

**VOLUME II: REMEDIAL INVESTIGATION
SAMPLING AND ANALYSIS PLAN
FOR THE MARINE ENVIRONMENT
AT THE
FORMER RAYONIER PULP MILL SITE**

Port Angeles, Washington

Prepared for

**Rayonier, Inc.
Jacksonville, Florida**

Prepared by

FOSTER  WHEELER

**FOSTER WHEELER ENVIRONMENTAL CORPORATION
12100 NE 195th Street
Bothell, WA 98011**

July 2002



CONTENTS

1.	INTRODUCTION	1-1
2.	OBJECTIVES OF THE SEDIMENT INVESTIGATION	2-1
2.1	OVERALL DESIGN	2-1
2.2	CHEMICAL ANALYTES	2-5
2.2.1	Deepwater Outfall	2-6
2.2.2	Dock	2-11
2.2.3	Log Pond	2-12
2.2.4	Intertidal Area	2-13
2.3	BIOLOGICAL TESTS	2-14
2.3.1	Testing Program	2-14
2.3.2	Deepwater Outfall	2-16
2.3.3	Dock	2-16
2.3.4	Log Pond	2-17
2.4	SAMPLING STATION LOCATIONS	2-17
2.4.1	Deepwater Outfall	2-17
2.4.2	Dock	2-18
2.4.3	Log Pond	2-23
2.4.4	Intertidal Area	2-23
2.4.5	Harbor Samples	2-24
3.	OBJECTIVES OF THE MARINE BIOTA INVESTIGATION	3-1
3.1	OVERALL DESIGN	3-1
3.2	TARGET SPECIES FOR SAMPLING	3-1
3.2.1	Crabs	3-2
3.2.2	Shrimp	3-2
3.2.3	Clams	3-3
3.2.4	Flatfish	3-3
3.3	CHEMICAL ANALYTES	3-4
3.4	SAMPLING STATION LOCATIONS	3-6
4.	FIELD SAMPLING METHODS	4-1
4.1	NAVIGATION AND POSITIONING	4-1
4.1.1	Differential Global Positioning System—Horizontal Control	4-2
4.1.2	Vertical Control	4-2
4.2	SEDIMENT SAMPLING COLLECTION METHODS	4-3
4.2.1	Surface Samples	4-3
4.2.2	Grab Sample Acceptability	4-5
4.2.3	Surface Sediment Field Tests	4-5
4.2.4	Subsurface Core Samples	4-6
4.2.4.1	Core Sample Acceptability	4-7
4.2.4.2	Core Compaction	4-8

CONTENTS

4.3	MARINE BIOTA SAMPLING COLLECTION METHODS	4-8
4.3.1	Crabs	4-8
4.3.2	Shrimp	4-10
4.3.3	Clams	4-12
4.3.4	Flatfish	4-13
4.4	SAMPLE COMPOSITING AND OTHER SUBSAMPLING	4-14
4.5	DECONTAMINATION PROCEDURES	4-15
4.6	INVESTIGATION-DERIVED WASTE	4-16
4.7	FIELD CHANGES	4-16
4.8	DOCUMENTATION	4-16
4.8.1	Site Logbooks	4-18
4.8.2	Photographs	4-18
4.8.3	Sample Summary Logs	4-19
4.8.4	Sample Labels	4-19
4.8.5	Custody Seals	4-19
4.8.6	Chain-of-Custody Forms	4-22
5.	SAMPLE HANDLING PROCEDURES	5-1
5.1	SAMPLE CONTAINERS AND PRESERVATION	5-1
5.2	SAMPLE PACKAGING AND SHIPPING	5-4
6.	LABORATORY ANALYTICAL METHODS	6-1
6.1	CHEMICAL AND PHYSICAL TESTING	6-1
6.2	BIOASSAY TESTING	6-1
6.2.1	Testing Program	6-2
6.2.2	Amphipod Bioassay	6-3
6.2.3	Larval Bioassay	6-3
6.2.4	Juvenile Polychaete Bioassay	6-4
7.	QUALITY ASSURANCE AND QUALITY CONTROL REQUIREMENTS	7-1
7.1	DATA QUALITY OBJECTIVES	7-1
7.2	FIELD QUALITY ASSURANCE/QUALITY CONTROL SAMPLES	7-1
8.	RECORD KEEPING AND REPORTING REQUIREMENTS	8-1
8.1	RECORD KEEPING	8-1
8.2	REPORTING REQUIREMENTS	8-1
8.2.1	Laboratory Reports	8-1
8.2.1.1	Chemistry Reports	8-1
8.2.1.2	Biological Reports	8-3
8.2.2	Quality Assurance Report	8-3
8.2.3	Final Report	8-3
9.	DATA ANALYSIS	9-1
9.1	SEDIMENT INVESTIGATION	9-1

CONTENTS

9.1.1	Sediment Chemistry Data	9-1
9.1.2	Biological Test Data	9-2
9.1.3	Data Interpretation	9-3
9.2	MARINE BIOTA	9-3
9.2.1	Statistical Summary	9-3
9.2.2	Calculation of Descriptive Statistics	9-4
10.	REFERENCES	10-1
	Required Equipment – General	55
	Typical Procedure – Trawl	57
APPENDIX A	STANDARD OPERATING PROCEDURES	

FIGURES

Figure 2-1.	Outfall and Harbor Sediment Sample Locations, Rayonier Port Angeles Mill Site	2-19
Figure 2-2.	Dock, Log Pond, and Intertidal Sediment Sample Stations, Rayonier Port Angeles Mill Site	2-21
Figure 3-1.	Bottom Fish, Shrimp, and Crab Sampling Areas, Rayonier Port Angeles Mill Site	3-15
Figure 3-2.	Clam Sampling Areas, Rayonier Port Angeles Mill Site	3-17
Figure 3-3.	Clam Sampling Areas Deep Water Outfall and Reference Areas, Rayonier Port Angeles Mill Site	3-19
Figure 4-1.	Field Change Request	4-17
Figure 4-2.	Sample Summary Log	4-20
Figure 4-3.	Sample Label and Custody Seal	4-21
Figure 4-4.	Chain-of-Custody Form	4-23

TABLES

Table 2-1.	Marine Sediment Sample Summary	2-7
Table 3-1.	Summary of Sampling Locations, Organisms, and Number of Samples	3-4
Table 3-2.	Decision Matrix for Marine Biota Sampling.	3-9
Table 5-1.	Laboratory Analyses, Methods, Holding Times, Preservation, Sample Quantities, and Containers for Sediments	5-1
Table 5-2.	Laboratory Analyses, Methods, Holding Times, Preservation, Sample Quantities, and Containers for Marine Biota	5-3
Table 7-1.	Data Quality Objectives for Sediment	7-1
Table 7-2.	Data Quality Objectives for Marine Biota	7-7

ACRONYMS AND ABBREVIATIONS

AET	apparent effects threshold
Ammonia	referred to in this document measured as total Ammonia as Nitrogen (mg/L)
AVS	acid volatile sulfide
CLP	Contract Laboratory Program
cm	centimeter
COPC	contaminant of potential concern
CSL	Cleanup Screening Level
DGPS	Differential Global Positioning System
DOT	U.S. Department of Transportation
DQO	data quality objective
Ecology	Washington State Department of Ecology
EDD	electronic data deliverable
EPA	U.S. Environmental Protection Agency
ESI	Expanded Site Inspection
FCR	Field Change Request
FOL	Field Operations Lead
ft./sec.	feet per second
MLLW	mean lower low water
NCASI	National Council of the Paper Industry for Air and Stream Improvement
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
ppt	parts per trillion
PSDDA	Puget Sound Dredged Disposal Analysis
PSEP	Puget Sound Estuary Program
QA/QC	quality assurance/quality control
QAPP	Quality Assurance Project Plan
QC Manager	Quality Control Manager
RME	reasonable maximum estimate
SAP	Sampling and Analysis Plan
SHSP	Site Health and Safety Plan

ACRONYMS AND ABBREVIATIONS (Continued)

SMS	Sediment Management Standards
SOP	Standard Operating Procedure
SQS	Sediment Quality Standards
SVOC	semivolatile organic compound
TCDD	2,3,7,8-tetrachlorodibenzo-p-dioxin
TEQ	TCDD equivalent
TOC	total organic carbon
Total HPAH	total high molecular weight polynuclear aromatic hydrocarbon
Total LPAH	total low molecular weight polynuclear aromatic hydrocarbon
TS	total sulfides
TVS	total volatile solids
USCG	U.S. Coast Guard
WAC	Washington Administrative Code