4. FIELD SAMPLING METHODS

Sediment and marine biota sampling will generally be performed in accordance with Puget Sound Estuary Program (PSEP) protocols (PSEP, 1997) and EPA guidelines (EPA, 1995). Detailed procedures for the sediment and marine biota sampling are provided in Standard Operating Procedures (SOPs) in Appendix A. Sample collection and approach to the sampling will be conducted in a manner that ensures materials are not introduced into samples that may compromise the integrity of the results.

4.1 NAVIGATION AND POSITIONING

Vessel navigation and positioning for the sampling program will be performed using a Differential Global Positioning System (DGPS) interfaced with PC-based navigation software (HYPACK or equal). The navigation software provides real time data display and logging. The objective of the sample location positioning control procedure is to accurately identify and record the location of all sampling locations. The DGPS will generate positions (latitude/longitude) based on WGS84 ellipsoid, with approximately submeter accuracy. These positions will be converted to state plane coordinates within the data logging software. This section summarizes the methods of horizontal and vertical control that will be used for sampling activities.

The following parameters will be documented at each sample location:

- Time and date of sample collection;
- Horizontal location in Washington state plane coordinates (North Zone), as displayed by navigation software;
- Depth to mudline (in feet)
- Tidal elevation referenced to mean lower low water (MLLW). All references to MLLW are based on the U.S. Army Corps of Engineers elevation datum.

Parameters listed above will be measured using combinations of:

- DGPS and navigation software to determine horizontal positions
- Tide gauges/tide staffs to determine water surface elevations

- Fathometer or leadline for depth-to-sediment measurements
- Backup methods that may be used include horizontal triangulation for position determination and predicted tides for determination of water surface elevation

4.1.1 Differential Global Positioning System—Horizontal Control

Sample locations will be surveyed with a mapping-grade DGPS capable of submeter accuracy. The DGPS will be interfaced with a computer running HYPACK (or similar) software. This method provides location data relative to the Washington State plane coordinate system with an accuracy of ±1 meter to a 95th percentile (PSEP requires ±3-meter accuracy). The DGPS will include a roving receiver unit on board the vessel. To achieve the submeter accuracy, differential corrections must be applied to the satellite-determined positions. Differential corrections will be received from the U.S. Coast Guard (USCG) broadcast correction signal. The on-vessel receiver will use the corrections data and satellite data to compute the receiver's (sampling vessel) position. The coordinates will then be processed in real time and the vessel position displayed on screen and stored using HYPACK (or equivalent) software.

To ensure the accuracy of the system, generated positions will be checked against a known point. A temporary control point will be surveyed to a recoverable point such as a pier face, dock, piling, or similar structure. This location will be accessible by the sampling vessel. At the beginning and end of each day, the vessel will station itself at this known location, take a position reading, and compare the reading to the known coordinates. Both readings must be within 2 meters of the known coordinates. The onboard computer will display the boat's position during sampling operations. The position of the boat will be shown in state plane coordinates and graphically on a video screen.

4.1.2 Vertical Control

The vertical control parameters to be measured are depth-to-sediment surface and tidal (water surface) elevation. The depth-to-sediment will be measured before and after each sampling event using a hand-held weighted tape. The incremented weighted tape will be dropped to the bottom off the work platform, pulled taut, and read to the nearest 0.1 foot. This observation will be crosschecked against the onboard depth sounder (fathometer).

Tidal water surface readings will be taken from tide gauges/tide staffs established at the Rayonier site. Water surface elevations (to the nearest 0.5 foot) and time (to nearest minute) will be monitored and recorded before each sample is collected. Sample elevations will be corrected to MLLW using the water surface elevation and depth to mudline for each individual sample. Procedures for navigation and position control are presented in detail in SOP 1, Appendix A.

4.2 SEDIMENT SAMPLING COLLECTION METHODS

4.2.1 Surface Samples

Surface sediment sampling (0 to 10 centimeters [cm]) will be performed using a modified Van Veen grab sampler or other similar equipment deployed from a work vessel of sufficient size to safely handle the sampling equipment. One of the main objectives in sediment sampling is to collect undisturbed samples that are representative of in situ conditions. Samples will be collected utilizing a modified Van Veen sampler, which is a stainless steel, clam shell-type grab used to retrieve bulk sediment samples. The unique scissors-like action of the jaws provides good leverage and helps to embed the sampler in the sediments. The modified versions of this particular sampler currently in use also have large access doors on the top for convenient removal of the upper sediment layers.

The modified Van Veen sampler is typically deployed and retrieved using a hydraulic winch and a hydro-wire (support cable) suspended from a davit or boom, which swings out over the side of the study area. The hydro-wire is attached to the sampler using a swivel connection to minimize twisting and spinning during retrieval.

Two or more grabs may be required to obtain the required sample volume of a representative sample. If so, all grabs will be composited together at each station prior to filling all sample jars, except those designated for the analysis of total sulfide and acid volatile sulfide (AVS). The modified Van Veen grab sampler is designed to consistently collect undisturbed samples to the required depth below the sediment surface without contaminating the samples and is capable of penetrating soft sediments to a depth of approximately 20 cm. Collection of undisturbed sediment requires that the sampler:

- Create a minimal bow wake when descending;
- Form a leak proof seal when the sediment sample is taken;

- Prevent winnowing and excessive sample disturbance when ascending; and
- Allow easy access to the sample surface.

The sampler will be set while it is resting on a stable surface. Once set, a safety pin will be set in place on the triggering mechanism and remain in place until the sampler is swung outboard of the vessel rail. Special care will be exercised when removing the safety pin to maintain personnel safety in the event of a gear or winch failure. Fingers will not be placed through the ring of the pin when it is removed and hands will be kept completely clear of the sampler interior after the pin has been removed. If a sampler is retrieved that has not been tripped, it will be lowered to a stable surface before any worker contact.

The sampler will be lowered by a hydraulic crane and winch at a controlled speed of approximately 1 to 2 feet per second (ft/sec). Under no circumstances will the grab sampler be allowed to free fall to the bottom, because this may result in premature triggering, an excessive bow wake, or improper orientation upon contact with the bottom. The sampler should contact the bottom gently and only its weight should be used to force it into the sediment.

A position fix will be taken the first time the sampler hits bottom. After impact, the sampler closing arms will be raised slowly to allow the sampler to close properly. When the sampler is free of the bottom (as evidenced by increased strain on the winch), the speed will be increased to a constant speed of approximately 4 ft/sec.

During grab retrieval, the winch operator will watch for the appearance of the grab sampler and an additional crewmember may be used if the winch operator does not have a clear view of the water surface. Care will be taken to minimize swinging of the grab sampler. This may require maneuvering the boat to minimize vessel rolling. Swinging of the grab sampler poses a serious risk to personnel, who may be hit or knocked overboard. Swinging of the grab sampler will also cause sample disturbance.

During retrieval and once secure, the grab will be visually evaluated for the absence of water leaking from the sides or bottom due to rocks, sticks, or organisms caught in the jaws of the grab. After retrieval, the sediment sample will be removed from the modified Van Veen sampler and placed in an appropriate container for either compositing with other grabs

or submittal to the laboratory. Specific procedures for sampling sediments with the Van Veen grab sampler are presented in SOP 6, Appendix A.

4.2.2 Grab Sample Acceptability

After recovery, the grab sampler will be placed on a flat surface while remaining closed. The hinged lids on top of the sampler will be opened and the sample inspected for the following criteria:

- Sediment does not extrude from the upper surface of the sampler and is not pressed against the top of the sampler. However, if very soft surficial sediments are typically encountered at the site, a reasonable effort will be made to limit the amount of extrusion.
- Sediment surface is relatively flat and undisturbed (not sloped with partial sample or washed near the sides of the grab).
- Overlying water is present to indicate minimal leakage.
- Overlying water is not excessively turbid.

If a sample does not meet any one of these criteria, it will be rejected. If the sampler cannot obtain an acceptable sample after a reasonable number of attempts, the Field Operations Lead (FOL) will make a determination as to whether an acceptable sample may be retrieved by applying engineering solutions, such as the addition of weights to the sampler, the removal of weights from the sampler, the addition of floats to the sampler, or adjustments to the deployment speed. That determination will be based upon professional judgment in conjunction with the volume and type of substrate retrieved at the site, debris encountered, and other pertinent observations. The number of attempts made at each site will be reasonable for conditions encountered, based on the judgment of the FOL. If no acceptable sample is retrieved at the first sampling site, one or more alternative locations for each site may be selected by the FOL.

4.2.3 Surface Sediment Field Tests

The development of valid, useful bioassay data requires running reference sediments along with the samples. These reference samples should be consistent with the grain size (percent fines) content found in the test samples. A field evaluation, using wet sieve procedures, will

be made on sediments from selected reference sites to determine whether similar grain size distributions occur at both test sample sites and the proposed reference areas. The purpose of the wet sieve procedure (Wakeman, 1990) is to separate sediment samples into size fractions greater than 62.5 µm (i.e., sand and gravel) and less than 62.5 µm (i.e., silt and clay). This procedure, outlined in SOP 8, Appendix A, requires a 62.5-µm sieve, a funnel with diameter slightly greater than that of the sieve frame, a 100-ml graduated cylinder, a squirt bottle, a supply of distilled water, and a bowl for collecting rinse water.

4.2.4 Subsurface Core Samples

Subsurface sampling will be performed using a vibracore coring system or other approved method as the primary sample collection system. The vibracore uses a hydraulic or electric system that vibrates and drives a length of 4-inch outer diameter (O.D.) aluminum tubing into the sediment. A continuous sediment sample is retained within the tubing with the aid of a stainless steel core cutter/catcher. Prior to sampling, each core tube and core catcher will be decontaminated following the procedures outlined in Section 4.5 or a new decontaminated core and catcher will be used for each sample.

The vibracore coring system should be capable of collecting a continuous core to the maximum sediment depth expected at the site of 10 to 12 feet. The standard 4-inch diameter core tube will provide a sufficient volume of sediment for analysis of intervals of approximately one foot.

Vibracore sampling procedures are outlined in SOP 13 of Appendix A, and in the following paragraphs.

Depth of penetration versus depth of recovery will be closely monitored during the collection of the cores. The *in situ* depth to the top of the section will be recorded for each section. After removing the core from the drive head, but before the tube is cut, the tube will be marked with an indelible marker identifying the station and core section and may be wrapped with transparent tape to prevent loss or damage of the marking. The core-sections will be labeled with the boring number and the top and bottom sample depths below the mudline.

Sediment at the end of each tube section will be visually classified for qualitative sample characteristics. Changes from the top to the bottom of each section of the tube will be noted

and recorded on the core log sheet. Empty tubing will be removed to assure that each section is full of sediment. The core ends will then be covered with aluminum foil, a protective cap, and duct tape to prevent leakage. The core sections will be stored upright in a container chilled with ice to approximately 4°C. A full tube will limit disturbance during storage and transport.

If core liners are used, the core tubes will not be cut. The core liner containing the sediment will be removed from the core tube. The core liner will be sealed by tying, taping or other appropriate means and the core placed on ice. The core tube will then be rinsed and a new core liner and core catcher installed.

Minimal processing of the samples will occur aboard the vessel. As soon as possible after collection, the cores will be transported to an onshore facility for sample processing, compositing, and subsampling. Processing of cores will occur as soon as possible after the cores are collected. If problems are discovered during sectioning, another core may need to be taken at the station. The FOL will consult with the Project Manager (PM) and make a decision as soon as possible if a problem is discovered. Processing of cores is described in SOP 14 in Appendix A.

4.2.4.1 Core Sample Acceptability

As the core is brought aboard, it will be visually evaluated for penetration and release of sediment from the tube. Overlying water should be present but should not be excessively turbid. Caution will be used to prevent disturbance of the surface of the sediment when the core is laid horizontal during removal from the drive head. The core catcher will be inspected for rocks or other obstacles that may have plugged the core while penetrating. A core may be rejected if there is doubt about its representativeness.

Sediment depth and sample characteristics in the core will be used to determine if the desired depth has been sampled. If recovery is poor, another core may be attempted at that station. The longer core of the two will be analyzed. The second core will be retained in case problems such as excessive disturbance are discovered during the core cutting procedure. Secondary cores will not be used if the first core is acceptable.

4.2.4.2 Core Compaction

Compaction will be estimated (measured recovery/penetration) and will be used to determine *in situ* sampling depths. Recovered cores will be "expanded" to their penetration depth to compensate for core compaction.

4.3 MARINE BIOTA SAMPLING COLLECTION METHODS

Table 3-1 summarizes the types and number of samples to be collected in each sampling location. The rationale for sampling frequency is derived from the requirements for human health and ecological risk assessment. Multiple data points and multiple organisms in each data point provide a more representative model of the overall population found in the study area. In addition, humans tend to consume only selected portions of marine organisms, while predators in the environment tend to consume an entire organism. Data are needed to support both types of risk assessment.

Whole body tissues and fillets will be collected and analyzed separately for flatfish. The fillets will represent human consumption whereas the whole body samples will be used for evaluating ecological risk to predators. The hepatopancreas ("crab butter") and muscle of the Dungeness crab will be sampled and analyzed separately. For clams, the shucked meat will be used because this entire portion is commonly consumed by humans and predators. The shrimp tails will be sampled because this is the portion of the shrimp commonly consumed by humans.

Analyses will include (as applicable) metals, COPCs, and lipids.

Methods for obtaining the samples and physical parameters for the samples (organism, size, sex, etc.) are presented in SOPs 9, 10, 11, and 12 included in Appendix A.

4.3.1 Crabs

Dungeness crabs are the primary epibenthic species that will be sampled. Crabs will be collected using standard (12 inch by 18 inch by 18 inch) commercial crab pots. The pots will be fished from a work vessel or the Rayonier dock. Up to six pots will be used at each sample location. The pots will be baited with fish, squid, or clams (captured from outside the study area). The bait will be held within small containers to disperse the smell of the bait and attract the crabs. These containers will be useful for two reasons: 1) to protect

against rapid consumption of the bait by smaller organisms, and 2) to minimize consumption by the crabs.

The crab pots will be dispersed throughout each sampling location. For the Port Angeles location, they will be fished near Rayonier project facilities (e.g., the log pond area, near the dock, and near the outfall). Pots will be initially fished for approximately 2 hours with the primary fishing time beginning approximately 2 hours prior to high tide (however, the intent of this sampling will be to collect crabs as quickly as possible under any given tidal conditions that permit). Following the soaking period, the pots will be retrieved. The intent of the capture approach is to obtain sufficient samples at each location for analysis. Therefore, capture methods may be modified to achieve this objective.

Efforts will be made to harvest those crabs with a carapace length greater than 6.25 inches as this is the current legal minimum size limit for Dungeness crabs. However, the effort required to collect enough of crabs of this size to satisfy the sampling requirement may be substantial, and thus crabs may be collected that are smaller than this size. The preference will be for male crabs (the current legal catch). However, female crabs may be an alternative if sufficient numbers of males are not available. Individual crabs will be measured, weighed, and examined for any discoloration, abnormalities, or lesions. Each crab will be killed by a rapid blow to the area on the underside of the carapace below the eyestalks. The crab will be weighed and the length at the widest part of the shell just in front of the rear-most point or tips will be recorded (WDFW, 2000). The crab will then be wrapped in decontaminated aluminum foil and placed in a cooler with ice. Three crabs from each location will be composited into one sample. Three data points (i.e., three composited crabs for each data point) will be developed for the Port Angeles location and three will be developed for the reference site.

Each crab greater than 6.25 inches is roughly estimated to have a total body weight of approximately 1.5 pounds (about 1,021 grams). (These estimates are based on rough approximations made for Dungeness crab). Of this total, approximately 30 percent or about 306 grams is edible meat in the main body and claws. Approximately 5 percent of the total body weight is represented by the hepatopancreas ("crab butter"). Although some people eat crab butter, it is likely that they eat the meat of the crab as well. Therefore, both tissues will be analyzed. This will provide a conservative estimate of body burdens for COPCs. About 100 grams will be needed per station to obtain sufficient material for analysis.

For replication purposes, 3 samples will be obtained at each sample location (i.e., Port Angeles Harbor and the two reference station). Each sample will be a composite of 5 individual animals. For the entire study area, 45 crabs will be required because there are 2 sampling locations. The crabs will be wrapped in decontaminated aluminum foil and placed in plastic bags for analysis of metals and other COPCs.

If sufficient numbers of crabs are not retrieved during the first set, several additional sets may be necessary. If additional sets are required, the pot will be re-baited (if necessary) and returned to its respective station. Decontamination of the pot will not occur with multiple sets at the same site. If insufficient numbers of crabs for analysis are obtained at a particular location (i.e., there are too few for analysis), the number caught will be recorded, but no further attempts will be made to obtain crabs during the sampling period. Sampling will then be attempted at another tide series and with the same procedures to confirm the lack of sufficient numbers. However, the time of fishing each pot may be extended for several hours to determine if any crabs can be caught. If no crabs are caught (either small or larger crabs) during any supplemental sampling series, further attempts to obtain this target species in the study area will be re-evaluated and potentially discontinued.

Crabs that are retained will be handled with decontaminated utensils or clean disposable latex gloves (see Appendix A, SOP 3 for decontamination procedures). Once the sampling is complete, the ice cooler will be sealed and prepared (labeled and chain-of-custody forms completed) for airfreight or ground transport to the laboratory for analysis. The samples must be in transit within a 24-hour period to minimize breakdown of tissues. No more than 48 hours should transpire between sampling and analysis. If this is not possible due to unforeseen conditions (e.g., transport within the designated time period is not possible), the samples must be frozen as quickly as possible.

4.3.2 Shrimp

The target species will be coonstripe (dock) shrimp (*Pandalus danae*) or coonstripe (Humpback) shrimp (*P. hypsinotis*). If these are not available, spot shrimp (*P. platyceros*) may be an alternate. The intent will be to capture one species in sufficient numbers at all sampling locations so that comparable data can be obtained.

Shrimp will be collected using standard sport fishing pots or will be collected during trawling activities. The pots will be fished from a work vessel or the Rayonier dock. Up to

ten pots will be used at each sample location. The pots will be baited with fish, squid, clams, or other bait captured from outside the study area. The bait will be held within small containers to disperse the smell of the bait and attract shrimp. These containers will be useful for two reasons: 1) to protect against rapid consumption of the bait by smaller organisms, and 2) to minimize consumption by the shrimp.

The shrimp pots will be dispersed throughout each sampling location. For Port Angeles, they will be initially fished in the primary area (see Figure 3-1). If sufficient numbers are not found in the primary area, the sampling will be expanded to the secondary area. Pots will be initially fished during late evening or nighttime (however, other times may be used if shrimp are available). Following the soaking period, the pots will be retrieved.

The intent of this sampling will be to collect shrimp as quickly as possible under any given conditions that permit. Therefore, capture methods may be modified to achieve this objective.

Efforts will be made to harvest those shrimp that meet current legal size requirements. For example, there is no minimum size restriction for shrimp in the Port Angeles Shrimp District (WDFW, 2002). However, for sampling areas outside of the District, there is a 1 3/16 inch minimum size for spot shrimp (the length is measured from the base of the eyestalk to the top rear edge of the carapace). For other shrimp species, there is no size limit.

Individual shrimp will be measured, weighed, and examined for any discoloration, abnormalities, or lesions. Each shrimp will be killed with a dissecting needle (or similar equipment). The shrimp will be weighed and the length from the base of the eyestalk to the top rear edge of the carapace will be recorded (WDFW, 2002). The tail section of the shrimp will be separated from the body by removing the head section (including the legs, carapace, and body parts under the carapace). The tail sections of the shrimp will be grouped with other tails from the same sample location, wrapped in decontaminated aluminum foil, and placed in a cooler with ice.

Three samples will be collected from the Port Angeles location and three samples will be collected for one reference site. Dungeness Spit will be considered the primary reference site followed by Freshwater Bay. A minimum of 10 shrimp tails will be composited into each sample (i.e., for Port Angeles, there will be 3 samples, so a minimum of 30 shrimp will

be collected). The intent will be to collect a minimum of 120 grams of shrimp tail meat for each sample.

Shrimp may also be collected using a trawl. In this case, shrimp that are brought onboard with the trawl will be sorted into live boxes. Targeted species will be processed in the same way as shrimp collected in shrimp pots.

Shrimp that are captured and retained by either pot or trawl will be handled with decontaminated utensils or clean disposable latex gloves (see Appendix A, SOP 3 for decontamination procedures). Once the sampling is complete at a location (either by shrimp pots or trawling), the ice cooler will be sealed and prepared (labeled and chain-of-custody forms completed) for airfreight or ground transport to the laboratory for analysis. The samples must be in transit within a 24-hour period to minimize breakdown of tissues. No more than 48 hours should transpire between sampling and analysis. If this is not possible due to unforeseen conditions (e.g., transport within the designated time period is not possible), the samples must be frozen as quickly as possible.

4.3.3 Clams

Butter clams, or if necessary, a mixture of butter/littleneck/manila clams will be the target clam species. Geoduck or horse clams will be possible alternatives. Existing literature indicates that few, if any, clams are likely to be found in the intertidal areas. Field sampling will attempt to collect clams from both intertidal and subtidal areas in the log pond, dock, and eastern beach areas. Studies by Shea et al. (1981) note that subtidal populations of clams are present near the dock, in the vicinity of the diffuser outfall, and at the reference sites.

Divers will collect the subtidal clams. To retrieve the clams, the divers will either use a venturi pump, hand-held devices (e.g., clam rake), or other hydraulic pumping system. Approximately 10 clams of similar size (2 to 3 inches) will be collected at each station. Only undamaged clams will be retained. The collected clams will be of legal size, at least 1.5 inches in length.

Intertidal clams may be sampled at low tide using a shovel or other appropriate sampling device.

The clams will be brought to the surface and the length of each clam will be recorded. Each group of clams from one station will be placed in a precleaned borosilicate glass jar, put on ice in an ice chest, and transported to the laboratory for analysis. The samples must be transported within a 24-hour period to minimize breakdown of tissues. No more than 48 hours should transpire between sampling and analysis. If this is not possible due to unforeseen conditions (e.g., transport is not possible), the samples must be frozen as quickly as possible.

4.3.4 Flatfish

English sole is the target demersal species in the study area. They will be captured using hook-and-line techniques. Alternatively, if approved by WDFW, an otter trawl or other appropriate sampling method may be used. The intent of this sampling is to obtain samples for bioaccumulation studies, not to develop abundance estimates. Therefore, the main focus will be on capturing specimens.

Hooks will be baited with a small piece of shrimp or clam. One sample of the bait will be retained for analysis to ensure that cross-contamination by consumption of bait has not occurred.

Upon retrieval, small fish (e.g., less than 5 to 6 inches) will be released if possible. Larger fish will be retained and sorted as to species. The length and weight of each fish will be recorded. In addition, the otoliths (both if possible) will be removed and placed in small vials. The otoliths will be used for determining the age of each fish.

For each sampling location (i.e., Port Angeles Harbor or the two reference locations), up to 30 fish will be retained at each station. Half of these (i.e., 15 fish) will be filleted in the laboratory. Altogether, this will result in the need of up to 90 fish from the three sampling locations.

To the extent possible, this will be one species, the target species being English sole with sanddabs as an alternative species. The intent is to obtain the number of fish required for analysis with as little species variation as possible.

Each fish will be killed using a decontaminated utensil (e.g., by inserting an ice pick through the head area). A new utensil will be used for each station. Each fish to be retained will be measured (total length in millimeters) and weighed (total weight in grams). The fish

will be individually wrapped in decontaminated aluminum foil and placed in individually marked plastic bags. These will be used for analysis of metals and other COPCs.

Fish that are retained will be handled with decontaminated utensils or decontaminated latex gloves. Once the sampling is complete, each plastic bag will be sealed. In addition, the ice cooler will be sealed and prepared (labeled and chain-of-custody) for transport to the laboratory for analysis. The samples must be transported within a 24-hour period to minimize breakdown of tissues. No more than 48 hours should transpire between sampling and analysis. If this is not possible due to unforeseen conditions (e.g., transport is not possible), the samples must be frozen as quickly as possible.

4.4 SAMPLE COMPOSITING AND OTHER SUBSAMPLING

Sediment sample aliquots being analyzed for total sulfide and AVS will not be composited during field collection. Instead, discrete samples will be collected for these two parameters. For all other parameters, sediment samples will be composited during collection by placing equal volumes of sampling material in a decontaminated bowl and mixing with a decontaminated mixing spoon. The sampling materials in the bowl will be mixed until homogeneous and will continue to be stirred while individual aliquots are taken of the homogenate. This will ensure that the mixture remains homogeneous and that settling of coarse-grained sediments does not occur.

Both chemistry and bioassay samples will be taken from the same sediment homogenate. Portions of each composite sample will be placed in appropriate containers obtained from the chemical and biological laboratories. See Table 5-1 in Section 5 for container and sample size information. After placement of the sample in the sampling jar, each sample container will be firmly sealed and properly labeled (see Section 4.8.4). Each sample will be stored at approximately 4°C until sent to the laboratory for analysis and will be handled in accordance with strict chain-of-custody procedures outlined in Section 4.8. Upon receipt, the laboratory will store the samples. Each sample reserved for bioassays will be stored at 4°C in a nitrogen atmosphere (i.e., nitrogen gas in the container headspace) for up to 56 days pending initiation of any required biological testing.

Core sections collected for chemical sampling will be extruded onshore at the core processing station. Cores will be extruded by elevating the tube at an angle and tapping the

tube with a mallet, by using a core press, or by vibrating the tube. This process produces a generally intact core for visual classification of the sediments with depth. Optionally, plastic core liners may be used during core collection. Plastic liners containing sediment are typically extracted from the core tube on the vessel and the sediment core within the plastic liner then transported to the core processing station. Core sections will be sampled according to strata. Each horizon will be homogenized and placed in appropriate containers to be analyzed and archived. Each sample will be stored at approximately 4°C until sent to the laboratory for analysis and will be handled in accordance with strict chain-of-custody procedures outlined in Section 4.8. Upon receipt, the laboratory will store the samples.

Marine biota samples will be processed and composited at the laboratory using a stainless steel blender or other appropriate equipment. Further details regarding the collection of specimens for marine biota compositing are provided in SOPs 10, 11, 12, and 15 in Appendix A.

4.5 DECONTAMINATION PROCEDURES

Field equipment used during the sampling activities will be decontaminated prior to sample collection to minimize the potential for cross-contamination. Whenever possible, disposable sampling equipment will be used to minimize the need for decontaminating equipment. Prior to sample collection, all non-disposable field sampling equipment that will come in contact with the samples will be cleaned and decontaminated following SOP 3, Appendix A. General decontamination procedures for heavy sampling equipment will be performed as detailed in SOP 7, Appendix A. Clean gloves will be worn at each sampling location, and no smoking will be allowed on the sampling vessel.

Acid or solvent washes will generally not be used in the field because of considerations such as safety, rinsate disposal, and sample integrity. The use of acids or organic solvents on the congested deck of the vessel may pose a safety hazard to the crew. Additionally, disposal and spillage of acids and solvents during field activities aboard ship pose an environmental concern. Residues of solvents and acids on sampling equipment may also affect sample integrity for chemical testing. However, as a contingency, if sticky or oily residues are encountered during sampling, an acid/solvent rinse sequence (i.e., nitric acid and isopropanol) will be implemented to prevent cross-contamination. Hexane or acetone will be available as a final backup rinse for removal of oily or sticky residues.

4.6 INVESTIGATION-DERIVED WASTE

All sediment and marine biota remaining after sampling will be disposed of in the vicinity of the collection site or by the analytical laboratory. All disposable sampling materials and personal protective equipment used in sample processing, such as disposable coveralls, gloves, and paper towels, will be placed in heavy-weight garbage bags, 5-gallon buckets, or other appropriate containers. These containers will be removed from sampling areas daily and placed in a central storage location at the project site. At the end of the field program, disposable waste will be removed from the storage area and placed in a normal refuse container for disposal at a solid waste landfill. Detergent-bearing liquid wastes from decontamination of the sampling equipment will be stored in carboys, plastic buckets with sealable lids, and/or 55-gallon drums. At the end of the sampling program, stored decontamination fluids will be disposed according to the SHSP (Volume V). Procedures for handling of investigation-derived waste are also presented in SOP 4, Appendix A.

4.7 FIELD CHANGES

Because of contingencies during field activities, modifications of the procedures outlined in the SAP may be required. Modifications of procedures will be at the discretion of the FOL after consultation with the Technical Lead, Quality Control Manager, or Project Manager. In the event that major modifications are required or warranted, every effort will be made to consult Ecology prior to implementation of the changes. Significant modifications will be documented with a Field Change Request (FCR) (Figure 4-1). If a field change is later found to be unacceptable, the action taken during the period of deviation will be evaluated to determine the significance of any departure from the established program practices and appropriate action taken.

4.8 DOCUMENTATION

Six primary types of documentation will be used for this project: site logbooks, photographs, sample summary logs, sample labels, custody seals, and chain-of-custody forms. The site logbooks are vital for documenting all on-site activities. Photographic documentation will be used to provide an accurate visual account of sampled materials, sample locations, and environmental conditions. Sampling information will be recorded on sample summary logs. Sample labels will be used to provide essential information and identification for all samples collected during field activities. Custody seals will be used on

Figure 4-1. Field Change Request

FOSTER WHEELER ENVIRONMENTAL CORPORATION

FIELD CHANGE REQUEST (FCR)

PROJECT NAME	PROJECT NO.	CHANGE REQUEST NO. **FCR-**
TO (Ecology Mgr.,Tribe Rep.,Rayonier PM):	LOCATION	DATE

RE: ___ Drawing No. _____ Title _____

___ Spec Section _____ Title _____

___ Other _____

***1. DESCRIPTION (Items involved, submit sketch, if applicable)*:**

2. REASON FOR CHANGE

3. RECOMMENDED DISPOSITION (Submit sketch, if applicable):

_____ Minor Change _____ Major Change (Impacts Cost, Schedule or Technical)

3a. Will this change result in a contract cost or time change? _____ YES _____ NO

3b. Estimate of contract cost or time charge (if any) _____

PREPARER (Signature)	DATE	PREPARER'S TITLE	SITE SUPERINTENDENT (Signature)	DATE

4. DISPOSITION

___ Not approved (give reason).

___ Considered minor change - approved per Recommended Disposition - Documents will not formally be revised, field to maintain as-built records.

___ Considered major change - approval required via contract modification process.

1) FOSTER WHEELER ENVIRONMENTAL DESIGN MANAGER (Signature) (IF ENGINEERING RELATED)	DATE	2) FOSTER WHEELER ENVIRONMENTAL PROJECT MANAGER (Signature)	DATE
3) HEALTH AND SAFETY MANAGER (Signature) (IF HEALTH AND SAFETY RELATED) _____ Comments (attached) _____ No Comments	DATE	4) QC REVIEWER (Signature) _____ Comments (attached) _____ No Comments	DATE

Project Manager distributes to:

Foster Wheeler Design Manager Contracts Manager QA Manager Site Management Team Reps. FCR Preparer
QC Manager Site Superintendent Project Controls Supervisor Project Health and Safety Manager

all sample shipment containers to detect any tampering that may have occurred during transport or shipment. The chain-of-custody forms will be used to track sample custody, which is an important aspect of field investigation activities that documents the proper handling and integrity of the samples. A description of each of these documentation methods is provided in the following sections.

4.8.1 Site Logbooks

Site logbooks will be used to document all field and sampling activities performed at the site. Entries to the logbooks will include the date, time, description of field activities performed, names of personnel, weather conditions, areas where photographs are taken (if applicable), and any other data pertinent to the project. The site logbooks will also contain all sample collection and identification information and (if appropriate) a drawing of each area sampled, along with the exact location (coordinates) of where the sample is taken. When samples are collected, the logbooks will include the date, time, sample location, sample identification number, sample matrix, sample collection method, analyses to be performed, any comments, and the sampler's name.

Each page of the site logbooks will be pre-numbered, dated at the time of use, and signed by the author at the end of each day's activities. The logbooks should be sturdy, weatherproof, and bound to prevent the removal of pages. All writing will be done in waterproof, permanent ink. No pages may be removed from the site logbooks for any reason. Blank pages must be marked "page intentionally left blank." Mistakes must be crossed out with a single line, initialed, and dated. If multiple logbooks are used, they will be numbered sequentially. Requirements for the site logbooks are detailed further in SOP 2, Appendix A.

4.8.2 Photographs

Photographs will be utilized during the project to document field activities and to provide an accurate visual record of the material sampled. All photographs taken will be identified in the site logbooks (preferably in a separate section of the book that is set aside for that purpose). Photographic logs will contain the film roll number, photograph number, date, time, initials of the photographer, and a description of the image in the photograph. Developed photographic prints will be sequentially numbered and dated corresponding to the logbook descriptions.

4.8.3 Sample Summary Logs

Sample summary logs will be maintained by the FOL and used to keep track of all phases of the sampling and analysis process for all individual samples (Figure 4-2). The summary logs will include the sample identification number, date of collection, sample delivery date, date analytical results are received, and laboratory identification number.

4.8.4 Sample Labels

Sample containers will be clearly labeled with waterproof black ink at the time of sampling. Sample labels (Figure 4-3) will include the following information:

- Project name
- Sampling date
- Sampling timeSample location
- Sample identification number
- Analysis to be performed
- Preservation used, if any
- Initials of sampler

The sample label will be attached to the sample container prior to, or just after, the container is filled and the lid secured. As an added measure of security, the finished label will be covered with clear packaging tape to protect the ink from moisture and to tightly secure the label to the sample container. Information on the sample label will match the information on the chain-of-custody form and in the site logbook.

4.8.5 Custody Seals

Custody seals (Figure 4-3) will be used on sample shipping containers (coolers) that will either be shipped or sent by messenger to the laboratory. Custody seals will be attached to the lid and body of the coolers to detect any tampering during shipment. The custody seals will be signed and dated. Custody seals are not required for samples hand-delivered directly to the laboratory, unless the coolers are left unattended at any time.

Figure 4-2. Sample Summary Log

Sample ID #	Sampling Location	Sampling Date	Time	Analysis Requested	Date Shipped	Date Fax Results	Due Date Prelim.	Due Date Final	Date Received	Laboratory ID No.	Notes

Figure 4-3. Sample Label and Custody Seal

Client _____

Collection Date _____ Time _____

Sample Location _____

Sample I.D. _____

Sampler _____

Analysis	Lab No.

Preserved with: None, H_2SO_4, Cool, NaOH, HNO_3, Other _____, HCL

CUSTODY SEAL

Date _____

Signature _____

Sample Container Label and Custody Seal

4.8.6 Chain-of-Custody Forms

The chain-of-custody form (Figure 4-4) is necessary to document sample collection and the analysis required for each sample. The history of each sample and its handling will be documented from its collection through all transfers of custody until it is transferred to the analytical laboratory. The custody record will be completed using waterproof ink. Any corrections will be made by drawing a line through and initialing and dating the change, then entering the correct information. Erasures or white-outs will not be permitted.

At a minimum, the chain-of-custody form will have the following information:

- Name of project
- Name and signature of sampler
- Sample identification numbers
- Sampling date Sampling time
- Number and type of containers per sample
- Sample matrix
- Sample preservation, if any
- Analyses requested

The chain-of-custody form will be filled out as each sample is taken and double-checked before the samples are delivered to the laboratory. When transferring possession of samples, the individuals relinquishing and receiving them will sign, date, and note the time on the form. This will document sample custody transfer from the sampler to the laboratory. Containers shipped by common carrier will have the chain-of-custody form enclosed in a watertight container (e.g., Ziploc® plastic bag) and placed in the container prior to sealing. Internal laboratory records will document custody of the sample from the time it is received through its final disposition. Copies of each chain-of-custody form will be given to the FOL for tracking of the sampling and analysis process for all samples. The copies will be maintained by the FOL, and will be kept in a binder on site. Sample shipping and handling procedures are detailed in SOP 5, Appendix A.

Figure 4-4. Chain of Custody Record
Request for Analysis

FOSTER WHEELER ENVIRONMENTAL CORPORATION
12100 NE 195th, Suite 200, Bothell, WA 98011
(425) 482-7600 ¥Fax (425) 482-7676

Page _____ of _____ Lab. Ref. No. _____

Project Name: _____
Project Address: _____
FW Project No.: _____

Sampling
Shipping
Shipping Ref.:

Analysis Laboratory:
Laboratory Contact: P.O. No.:
Reports to be Sent to:
Address/Phone No.:

Sampler(s): *(printed name)*
Sampler(s): *(signature)*

Sample Disposal Instructions:
- ☐ Lab disposal
- ☐ Return to FWENC
- ☐ Hold for pickup (will call)

Special Instructions:

SAMPLE IDENTIFICATION	TIME COL-LECTED	NO. OF CONTAINERS, SIZE & TYPE	PRES-ERV-ATIVE	MATRIX	SAMPLE TYPE Com-posite	SAMPLE TYPE Grab	Sample prep. Method Standard (EPA # ____)	Sample prep. TCLP (1311) ____ Other ____	CLP Data Pkg.; Other	Halogenated Volatiles 8010B, 8121, 601, 502.1, CLP	Aromatic Volatiles 8020A,8021B, 602, 502.2, 503.1, CLP	BETX Only 8020A, 602, CLP	GC/MS VOAs 8260B, 624, 524.1, 524.2, CLP	GC/MS SVOAs 8270C, 625, 525, CLP	Pesticides (Organochlorine) 8081A, 608, 505, CLP	PCBs 8082 (Aroclors, Full Congeners)	HPLC PNA/PAHs 8310,610	Organophosphorus Comps. (Pest. & Herbs) 8141A	Chlorinated Herbicides 8151A	Dioxins 8290, CLP, 1613	Nitroaromatics and Nitramines(Ordnance) 8330	TPH-HCID AK, NWHCID	TPH-Gx AK101, NWTPHGx	TPH-Dx AK102,103, NWTPHDx	TPH frac. NWVPH NWEPH AK101AA AK102AA	Lead 6010, 7420, 7421	Priority Poll. Metals (13) 6010B & 7000 Series, 6020 CLP	TCL Metals (23) 6010B & 7000 Series,6020, CLP	TCLP 1311 (metals, VOAs, SVOAs, Pest., Herb.)	Inorganic Anions (Cl, F, NO_3, NO_2, PO_4, SO_4) 300,____	Total Organic Carbon (TOC) 9060,____				REMARKS

Turnaround Time:
- ☐ Standard
- ☐ 1 Week
- ☐ 4 Work Day
- ☐ 3 Work Day
- ☐ 2 Work Day
- ☐ 24 Hour

Sample Receipt:
Total # Containers Recvd.: _____
COC Seals Present? _____
COC Seals Intact? _____
Received Cold? _____
Received Intact? _____
Received Via: _____

Relinquished by: *(signature)*	Relinquished by: *(signature)*	Relinquished by: *(signature)*	Relinquished by: *(signature)*
Date: Time:	Date: Time:	Date: Time:	Date: Time:
Received by: *(signature)*	Received by: *(signature)*	Received by: *(signature)*	Received by: *(signature)*
Date: Time:	Date: Time:	Date: Time:	Date: Time:

Rev 7/28/99