3. OBJECTIVES OF THE MARINE BIOTA INVESTIGATION

3.1 OVERALL DESIGN

The former Rayonier Mill has discontinued operation; however, existing sources of COPCs may be present in the sediments and depositional materials in the study area. Because of their proximity to these potential sources, flatfish, crabs, and clams will be examined to determine if they currently have any COPC accumulations and to assess the potential risk associated with concentrations of these COPCs in the food web. It is believed that if COPCs from the former Rayonier Mill are present, the highest concentrations likely would be in the study area near the plant site and the Rayonier deepwater outfall diffuser. Therefore, the greatest level of sampling effort to determine if any bioaccumulation occurs will be in these areas.

3.2 TARGET SPECIES FOR SAMPLING

Target species from several groups of organisms will be evaluated. These groups are demersal fish (e.g., flatfish), epibenthic organisms (e.g., crabs and shrimp), and benthic infauna (e.g., clams). Other more mobile species such as salmon, herring, and sandlance are considered transient and less likely to bioaccumulate potential COPCs. General guidelines in EPA's document entitled *Guidance for Assessing Chemical Contaminant Data for Use in Fish Advisories—Volume 1, Fish Sampling and Analysis, Second Edition* (EPA, 1995) were used for selecting target species.

Even though the target species are present in the study area (as indicated by literature review, discussions with local biologists, and on-site investigations), they are anticipated to have a non-uniform or patchy distribution. Therefore, sampling locations and primary target species may need to be adjusted as field conditions warrant (e.g., if the target species is not present in sufficient quantities to make a complete sample, other species may need to be used as alternatives).

Target species have been selected based on several criteria:

- Potential to bioaccumulate COPCs (e.g., transient organisms vs. fixed or less mobile)

- Relatively abundant in the area (e.g., sufficient numbers available for sampling and distribution in relation to the former Rayonier Mill Site)
- Representatives of a general group of organisms (e.g., bottom-dwellers such as crabs and flatfish, and infauna)
- Relatively high level of importance (e.g., ecological, subsistence, economic, commercial, recreational)
- Body size that is large enough to provide tissues for chemical analysis

3.2.1 Crabs

The target crab species is Dungeness crab (*Cancer magister*). Through review of the literature (PTI Environmental Services, 1991; Rayonier, Inc., 1995) and preliminary on-site investigations, it is anticipated that sufficient numbers of this species will be available in the study area for analysis. Adult Dungeness crabs characteristically live on the bottom and opportunistically feed on worms, clams, and dead organisms that may be found in or near the bottom. They are sought by sport, commercial, and tribal fishermen for human consumption. They also are consumed by other receptors such as octopus and otter. Dungeness crab will be collected using commercial crab pots. If Dungeness crabs are not available, red rock crabs (*C. productus*) have been selected as an alternative species.

3.2.2 Shrimp

Shrimp were selected as a target species because of their high level of importance as a recreational fishery. The target species is coonstripe shrimp (*Pandalus danae*). Shrimp provide an important recreational fishery in Port Angeles harbor. Pandalid shrimp are opportunistic bottom feeders that will eat a wide variety of items such as worms, diatoms, detritus (dead organic material), algae, and various invertebrates (ADF&G 2002). Shrimp inhabit varying depths and habitat types, and most shrimp migrate seasonally from deep to shallow waters and also more vertically in the water column. Coonstripe shrimp have been observed around the dock and log pond, while spot shrimp are more likely to be found in deeper water. If coonstripe shrimp are not available, spot shrimp (*Pandalus platyceros)* have been selected as an alternative species.

3.2.3 Clams

The target clam species is a mixture[3] of butter clams (*Saxidomus giganteus*), native littleneck clams (*Protothaca staminea*), and manila clams (*Tapes philippinarum*). These species live within the substrate and are filter feeders (i.e., they consume bits of algae, bacteria, plankton, and other suspended detritus by taking in water through their siphons, extracting the food, and expelling the filtered water) and have a similar potential to accumulate chemicals from the sediment. They are also a highly sought sport and commercial species. Intertidal beds of these species appear to be sparse or non-existent in the study area. However, subtidal populations appear to be available in sufficient numbers for sampling (Goodwin and Shaul, 1978; Shea et al., 1981; Evans-Hamilton and D.R. Systems, 1987; WDF, 1992). If insufficient numbers of butter/littleneck/manila clams are available, geoduck clams[4] (*Panope abrupta*) will be the preferred alternative species. If insufficient geoducks are available, horse clams (*Tresus capax*) are considered a secondary alternative species.

3.2.4 Flatfish

The target bottom-dwelling flatfish is the English sole (*Pleuronectes vetulus*). Previous investigations in the study area indicated that this species might be the most abundant flatfish (Shea et al., 1981; Evans-Hamilton and D.R. Systems, 1987; WDF, 1992; Simenstad et al., 1979; EVS Consultants, 1994).

Flatfish live on or near the bottom sediments and consume organisms such as worms or clams that live in the sediment, small fish, and dead organisms. Flatfish are used for human consumption and are likely consumed by other receptors such as seals and sea lions. Flatfish can be captured by hook-and-line or nets.

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[3] If possible, the intent is to collect butter clams from all areas of sampling. However, if adequate mass of butter clams is not available, a mixture of similar clams as noted will be collected to satisfy the primary target species objective.

[4] Although geoducks are part of the sampling design, their importance to the Tribe necessitates some samples being collected regardless of the availability of other species of shellfish. Therefore, if geoducks are collected as an alternative species as part of the primary sampling design described in this document, no additional sampling will be performed. However, if geoducks are not selected as one of the targeted sampling species in the primary design, geoducks will be collected from the closest inhabited area near the mill for analyses of dioxins and furans. In addition, geoducks will also be collected from Dungeness Spit and Freshwater Bay for similar analyses.

Various other flatfish have been reported in the Port Angeles area including rock sole (*Pleuronectes bilineata*), sanddabs (*Citharichthys sordidus*), starry flounder (*Platichthys stellatus*), and Pacific halibut *(Hippoglossus stenolepis*). Sanddabs are selected as the alternative species based upon their likely presence in the area.

3.3 CHEMICAL ANALYTES

The chemical analytes considered for analysis will be based on results from past marine studies in the Port Angeles area. They will also parallel the analytes considered for sediment samples. The analyses include lipids, metals, SVOCs (includes PAHs and phenols), arsenic speciation, dioxin and furans (all forms), and PCBs. Approximately 120 grams of tissue are required for each sample. Additional sample mass will be required for QA samples. Proposed analytical testing is summarized in Table 3-1.

Table 3-1. Summary of Sampling Locations, Organisms, and Number of Samples

Organism	Sampling Area	No. of Samples	Organisms Per Sample	No. of Organisms per Area	Comments
Crab[1/]	Port Angeles Harbor (General Site)	3 – muscle 3 – butter	5	15	Each sample will be a composite of at least 5 individuals. Limiting factor is mass of butter.
	Dungeness Spit (Reference)	3 – muscle 3 – butter	5	15	Each sample will be a composite of at least 5 individuals. Limiting factor is mass of butter.
	Freshwater Bay (Reference)	3 – muscle 3 – butter	5	15	Each sample will be a composite of at least 5 individuals. Limiting factor is mass of butter.
Flatfish[2/]	Port Angeles Harbor (General Site)	3 – whole body 3-fillet	5	30	Each sample will be a composite of up to 5 individual fish.
	Dungeness Spit (Reference)	3 – whole body 3-fillet	5	30	Each sample will be a composite of up to 5 individual fish.
	Freshwater Bay (Reference)	3 – whole body 3-fillet	5	30	Each sample will be a composite of up to 5 individual fish.

Table 3-1. Summary of Sampling Locations, Organisms, and Number of Samples

Organism	Sampling Area	No. of Samples	Organisms Per Sample	No. of Organisms per Area	Comments
Clams[3/]	Rayonier Log Pond	3	10	30	Preferably butter, but a mixture of butter/littleneck/manila if necessary, each sample will be a composite of at least 10 individuals (or sufficient to provide a minimum of 120 g of tissue). If geoduck or horse clam are sampled, each sample will be an individual clam.
	Rayonier Dock	3	10	30	Preferably butter, but a mixture of butter/littleneck/manila, if necessary each sample will be a composite of at least 10 individuals (or sufficient to provide a minimum of 120 g of tissue). If geoduck or horse clam are sampled, each sample will be an individual clam.
	Rayonier Deepwater Outfall	3	10	30	Preferably butter, but a mixture of butter/littleneck/manila, if necessary, each sample will be a composite of at least 10 individuals (or sufficient to provide a minimum of 120 g tissue). If geoduck or horse clam are sampled, each sample will be an individual clam.
	East Beach Area	3	10	30	Preferably butter, but a mixture of butter/littleneck/manila, if necessary, each sample will be a composite of at least 10 individuals (or sufficient to provide a minimum of 120 g tissue). If geoduck or horse clam are sampled, each sample will be an individual clam.

Table 3-1. Summary of Sampling Locations, Organisms, and Number of Samples

Organism	Sampling Area	No. of Samples	Organisms Per Sample	No. of Organisms per Area	Comments
	Dungeness Spit (Reference)	3	10	30	Preferably butter, but a mixture of butter/littleneck/manila, if necessary each sample will be a composite of at least 10 individuals (or sufficient to provide a minimum of 120 g of tissue).
	Freshwater Bay (Reference)	3	10	30	Preferably butter, but a mixture of butter/littleneck/manila, if necessary each sample will be a composite of at least 10 individuals (or sufficient to provide a minimum of 120 g of tissue
Shrimp	Port Angeles Harbor (General Site)	3 – tails	10	30	Each sample will be a composite of at least 10 individuals (or sufficient to provide a minimum of 120 g of tissue)
	Dungenss Spit or Freshwater Bay (Reference)	3 – tails	10	30	Each sample will be a composite of at least 10 individuals (or sufficient to provide a minimum of 120 g of tissue)

Notes:

Organism	**Totals**
Crabs	45
Flatfish	90
Clams	180 (butter/littleneck/manila clams)
Shrimp	60

1/ Dungeness crabs are the primary species. Red rock crabs are the alternative species.
2/ English sole are the primary species. Sanddabs are thealternative species.
3/ Butter/littleneck/manila clams are the primary species. Geoducks and horse clams are alternative species.
4/ Coonstripe shrimp are the primary species. Spot shrimp are the alternative species.

3.4 SAMPLING STATION LOCATIONS

In general, the more mobile organisms (crab, shrimp, and flatfish) were considered to be capable of moving within the general Port Angeles Harbor area and within the reference site, but unlikely to move between these two areas. Therefore, sampling for these species will be conducted over these locations. For the Port Angeles location, emphasis will be placed on collecting organisms (as available) in areas near the Rayonier project facilities (e.g., log pond, dock facilities, and outfall).

Less mobile organisms, such as clams, provide opportunities for gathering information at more defined and specific locations in relation to project features. However, they may not be found at all sites near the Rayonier project facilities (e.g., log pond, dock facilities, and outfall) due to patchy distribution based on habitat, tidal currents, and other conditions. Emphasis will be placed on collecting less mobile organisms at the nearest location to these facilities as possible, depending on abundance and distribution. Background information from the literature, video surveys conducted by Rayonier of the project area, and discussions with local biologists have indicated that the likelihood of collecting less mobile organisms in the log pond area is low. Near the dock facilities, there may be some opportunities whereas the likelihood increases toward the outfall area.

Because organisms are not distributed uniformly in nature, it may not be possible to achieve all the marine biota sampling goals. Table 3-2 presents a decision matrix for selecting marine biota sampling options for flatfish, crabs, shrimp, and clams that will maximize the achievement of the sampling goals. The decision matrix will be used to guide the marine biota field sampling effort. It is organized by sampling area and then target species because greater priority was placed on the successful collection of biota from each sample area rather than sampling a specific target species from each area. The decision matrix describes several likely sampling options and the criteria used to select them. However, it is not possible to address all possible sampling options. If none of the likely sampling options are achievable, the best professional judgment of the marine ecologists conducting the field sampling will be used to optimize the sampling.

Sampling areas for flatfish, shrimp, and crabs are shown in Figure 3-1 and sampling areas for clams are shown in Figures 3-2 and 3-3. Sampling areas were selected that are potentially affected by chemical releases from the former Rayonier mill site. Sampling will preferentially occur as close as possible to the potentially affected areas in Port Angeles Harbor (primary sampling areas). If target species are not found in the primary sampling

areas in Port Angeles Harbor, the sampling area will be expanded (secondary sampling areas) to increase the probability of achieving sampling goals. Sampling areas were identified using available sediment chemistry data and results of outfall modeling to indicate the areas of highest potential chemical concentrations. It is assumed that the reference sampling areas are sufficiently large and ecologically diverse to meet sampling requirements.

Table 3-2. Decision Matrix for Marine Biota Sampling.

Sample Type	Sample Area	Sampling Options						Comments
		Option #1	Option #2	Option #3	Option #4	Option #5	Option #6	
Flatfish	Port Angeles Harbor	Collect English sole from primary sampling area (Area A on Figure 3-1)	Collect sanddabs from primary sampling area (Area A on Figure 3-1)	Collect English sole from secondary sampling area (Area B on Figure 3-1)	Collect sanddabs from secondary sampling area (Area B on Figure 3-1)	NR	NR	A reconnaissance sampling will be conducted to determine the species availability, abundance, and distribution in Port Angeles Harbor and the two reference sampling areas. A hook and line capture technique will be used to sample fish, although a beach seine might also be used if practicable. During reconnaissance sampling, all candidate species of acceptable size will be retained in on-board live tanks until a sampling option is selected when unwanted individuals will be released. The minimum acceptable fish length is 6 inches. If possible, the same species will be collected from Port Angeles Harbor and the reference areas. Sampling requirements are 3 whole body and 3 fillet composite samples from each of three sampling areas. Each sample will be a composite of up to 5 individual fish. Based on the reconnaissance sampling, the following criteria will be used to select the most appropriate sampling option: a. If at least one English is collected from the primary sampling area in Port Angeles Harbor (Area A on Figure 3-1) and each of the two reference areas during reconnaissance sampling, English sole will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #1). b. If no English sole are collected from the primary sampling area in Port Angeles Harbor (Area A on Figure 3-1) or either of the two reference areas, but sanddabs are collected from these areas, sanddabs will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #2). c. If no English sole or sanddabs are collected from the primary Port Angeles sampling area during reconnaissance sampling, sampling of Port Angeles Harbor will be expanded to the secondary area (Area B on Figure 3-1). If at least one English sole is collected from the secondary sampling area in Port Angeles Harbor and the two reference areas, English sole will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #3). d. If no English sole or sanddabs are collected from the primary Port Angeles sampling area during reconnaissance sampling, sampling of Port Angeles Harbor will be expanded to the secondary area (Area B on Figure 3-1). If no English sole are collected from the secondary sampling area in Port Angeles Harbor or either of the two reference areas, but sanddabs are collected from these areas, sanddabs will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #4). e. If none of the preceding criteria are met or prolonged sampling (e.g., > 2 days) fails to meet sampling requirements, best professional judgment will be used to define the most appropriate sampling design.
	Dungeness Spit and Freshwater Bay Reference Areas	Collect English sole from the two reference areas (Figure 3-1)	Collect sanddabs from the two reference areas (Figure 3-1)	NR	NR	NR	NR	
Crabs	Port Angeles Harbor	Collect Dungeness crabs from primary sampling area (Area A on Figure 3-1)	Collect red rock crabs from primary sampling area (Area A on Figure 3-1)	Collect Dungeness crabs from secondary sampling area (Area B on Figure 3-1)	Collect red rock crabs from a secondary sampling area (Area B on Figure 3-1)	NR	NR	A reconnaissance sampling will be conducted to determine the species availability, abundance, and distribution in Port Angeles Harbor and the two reference sampling areas. Crabs will be sampled using standard sport fishing crab pots. During reconnaissance sampling, all candidate species will be retained in on-board live tanks until a sampling option is selected when unwanted individuals will be released. The largest of the crabs collected will be sampled and the remaining crabs will be released. If possible, the same species should be collected from Port Angeles Harbor and the reference areas. Sampling requirements are 3 composite samples from each of the three sampling areas. Composite samples will consist of a minimum of 5 individual crabs for analysis of muscle and hepatopancreas tissues (muscle and hepatopancreas tissues will be analyzed separately). Based on the reconnaissance sampling, the following criteria will be used to select the most appropriate sampling option: a. If at least one Dungeness crab is collected from the primary sampling area in Port Angeles Harbor (Area A on Figure 3-1) and each of the two reference areas, Dungeness crab will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #1). b. If no Dungeness crab are collected from the primary sampling area in Port Angeles Harbor (Area A on Figure 3-1) or other of the two reference areas, but red rock crabs are collected from these areas, red rock crabs will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #2). c. If no Dungeness crab or red rock crabs are collected from the primary Port Angeles sampling area during reconnaissance sampling, sampling of Port Angeles Harbor will be expanded to the secondary area (Area B on Figure 3-1). If at least one Dungeness crab is collected from the secondary sampling area in Port Angeles Harbor and each of the two reference areas, Dungeness crab will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #3). d. If no Dungeness crab or red rock crabs are collected from the primary Port Angeles sampling area during reconnaissance sampling, sampling of Port Angeles Harbor will be expanded to the secondary area (Area B on Figure 3-1). If no Dungeness crab are collected from the secondary sampling area in Port Angeles Harbor or either of the two reference areas, but red rock crabs are collected from these areas, red rock crab will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #4). e. If none of the preceding criteria are met or prolonged sampling (e.g., > 2 days) fails to meet sampling requirements, best professional judgment will be used to define the most appropriate sampling design.
	Dungeness Spit and Freshwater Bay Reference Areas	Collect Dungeness crabs from the two reference areas (Figure 3-1)	Collect red rock crabs from the two reference areas (Figure 3-1)	NR	NR	NR	NR	

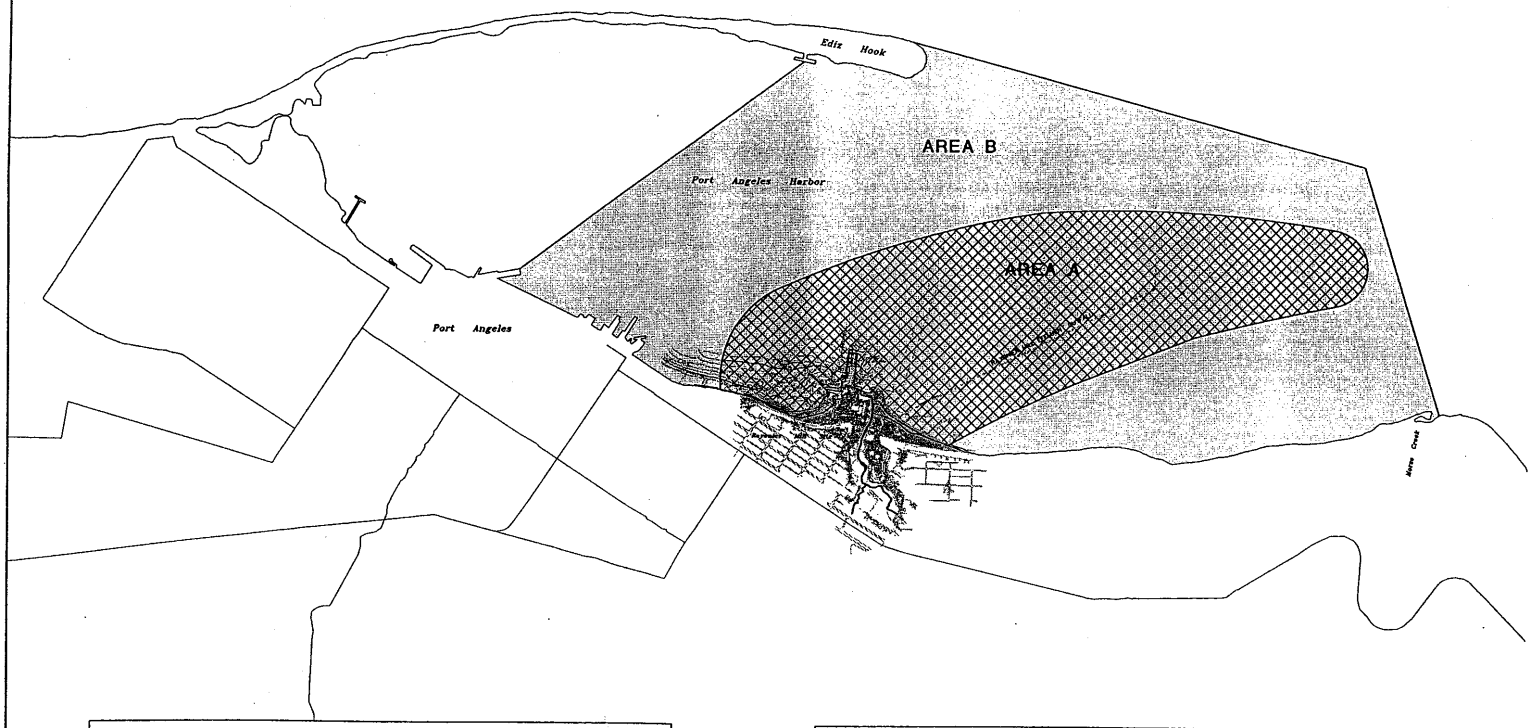
Table 3-2. Decision Matrix for Marine Biota Sampling. (continued)

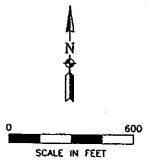
Sample Type	Sample Area	Sampling Options						Comments
		Option #1	Option #2	Option #3	Option #4	Option #5	Option #6	
Clams	Log Pond	Collect butter/littleneck/manila clams from the log pond (Area E on Figure 3-2)	Collect geoducks from the log pond (Area E on Figure 3-2)	Collect horse clams from the log pond (Area E on Figure 3-2)	Collect butter/littleneck/manila clams from the log pond (Area F on Figure 3-2)	Collect geoducks from the log pond (Area F on Figure 3-2)	Collect horse clams from the log pond (Area F on Figure 3-2)	A reconnaissance sampling will be conducted to determine the species availability, abundance, and distribution in the log pond, dock area, deepwater outfall area, and the two reference sampling areas. Intertidal clams will be collected using a shovel or other appropriate sampling device. Subtidal clams will be collected by divers using a venturi pump, clam rake, or other hydraulic pumping system. During reconnaissance sampling, all candidate species of acceptable size will be retained in on-board live tanks until a sampling option is selected when unwanted individuals will be released (Note; Geoducks will not rebury once collected). The minimum acceptable size for the butter/littleneck/manila clams is 1.5 inches. If possible, the same species should be collected all the sampling areas. Sampling requirements are 3 composite samples of 10 individual butter/littleneck/manila clams from each of the sample areas or 3 samples of individual geoducks or horse clams from each sample area. Based on the reconnaissance sampling, the following criteria will be used to select the most appropriate sampling option: a. If butter/littleneck/manila clams are present in the primary sampling areas in Port Angeles Harbor (Areas C, E, G, and I on Figures 3-2 and 3-3) and the reference areas, butter/littleneck/manila clams will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #1). b. If butter/littleneck/manila clams are not present in the primary sampling areas in Port Angeles Harbor (Areas C, E, G, and I on Figures 3-2 and 3-3) or the reference areas, but geoducks are present in these areas, geoducks will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #2). c. If butter/littleneck/manila clams and geoducks are not present in the primary sampling areas in Port Angeles Harbor (Areas C, E, G, and I on Figures 3-2 and 3-3) or the reference areas, but horseclams are present in these areas, horse clams will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #3). d. If butter/littleneck/manila clams, geoducks, or horse clams are not found in the primary sampling areas in Port Angeles Harbor during 4 hours of reconnaissance sampling, sampling in Port Angeles Harbor will be expanded to the secondary areas (Areas D, F, H, J on Figures 3-2 and 3-3). If butter/littleneck/manila clams are present in the secondary sampling areas in Port Angeles Harbor and the reference areas, butter/littleneck/manila clams will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #4). e. If butter/littleneck/manila clams, geoducks, and horse clams are not found in the primary sampling areas in Port Angeles Harbor during reconnaissance sampling, sampling in Port Angeles Harbor will be expanded to the secondary areas (Areas D, F, H, J on Figures 3-2 and 3-3). If butter/littleneck/manila clams are not present in the secondary sampling areas in Port Angeles Harbor and the reference areas, but geoducks are present in all sample areas, geoducks will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #5). f. If butter/littleneck/manila clams, geoducks, and horse clams are not found in the primary sampling areas of Port Angeles Harbor during reconnaissance sampling, sampling in Port Angeles Harbor will be expanded to the secondary areas (Areas D, D, F, H, J on Figures 3-2 and D33). If butter/littleneck/manila clams and geoducks are not found in the secondary sampling areas in Port Angeles Harbor and the reference areas, but horse clams are present in all sampling areas, horse clams will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #6). g. If none of the preceding criteria are met or prolonged sampling (> e.g., 2 days) fails to meet sampling requirements, best professional judgment will be used to define the most appropriate sampling design.
	Dock Area	Collect butter/littleneck/manila clams from primary dock area (Area C on Figure 3-2)	Collect geoducks from primary dock area (Area C on Figure 3-2)	Collect horse clams from primary dock area (Area C on Figure 3-2)	Collect butter/littleneck/manila clams from secondary dock area (Area D on Figure 3-2)	Collect geoducks from secondary dock area (Area D on Figure 3-2)	Collect horse clams from secondary dock area (Area D on Figure 3D-2)	
	East Beach Area	Collect butter/littleneck/manila clams from primary east beach area (Area G on Figure 3-2)	Collect geoducks from primary east beach area (Area G on Figure 3-2)	Collect horse clams from primary east beach area (Area G on Figure 3-2)	Collect butter/littleneck/manila clams from secondary east beach area (Area H on Figure 3-2)	Collect geoducks from secondary east beach area (Area H on Figure 3-2)	Collect horse clams from secondary east beach area (Area H on Figure 3-2)	
	Deep Water Outfall	Collect butter/littleneck/manila clams from primary outfall area (Area I on Figure 3-3)	Collect geoducks from primary outfall area (Area I on Figure 3-3)	Collect horse clams from primary outfall area (Area I on Figure 3-3)	Collect butter/littleneck/manila clams from secondary outfall area (Area J on Figure 3-3)	Collect geoducks from secondary outfall area (Area J on Figure 3-3)	Collect horse clams from secondary outfall area (Area J on Figure 3-3)	
	Dungeness Spit and Freshwater Bay Reference Areas	Collect butter/littleneck/manila clams from reference areas (Figure 3-3)	Collect geoducks from reference areas (Figure 3-3)	Collect horse clams from reference areas (Figure 3-3)	NR	NR	NR	

Table 3-2. Decision Matrix for Marine Biota Sampling. (continued)

Sample Type	Sample Area	Sampling Options						Comments
		Option #1	Option #2	Option #3	Option #4	Option #5	Option #6	
Shrimp	Port Angeles Harbor	Collect coonstripe shrimp from primary sampling area (Area A on Figure 3-1)	Collect spot shrimp from primary sampling area (Area A on Figure 3-1)	Collect coonstripe shrimp from secondary sampling area (Area A on Figure 3-1)	Collect spot shrimp from secondary sampling area (Area A on Figure 3-1)	NR	NR	A reconnaissance sampling will be conducted to determine the species availability, abundance, and distribution in Port Angeles Harbor and the two reference sampling areas. Shrimp will be sampled using standard sport fishing pots or during trawling activities. During reconnaissance sampling, all candidate species will be retained in on-board live tanks until a sampling option is selected when unwanted individuals will be released. The largest of the shrimp collected will be sampled and the remaining shrimp will be released. If possible, the same species should be collected from Port Angeles Harbor and the reference areas. Sampling requirements are 3 composite samples from Port Angeles harbor and three composite samples from a reference area. Composite samples will consist of a minimum of 10 individual shrimp. Only shrimp tails will be included in the samples as this is the portion of the shrimp consumed by people. Based on the reconnaissance sampling, the following criteria will be used to select the most appropriate sampling option: a. If sufficient coonstripe shrimp is collected from the primary sampling area in Port Angeles Harbor (Area A on Figure 3-1) and the reference area, coonstripe shrimp will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #1). b. If insufficient coonstripe shrimp are collected from the primary sampling area in Port Angeles Harbor (Area A on Figure 3-1) or the reference area, but spot shrimp are collected from these areas, spot shrimp will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #2). c. If insufficient coonstripe or spot shrimp are collected from the primary Port Angeles sampling area during reconnaissance sampling, sampling of Port Angeles Harbor will be expanded to the secondary area (Area B on Figure 3-1). If at least one coonstripe shrimp is collected from the secondary sampling area in Port Angeles Harbor and the reference area, coonstripe shrimp will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #3). d. If insufficient coonstripe or spot shrimp are collected from the primary Port Angeles sampling area during reconnaissance sampling, sampling of Port Angeles Harbor will be expanded to the secondary area (Area B on Figure 3-1). If no coonstripe shrimp are collected from the secondary sampling area in Port Angeles Harbor or the reference area, but spot shrimp are collected from these areas, spot shrimp will be selected as the target species and sampling will continue until sampling requirements are maximized (Option #4). e. If none of the preceding criteria are met or prolonged sampling (e.g., > 2 days) fails to meet sampling requirements, best professional judgment will be used to define the most appropriate sampling design.
	Dungeness Spit or Freshwater Bay Reference Area	Collect coonstripe shrimp from Dungeness Spit (Figure 3-1)	Collect spot shrimp from Dungeness Spit (Figure 3-1)	Collect coonstripe shrimp from Freshwater Bay (Figure 3-1)	Collect spot shrimp from Freshwater Bay (Figure 3-1)	NR	NR	

NR – not required

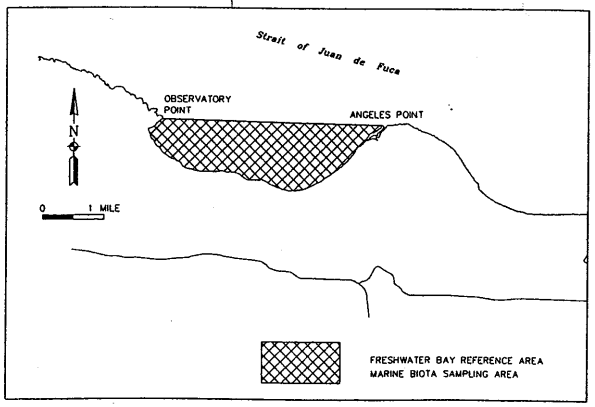


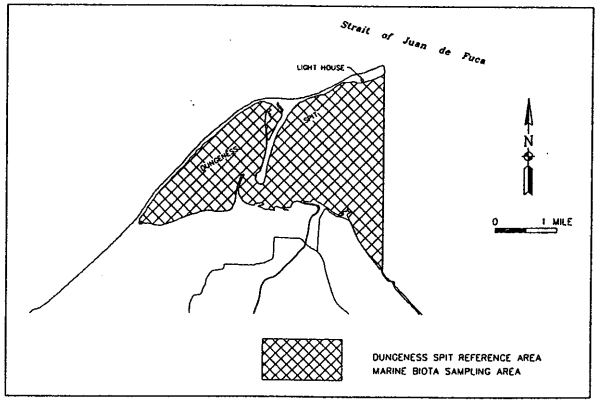


LEGEND

AREA A – PRIMARY SAMPLING AREA

AREA B – SECONDARY SAMPLING AREA





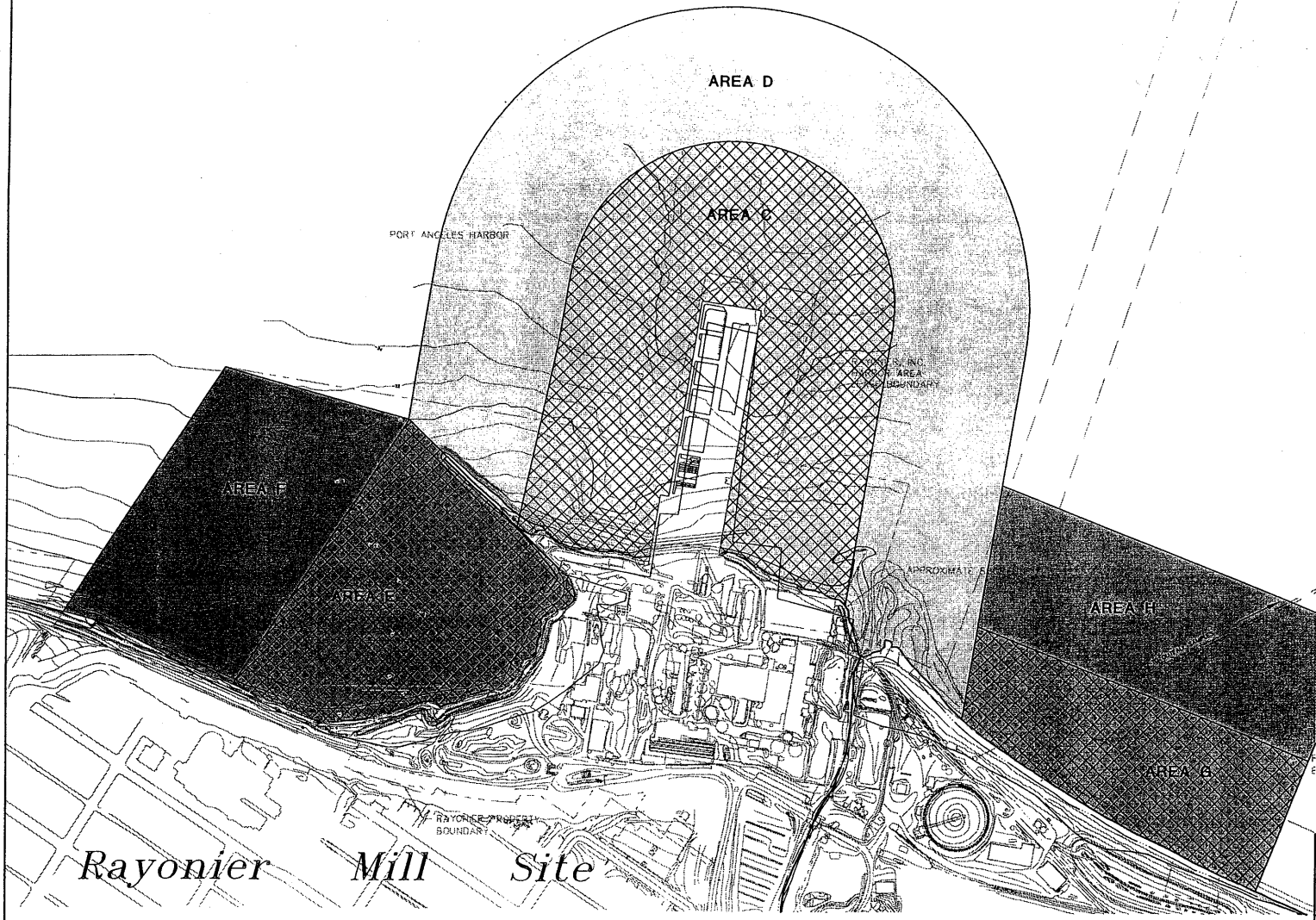
HORIZ: NAD83, WA SPC N. ZONE

FIGURE 3-1
BOTTOM FISH, SHRIMP, AND CRAB SAMPLING AREAS
RAYONIER PORT ANGELES MILL SITE

FOSTER WHEELER ENVIRONMENTAL CORPORATION

SCALE: AS NOTED	APPROVED	DATE: 10/08/01
DIVISION:		MRAYLR11
DRAWN: KSK		
CHECKED:		

I:\Projects\18340001\dwg\MRAYLR11.dwg 07/11/2002 09:17:29 AM PDT



N

0 400
SCALE IN FEET

LEGEND

- AREA C – DOCK PRIMARY SAMPLING AREA
- AREA D – DOCK SECONDARY SAMPLING AREA
- AREA E – LOG POND PRIMARY SAMPLING AREA
- AREA F – LOG POND SECONDARY SAMPLING AREA
- AREA G – EAST BEACH PRIMARY SAMPLING AREA
- AREA H – EAST BEACH SECONDARY SAMPLING AREA

HORIZ: NAD83, WA SPC N. ZONE

FIGURE 3-2
CLAM SAMPLING AREAS
RAYONIER PORT ANGELES MILL SITE

FOSTER WHEELER ENVIRONMENTAL CORPORATION

SCALE: AS NOTED	APPROVED	DATE: 10/08/01
DIVISION:		MRAYLR09
DRAWN: KSK		
CHECKED:		

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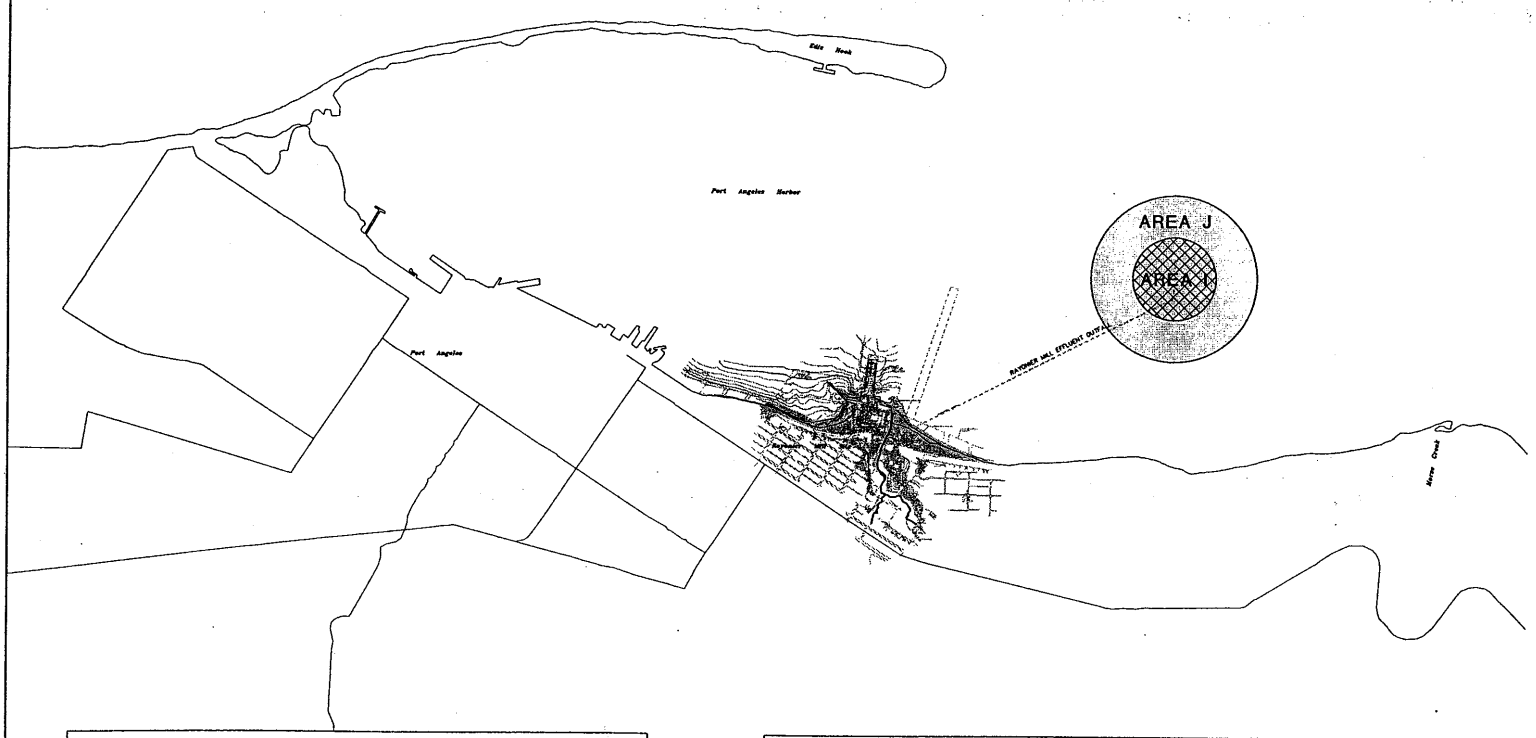

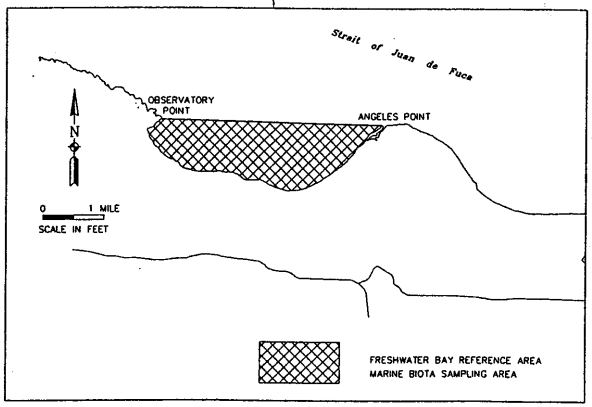

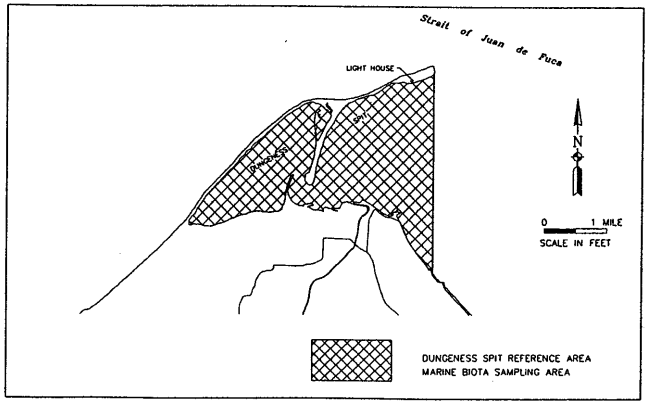

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LEGEND

AREA I – PRIMARY SAMPLING AGREA

AREA J – SECONDARY SAMPLING AGREA

HORIZ: NAD83, WA SPC N. ZONE

FIGURE 3-3
CLAM SAMPLING AREAS
DEEP WATER OUTFALL AND REFERENCE AREAS
RAYONIER PORT ANGELES MILL SITE

FOSTER WHEELER ENVIRONMENTAL CORPORATION

SCALE: AS NOTED	APPROVED	DATE: 10/08/01
DIVISION:		MRAYLR10
DRAWN: KSK		
CHECKED:		

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