completing this checklist, but shall not direct the means and methods of drilling operations nor direct the details of corrective actions. Drilling subcontractors shall determine how to correct deficiencies and we must carefully rely on their expertise. Items considered to be imminently dangerous (possibility of serious injury or death) shall be corrected immediately or all exposed personnel shall be removed from the hazard until corrected.

Completed checklists shall be sent to the Health and Safety Manager for review.

Project Name: ____ Project No.: ______________________

Location: ____ PM: ___________________________________

Auditor: __________________________________ Title: ____________________________ Date: _____________

This specific checklist has been completed to:

☐ Evaluate CH2M HILL employee exposures to drilling hazards
☐ Evaluate a CH2M HILL subcontractor's compliance with drilling H&S requirements
Subcontractors Name: ____

- Check "Yes" if an assessment item is complete/correct.
- Check "No" if an item is incomplete/deficient. Deficiencies shall be brought to the immediate attention of the drilling subcontractor. Section 3 must be completed for all items checked "No."
- Check "N/A" if an item is not applicable.
- Check "N/O" if an item is applicable but was not observed during the assessment.

Numbers in parentheses indicate where a description of this assessment item can be found in Standard of Practice HS-35.

SECTION 1	Yes	No	N/A	N/O
PERSONNEL SAFE WORK PRACTICES (3.1)				
1. Only authorized personnel operating drill rig	☐	☐	☐	☐
2. Personnel cleared during rig startup	☐	☐	☐	☐
3. Personnel clear of rotating parts	☐	☐	☐	☐
4. Personnel not positioned under hoisted loads	☐	☐	☐	☐
5. Loose clothing and jewelry removed	☐	☐	☐	☐
6. Personnel instructed not to approach equipment that has become electrically energized	☐	☐	☐	☐
7. Smoking is prohibited around drilling operation	☐	☐	☐	☐
8. Personnel wearing appropriate PPE, per HSP/FSI	☐	☐	☐	☐

SECTION 2	Yes	No	N/A	N/O
GENERAL (3.2.1)				
9. Daily safety briefing/meeting conducted with crew	☐	☐	☐	☐
10. Daily inspection of drill rig and equipment conducted before use	☐	☐	☐	☐
DRILL RIG PLACEMENT (3.2.2)				
11. Location of underground utilities identified	☐	☐	☐	☐
12. Safe clearance distance maintained from overhead powerlines	☐	☐	☐	☐
13. Drilling pad established, when necessary	☐	☐	☐	☐
14. Drill rig leveled and stabilized	☐	☐	☐	☐
DRILL RIG TRAVEL (3.2.3)				
15. Rig shut down and mast lowered and secured prior to rig movement	☐	☐	☐	☐
16. Tools and equipment secured prior to rig movement	☐	☐	☐	☐
17. Only personnel seated in cab are riding on rig during movement	☐	☐	☐	☐
18. Safe clearance distance maintained while traveling under overhead powerlines	☐	☐	☐	☐
19. Backup alarm or spotter used when backing rig	☐	☐	☐	☐
DRILL RIG OPERATION (3.2.4)				
20. Kill switch clearly identified and operational	☐	☐	☐	☐
21. All machine guards are in place	☐	☐	☐	☐
22. Rig ropes not wrapped around body parts	☐	☐	☐	☐
23. Pressurized lines and hoses secured from whipping hazards	☐	☐	☐	☐
24. Drill operation stopped during inclement weather	☐	☐	☐	☐
25. Air monitoring conducted per HSP/FSI for hazardous atmospheres	☐	☐	☐	☐
26. Rig placed in neutral when operator not at controls	☐	☐	☐	☐
DRILL RIG MAINTENANCE (3.2.5)				
27. Defective components repaired immediately	☐	☐	☐	☐
28. Lockout/tagout procedures used prior to maintenance	☐	☐	☐	☐
29. Cathead in clean, sound condition	☐	☐	☐	☐
30. Drill rig ropes in clean, sound condition	☐	☐	☐	☐
31. Fall protection used for fall exposures of 6 feet or greater	☐	☐	☐	☐
32. Rig in neutral and augers stopped rotating before cleaning	☐	☐	☐	☐
33. Good housekeeping maintained on and around rig	☐	☐	☐	☐
DRILLING AT HAZARDOUS WASTE SITES (3.2.6)				
34. Waste disposed of according to HSP	☐	☐	☐	☐
35. Appropriate decontamination procedures being followed, per HSP	☐	☐	☐	☐

<u>SECTION 3</u>

Complete this section for all items checked “No” in Sections 1 or 2. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

HEALTH AND SAFETY PLAN

Attachment 6. Behavior Based Loss Prevention System Forms (AHA and Pre-Task Safety Plan)

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ACTIVITY HAZARD ANALYSIS (p. 1 of 4)

Activity:	**Date:**
	Project:
Description of the work:	**Site Supervisor:**
	Site Safety Officer:
	Review for latest use: **Before the job is performed.**

Work Activity Sequence (Identify the principal steps involved and the sequence of work activities)	**Potential Health and Safety Hazards** (Analyze each principal step for potential hazards)	**Hazard Controls** (Develop specific controls for each potential hazard)

ACTIVITY HAZARD ANALYSIS (p. 2 of 4)

Work Task Sequence (Identify the principal steps involved and the sequence of work activities)	**Identify & Analyze the Hazards** (Analyze each principal step for potential hazards)	**Hazard Controls** **(**Develop specific controls for each potential hazard)

ACTIVITY HAZARD ANALYSIS (p. 3 of 4)

Equipment to be used (List equipment to be used in the work activity)	Inspection Requirements (List inspection requirements for the work activity)	Training Requirements (List training requirements including hazard communication)

ACTIVITY HAZARD ANALYSIS (p. 4 of 4)

	PRINT	SIGNATURE	
Supervisor Name:	______________________	______________________________	**Date/Time:**____________________________________
Safety Officer Name:	______________________	______________________________	**Date/Time:**____________________________________
Employee Name(s):	______________________	______________________________	**Date/Time:**____________________________________
	______________________	______________________________	**Date/Time:**____________________________________
	______________________	______________________________	**Date/Time:**____________________________________
	______________________	______________________________	**Date/Time:**____________________________________
	______________________	______________________________	**Date/Time:**____________________________________
	______________________	______________________________	**Date/Time:**____________________________________
	______________________	______________________________	**Date/Time:**____________________________________
	______________________	______________________________	**Date/Time:**____________________________________
	______________________	______________________________	**Date/Time:**____________________________________
	______________________	______________________________	**Date/Time:**____________________________________
	______________________	______________________________	Date/Time:____________________________________

Pre-Task Safety Plan

CH2MHILL

PRE-TASK SAFETY PLAN (p. 1 of 2)

Project: ________________________ Location: _______________________Date:__________________________

Supervisor: ________________________________ Job Activity:_______________________________________

____

Task Personnel:

____
____
____
____

List Tasks:

____
____
____
____

Tools/Equipment required for Tasks (ladders, scaffolds, fall protection, cranes/rigging, heavy equipment, power tools):

____
____
____
____

Potential H&S Hazards, including chemical, physical, safety, biological and environmental (Check all that apply):

__ Chemical burns/contact	__ Trench, excavations, cave-ins	__Ergonomics
__ Pressurized lines/equipment	__ Overexertion	__ Chemical splash
__ Thermal burns	__ Pinch points	__ Poisonous plants/insects
__ Electrical	__ Cuts/abrasions	___Eye hazards/flying projectile
__ Weather conditions	__ Spills	__ Inhalation hazard
__Heights/fall> 6’	__ Overhead Electrical hazards	__ Heat/cold stress
__ Noise	__ Elevated loads	__ Water/drowning hazard
__ Explosion/fire	__ Slips, trip and falls	__ Heavy equipment
__Radiation	__ Manual lifting	__ Aerial lifts/platforms
__ Confined space entry	__Welding/cutting	__ Demolition

Other Potential Hazards (Describe):

____
____
____
____
____
____
____

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PRE-TASK SAFETY PLAN (p. 2 of 2)

Hazard Control Measures (Check all that apply):

PPE	Protective Systems	Fire Protection	Electrical
__ Thermal/lined	__ Sloping	__ Fire extinguishers	__ Lockout/tagout
__ Eye	__ Shoring	__ Fire watch	__ Grounded
__ Dermal/hand	__ Trench box	__ Non-spark tools	__ Panels covered
__ Hearing	__ Barricades	__ Grounding/bonding	__ GFCI/extension cords
__ Respiratory	__ Competent person	__ Intrinsically safe equipment	__ Power tools/cord inspected
__ Reflective vests	__ Locate buried utilities		
__ Flotation device	__ Daily inspections		
Fall Protection	**Air Monitoring**	**Proper Equipment**	**Welding & Cutting**
__ Harness/lanyards	__ PID/FID	__ Aerial lift/ladders/scaffolds	__ Cylinders secured/capped
__ Adequate anchorage	__ Detector tubes	__ Forklift/ Heavy equipment	__ Cylinders separated/upright
__ Guardrail system	__ Radiation	__ Backup alarms	__ Flash-back arrestors
__ Covered opening	__ Personnel sampling	__ Hand/power tools	__ No cylinders in CSE
__ Fixed barricades	__ LEL/O2	__ Crane w/current inspection	__ Flame retardant clothing
__ Warning system	__ Other	__ Proper rigging	__ Appropriate goggles
		__ Operator qualified	
Confined Space Entry	**Medical/ER**	**Heat/Cold Stress**	**Vehicle/Traffic**
__ Isolation	__ First-aid kit	__ Work/rest regime	__ Traffic control
__ Air monitoring	__ Eye wash	__ Rest area	__ Barricades
__ Trained personnel	__ FA-CPR trained personnel	__ Liquids available	__ Flags
__ Permit completed	__ Route to hospital	__ Monitoring	__ Signs
__ Rescue		__ Training	
Permits	**Demolition**	**Inspections:**	**Training:**
__ Hot work	__ Pre-demolition survey	__ Ladders/aerial lifts	__ Hazwaste
__ Confined space	__ Structure condition	__ Lanyards/harness	__ Construction
__ Lockout/tagout	__ Isolate area/utilities	__ Scaffolds	__ Competent person
__ Excavation	__ Competent person	__ Heavy equipment	__ Task-specific (THA)
__ Demolition	__ Hazmat present	__Cranes and rigging	__ Hazcom
__ Energized work			

FieldNotes:____

____

____

____