July 1998

Westport
Sediment Sampling Evaluation


## Abstract

Four sediment samples were taken in the Columbia River on the Oregon side of the Wahkiukum/Westport Ferry channel on June 4, 1998 (see Figure 1). The samples were sent to Sound Analytical Services, Inc. laboratory of Seattle, WA, for physical and chemical analyses, to include: metals, total organic carbon (TOC), pesticides/polychlorinated biphenyls (PCBs), phenols, phthalates, miscellaneous extractables, polynuclear aromatic hydrocarbons (PAHs), dioxins/furans and P-450 RGA (a dioxin/furan screen). The screening levels used are those adopted for use in the draft Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area (1998). This evaluation was conducted following procedures set forth in the Inland Testing Manual, developed jointly by the Corps and EPA to assess dredged material and in accordance with 404 (b)(1) guidelines set forth in 40 CFR 230 developed to implement the Clean Water Act. The proposed dredge material from this project is acceptable for both unconfined in-water and upland disposal. No significant, adverse ecological impacts are expected from such disposal in terms of sediment toxicity.


## Introduction

The purpose of this report is to characterize the sediment of shoaling with-in the ferry channel, based on the sampling event described. Frequent reference will be made to the project Sampling and Analysis Plan (SAP) attached to this report. The project description, site history and assessment are detailed in section 1 of the SAP. The sampling and analysis objectives listed below are those stated in the (SAP) (sec. 2.0). This report will outline the procedures used to accomplish these goals.

SAMPLING AND ANALYSIS OBJECTIVES

The sediment characterization program objectives and constraints are summarized below:

- To characterize sediments in accordance with the draft regional dredge material testing manual, the Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River Management Area.
- Collect, handle and analyze representative sediment, of the purposed dredging prism, in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.
- Characterize sediments to be dredged for evaluation of environmental impact.
- Only physical and chemical characterization will be conducted.

The Corps of Engineers, Portland District personnel, collected 4-gravity core samples on June 4, 1998. The first sample, WP-GC-01, was a silty sand 21-inch core and was submitted for physical and chemical analysis. The WP-GC-O2 sample was a 5-inch core collected on the second attempt. Due to lack of sample it was only submitted for physical analysis. The WP-GC-03 sample also took two tries to recover sample. The second try produced a sandy silt 44-inch long core. From this sample a field replicate (WP-GC-03A) was also submitted for analysis. The fourth sample taken was a sandy silt 14-inch core that was submitted for physical and chemical analyses. The mean grain size was 0.06mm, with 25.0 % fines. The samples were sent to Sound Analytical laboratory of Seattle, WA, for physical and chemical analyses; to include metals, total organic carbon (TOC), pesticides/PCBs, phenols, phthalates, miscellaneous extractables and polynuclear aromatic hydrocarbons (PAHs).

**Historical Data**

The last sampling event took place in 1990 when 4 samples were taken by vibracore on May 10$^{th}$, with sample core length ranging form 20 to 43 inches. Analyses showed that the samples ranged from 39.4 to 73.5 % fines and a mean volatile solid content of <1.0 %. Due to the proximity of James River paper mill at Wauna, 2 miles downstream, and the tidal influence, Dioxin/Furans were tested for in one composite sample. While there are no established screening levels for Dioxin/Furans by EPA for this region, it was determined that the levels detected were at or near the detection limits of the method and of little or no concern. No chemicals of concern were detected above screening levels. The material represented by these samples was approved for unconfined open water or upland disposal.

**Current Sampling Events**

**Results/Discussion of Physical and Chemical Sampling from June 10, 1998 Sampling.**

Physical and Total Volatile Solids (TVS): Data for these analyses are presented in Table 1. Three of 4 samples submitted for analysis exceeded 20 % fines, however, none exceeded 5% volatile solids. All samples submitted were classified as "silty sand" (SM). Median grain size for all samples is 0.10 mm, with 75.0 % sand and 25.0 % fines.

Metals and Total Organic Carbon (TOC): Data for these analyses are presented in Table 2. Low levels of 5 metals were found in all of the samples collected, but do not approach the SL. The highest level detected was for Zinc, which was 31.7 % of the SL.

Pesticide/PCBs, Phenols, Phthalates and Misc. Extractables: Data for these analyses are presented in Table 3. One pesticide (4,4'-DDE at 2.6 ppb) was found in 1 sample, 37.7 % of the SL. One phenol was detected at a very low level in all the samples. Four phthalates were detected at low levels in 3 of the 4 samples and 3 phthalates were found in the all samples. Benzoic Acid was found in 3 of the 4 samples at low levels. All levels, except 4,4'-DDE mentioned above, were less than 10 % of the corresponding SL.

Polynuclear Aromatic Hydrocarbons (PAHs): Data for PAHs is presented in Tables 4 & 5. Low levels of some "low molecular weight" PAHs were found in all samples. The highest level detected was only 3.1 % of the SL. Low levels of some of the "high molecular weight" PAHs were also found in all samples. The highest level was 5.5 % of the SL.

Dioxin/Furan: Data for Dioxin/Furan is presented in Tables 6. This method provides procedures for the detection and quantitative measurement of polychlorinated dibenzo-p-dioxins (tetra- through octachlorinated homologues; PCDDs), and polychlorinated dibenzofurans) (tetra- through octachlorinated homologues; PCDFs) in a variety of environmental matrices and at part-per-trillion (PPT) concentrations. The PCDDs include 75 individual compounds, and the PCDFs include 135 individual compounds. These individual compounds are technically referred to as congeners. Only 7 of the 75 congeners of PCDDs are thought to have "dioxin-like" toxicity; these are ones with chlorine substitutions in, at least, the 2,3,7,8 positions. Only 10 of the 135 possible congeners of PCDFs are thought to have "dioxin-like" toxicity: these also are ones with substitutions in the 2,3,7,8 positions. For risk assessment purposes, a toxicity equivalency procedure was developed to describe the cumulative toxicity of these mixtures. This procedure involves assigning individual toxicity equivalency factors (TEFs) to the PCDD and PCDF congeners. These TEF values have been adopted by international convention (U.S. EPA, 1989: Ahlborg, et al., 1994). TEFs are estimates of the toxicity of dioxin-like compounds relative to the toxicity of 2,3,7,8-TCDD, which is assigned a TEF of 1.0. All other congeners have lower TEF values ranging from 0.5 to 0.001 for dioxin/furans. Calculating the toxic equivalency (TEQ) of a mixture involves multiplying the concentration of individual congeners by their respective TEF. The sum of the TEQ concentrations for the individual congeners is the TEQ concentration for the mixture. Sample WP-GC-013 (which is a composite of samples 01 and 03) was the only sample analyzed for Dioxin/Furans. The TEQ for all dioxins and furans detected calculates to be 0.978 pptr. This TEQ value is well below the guidance level of < 5 pptr TCDD and <15 pptr TEQ determined to be suitable for unconfined open water disposal.

P-450 Reporter Gene Assay, (Dioxin/Furan Screen): Results for P450 RGA are presented in Table 10. P-450 is the designation for a group of enzymes that play a key role in activating or deactivating many toxic chemicals including PAHs, PCBs, dioxins and furans. The results indicate that sample WP-GC-013 is a candidate to contain dioxins/furans using the P-450 method. The P-450 screening method was run in conjunction with the SW 846 method 8290 (dioxin/furan above), to help verify the usefulness of the method as a screen in future studies.

**Conclusion**

Sampling and analyses were performed using proper quality control measures including: proper procedures for chain of custody, preservation (4°C.) and cooler receipt. A minimum ten-percent replicate (one sample) was taken and analyzed. Replicate correlation with the primary sample results was acceptable. The laboratory reported no quality control issues for the analytical procedures carried out on the sediment sampled in the ferry channel.

According to 404 (b)(1) guidelines and procedures in the Inland Testing Manual (ITM), and the Tiered testing approach adopted in the Dredged Material Evaluation Framework for the

Lower Columbia River Management Area, this material is acceptable for both upland and in-water disposal with no adverse, unacceptable ecological consequences expected. The tiered testing approach requires that material in excess of 20 % fines and greater than 5 % volatile solids be subjected to chemical as well as physical analyses. If the chemical analysis results do not exceed the established screening levels, then it is cleared for unconfined in-water disposal. The ITM also uses a tiered approach in evaluating dredged material. The ITM describes procedures for evaluating the potential for adverse ecological impacts of disposal related to sediment toxicity. The evaluation proceeds through the tiers until "factual determinations" can be made regarding potential for toxicity. Factual determination was made at the Tier I level based on a review of sediment contamination data collected. The material is only slightly contaminated and water quality standards will not be exceeded during dredging and disposal. Tier I calls for a review of current and past data relevant to the site.

**References**


1. U.S. army Corps of Engineers, Portland District, Seattle District, U.S. Environmental Protection Agency, Region 10, Oregon Department of Environmental Quality, Washington State Department of Natural Resources. April 1998 (draft document). Dredge Material Evaluation Framework Lower Columbia River Management Area.

2. U. S. Environmental Protection Agency and U. S. Army Corps of Engineers. February 1998. Evaluation of Dredged Material Proposed for Discharge in Inland and Near Coastal Waters – Testing Manual, dated (referred to as the "Inland Testing Manual").

3. Siipola, M., U.S. Army corps of Engineers, Portland District. Nov 1990. St. Helens, Oregon Cross Channel Sediment Quality Evaluation, 1989.

4. Army Corps of Engineers, Portland District. Aug 1990. Results of Westport Slough Sediment Quality Evaluation.

5. Army Corps of Engineers, Portland District. Oct 1994. Raw data of Wahkiakum County Ferry Channel Sampling.

Table 1, Westport

# Physical Analysis

Sampled June 4,1998

| Sample I.D. | Grain Size (mm) | | | % | | |
|---|---|---|---|---|---|---|
| | Median | Mean | | Sand | Silt/Clay | Volitle solids |
| WP-GC-01 | 0.10 | 0.06 | | 76.7 | 23.3 | 2.7 |
| WP-GC-02 | 0.11 | 0.06 | | 80.2 | 19.8 | 2.1 |
| WP-GC-03 | 0.09 | 0.06 | | 66.2 | 33.8 | 3.6 |
| WP-GC-03 Lab Dup | 0.09 | 0.05 | | 65.3 | 34.7 | N/A |
| WP-GC-05 | 0.10 | 0.06 | | 76.8 | 23.2 | 2.5 |
| Mean | 0.10 | 0.06 | | 75.0 | 25.0 | 2.7 |
| Maximum | 0.11 | 0.06 | | 80.2 | 34.7 | 3.6 |

N/A = Not Available

Table 2, Westport

# Inorganic Metals and TOC

Sampled June 4, 1998

| Sample I.D. | As | Sb | Cd | Cu | Pb | Hg | Ni | Ag | Zn | TOC |
|---|---|---|---|---|---|---|---|---|---|---|
| | mg/kg (ppm) | | | | | | | | | |
| WP-GC-01 | 3.1 | <1.8 | <0.58 | 23 | 13 | <0.10 | 15 | <0.88 | 100 | 6600 |
| WP-GC-03 | 3.7 | <1.8 | <0.61 | 27 | 11 | <0.13 | 15 | <0.92 | 110 | 10000 |
| WP-GC-03A | 4.4 | <1.7 | <0.56 | 30 | 10 | <0.11 | 17 | <0.84 | 130 | 11000 |
| WP-GC-05 | 3.0 | <1.5 | <0.50 | 23 | 9.1 | <0.16 | 15 | <0.75 | 100 | 4600 |
| Screening level (SL) | 57 | 150 | 5.1 | 390 | 450 | 0.41 | 140 | 6.1 | 410 | |
| Mean | 3.6 | N/A | N/A | 25.8 | 10.8 | N/A | 11.8 | N/A | 110 | |
| Maximum | 4.4 | N/A | N/A | 30 | 13 | N/A | 17 | N/A | 130 | |

N/A = Not Applicable

The symbol "<" denotes a non-detect at the numerical value listed.

Table . . Westport **Pesticides/PCBs, Phenols, Phthalates and Extractables** Sampled Jun. 1998

| Sample I.D. | PCB | Pesticides | Phenols | Phthalates | | | | Extractables |
|---|---|---|---|---|---|---|---|---|
| | ug/kg (ppb) | | | | | | | |
| | 7 Arochlor | 4,4'-DDE | 3-&4-Methyl phenol | Diethyl phthalate | Di-n-butyl phthalate | Butylbenzyl phthalate | bis(2-Ethylhexyl) phthalate | Benzoic Acid |
| WP-GC-01 | <.37 | 2.6 | 12 | 7.3 | 9.4 | 11 | 41 | 65 |
| WP-GC-03 | <.37 | <.74 | 18 | 7.6 | 12 | 8.1 | 38 | 24 |
| WP-GC-03A | <.37 | <.74 | 15 | 7.4 | 12 | <1.6 | 17 | <3.8 |
| WP-GC-05 | <.37 | <.74 | 8.2 | 7.9 | 22 | 5.7 | 24 | 9.8 |
| Screening level (SL) | 130 | 6.9 | 670 | 1200 | 5100 | 970 | 8300 | 650 |
| Mean | N/A | 0.65 | 13.3 | 7.6 | 13.9 | 6.2 | 30 | 24.7 |
| Maximum | N/A | 2.6 | 18 | 7.9 | 22 | 11 | 41 | 65 |

The symbol "<" denotes a non-detect at the numerical value listed.

Table 4, Westport

# Polynuclear Aromatic Hydrocarbons (PAHs)

## Low Molecular Weight Analytes

## ug/kg (ppb)

Sampled June 4, 1998

| Sample I.D. | Acenapthene | Acenaphthylene | Anthracene | Fluorene | |
|---|---|---|---|---|---|
| WP-GC-01 | <1.7 | 5.3 | 6.5 | <2.7 | |
| WP-GC-03 | 5.4 | 7.2 | 9.4 | 5.4 | |
| WP-GC-03A | <1.9 | 5.7 | 7.9 | 5.2 | |
| WP-GC-05 | <1.7 | <2.6 | 9.4 | 4.3 | |
| Screening level | 500 | 560 | 960 | 540 | |
| Mean | 1.4 | 4.6 | 8.3 | 3.7 | |
| Maximum | 5.4 | 7.2 | 9.4 | 5.4 | |
| | **2-Methylnapthalene** | **Naphthalene** | **Phenanthrene** | | **Total Low PAHs** |
| WP-GC-01 | <4.5 | 9.8 | 28 | | 49.6 |
| WP-GC-03 | 5.8 | 14 | 46 | | 93.2 |
| WP-GC-03A | 5.2 | 10 | 34 | | 68 |
| WP-GC-05 | <4.3 | 4.3 | 30 | | 48 |
| Screening level | 670 | 2100 | 1500 | | 29000 |
| Mean | 2.8 | 9.5 | 34.5 | | |
| Maximum | 5.8 | 14 | 46 | | |

The symbol "<" denotes a non-detect at the numerical value listed.

Table 5, Westport

# Polynuclear Aromatic Hydrocarbons (PAHs)

## High Molecular Weight Analytes

## ug/kg (ppb)

Sampled June 4, 1998

| Sample I.D. | Benzo(a)anthracene | Benzo(b)fluroanthene | Benzo(k)fluroanthene | Benzo(g,h,i)perylene | Chrysene | Pyrene |
|---|---|---|---|---|---|---|
| WP-GC-01 | 22 | 25 | 14 | 20 | 24 | 53 |
| WP-GC-03 | 26 | 38 | 13 | 37 | 32 | 73 |
| WP-GC-03A | 22 | 41 | 10 | 21 | 35 | 42 |
| WP-GC-05 | 12 | 18 | <3.9 | 7.8 | 11 | 29 |
| Screening level | 1300 | 3200 | No (SL) established | 670 | 1400 | 2600 |
| Mean | 20.5 | 30.5 | 9.3 | 21.5 | 25.5 | 49.3 |
| Maximum | 26 | 41 | 14 | 37 | 35 | 73 |

| | Benzo(a)pyrene | Dibenz(a,h)anthracene | Indeno(1,2,3-cd)pyrene | Fluoranthene | Total High PAH |
|---|---|---|---|---|---|
| WP-GC-01 | 26 | <1.4 | 11 | 48 | 243 |
| WP-GC-03 | 35 | <1.5 | 17 | 74 | 345 |
| WP-GC-03A | 31 | <1.5 | 15 | 51 | 268 |
| WP-GC-05 | 11 | <1.3 | 5.9 | 32 | 126.7 |
| Screening level | 1600 | 230 | 600 | 1700 | 12000 |
| Mean | 25.8 | N/A | 12.2 | 51.3 | |
| Maximum | 35 | N/A | 17 | 78 | |

The symbol "<" denotes a non-detect at the numerical value listed.

Table . . Westport

# Dioxin/Furan and P-450

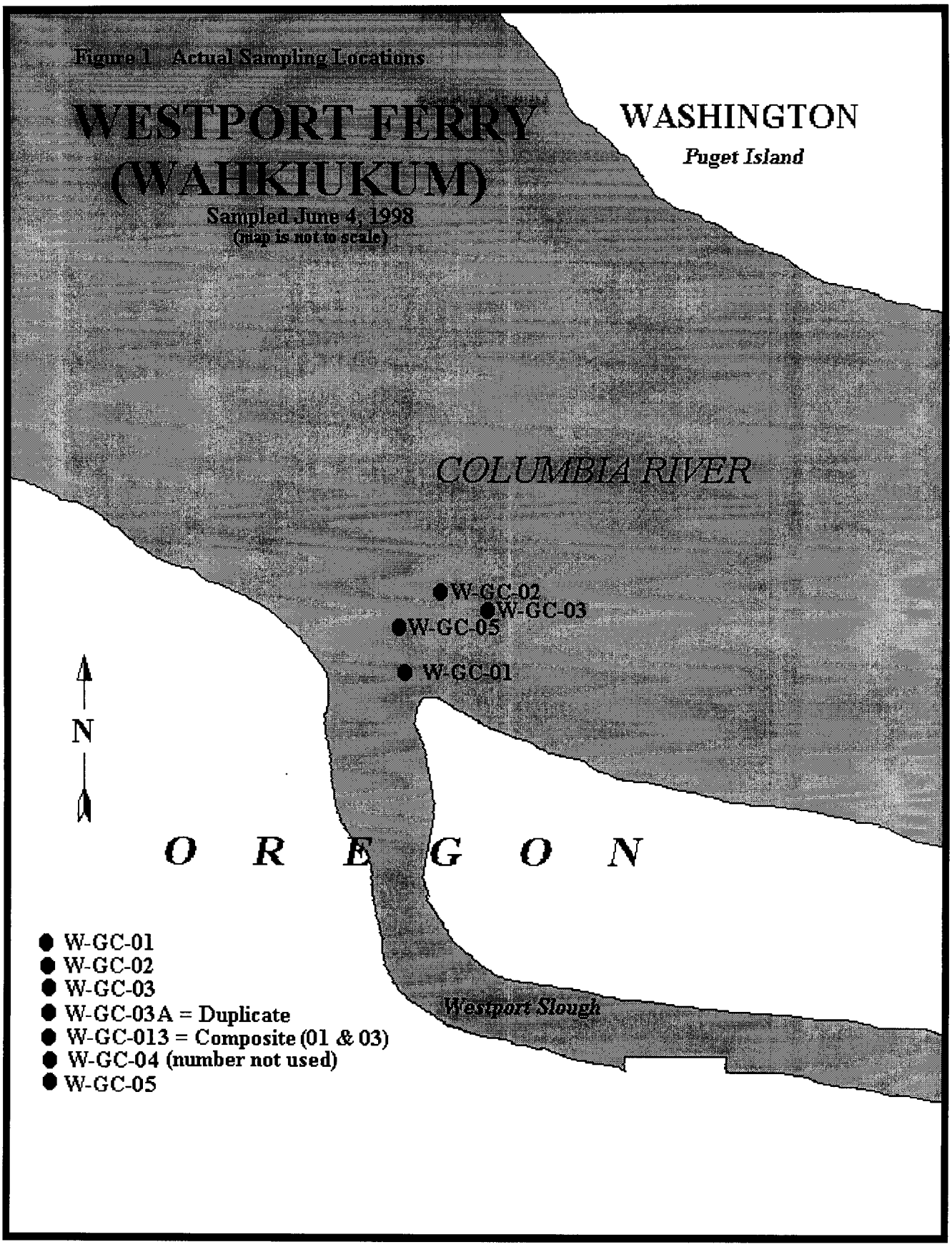
Sampled Jun. 1998

| Sample I.D. | Method | Dioxin/Furans (8290) | |
|---|---|---|---|
| WP-GC-13 | **Furans** | pg/g | (ppt) |
| | TCDFs (total) | | 1.9 |
| | 2,3,7,8 - TCDF | | 0.94 |
| | HpCDFs (total) | | 4.3 |
| | OCDF | | 5.3 |
| | | | |
| | **Dioxins** | pg/g | (ppt) |
| | HpCDDs (total) | | 33 |
| | 1,2,3,4,7,8 - HpCDDs (total) | | 15 |
| | OCDD | | 170 |

| Sample I.D. | Method | | |
|---|---|---|---|
| | **P-450 RGA** | B[a]P Eq. ug/g dry (ppm) | TEQ ng/g dry (ppb) |
| WP-GC-13 | | 26.7 | 1.60 |
| Duplicate | | 23.5 | 1.41 |

*P-450 Reporter Gene Assay
This sample is a composite of WP-GC-01 and WP-GC-03.
(See page 3 for discussion)

Figure 1 Actual Sampling Locations



# SEDIMENT
# SAMPLING & ANALYSIS PLAN
# FOR WESTPORT FERRY

JUNE 1998

Prepared by:

Portland District
Corps of Engineers

TABLE OF CONTENTS

## 1.0 PROJECT DESCRIPTION, SITE HISTORY AND ASSESSMENT

1.1 Project Site Description and Location: The Westport Slough is located on the Oregon side of the Columbia River at approximately river mile 43.5. The River and Harbor Act of August 26, 1937 authorized a 28-ft. deep by 200-ft wide, 3500-ft. long channel. The Westport Ferry proceeds down the slough channel then across the Columbia River to connect Westport to the south side of Puget Island on the Washington side of the Columbia River. Shoaling across the mouth of the slough will require maintenance dredging for navigational purposes.

1.2 Site History: Dredging of the slough, itself last took place in 1966. In 1990 samples were taken prior to dredging shoals at the mouth of Westport Slough. There are no known sources of contamination in the area upstream. James River paper mill is located at Wauna 2.0 miles down stream.

1.3 Previous Sediment Sampling: Four samples were taken by vibra core on May 10, 1990. Sample cores ranged from 1.8-ft. to 3.6-ft. in length. Physical analysis of the samples revealed that the sediment samples taken near shore contained less fine-grained material (39.6 %) than the two samples taken near the center of the slough channel (73.5 %). Some metals were detected at levels below the screening levels (SL). Pesticides, PCBs and PAHs were all non-detect (ND) at reporting limits. Dioxin/Furans were run and one furan (2,3,7,8 – TCDF) was detected at 0.89 ng/kg, close to the method detection limit. All material was approved for unconfined open water disposal.

## 2.0 SAMPLING AND ANALYSIS OBJECTIVES

- To characterize sediments in accordance with the draft Dredge Material Evaluation Framework (DMEF) for the Lower Columbia River manual.

- Collect, handle and analyze representative sediment, core samples of the proposed dredging prism in accordance with protocols and Quality Assurance/Quality Control (QA/QC) requirements.

- Characterize sediments to be dredged for evaluation of environmental impact.

- Only physical and chemical characterization will be conducted.

## 3.0 SAMPLING AND ANALYSIS REQUIREMENTS

3.1 Project Ranking: The Columbia River Navigational Channel has been ranked "Exclusionary". The area at the mouth of the slough, to be dredged, is outside the navigational channel and contains much finer grained material and is considered a "low" ranked area. The sediment will be subjected to both physical and chemical testing. The material from past sampling was cleared for unconfined open water disposal.

3.2 Sampling and Analysis Requirements: Material to be dredged from the mouth of Westport Slough will be sampled using a gravity core sampling devise. A gravity coring system collects a continuous profile of sediments below the mudline. All samples will be subjected to both physical and chemical analyses. Ten percent (minimum 1 sample) will be Quality Control blind replicate sample(s), submitted for select chemical analysis only.

## 4.0 SAMPLE COLLECTION AND HANDLING PROCEDURES

4.1 Sampling Locations and Numbering: Figure 1 shows the project area and sample locations. Sampling sites are located for the best characterization of the material within the dredging prism as possible. Proper QA/QC procedures as outlined in this section will be followed. Any deviation from these procedures shall be noted in the field log. Sample identification shall follow the following convention:

WP-XX-YY (Z)

Where, WP denotes samples collected from Westport, "XX" denotes the type of sampling device such as GC - gravidity corer; "YY" denotes the numeric sample number and will consist of two digits for all samples (i.e. 01, 05, 15, etc.). For cores an alpha character (i.e. A, B, C, etc.) will be used to denote vertical location (if applicable) as represented here by "Z". The core will be sampled in sections starting from the surface to 5-foot depth and each subsequent 5-foot depth (or partial 5-foot depth). The surface section will be labeled WP-XX-YYA, the second section WP-XX-YYB, etc. The QC replicates will have the same sample number as the primary sample, with an additional "A" added (WP-GC-YY-AA). Composite samples, if used, will have a combined number in the "YY" designation (i.e. sample 02 & 03 = 023, etc.).

4.2 Field Sampling Schedule: Sampling is planned for June 4, 1998.

4.3 Field Notes: Field notes will be maintained during sampling and compositing operations. Included in the field notes will be the following:

- Names of the person(s) collecting and logging in the samples.
- Weather conditions.
- Depth of each station sampled as measured from the water surface. This will be accomplished using a leadline or corrected depth recorder.
- Date and time of collection of each sediment sample.
- The sample station number and individual designation numbers assigned for each individual sample.
- Descriptions of sediment or core sections.
- For cores the length of core and the penetration depth of the sampling device.
- Any deviation from the approved sampling plan.

4.4 Positioning: Sampling locations will be recorded in the field using a hand held GPS. Horizontal coordinates will be referenced to the Oregon Coordinate System for proper North or South Zones NAD 83 (North American Datum 1983). Horizontal coordinates will be identified as latitude and longitude to the nearest 0.1 second.

4.5 Decontamination: All sampling devices and utensils will be thoroughly cleaned prior to use according to the following procedure:

- Wash with brush and Alconox soap
- Rinse with distilled water
- Rinse with 10% HCl acid solution
- Rinse with distilled water

Sampling devices such as the gravity core sampler will be washed down before each sampling event or a pre-cleaned plastic tube insert will be used to collect these samples. However, they will not require the cleaning

procedure listed above as long as samples collected for chemical analyses are not in contact with the core walls. All utensils used to collect chemical samples will require decontamination prior to each use. All hand work for chemical analyses will be conducted with disposable latex gloves which will be rinsed with distilled water before and after handling each individual sample, as appropriate, to prevent sample contamination. Gloves will be disposed of between samples or composites to prevent cross contamination between samples.

4.6 Core Logging: Each discrete core section will be inspected and described. For each core sample, the following data will be recorded on the core log:

- Depth interval of each core section as measured from Columbia River Datum.
- Sample recovery
- Physical soil description in accordance with the Unified Soil Classification System (includes soil type, density/consistency of soil, color)
- Odor (e.g., hydrogen sulfide, petroleum products)
- Visual stratification and lenses
- Vegetation
- Debris
- Biological Activity (e.g., detritus, shells, tubes, bioturbation, live or dead organisms)
- Presence of oil sheen
- Any other distinguishing characteristics or features

4.7 Field Replicates: Blind field replicates will be prepared and submitted along with the rest of the samples to the laboratory. This represents about 10% of the total samples collected. Sample numbers shall be labeled the same as the primary sample with the last letter duplicated i.e. WP-XX-YY (primary), WP-XX-YYA (replicate). Replicate sample locations shall be documented in the field log.

4.9 Sample Transport and Chain-of-Custody Procedures: After sample containers have been filled they will be packed on iced in coolers. Chain-of-custody procedures will commence in the field and will track delivery of the samples. Sample holding times and storage requirements are presented in Table 1. Specific procedures are as follows:

- Samples will be packaged and shipped in accordance with U.S. Department of Transportation regulations as specified in 49 CFR 173.6 and 49 CFR 173.24 or delivered directly to the testing laboratory.
- Individual sample containers will be packed to prevent breakage.
- The coolers will be clearly labeled with sufficient information (name of project, time and date container was sealed, person sealing the cooler and office name and address) to enable positive identification.
- A sealed envelope containing chain-of-custody forms will be enclosed in a plastic bag and taped to the inside lid of the cooler.

Upon transfer of sample possession to the laboratory, the persons transferring custody of the coolers will sign the chain-of-custody form. Upon receipt of samples at the laboratory, the coolers will be inspected and the receiver will record the condition of the samples.

**Table 1, Sample Volume and Storage**

| Sample Type | Holding Time | Sample Size (a) | Temperature (b) | Container | Archive (c) |
|---|---|---|---|---|---|
| Particle Size | 6 Months | 200 g | 4°C | 1-1 Quart Plastic Bag | |
| Dioxin/Furan P-450 RGS | 30 Days | 10g | 4°C | 8-oz Glass | |
| PAH, Phenols, Phthalates, Misc. Extract. | 14 Days | 10g | 4°C | 1-Liter Glass (combined) | |
| Total Volatile Solids | 14 Days | 125 g | 4°C | | |
| Total Organic Carbon | 14 Days | 125 g | 4°C | | |
| Mercury | 28 Days | 5g | 4°C | | |
| Metals (except Mercury) | 6 Months | 50 g | 4°C | | |
| Pesticides and PCBs | 14 Days | 10 g | 4°C | | |
| | | | | | |

a. Required sample sizes for one laboratory analysis. Actual volumes to be collected have been increased to provide a margin of error and allow for retest.
b. During transport to the lab, samples will be stored on blue ice.

5.0 LABORATORY PHYSICAL AND CHEMICAL SEDIMENT ANALYSIS

5.1 Laboratory Analyses Protocols. Laboratory testing procedures will be conducted in accordance with the DNEF. The samples will be analyzed for all the parameters listed in sections 5.1.3 and 5.1.4 as requested on the chain-of-custody record. Private contract analytical chemical laboratories will conduct all physical and chemical analyses.

5.1.1 Chain-of-Custody: A chain-of-custody record for each set of samples will be maintained throughout all sampling activities and will accompany samples and shipment to the laboratory. Information tracked by the chain-of-custody records in the laboratory include sample identification number, date and time of sample receipt, analytical parameters required, location and conditions of storage, date and time of removal from and return to storage, signature of person removing and returning the sample, reason for removing from storage, and final disposition of the sample.

5.1.2 Limits of Detection: Detection limits of all chemicals of concern must be below screening levels. All reasonable means, including additional cleanup steps and method modifications, will be used to bring all limits-of-detection below the screening levels. In addition, an aliquot of each sediment sample for analysis will be archived and preserved at -18 C for additional analysis if necessary. Sediments or extracts will be kept under proper storage conditions until the chemistry data is deemed acceptable.

5.1.3 Sediment Chemistry: Private analytical laboratories will conduct all chemical analyses. Chemical analyses will include metals (As, Sb, Cd, Cu, Pb, Hg, Ni, Ag and Zn) (6010/7000 or 6020 series, Hg by CVAA). Total organic carbon (TOC) by method 9060. Phenols, phthalates, extractables, and polynuclear aromatic hydrocarbons (PAHs) by method 8270 and Pesticides/PCBs by method 8081. SIM method or other low level detection method to be used, if required to reach requested detection limits. All detection limits must be lower than SL indicated in draft DMEF for the Lower Columbia River Management Area.

5.1.4 Sediment Conventionals: The private analytical laboratories will analyze physical parameters. Particle grain size distribution for each sample will be determined. Sieve analysis will use a geological sieve series, which will include the sieve sizes U.S. NO. 5, 10, 18, 35, 60, 120, and 230. Hydrogen peroxide will not be used in preparations for grain-size analysis. Hydrometer analysis will use for particle sizes finer than the 230 mesh. Water content will be determined using ASTM D 2216. Sediment classification designation will be made in accordance with U.S. Soil Classification System, ASTM D 2487.

5.1.5 Holding Times: To the maximum extent practicable all chemical results will be provided within 30 days of receipt. All samples for physical and chemical testing will be maintained at the testing laboratory at the temperatures specified in Table 1 and analyzed within the holding times shown in the table.

5.1.6 Quality Assurance/Quality Control: The chemistry QA/QC procedures found in Table 2 will be followed.

5.2 Laboratory Written Report: The analytical laboratory documenting all the activities associated with sample analyses will prepare a written report. As a minimum, the following will be included in the report:

- Results of the laboratory analyses and QA/QC results.
- All protocols used during analyses.
- Chain of custody procedures, including explanation of any deviation from those identified herein.
- Any protocol deviations from the approved sampling plan.
- Location and availability of data.

As appropriate, this sampling plan may be referenced in describing protocols.

**Table 2, Minimum Laboratory QA/QC**

| Analytical Type | Method Blank[2] | Duplicate[2] | RM[2,4] | Matrix Spikes[2] | Surrogates[7] |
|---|---|---|---|---|---|
| Semivolatiles[1] | X | X[3] | X[5] | X | X |
| Pesticides/PCBs[1] | X | X[3] | X[5] | X | X |
| Metals | X | X | X[6] | X | |
| Total Organic Carbon | X | X | X[6] | | |
| Total Solids | | X | | | |
| Total Volatile Solids | | X | | | |
| Particle Size | | X | | | |

1. Initial calibration required before any samples are analyzed, after each major disruption of equipment, and when ongoing calibration fails to meet criteria. Ongoing calibration required at the beginning of each work shift, every 10-12 samples or every 12 hours (whichever is more frequent), and at the end of each shift.
2. Frequency of Analysis = one per batch
3. Matrix spike duplicate will be run
4. Reference Material
5. Canadian standard SRM-1
6. NIST certified reference material 2704
7. Surrogate spikes will be included with every sample, including matrix-spiked samples, blanks and reference materials

## 6.0 BIOLOGICAL TESTING

6.1 Biological Testing: No biological testing will be conducted under this study, however the need for biological testing will be assessed per the DMEF.

## 7.0 REPORTING

7.1 QA Report: The laboratory QA/QC reports will be incorporated by reference. This report will identify any laboratory activities that deviated from the approved protocols and will make a statement regarding the overall validity of the data collected.

7.2 Sediment Evaluation Report: A written discussion of findings shall be prepared documenting the physical and chemical character of potential material to be dredged. The physical and chemical reports will be included as reference; individual copies will be furnished as requested. As a minimum, the following will be included in the

- Previous sampling and analyses.
- Locations where the sediment samples were collected.
- A plan view of the project showing the actual sampling location.
- Description of sampling.
- Chemical testing data, with comparisons to screening levels guidelines.

APPENDIX A

PARAMETERS AND METHODS

1. Recommended Sample Preparation Methods, Cleanup Methods, Analytical Methods and Detection Limits for Sediment Management Standards, Chapter 173-204 WAC, Draft - July 1996.

2. Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound, Puget Sound Estuary Program, March 1986.

3. Recommended Methods for Measuring TOC in Sediments, Kathryn Bragdon-Cook, Clarification Paper, Puget Sound Dredged Disposal Analysis Annual Review, May, 1993.

4. Units: ug = microgram, mg = milligram, kg = kilogram, dw = dry weight, oc = organic carbon.

5. Test Methods for Evaluating Solid Waste. Laboratory manual physical/chemical methods. Method 3050, SW-846, 3rd ed., Vol. 1A, Chapter 3, Sec 3.2, Rev 1. Office of Solid Waste and Emergency Response, Washington, DC.

6. Graphite Furnace Atomic Absorption (GFAA) Spectrometry - SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

7. Inductively Coupled Plasma (ICP) Emission Spectrometry - SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

8. Test Methods for Evaluating Solid Waste. Laboratory manual physical/chemical methods. Method 7471, SW-846, 3rd ed., Vol. 1A, Chapter 3, Sec 3.3. Office of Solid Waste and Emergency Response, Washington, DC.

9. Sonication Extraction of Sample Solids - Method 3550 (Modified), SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986. Method is modified to add matrix spikes before the dehydration step rather than after the dehydration step.

10. GCMS Capillary Column - Method 8270, SW-846, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

11. Purge and Trap Extraction and GCMS Analysis - Method 8260, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

12. Soxhlet Extraction and Method 8081, Test Methods for Evaluating Solid Waste Physical/Chemical Methods, EPA 1986.

13. Total PCBs BT value in mg/kg oc.

QA2 DATA REQUIREMENTS

CHEMICAL VARIABLES

ORGANIC COMPOUNDS

The following documentation is needed for organic compounds:

A cover letter referencing or describing the procedure used and discussing any analytical problems

Reconstructed ion chromatograms for GC/MS analyses for each sample

Mass spectra of detected target compounds (GC/MS) for each sample and associated library spectra

GC/ECD and/or GC/flame ionization detection chromatograms for each sample

Raw data quantification reports for each sample

A calibration data summary reporting calibration range used [and decafluorotriphenylphosphine (DFTPP) and bromofluorobenzene (BFB) spectra and quantification report for GC/MS analyses]

Final dilution volumes, sample size, wet-to-dry ratios, and instrument detection limit

Analyte concentrations with reporting units identified (to two significant figures unless otherwise justified)

Quantification of all analytes in method blanks (ng/sample)

Method blanks associated with each sample

Recovery assessments and a replicate sample summary (laboratories should report all surrogate spike recovery data for each sample; a statement of the range of recoveries should be included in reports using these data)

Data qualification codes and their definitions.

METALS

For metals, the data report package for analyses of each sample should include the following:

Tabulated results in units as specified for each matrix in the analytical protocols, validated and signed in original by the laboratory manager

Any data qualifications and explanation for any variance from the analytical protocols

Results for all of the QA/QC checks initiated by the laboratory

Tabulation of instrument and method detection limits.

All contract laboratories are required to submit metals results that are supported by sufficient backup data and quality assurance results to enable independent QA reviewers to conclusively determine the quality of the data. The laboratories should be able to supply legible photocopies of original data sheets with sufficient information to unequivocally identify:

Calibration results

Calibration and preparation blanks

Samples and dilutions

Duplicates and spikes

Any anomalies in instrument performance or unusual instrumental adjustments.

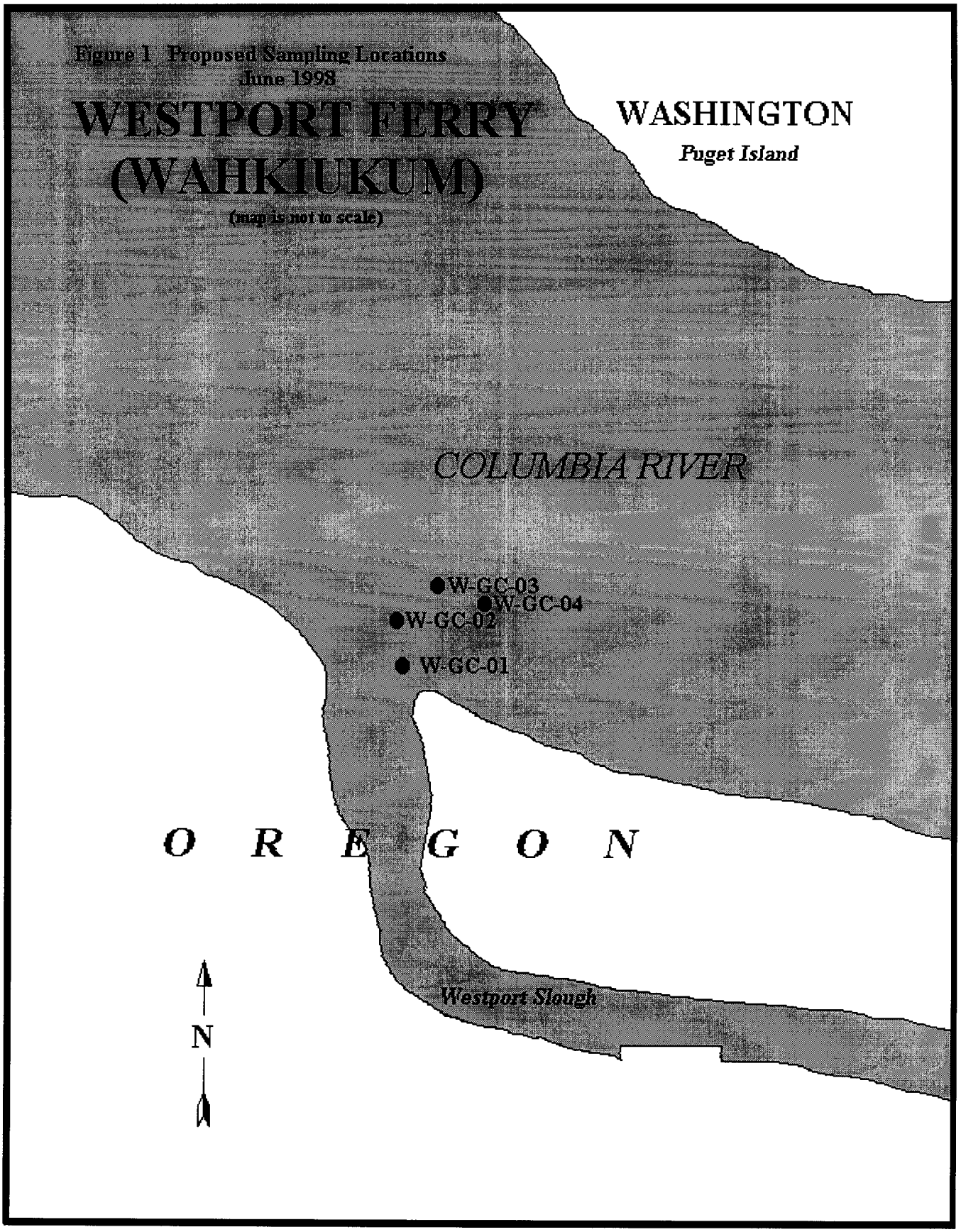


Figure 1 Proposed Sampling Locations
June 1998
WESTPORT FERRY
(WAHKIUKUM)
(map is not to scale)
WASHINGTON
Puget Island
COLUMBIA RIVER
W-GC-03
W-GC-04
W-GC-02
W-GC-01
O R E G O N
Westport Slough
N